

**Geographic Literacy and World Knowledge
Among Undergraduate College Students**

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in partial fulfillment of the requirements for the degree of

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in
Geography

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ABSTRACT

To succeed in today's globalized world, it is important to understand the places and cultures outside our own. Yet despite the acknowledged need for and importance of a greater understanding of the world, various surveys assessing geographic knowledge have demonstrated the geographic ignorance of people in the U.S. The purpose of this study is to assess the level of geographic literacy among undergraduate college students and to investigate factors that may influence geographic literacy.

An on-line survey, adapted from the National Geographic –Roper 2002 Global Geographic Literacy Survey, was administered to a sample of undergraduate students at Virginia Tech. The survey included a geography “quiz” to assess knowledge of geography and world events and a background section to collect information about various factors that may influence the participants' geographic literacy. Over 400 students participated in the study. The data were statistically analyzed using the Mann-Whitney U and Kruskal-Wallis tests for differences in means. Contrary to much of the previous research, the participants in this survey demonstrated a good level of geographic knowledge. The mean score of the geography “quiz” was 81 percent. Some of the factors found to have influence on the scores were gender, international travel, major, fulfillment of Virginia Tech's Area 7 requirement, frequency of news media access, and type of news accessed. Age, academic class, GPA, residency status, junior/high school geography classes, international friends, and knowledge of foreign languages were found to have little or no influence.

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CHAPTER 1: INTRODUCTION

The world is shrinking. “Distant lands” are no longer so distant. We wear clothes manufactured in Bangladesh and drive cars produced in Japan. People eat Kentucky Fried Chicken in China and Chinese food in Kentucky. Your next door neighbor might be from Albania, or India, or Somalia. The European Union politically and economically binds many countries of that continent, while the goal of the United Nations is to bring together all the countries of the world. Scrap metal from the United States causes lead poisoning in Asia; civil wars in Africa result in refugees relocated to the United States; and an escaped snakehead fish from China threatens aquatic ecosystems of Maryland. We live in an interconnected world. What occurs in one place can and probably will affect another. The Internet, telephones, airplanes, and television all provide nearly instant access to the cultures, politics, religions, economies, languages, and problems of the world.

In this age of globalization, the need for understanding the world in which we live is greater than ever. Former President William Clinton (2000) has stated that “to continue to compete successfully in the global economy and to maintain our role as a world leader, the United States needs to ensure that its citizens develop a broad understanding of the world, proficiency in other languages, and knowledge of other cultures.” U.S. Secretary of Education, Rod Paige (2002), has declared that “Each of us is an ambassador when we interact with our global neighbors. Thus, giving our children a solid education, which includes the skills they will need to succeed in a global context, is essential.” Professor David Keeling (2003, 5) believes that “having a good level of global knowledge is fundamental to the enlightenment of society, and democracy is absolutely dependent on the people’s enlightenment.” Whether to maintain global superiority or to ensure democracy, most would agree that global knowledge and understanding is imperative in the twenty-first century.

Perhaps more than any other discipline, geography is well equipped to provide the knowledge and skills necessary to understand the world in which we live. As historians study the past and biologists study living things, geographers study the world. In *Geography for Life: National Geography Standards* (1994, 18), which established national standards for K-12 geography curriculum, the subject matter of geography is explained to be “the earth’s surface and the processes that shape it, the relationships between people and environments, and the

connections between people and places.” The role of geography in educating about the world was emphasized by the Southern Governor’s Association Advisory Council on International Education. The Council (Southern Governor’s Association 1986, 10) recognized that “a sound geographic education offers perspective and information to understand ourselves, our relationship to the earth, and our interdependence with other peoples of the world... To develop a level of international understanding, it is essential to learn how ‘place’ influences cultures and economies.” Geography provides the base on which global understanding and knowledge are built.

Yet despite the acknowledged need for and importance of a greater understanding of the world, the U.S. continually falls behind when it comes to geographic literacy. Various surveys assessing geographic knowledge in the 1980s and 1990s demonstrated the geographic ignorance of people in the U.S. Helgren (1983) found that undergraduate students in his courses were unable to locate major countries and cities on a map. The 1988 National Geographic-Gallup (Gallup 1990, 32) survey examined the geographic literacy of adults in nine industrialized countries and found that the U.S. cohort ranked near the bottom in all international comparisons. A study by Saarinen and MacCabe (1995) supported the 1988 National Geographic survey, though they concluded that the U.S. was not the only country that needed to improve its levels of geographic literacy. The most recent National Geographic survey (National Geographic 2002) gave some indication that geographic literacy in the U.S. had improved since 1998; however, the U.S. still remained near the bottom, with only Mexico ranked lower.

The concern over inadequate geographic knowledge is not new, and many educational initiatives have been developed to address the problem. Responding to the need for improvement, the 1958 National Defense Act was revised in 1964 to include additional funding for geography education (James 1971). This was especially significant because geography historically has been integrated into the history-heavy social studies curriculum in which it was often neglected by teachers untrained in the subject of geography (James 1971). The 1964 revisions signified to educators that geography was important and could no longer be overlooked. Among other things, the funds provided by the Act trained teachers in geography and updated classroom equipment. A result of the new focus on geography was the establishment of the High School Geography Project (HSGP) sponsored by the National Science Foundation (James 1971; Gaile and Willmott 1989). Because the traditional social studies

curriculum did not emphasize geography, the HSGP sought to more clearly realize the place of geography within high school education (James 1971). Unfortunately, the HSGP was not successful (Gaile and Willmott 1989; Douglass 1998). By the 1970s, the perceived necessity for educational reforms and better geographic education slowly faded, and geography remained insignificant within the education system.

The 1980s brought renewed concern for the adequacy of the U.S. educational system. Stoltman (1992) optimistically referred to the 1980s as a renaissance in geography education. In 1984 the Joint Committee on Geographic Education published the *Guidelines for Geographic Education: Elementary and Secondary Schools*, which, for the first time, clearly laid out comprehensive geographic themes, concepts, and skills to be included in school curriculums (Stoltman 1992, 266). To implement the *Guidelines*, the Geographic Education National Implementation Project (GENIP) was established in 1985 by a consortium of professional geography societies, including the Association of American Geographers and National Geographic Society (Stoltman 1992). Another important development during the 1980s was the formation and growth of state geographic alliances. Initiated by the National Geographic Society, the geographic alliances included teachers, school districts, university departments, and public and private agencies; they functioned to promote, lobby for, and strengthen geography education. Today every state, the District of Columbia, and Puerto Rico have active geographic alliances (NationalGeographic.Com 2004).

While geography is still often integrated into the social studies curriculum, the GENIP consortium and geographic alliances have ensured that geographic knowledge remains an important educational issue. In 1989, President George H. Bush included geography as one of the five core subjects in the National Education Goals (Munroe and Smith 1998; Daley 2003). This event, for the first time, elevated the study of geography to same status as the more established disciplines, such as math and English. In 2000, President William Clinton signed the National Education Goals into law with the *Goals 2000: Educate America Act* (Daley 2003). In 1994, the *Geography for Life: National Geography Standards* (Geography for Life 1994) was developed and published on behalf of the American Geographical Society, the Association of American Geographers, the National Council for Geographic Education, and the National Geographic Society. The stated purpose of the standards is to “bring all students up to internationally competitive levels to meet the demands of a new age and a different world”

(Geography for Life 1994, 9). Yet despite the apparent advances in geography education, geographic literacy problems persist.

One strategy in education policy designed to combat lack of global knowledge is “international education.” International education is a multi-dimensional initiative which, according to The Virginia Council for International Education (2004), includes “programs of study, service, and research that enlarge the understanding of the world beyond our borders”. In creating a taxonomy for international education, Barker and Smith (1996, 44-45) offer several ways to internationalize the curriculum including: adding courses that incorporate international dimensions, offering majors in international studies, requiring foreign languages, and developing study abroad programs. To some degree nearly all college curriculums today include an international dimension (Altbach and Peterson 1998). While geography is not always specified in international education efforts, at least one study argues that it should be. Hill (1981, 239) found that 74 percent of the questions included in the Educational Testing Service’s survey of international perspectives contained geographic content; thus, he argues for the explicit expansion of geography in the internationalized curriculum. International education, he writes, is “no more than geographic education dressed up in new jargon” (Hill 1981, 237). However, more than twenty years after Hill’s conclusions, geography maintains its position on the periphery of internationalized curriculums, and students’ international knowledge remains low.

Purpose of the Study

The purpose of this study is to assess the level of geographic literacy among undergraduate students at Virginia Tech within the context of current events and world issues and to investigate factors that may influence geographic literacy.

The Study

An on-line survey was administered to a sample of undergraduate students currently attending Virginia Tech. The survey instrument was adapted from the *National Geographic-Roper 2002 Global Geographic Literacy Survey* (National Geographic 2002). The survey comprised three parts. The first section gathered data on students’ attitudes towards the importance of geography and world knowledge. The second section was a geography “quiz” to assess knowledge of geography and world events. The final section collected information about

various factors that may influence the participants' geographic literacy as measured by the geography quiz.

This study focuses on two central questions:

- (1) How geographically literate are undergraduate college students?
- (2) What factors influence geographic literacy?

Based on my review of the literature and knowledge of geographic literacy, I identified several factors and related issues that should be investigated as possible influences on geographic literacy. For organizational purposes, I group the factors into four general themes: demographics, education, travel and international experience, and media usage. These will be discussed in detail in a later chapter.

Defining Geographic Literacy

Defining "geographic literacy" is not an easy task because of a lack of consensus among geographers. Place location knowledge (PLK), or the ability to locate places on a map, is perhaps the most researched aspect of geographic knowledge and is often equated with geographic literacy. Those who study PLK argue that it provides the foundation upon which the study of geography is rooted (Marran 1992; Torrens 2001). "The geographer," Torrens posits (2001,49), "must have a basic understanding of the world around him/her before he/she can comprehend the processes at work in the environment." Saarinen and MacCabe (1995, 197) applied a similar definition of geographic literacy in their study of PLK. They used the term to mean "knowledge of world places" and their justification, similar to that of Torrens, was that people need detailed knowledge of the world "so that they can draw informed conclusions related to world affairs."

Despite the prominence and popularity of PLK studies in the literature, many believe that PLK can not stand alone in defining geographic literacy. There are geographers, such as Keeling (2003, 5), who believe that overcoming the popular misconception of global knowledge as simply learning place names is one of the discipline's greatest challenges. Bein (1990, 260) acknowledges the relevance of PLK but argues that it "does not reveal the conceptual extent of geographic knowledge." Donovan (1993) admits that PLK may be a possible indicator of geographic literacy, but in his own survey of geographic literacy, he included a series of "general geography" questions to accompany the place identification maps. Other studies of geographic

literacy, such as those by Eve et al. (1994), National Geographic – Gallup (Gallup 1990), and National Geographic – Roper (National Geographic 2002), included geography questions beyond simply locating places on a map.

A variety of definitions can be found in the literature on geographic literacy that encompass more than just PLK. For example, Eve et al. (1994, 408) assert that geographic literacy is “the ability of individuals to demonstrate map reading skills, knowledge of spatial locations of places, and understanding of peoples and cultures associated with various regions.” Bien’s (1990) study included four areas of geographic knowledge: map skills, PLK, physical geography, and human geography. The National Geographic - Roper 2002 Global Geographic Literacy Survey (National Geographic 2002, 1) was designed to examine the “building blocks of geographic literacy:”

Children in every nation will need to possess basic 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. This survey was designed to shed light on the competency of respondents on the most basic components of geographic knowledge and skills: the building blocks of geographic literacy.

The one common characteristic among all the geographic literacy surveys was the inclusion of PLK as one of the dimensions of geography. Beyond that, however, there was little agreement on what constitutes geographic literacy.

One of the most extensive discussions of the dimensions of geographic literacy is provided in *Geography for Life: National Geography Standards* (1994). In the Standards (Geography for Life 1994, 30), geography is considered to be “composed of three interrelated and inseparable components: subject matter, skills, and perspective...all three are necessary to being geographically informed.” The “subject matter” of geography is divided into several essential elements: “the world in spatial terms,” “places and regions,” “physical systems,” “human systems,” “environment and society,” and “the uses of geography.” “Geographic skills” include: the tools and techniques used to think geographically; the ability to ask geographic

questions and collect, organize, and analyze geographic information; and the development of critical thinking skills. “Geographic perspectives” involve both a spatial perspective and an ecological perspective: “Where something occurs is the spatial perspective; how life forms interact with the physical environment is the ecological perspective” (Geography for Life 1994, 59). The standards established by *Geography for Life* provide the most comprehensive approach to developing the geographically literate student. However, operationalizing many of the concepts, particularly those that require higher-level critical thinking skills, is quite subjective and difficult to assess. Perhaps for this reason, many surveys designed to assess geographic knowledge utilize a more simplified definition of geographic literacy.

For the purpose of this study, I needed a definition of geographic literacy that was both broad enough to encompass the various dimensions of geographic knowledge, yet narrow enough to be easily measured. The *Geography for Life* definition was created as a tool for educators and as a guideline for geography curriculums, and thus it may be too complex to fully measure. On the other hand, PLK studies too narrowly define geographic literacy. Incorporating the general concepts from these varied definitions and using the “geography’s building blocks” approach from the National Geographic – Roper (National Geographic 2002) definition, the following definition of geographic literacy will be used in this study:

the ability to express knowledge of basic geographic subject matter, specifically the ability to (1) demonstrate map reading skills, (2) knowledge of place locations, and (3) an understanding of human systems, society, and the physical environment.

Significance of the Study

In a globalized society it is important to understand the places and cultures outside our own so that we can make informed decisions and form intelligent opinions about the activities around us. One major purpose of attending college is to prepare students for entering the workforce so it is important that students graduate with the global knowledge they will need to be successful. By assessing the level of geographic literacy among college students at Virginia Tech, this study will assist educators and administrators in determining whether educational

deficiencies exist. A better understanding of the factors that may influence geographic literacy will help establish a plan of action to ensure that all students are geographically literate.

This study also adds to the literature on geographic literacy and provides insight into the factors that may influence it. It expands on current research that examines the role of demographic factors, geography education, travel experience, and media usage in geographic literacy. This study also considers the possible relationship between international education efforts and geographic literacy.

Limitations of the Study

No research is without its limitations, and the same is true of this study. First, the survey was simplified to assess the most basic and readily measurable components of geographic knowledge. It is not meant to assess higher-level thinking skills, such as the ability to apply geographic knowledge to understand a world event. Thus caution should be taken when interpreting the results.

This study examined only geographic literacy among college undergraduates. It did not address geographic literacy among those who did not go to college, those who already graduated, or those who continued their education in graduate school. Accordingly, the results of this study are limited to undergraduate college students and should not be projected onto other populations.

These data were collected from a single educational institution, Virginia Tech. The results of this study cannot be assumed to be applicable to the U.S. undergraduate population in general because factors influencing a student's decision to attend this university (such as grades, SAT scores, or costs) and factors specific to this university (such as the international student population and the existence of a geography department) may have affected the results.

Lastly, the results of the study cannot be used to determine causal relationships between geographic literacy and the various factors investigated. Rather, by identifying differences in geographic literacy rates in relation to a variety of characteristics (such as gender or academic level), the study can identify factors that *may* have influenced geographic literacy. Further research, ruling out spuriousness¹ and isolating unique factors, would be needed to establish causality.

¹ "Spuriousness occurs when two variables are associated but are not causally related because there is actually an unseen third factor that is the real cause" (Neuman 2000: 139).

In spite of these limitations, this study is valuable in that it will provide further understanding of what factors may be associated with geographic literacy. In addition, it will provide insight into what college students know about geography.

Organization of the Study

This study is composed of six chapters. This chapter provided an introduction to the study, the purpose of the research, and the research questions. Chapter Two presents background information on geography education in the U.S., Virginia, and at Virginia Tech. A review of the literature about the factors influencing geographic literacy is provided in Chapter Three. Chapter Four explains the research design and survey procedures. The results of the survey are presented in Chapter Five and discussed in detail in Chapter Six.

CHAPTER 2: BACKGROUND

In this chapter, I provide information on the status of geography in the education system. I first briefly examine geographic education at the national level in the United States and then provide a more thorough description of geography as a subject matter in Virginia's kindergarten through grade 12 (K-12) public schools. This chapter concludes with a discussion of geography at Virginia Tech and the University's efforts to internationalize the curriculum.

Geography in the United States

The situation of geography as an academic subject today is perhaps described best by Alexander B. Murphy (2003,2), Vice President of the American Geographical Society, when he stated "the United States is the only major power where it is possible to go from kindergarten through higher education without a single course in geography. Some of our most prestigious universities do not even have geography departments – an unthinkable circumstance in other parts of the world." Geography as an academic subject in the U.S. has historically lagged behind the academic subject in the rest of the world. For example, geography was part of university study in Europe during the seventeenth and eighteenth centuries (James 1971; Douglass 1998), with the first university geography department established in Germany in 1874 (Douglass 1998), whereas the U.S. did not have an independent geography department until 1903 (although there were combined geology and geography departments prior to that date) (Douglass 1998).

Geography has had fluctuating fortunes throughout the years and has undergone various changes in identity. In the K-12 curriculum of the nineteenth century, geography was considered the study of the physical environment until it slowly became engulfed by "general science" classes, which, by the early twentieth century, dominated the science curriculum (James 1971; Graves 1984; Gaile and Willmott 1989). As educators and public administrators began reassessing the purpose of education, they began to focus more on how to "prepare future citizens to participate in civic life" (Douglass 1998, 14). With this shift in educational priorities came the advent of social studies. Social studies, as it was first designed in 1911, would encompass history, civics, economics, and geography, and would be built around the study of issues or problems, such as nationalism, socialism, or imperialism. The shift towards social studies was not beneficial to geography education (James 1971; Douglass 1998).

The committees and commissions involved in social studies curriculum development were most influenced by academic historians and the American Historical Association (AHA), whose self-interest was reflected in the prominence of history within the rubric of social studies (Gaile and Willmott 1989; Douglass 1998). While those involved in the development of the new social studies curriculum indicated that geographic ideas and concepts were to be integrated into the curriculum, they did not possess the knowledge to actually implement such a proposal. The lack of geographic emphasis within the social studies curriculum can be attributed, in part, to the resistance of geographers themselves. Geographers had the explicit opportunity to be involved in social studies curriculum development. In the years after World War I, a group of social studies teachers convened to develop new materials and texts. Geographers were asked to join the team to ensure that geography was adequately and correctly included in social studies. The geographers, however, reflecting struggles within the discipline itself in regards to defining the academic substance of the subject, refused to participate, insisting that geography was a physical science and not a “social” study (James 1971; Gaile and Willmott 1989). This lack of involvement by trained geographers resulted in flawed geographic components of the curriculum. Thus, it was at the beginning of the twentieth century that the future of geography in schools was set; history-laden social studies persist to this day.

Recent efforts to increase geography education in the schools have been moderately successful. Geography has been included as one of five core subject areas in the *Goals 2000: Educate America Act* signed by President Clinton (Daley 2003), and since 1994, geography has been one of seven subjects included in the National Center for Education Statistics (NCES) “national report card” (NCES 2002). The NCES is a division of the U.S. Department of Education. Yet despite this apparent progress, Chester Finn, Jr., president of the Fordham Foundation, believes that “[geography] may have earned legitimacy within the curriculum as far as policy makers are concerned, but the knowledge and skills that it presently expects of young Americans are meager indeed” (Munroe and Smith 1998, vi). While the comprehensive *Geography for Life: National Geography Standards* (1994) provide guidelines for developing geography curriculums, it is the responsibility of each state to set and apply academic standards in their schools. A 1998 study by the Fordham Foundation examined each state’s geography standards. The evaluation sought “clear, specific, assessable state standards that establish high expectations for student mastery of essential geographic knowledge and skills...” (Munroe and

Smith 1998, vii). Of the 38 states assessed, 23 received a “D” or “F” rating (on the standard A-F grading scale), eight states received a “C”, and only six states earned “honor” grades of “A” or “B”; the other 12 states either did not have standards or were revising them during the time of the study (Munroe and Smith 1998, vii). Perhaps Douglass (1998, 26) is correct in asserting that “more recent data give us little encouragement that the rekindling of interest in geography as a school subject will bear much fruit.”

Still, there may be hope on the horizon. Advanced Placement (AP) courses and tests are offered in many U.S. high schools and provide college credit with the successful completion of the exam. AP classes are typically reserved for the brightest high school students, as the rigorous workload is comparable to a college-level course. The College Board, the organization that develops the courses and exams, first began the AP program in traditional subject areas, such as English, biology, and U.S. history. Today there are 34 AP exams in 19 subject areas, including human geography, which was introduced in 2001 (College Board 2004a). In 2002, 5,286 students took the AP human geography exam, up 62 percent from the year before. Only AP Studio Art-Drawing had a greater growth rate. Despite the rapid growth rate, it must be noted that its significance within the AP curriculum in general is quite limited. With over 1.5 million AP exams taken in 2002, AP human geography represents less than one percent of the total (College Board 2004b). The “traditional” subjects continue to dominate; for example, over 200,000 students took the AP U.S. history exam in 2002. Even the AP world history exam, which was first offered in 2002, had a greater number of participants (20,955) than AP human geography (5,286), which in 2002 was in its second year (College Board 2004b). Regardless, the inclusion of human geography in the AP curriculum and the rapid growth in popularity of the AP human geography exam are promising and perhaps indicate resurgence in interest in geographic education, although the long-term significance is yet to be determined.

K-12 Geography in Virginia

In 2003, the Virginia Department of Education (VDOE) developed *Standards of Quality* for K-12 public schools. While the standards include the traditional subjects, such as reading, writing, and math, they also state that curriculums should be designed to emphasize the skills necessary for “responsible participation in American society and in the international community” (VDOE 2003, 5). Geography is specifically mentioned as one such skill.

Currently, geography education in Virginia follows the national trend of integrating the subject into the social studies. This is evidenced by the inclusion of geography standards within the *History and Social Science Standards of Learning* (VDOE 2001a). Virginia's *Standards of Learning* (SOLs) (VDOE 2004) were developed in four core subject areas: science, math, English, and history and social science as a mechanism to standardize and assess the information being taught.

At the elementary school level, there are no specific geography courses; rather geography units are incorporated into social studies curriculum. For example, in the third grade the SOLs recommend that the social studies curriculum include a unit on "locating and interpreting geographic information" (VDOE 2002a, 1). At the secondary school level, the components of social studies (mainly history, government, and geography) are separate classes. At present, there are three geography courses that fulfill the SOL graduation requirement: World History and Geography to 1500 AD, World History and Geography 1500 AD to the Present, and World Geography (VDOE 2002b).

Current state high school graduation requirements for a standard diploma include three credits (courses) in history and social sciences. Two of the courses must be in Virginia/U.S. history and Virginia/U.S. government, and only one world history/geography course is required (VDOE 2001b). The requirements for an advanced studies diploma require four history/social science credits, including two courses in world history/geography (ibid.). Although it is apparent that the curricular focus is still on history, it is encouraging that geography is required at all.

The development and inclusion of AP human geography courses in Virginia schools is another indication of progress in geography education. The numbers are still very small compared to the more traditional social studies exams offered – 424 students took AP human geography compared to nearly 10,000 who took the AP U.S. history exam in 2002 (College Board 2004c). The imbalance is most likely attributed to the long-standing focus on U.S. history in Virginia's curriculum and the ease of integrating an AP component into already existing classes.

The lack of teachers educated in geography is a persistent barrier to sound geography education. The required Praxis II exam to obtain social studies teacher licensure in Virginia exemplifies the history-centric focus of the social studies curriculum. Approximately 44 percent of the exam questions cover U.S. and world history. Only approximately 15 percent of the exam

questions relate to geography. The remainder of the test consists of questions on government, economics, and the behavioral sciences (ETS 2004).

The Virginia Geographic Alliance (2000a) has helped to rectify this problem by offering training to teachers in geography content and instruction. Thousands of teachers have benefited from their participation in Alliance activities and programs. The Alliance has also been beneficial in developing and providing educational materials as well as assisting with curriculum development for AP geography courses (Virginia Geographic Alliance 2000b).

While six years have elapsed since Munroe and Smith's (1998) examination of state geography standards, it could be argued that, despite some minor advancements for geography education, their 1998 assessment is applicable even today. Munroe and Smith gave Virginia a grade of "D." In their assessment of Virginia's geography standards, they (1998, 56) found that "Virginia's standards place geography in a supporting role in its widely praised but history-driven standards. Geography is explicitly addressed throughout, but primarily as a prism to help students better understand the historical events that they are studying rather than as a discipline in its own right."

Geography at Virginia Tech

While the purpose of K-12 education is to provide a general education and the basic skills and knowledge necessary to participate in society, a college/university education strives to expand general education and also provide more specialized training in a particular discipline. Virginia Tech has developed a *Core Curriculum* to ensure that its graduates receive a broad, liberal education that aims to "introduce the student to a range of traditions, modes of thinking and inquiry, and issues of central human importance" (Virginia Tech 2003, 4). At the university level, geography and the other social sciences that are integrated in K-12 social studies become independent academic disciplines. In essence, however, the Core Curriculum revives the K-12 integrated approach to education. Required courses are not organized around specific academic departments, but around seven core concepts as defined by the University in the Core Curriculum Guide (Virginia Tech 2003). The seven core areas are:

- Area 1: Writing and Discourse
- Area 2: Ideas, Cultural Traditions, and Values
- Area 3: Society and Human Behavior
- Area 4: Scientific Reasoning and Discovery
- Area 5: Quantitative and Symbolic Reasoning
- Area 6: Creativity and Aesthetic Experience
- Area 7: Critical Issues in a Global Context

Although geography is not required for graduation, geography classes can be found within two of the core areas -- Area 3: Society and Human Behavior and Area 7: Critical Issues in a Global Context. Three geography courses fulfill the Area 3 requirement. Two of the Area 3 geography courses (World Regions and World Politics and Economy I²) also fulfill the Area 7 requirement. Courses in Area 7 “focus on major international and intercultural issues in contemporary world affairs, including such areas as politics, the management of conflict, the roles of economic competition and cooperation, demographic issues, and the emerging world order” (Virginia Tech 2003, 23). It is Area 7 in which geography is particularly suited and in which geographic concepts and understanding are imperative. According to the 2003-2004 Core Curriculum guide, there are 62 specific courses in 41 disciplines that meet the Area 7 requirement (Virginia Tech 2003, 24-25). Geography’s eight Area 7 classes (Table 2.1) comprise about 13 percent of the total Area 7 courses, more than that in any other department. One course (three credits) is needed to fulfill Area 7.

The number of geography majors at Virginia Tech has been increasing over the last several years. At the time that this survey was administered during the spring 2003 semester, there were 67 majors. A year later, in the spring 2004 semester, there are more than 90 geography majors. The popularity in geography is also evidenced by the growth of enrollment in geography courses. This, of course, is due, in part, to the increase in the number of geography majors, but significantly more non-majors are also enrolling in geography courses, including courses emphasizing geospatial analysis, such as GIS and remote sensing.

² World Politics and Economy I is a course taught in the Department of Political Science but is cross-listed as a geography class.

Table 2.1
Area 7 Geography Classes at Virginia Tech

-
1. World Regions
 2. Geography of Global Conflict
 3. World Politics and Economy I
 4. Geography of Global Economy
 5. Environmental Problems, Population, and Development
 6. Medical Geography
 7. Geography of Resources
 8. International Development³
-

Source: *Virginia Tech 2003*

While geography majors have some flexibility in the courses that they take and in the plan of study that they design, the department currently requires that all majors take four introductory-level classes: introduction to human geography, introduction to physical geography, maps and mapping⁴, and world regions. Beyond these basic requirements, majors are provided much leeway concerning the classes that they chose.

At the time of the survey, there were three different “checksheets” used by geography majors to identify the courses necessary to graduate. Geography majors graduating before 2005 used a single checksheet. Geography checksheets for students graduating in 2005 or later offer two concentrations: geospatial and environmental analysis (GEA), and cultures, regions, and international development (CRID). Both concentrations require the four core geography classes noted above. The GEA concentration requires a substantially larger number of geospatial and environmental analysis courses (classes such as GIS and geomorphology), while only requiring a minimal number (two) of courses in regional geography or international development. The CRID concentration, on the other hand, requires only a minimal number of geospatial and environmental analysis courses, with the primary focus being on courses in regional geography and international development.

Internationalizing the Curriculum at Virginia Tech

Over the past decade, as it became clear that students would need a better understanding of the world in order to compete in the global society, colleges and universities responded by

³ International Development is taught in the Department of Urban Affairs and Planning but is cross-listed as a geography class.

⁴ Students graduating prior to 2005 were not required to take Maps and Mapping, but instead chose from a variety of “geospatial techniques” courses.

expanding their efforts at internationalizing curriculums. Today internationalization “has become an integral part of mission statements in colleges and universities in the United States” (Schoorman 2000, 5). Virginia Tech has regularly been involved in international efforts, such as the establishment in 1992 of the Center for European Studies and Architecture in Switzerland and the recruitment of international students. However, the goal of internationalization was not specifically addressed until 1995 – 1996. Under the direction of former Provost Peggy S. Meszaros, Patrick Liverpool, former vice provost for international outreach and international programs, prepared a position paper in 1995 to describe the goals and direction of the University’s international programs. In his paper, Liverpool (1995) identified internationalizing the curriculum, increasing the number of student exchanges, and increasing the number of international students as necessary steps for the university to successfully compete in the international arena.

A year later, in 1996, the Virginia Tech Board of Visitors formally acknowledged the need for greater internationalizing efforts at Virginia Tech in their approved action plan. Among other strategies to move Virginia Tech into the twenty-first century, the Board of Visitors prescribed promoting a global perspective through internationalizing the curriculum and increasing student exchanges (Nutter 1996).

These goals were put into action in several significant ways. First, the 1995-1996 academic year marked the initiation of the Area 7 requirement of the Core Curriculum. It is also the year that the international development concentration became available to graduate students. To further promote the internationalizing efforts during this time, the University provided mini-grants (\$1,500) to professors who would include an international dimension in their courses. Ten grants were awarded, including one to a geography professor (Cox 1996).

Since that time, the administration has made further efforts to strengthen international education at Virginia Tech. The 2001 Strategic Plan (Virginia Tech 2001a) included the following vision for the future of Virginia Tech: the need to “develop an appreciation of other cultures by expanding our global focus; by increasing international study and research opportunities; by expanding international government, university, and corporate partnerships; and by imbuing an international flavor to curricular offerings.” The Plan (Virginia Tech 2001b) further explained the importance of an international focus when it stated that the “the University must seek to instill in all students, regardless of disciplinary focus, an appreciation and

understanding of the foundations and significance of other cultures and languages, of the pervasive implications of global economic change, and the compelling need to find mechanisms to address global environmental, political, economic and social challenges.” The 2001 Strategic Plan also reiterated the needs first expressed in the 1996 action plan: incentives for faculty to internationalize the curriculum, strengthening study abroad, and recruitment and retention of international students, particularly at the undergraduate level.

The Cranwell International Center and the Office of International Research, Education, and Development (OIREd) are the primary implementers of the University’s internationalizing efforts. The Cranwell International Center has operated since 1986; its purpose is to assist the University’s international community by providing resource and referral networks and direct services, such as assistance with immigration policies as well as English language institutes (Cranwell 2004). It also works with international groups and departments on campus to organize educational and social programs to benefit not only international students and the university in general, but the greater Blacksburg community (ibid.). Currently there are over 2,000 international students from over 100 countries (Cranwell 2003). There are significantly more international graduate students than international undergraduates (1,464 graduate and 624 undergraduate), a trend that has remained consistent over the years (ibid). Still, with over 25,000 students attending Virginia Tech, the proportion of international students is extremely small.

The OIREd organizes study abroad opportunities at Virginia Tech and provides faculty with grants to promote efforts to internationalize the curriculum. Nearly 600 Virginia Tech students participate in study abroad every year (OIREd 2004). Several study abroad options are available. Virginia Tech has bi-lateral exchange agreements with nearly 30 institutions world wide. Students are also able to enroll in private programs not managed through Virginia Tech. The Center for European Studies and Architecture (CESA) offers Virginia Tech students the opportunity to take Virginia Tech classes in a European setting. While primarily focused on architecture and business students, CESA operates semesters abroad for the general student population as well. And lastly, there are numerous faculty-led study abroad programs, an endeavor in which the geography department is becoming more active. Since the time of this survey, the geography department has offered study abroad opportunities to Russia, Estonia, and Finland; the U.S. and Canada; and Cuba, all of which were very well received by students.

Finally, a discussion of international education efforts at Virginia Tech is not complete without mention of the International Studies program. Housed within the Department of Political Science⁵, this interdisciplinary major “offers a broad training in the liberal arts and human sciences with a special emphasis on the study of foreign languages” (International Studies 2004). Beyond foreign language education, the sequence of required courses for international studies majors includes classes in international relations and theory, economics, and world politics. Two of the four major concentrations (environmental affairs and global development) include a geography requirement, while numerous geography classes are included as approved international studies electives.

For the majority of Virginia Tech students who choose different majors, the University provides alternative means to gain global knowledge. Through the Area 7 Core Curriculum requirement, recruitment of international students, and promotion and availability of many study abroad options, Virginia Tech strives to guarantee that all of its graduates, regardless of major, are exposed to an internationalized curriculum.

⁵ Prior to Spring 2003, International Studies operated as a separate program.

CHAPTER 3: LITERATURE REVIEW

As discussed in the first chapter, there is no single agreed upon definition of geographic literacy. Similarly, there are many different approaches to studying geographic literacy and geographic knowledge, such as sketch mapping, assessment of place location knowledge, and multi-dimensional tests of geographic knowledge. In this chapter, I discuss the various approaches to studying geographic knowledge. I will provide a summary of the related studies on geographic literacy surveys, including the National Geographic – Roper 2002 Global Geographic Literacy Survey (National Geographic 2002) from which this study was adapted. I will also examine factors that have been investigated as indicators of geographic knowledge and how they have been measured in the various studies. I will then conclude the chapter with a discussion of how my study fits into the overall body of geographic literacy research.

Approaches to the Study of Geographic Knowledge

Sketch Mapping

Sketch mapping is often associated with studies of mental mapping and place perception; for example, Saarinen et al. (1996) world sketch map study explored how individuals' perceptions of the world were represented in their sketch maps. But it is also used as a technique for assessing factual geographic knowledge. An advantage to using sketch maps for geographic knowledge assessment is the ease of administration and comparability across cultures (Chiodo 1993; Saarinen and MacCabe 1995). In addition, sketch mapping, unlike other methods of assessing geographic knowledge, is not restricted by a sample of test items selected by researchers (Wise and Kon 1990, 123). There are also disadvantages to using sketch maps, for example the complexity of analysis. Because sketch mapping is unconstrained, it often results in highly irregular maps that lead to difficulty in assessing and quantitatively analyzing the results (Torrens 2001). The "correctness" of a sketch map can be assessed in numerous ways, such as by the inclusion/exclusion of places, the size and shape of places, spatial relationships of places, and/or use of map conventions (such as the equator line and compass rose) (Wise and Kon 1990). Furthermore, critics of sketch mapping contend that the method assesses a person's drawing ability rather than geographic knowledge (Downs and Stea 1977). Nevertheless, sketch

mapping has been used in many studies to assess geographic knowledge (see, for example, studies by Chiodo 1993; Saarinen and MacCabe 1995; or Bunin 2001).

Place Location Knowledge

Studies of place location knowledge provide another avenue to assess geographic knowledge. Place location knowledge (PLK) is the ability to identify places (such as countries, cities, and bodies of water) on a map. It differs from sketch mapping because participants simply label places on a provided outline map, rather than actually drawing the map. While most researchers (particularly geographers) realize that geographic knowledge encompasses a broader array of skills than the ability to memorize places on a map, PLK is often considered “the foundation within which the discipline is rooted” (Torrens 2001, 49). For this reason PLK is often seen as a proxy or starting point for examining geographic knowledge (Hise, et al. 2000; Torrens 2001). Nevertheless, most investigations of PLK are integrated into more comprehensive studies of geographic literacy, which will be discussed later in this literature review. There are, however, a few academic studies that focus solely on PLK (see, for example, studies by Cross 1987; Wood, et al. 1988; Hise, et al. 2000; or Torrens 2001).

Studies of Geographic Literacy

The final approach is the comprehensive, multidimensional tests of geographic knowledge (which I will refer to as studies of geographic literacy). This is perhaps the most complex approach in terms of survey design as there is no unified prescription for the elements of geography that should be included. While most of these types of studies include map identification sections (PLK), they also include questions covering other dimensions of geography, such as human geography and physical geography. Such tests of geographic literacy vary greatly in their content, scale, and objectives.

Some studies, such as the one developed by the Wisconsin Pupil Assessment Project (Laughlin 1985), focus on educational objectives. Still other studies are not trying to assess specific educational standards at all, and instead the content is developed to be “reflective of what one would read in the press, popular magazine, and what one would see on television” (Nolan 2002, 136).

The objectives included for assessment also vary across surveys. The survey instrument used in a study by McKinney, et al. (1989) focused solely on physical geography and map reading skills with no attention paid to human geography. The study by Eve, et al. (1994), on the other hand, did not cover physical geography at all, but focused on human and cultural geography as well as place location knowledge. Unique to their study, Eve, et al. (1994) included in their survey a section on icon recognition. The scale of the content also varies from study to study. Some surveys focus on local geography, such as Donovan's (1993) study of the geographic literacy of adults and schoolchildren in Dublin, Ireland. His study included multiple questions concerning local geography, while other studies, such as one conducted by Nolan (2002), specifically removed local references from the survey from which the study was adapted, to create a survey of U.S. and world geography. As is apparent from these few examples, there is little consistency in studies of geographic literacy.

The following section provides a more in-depth overview of several studies of geographic literacy conducted over the past twenty years. My survey was mostly influenced by the National Geographic – Roper 2002 Global Geographic Literacy Survey, but other research also affected the types of variables included in this study.

A Summary of Related Geographic Literacy Research

Both the 1994 and 2001 National Assessment of Educational Progress (NAEP) (National Center for Education Statistics 2002) studies were developed as nation-wide standardized tests of geographic knowledge for fourth, eighth, and twelfth graders. The NAEP is affiliated with the National Center for Education Statistics in the U.S. Department of Education. The NAEP is the “sole, ongoing national indicator of what American students know and can do in major academic subjects” (National Center for Education Statistics 2002, 1). The test included both multiple choice and constructed response/short answer questions and was developed so that equal test-taking time was devoted to each question type. The multiple choice questions focused on three types of geographic knowledge: “space and place,” “environment and society,” and “spatial dynamics and connections.” The grade appropriate surveys were administered to representative samples of public and private school students. Rather than report the actual score or number of questions correctly answered, the scores were divided into three NAEP-defined achievement levels: basic, proficient, and advanced. In addition to questions about geography, the study

included personal questions. With the personal information, the test performance results were compared among several subgroups of the sampled population. The results showed that males scored better than females, that white and Asian/Pacific Islanders scored higher than black and Hispanic students, and that students at private schools scored higher than those at public schools. The study also examined several school-related factors. It found that students whose teachers reported more classroom use of the Internet and CD-ROM resources scored higher than students whose teachers reported less use. Furthermore, the results indicated that students who reported studying countries and cultures at least once or twice a month performed better than students who rarely studied about other countries and cultures. Rather than identifying factors contributing to geographic literacy, the primary purpose of the NAEP geography assessments was to measure progress and improvements in geographic knowledge. And indeed, the results indicate that the average scores of fourth and eighth grade students have improved, whereas twelfth grade scores remain unchanged from 1994 to 2001 (National Center for Education Statistics 2002, 1).

In 1985, the Wisconsin Pupil Assessment Program developed a standardized geography test to assess the geographic knowledge of twelfth graders in the Wisconsin public school system. The need for the new assessment was a result of a greater inclusion of geography in the state's social studies curriculum (Laughlin 1985). The test that the authors developed measured eighteen specific geography objectives grouped into four basic dimensions of knowledge: geographic skills (including, for example, map reading skills, scale, and direction), cultural geography, physical geography, and place location knowledge (including countries, cities, landforms, and climate regions). Questions specific to Wisconsin geography were also included. The test was completely multiple choice and divided into two sections that would each take approximately 45 to 50 minutes to complete. The study found that students were most knowledgeable about cultural geography and geography skills (with an average score of 69 percent) and less knowledgeable about physical geography and place location (with an average score of 57 percent). Although the study also included demographic data and an attitude questionnaire, I unfortunately have been unable to locate any report that analyzed the test results using these variables.

To assess the geographic literacy of university students, Bein (1990) used a survey instrument written by the National Council for Geographic Education for use as a standardized

high school geography post-test⁶ (the *Competency-Based Geography Test, Secondary Level*). The test consisted of 75 questions that were grouped into similar categories used by the Wisconsin assessment: map skills, place-name identification, physical geography, and human geography. The test was administered to over 3,000 university students in Indiana. The results reveal that students scored highest on the place-name identification section (mean score of 75 percent), followed by maps skills (mean score of 70 percent), human geography (mean score of 63 percent), and, lastly, physical geography (mean score of 58 percent) (Bein 1990, 261). Test scores were then correlated with personal information and demographics. Consistent with most other studies, the results revealed that males scored higher than females. Age was not a significant factor overall, though in parts of the test it was; for physical and human geography, older people scored higher. Students in upper-college levels (juniors and seniors) scored better than students in lower levels (freshman and sophomores). Students who thought that their geography classes were boring had significantly lower scores than those who thought they were at least somewhat interesting; the study also found that students who took geography as an elective scored higher than students who took geography because it was required. Area of study was also found to be a significant factor. Students majoring in Arts and Sciences had higher average scores than those majoring in business, education, or other majors. Taking high school geography proved to have no significance on the scores, while students who took at least one college-level geography course scored higher than those with no college geography. Travel was also found to be an important indicator of geographic literacy. Those who traveled more frequently outside their home state scored higher on the test, as did those who traveled to more places outside their home state. Interestingly, the number of states a student lived in before age 17 had no relationship to geographic literacy, whereas the number of states lived in after age 17 did.

Another example of a standardized K-12 educational test being used for an unintended population is McKinney, et al.'s (1989) research on the geographic knowledge of preservice elementary education majors. McKinney, et al. (1989) used *The High School Subject Tests: World Geography*, published by Scott, Foresman and Company, to survey 124 undergraduate elementary education students at a university. The test consisted of 45 multiple choice questions

⁶ A post-test measures the level of knowledge after a course is taken, as opposed to a pre-test, which measures the level of knowledge prior to taking a course.

covering six content areas: basic definitions; chronology and seasonal change; determining direction, distance, and elevation; determining location; identifying landforms; and map reading. The study sought only to determine the level of geography knowledge of the preservice teachers, which, it turns out, was quite low, with an average of 27 out of 45 answers correct.

A modification of the *Oklahoma Geographic Competency Assessment* was used in a study of geographic literacy among adults (Nolan 2002). The study removed all questions specific to Oklahoma, leaving a 29 question survey of U.S. and world geography. In addition, the questions were considered “reflective of what one would read in the press, popular magazines, and what one would see on television” (Nolan 2002, 136). This is a change from previous standardized educational tests that focused on geography as learned in academic settings. The test contained questions on physical and political geography as well as place location knowledge. The survey was administered to two samples: the first included 161 adult students returning to part-time university study, and the second consisted of 160 adults randomly selected at a shopping center. The mean score of the student group was 18 out of 29, while the mean score of the shopping mall group was 16 out of 29, a difference that is very small but nevertheless statistically significant. The main purpose of the study was to identify factors associated with geographic knowledge. Level of prior education was found to be a significant influence in both samples, with more education leading to greater geographic literacy. Participants were also asked to identify their main sources for geographic information. Both samples listed books, formal classes, and television as their primary sources; in addition, newspapers were high on the shopping mall sample’s lists, while travel was listed as an important source for the student sample. While correlation of geographic literacy with travel was low, patterns emerged in the data to suggest that the more formal education that an individual has, the more benefit travel is to increasing a person’s geographic knowledge. Age was found to be a significant factor, with older people scoring better than those who are younger. Finally, even controlling for education, gender was found to be a significant influence; men scored higher than women.

The previously mentioned surveys all used standardized educational assessments for their research. The following two studies developed surveys specific to their own research. Eve et al. (1994, 409) created a survey to “isolate individual variations that inhibit or promote students’ acquisition of geographic knowledge.” The survey consisted of 50 multiple choice questions in

four areas: spatial locations of major geographic entities, place location knowledge, cultural literacy, and landmark/icon recognition. It was administered to 313 students at a single university. Statistical analyses identified factors associated with geographic literacy, but total or mean survey scores were not reported in the results. The authors examined several academic factors; grade point average was not related to geographic knowledge, whereas class standing (freshman, sophomore, junior, or senior) was. Engineering and natural science majors scored the highest, while social scientists and nurses scored the lowest. Increased reading was found to be associated with a higher score, but reading “geography” magazines was not. Neither the number of geography classes taken nor the recency of geography classes were found to be associated with geographic knowledge. The authors also explored the possible influence of travel. Students whose parents regularly traveled outside of the U.S. did not do significantly better than those whose parents traveled less; nor were scores significantly different between students who traveled outside of the U.S. three or more times and those who did not. Students whose parents or grandparents were born outside of the U.S. did not score higher than students with U.S.-born parents or grandparents. Students from the western U.S. scored higher than students from other parts of the country, and foreign-born students scored slightly worse than those who were born in the U.S. In this study, the strongest correlates to geographic knowledge were race, age, and gender.

In designing his own survey, Donovan (1993) explained that his instrument was designed to measure knowledge and factual recall, not higher-order educational objectives, such as synthesis and evaluation. The majority of the questions (thirteen) were map identification questions, but the survey also included seven multiple choice questions. The questions covered local, national, and global geography. The survey was administered to both adults and school children. The scores were examined in relation to the demographic data that he had also collected. Social class as measured by property value was a significant influence on geographic knowledge among adults. Gender was found to be significant factor for both adults and children. Education was also found to be important. In the adult sample, those who attained higher levels of education scored higher on the test as did the children who had higher levels of geography education. Travel was only found to be significant in the adult sample. Television watching was not related to geographic knowledge, but reading about international news in the newspaper was. Age was not found to be a factor. In his study, Donovan (1993) also investigated how

representative PLK was of geographic knowledge in general. After comparing the results of the map identification section to the multiple choice section, he concluded that indeed PLK appeared to be a good indicator of general geographic knowledge.

National Geographic Survey

Finally, I provide a thorough review of the 2002 National Geographic – Roper Survey of Geographic Literacy (henceforth to be referred to as the National Geographic Survey), from which my own study is adapted. As with other studies of geographic literacy, the National Geographic Survey combines various elements of geographic knowledge in order to provide a more comprehensive assessment (National Geographic 2002). The content focus is similar to that in Nolan’s (2002) study in that it focuses on geographic knowledge in the context of global current events. This is a departure from the majority of geographic literacy surveys, such as those by Bein (1990) and Laughlin (1985), which were developed for use as standardized educational post-tests.

Built on the idea that “broad and integrated geographic knowledge is critical to becoming a global citizen” (National Geographic 2002, 1), the survey sought to assess general geographic knowledge that emphasized geography for understanding the context of current events, in addition to PLK and developing a spatial perspective. Another factor that distinguishes this study from most other studies of geographic literacy is that the National Geographic Survey examined young people’s (ages 18 to 24) attitudes towards and perceptions of geography.

The National Geographic Survey was developed as a follow up to a 1988 National Geographic study of geographic knowledge among young adults in the United States (National Geographic 2002, 1), and is perhaps the largest study of its kind. The National Geographic study expanded the scope of the 1988 project to include a world-wide comparison of geographic literacy among representative samples of 18- to 24-year-olds in the U.S., Canada, France, Germany, Great Britain, Italy, Japan, Mexico, and Sweden. The National Geographic Survey was administered to a total of 3,250 young adults. It consisted of three parts: attitudes towards geography, geographic knowledge, and a demographic profile. I discuss the results for the latter two parts here because they are integral to my study.

The geographic knowledge section, which is referred to as the “quiz,” contained questions designed to measure the geographic literacy of the respondents. The quiz tested two

types of geographic knowledge: maps skills and knowledge of world issues and current events. The questions were further categorized by topic, as shown in Table 3.1 below.

Table 3.1
Categories and Topics in Geographic Knowledge Questions Used in the 2002 National Geographic – Roper Survey of Geographic Literacy

| Map Skills* | World Issues/Current Events** |
|--|--|
| A. Navigational Skills B. Country Identifications (identified from the following maps): <ul style="list-style-type: none"> • Map of Europe • Map of Asia • Map of the World | A. Population B. Natural Resources and Weather C. Health D. Religion and Politics E. Economics F. Nuclear Weapons |

Source: *National Geographic (2002)*

* Total of 41 questions

** Total of 11 questions

In addition, only the U.S. sample was asked questions regarding popular culture, U.S. immigration, and location of U.S. states. Out of a total possible score of 56 points, the U.S. sample averaged 23 (National Geographic 2002, 16). Only those from Mexico did worse, with a score of 21 (*ibid.*).

The third section of the survey, the demographic profile, included questions about the respondents' age, sex, travel history, geography education, languages spoken, education level, sources of news, magazine subscriptions, and Internet usage. U.S. respondents were also asked which member of their family was the first to be born in the U.S. The demographic data were used to examine the factors associated with the level of geographic knowledge revealed by the results of the quiz. The influential factors were summarized in the report:

1. *Education*: “Respondents who completed more school and those who reported taking a geography course in school did somewhat better on the survey than those who did not” (National Geographic 2002, 8). Interestingly, in the U.S. sample, respondents with at least some college education had an average score of 30 out of 56 compared to an average of 21 for those with less education (*ibid.*, 8).

2. *International travel and language skills*: “Respondents who travel internationally and/or speak more than one language did better on the survey”

(ibid., 8). Furthermore, among the U.S. sample, the average score of respondents who had traveled outside of the country in the past three years was 31, compared to an average score of 22 for those who had not traveled (ibid., 9).

3. *Internet usage*: “Those who accessed the Internet in the past 30 days performed better on the quiz” (ibid., 45).

4. *Media usage*: “With a few exceptions, countries where young adults had a well-rounded diet of media sources generally performed better on the survey. Young people internationally reported making more varied use of media to keep up with current events than did those in the U.S.” (ibid., 9).

5. *Age*: (Age was only examined in the U.S. samples, which was possible because an additional group of 25- to 34-year-olds was also surveyed) “On some questions, young Americans ages 18 to 24 performed more poorly than did their slightly older counterparts, 25- to 34-year-olds” (ibid., 9).

6. *Gender*: “In all countries except France, men tended to answer more questions correctly than women. Across all nine countries surveyed male respondents answered an average of 29.2 questions correctly, while females answered 25.8 correctly” (ibid., 10).

Overall, the results of the survey indicate that the U.S. sample is more knowledgeable of geographic issues closer to home or that affect U.S. life, than they are of world issues and events. This finding is consistent with both sketch map research and PLK research that found that people are more knowledgeable about places closer to home (Saarinen, et al. 1996; Torrens 2001). Young adults in the U.S. also have fairly strong navigational skills, but their ability to locate countries on maps is poor.

Factors Related to Geographic Knowledge

Just as there are many ways to measure geographic knowledge, studies of geographic literacy examine numerous variables for their relationship to geographic knowledge. Furthermore, in the cases in which similar variables are included in different studies, different ways to measure the variable are found across the literature. This section will focus not on the results of the studies, as results were described in the previous section, but will examine the

numerous variables explored and the many ways the factors are defined. While the specific factors examined in the studies can vary, for organizational purposes, I have divided them into four broad categories: demographic, educational, travel experience, and media usage.

Demographics

Gender far the most frequently considered factor, and the most consistent in terms of findings. Males significantly outperformed females in almost all geographic literacy studies and place location and mental mapping studies. There is no conclusive research to explain the gender gap, but there are three modes of thought for explaining these differences: deficiency theory, difference theory, and inefficiency theory. The deficiency theory contends that spatial ability is related to human physiology and hormonal levels and that differences in physiology and hormones between men and women lead to differences in spatial ability (Kitchin 1996, 274). Studies advocating the deficiency theory are generally conducted by psychologists rather than geographers and the focus of the studies is on spatial ability which may not be directly related to geographic knowledge. Henrie et al. (1997, 606) argues that “although map reading bears some surface similarity to spatial reasoning tasks, the comparison may not be appropriate.”

The more widely accepted theory among geographers is difference theory, which contends that “the sexes differ because of a range of socio-cultural factors, such as early childhood training and expectations, parental and institutional expectations, stereotyping and experience, and differences in the courses taken at school level” (Kitchin 1996, 274). For example, studies on geographic literacy have suggested that the gender gap may be attributed to differences in socialization or cognitive style (Eve, et al. 1994; Henrie, et al. 1997) and differences in exposure to geography (Bein 1990; Henrie, et al. 1997).

The inefficiency theory suggests that men and women do not actually differ in their geographic abilities, but that the way geographic ability is tested or measured favors male problem solving strategies (Kitchin 1996, 274). Henrie, et al. (1997, 619) also supports the inefficiency theory when they suggest that gender differences in their study of geographic knowledge may be “due to test factors that are unrelated to background knowledge.”

Race, which is notoriously difficult to define, was included in two of the studies that I reviewed. Both studies used similar racial categories: white, black, Hispanic, or Asian (Eve, et

al. 1994; National Center for Education Statistics 2002). As with gender differences, racial differences are assumed to occur due to educational and socialization differences.

While measuring age would appear to be rather straightforward, it is not. Each study used different age intervals to compare age groups. For example the 2002 National Geographic Survey measured just two age groups, 18-24 and 25-35. Bein (1990), on the other hand, included five age categories with smaller age intervals: 17 and under, 18-24, 25-35, 35-44, 45 and older. And Donovan (1993) had more categories than the 2002 National Geographic Survey, but at larger intervals: 18-31, 32-51, 52 and older.

An infrequently studied variable, perhaps due to the difficulty in directly assessing it, is socioeconomic status. In his study, Donovan (1993) surveyed populations in three Dublin neighborhoods representing three general socioeconomic levels. He (Donovan 1993, 83) found that there was “a clear gradation in mean scores between the lower, middle and upper income areas.”

Eve, et al. (1994) studied other demographic factors, including whether the parents or grandparents of the students were born overseas. They measured the location of students' home residency by asking students to identify the U.S. region in which they grew up. Unfortunately, the study did not specify the regions from which the students were to choose; it indicated only that students from Western states performed slightly better than students from other parts of the country (Eve, et al. 1994, 722).

Educational

Because many studies of geographic knowledge are conducted for educational purposes and it is thought that geographic knowledge is learned in schools, various variables related to education have been examined. Many studies have explored the effect of education level on geographic knowledge. Education level has been measured in various ways. Because they were studying university populations, Bein (1990) and Eve, et al. (1994) used the traditional U.S. university classification system: freshman, sophomore, junior, senior, and graduate. Studies using samples of the general population provide more wide-ranging options. The National Geographic Survey (National Geographic 2002) employed the following categories: less than high school, high school graduate, technical/trade school, some college, college graduate, and graduate/professional school. Nolan (2002) used an even more specific categorization: high

school, high school plus one year of college, high school plus two years of college/associates degree, high school plus three years of college, BA/BS, MA/MS, and Ph.D.

College major is often examined in studies of university students. Both studies that considered this factor (Bein 1990 and Eve, et al. 1994) grouped the majors into general categories. In Bein's study, this included just Arts and Sciences, Business, and all other majors. Eve, et al. included social sciences, liberal arts, engineering, business, architecture, natural science, and nursing.

Other issues related to college education have also been considered. Eve, et al. (1994) measured grade point average in .49 increments on the tradition four-point grade scale. Bein's (1990) study included the most distinctive educational factors of any of the studies. To measure interest in geography, students were asked to rate their past geography class using a five-category Likert Scale: interesting, somewhat interesting, neutral, somewhat boring, or boring. The recency of geography classes was measured as elementary school, middle school, high school, or college. Students were also asked to indicate how many college and how many high school geography classes they had taken. The National Center for Education Statistics (2002) study asked teachers to determine how often they studied different countries and cultures; teachers could rate their activity as: almost every day, once or twice a week, once or twice a month, or never or hardly ever.

Travel Experience

The possibility that travel might influence geographic knowledge relates to results of studies on mental mapping and perception of place. A 1986 study by Saarinen, et al. (1996) hypothesized that when drawing a map of the world, a person's home country would be exaggerated in size compared to its actual area due to a greater knowledge and perceived importance of the area, while places farther from the home country would be diminished in size. They further indicated that the more places one visits, the more familiar that they will become with those places and the greater knowledge they will have of them.

Travel has been measured in various ways. The National Geographic Survey (National Geographic 2002) and Eve, et al. (1994) both examined travel outside of the participants' home countries, while Bein (1990) included travel outside the home state as well as the home country. Both the number of times a person has traveled (National Geographic 2002; Bein 1990; Eve, et

al. 1994) and the number of places visited (Bein 1990) have been studied. In the National Geographic Survey, recency of travel was incorporated into the measurement; data were collected on the number of times a participant traveled in the past three years. While Bein (1990) did not specify time of travel, he did investigate the effects of living in different states/countries prior to age 17 and after age 17.

Media Usage

Media and other informal, non-academic channels of learning are also thought to play a role in education, and indeed, most studies support the idea. Studies, such as those done by Roberts (2003) and Bunin (2001), were designed to explore the relationship between media and geographic knowledge. Both studies concluded that media usage is a significant factor in enhancing geographic knowledge.

Various aspects of media are often assessed in studies of geographic literacy. Both the National Geographic Survey (National Geographic 2002) and NAEP (National Center for Education Statistics 2002) examined Internet usage. The National Geographic Survey simply asked whether the participant had accessed the Internet during the past 30 days, while the NAEP developed a more precise measure. In the latter study, teachers were asked to rate their extent of use of Internet/CD-ROM's in the classroom according to the following categories: small, moderate, or large extent, or not at all (National Center for Education Statistics 2002). The National Geographic Survey asked participants to indicate whether they used newspapers, magazines, radio, television news, or the Internet to keep up with current events (National Geographic 2002), and Donovan (1993) measured the frequency with which participants read about international news in newspapers/magazines as: everyday, most days, occasionally, or never/almost never. Nolan (2002) had participants rank their top sources of geography information; the list of choices included: formal classes, books, television, newspapers, and travel. The amount of time spent using media has also been measured. Donovan (1993) included the average number of hours of television watched each week, and Eve, et al. (1994) measured the number of books read per year. And finally, Eve, et al. (ibid.) and the National Geographic Survey included a list of geographic/news magazines and had participants indicate whether they regularly read any of the magazines.

The Approach of this Study and Place in the Literature

Although there are numerous perspectives and approaches in the literature, I chose to use the geographic literacy approach, which I believe is more suited to studying factual geographic knowledge than are either sketch map or simple PLK studies, which assess only one dimension of geographic knowledge. I chose to approach geographic knowledge as can be revealed in the context of current events and general knowledge, rather than as purely academic knowledge. As is common in many studies of geographic literacy, the survey that I used was adapted from a previously developed instrument.

Consistent with other research, my study of geographic literacy will also examine the factors related to geographic literacy. It will strengthen previous findings by investigating similar variables, but will also contribute to the research literature by exploring new variables.

CHAPTER 4: METHODOLOGY

In this chapter, I explain the methodology employed for this research, including the development of the survey instrument, sampling of the population, administration of the survey, and the methods used to analyze the survey data.

The Survey

The survey instrument used for this project (Appendix 1) was adapted from the *National Geographic – Roper 2002 Global Geographic Literacy Survey* (National Geographic 2002). Many studies of geographic literacy, such as those by Bein (1990) and Nolan (2002), used a survey instrument that was designed for a different study. There are two primary reasons that I chose to adapt the National Geographic Survey rather than to create a new one. First, maintaining the format and wording of the questions from the National Geographic Survey provides validity to the survey. National Geographic contracted with RoperASW, an international survey research and consulting firm, to design the survey. Knowing that experts in survey design created the instrument provides assurance that the questions were well written and the design was well researched and tested. Secondly, using a survey that has been used in a different study allows comparison of results to that study.

I specifically chose the National Geographic Survey for three main reasons. First, the complete survey instrument was made available through the National Geographic website and thus was easily accessible. Second, I wanted to examine geographic literacy in the context of current events and general knowledge, which the National Geographic Survey does. Third, the results of the National Geographic Survey were publicized throughout the country in both academic and popular media. As the public was once again reminded of the limited geographic knowledge of U.S. students, I wanted to extend the scope of the National Geographic Survey and examine geographic literacy among college students, rather than young people in general.

Survey Design

While the survey used in this research was based on the National Geographic Survey, there are distinct differences between the two, particularly in the design and delivery of the survey. The National Geographic Survey was administered in-home and in-person. The

questions were read out loud by the interviewer and respondents were shown cards with the questions and maps on them. The interviewer recorded the answers. By having the survey presented to them orally, people of all educational levels were able to participate; the ability to read and write was not a prerequisite. This allowed for a more representative sample nationwide.

In contrast to the National Geographic's nation-wide sample, the survey used in this study was designed to examine geographic knowledge within a small subpopulation of young adults: undergraduate college students at Virginia Tech. A certain level of education, at minimum the ability to read and write, is assumed to exist among college students. The admission process for Virginia Tech requires applicants to write a personal essay, take a college entrance exam, and have an adequate grade point average. It is highly unlikely that an illiterate student could gain acceptance into Virginia Tech. For this reason, and for efficiency, this survey was a self-administered questionnaire rather than a face-to-face interview.

Traditionally a questionnaire is completed with pen/pencil and paper. The survey is delivered or mailed to the respondents, or the respondents are asked to go to a specific location to take the survey. These methods were considered for the administration of this survey, but neither was ideal. The monetary cost of mailing surveys can be high. Furthermore, mail surveys are notorious for having low response rates (Dillman 1991). A large number of surveys would need to be mailed out in order to obtain an adequate number of responses. To ensure the necessary diversity of respondents in terms of age, academic class, major and residency status, I decided to administer the survey using the Internet.

Internet Surveys

The use of the Internet for conducting surveys is a relatively new phenomenon and the body of research on the effectiveness of Internet surveys is continually growing. In his book *Mail and Internet Surveys: The Tailored Design Method*, Dillman (2000) suggests that Internet surveys have a similar response rate to mail surveys. A primary benefit of the Internet survey over the mail survey is the cost (Tse 1998, Dillman 2000). In order to increase the number of respondents, a survey can be sent by mail to a greater number of people, but the larger the sample, the higher the cost for copies and postage. This is not the case for Web-based surveys. The cost is the same whether electronically distributing a survey to 10 people or 1,000. Tse

(1998) cites that faster transmission of the survey to participants is another advantage of using Web-based surveys over traditional mailed surveys.

While not documented in research, another potential benefit to using an Internet survey is the flexibility it provides the respondent. The survey can be taken at any time and in any place that is convenient, whether that be at home, late at night, or in the library between classes. It has the potential to include participants who may not be willing to give up their free time to meet during conventional times at a designated place to take a survey. However, this potential benefit has also been a criticism of Web-based surveys. Moss and Hendry (2002, 585) propose that the shorter attention span of Internet users and the distractions posed by the World Wide Web (for example, “surfing the net” while taking the survey) may negatively impact the response rate or the quality of the responses received. They also note that Internet users may be reluctant to open e-mail from an unknown sender for fear of infection of a computer virus, or because they believe it is Internet “junk mail.”

Dillman (2000) cautions that current computer and Internet access is inadequate for most Web-based surveys. His concern though, is for surveys that aim to obtain a sample of the general population. He (2000, 355) explains that if only part of the population has access to the Internet (which is the current situation even today), “then there is no possibility for listing general populations and drawing a sample in which nearly every adult in the U.S. population has a known nonzero chance of being selected for participation in a survey.” The situation for this research project, however, is very different. The population from which the sample was drawn was not the general U.S. population, but undergraduate students at Virginia Tech. Every student at Virginia Tech is given an e-mail address upon entering the University. Computer labs, available to all students, are abundant on campus. Furthermore, since 1998, the University has instituted a requirement that all students own a personal computer. Therefore, computer and Internet access is not an issue among this particular population, and an Internet-based survey can be effective.

The survey was created with *survey.vt.edu*, an on-line survey program made available by Virginia Tech. The software provides the basic tools to create and format a survey. It also acts as a host for the survey website and stores survey responses on its server. I designed the survey webpage using both the point and click platform provided by *survey.vt.edu* and HTML coding

for the more complex formatting of the survey. The survey can be viewed on-line at: <https://survey.vt.edu/survey/entry.jsp?id=1050500809901> (See Appendix 1).

Dillman (2000) points out that there are different factors involved in designing a survey for the Internet compared to designing one for paper. Colors, formatting, and the visual appearance in general may look different on different computers due to such factors as the use of different operating systems (PC and Mac), Web browsers (Internet Explorer and Netscape Navigator), or screen configurations. When drafting the Internet survey, I tested the survey using different operating systems, Web browsers, and monitor sizes to ensure the readability on all types of computers. I also sent the survey to approximately twelve people, mainly graduate students and students from other universities who would not be included in the sample, to obtain feedback on the colors and formatting of the website. During the development, I also had the testers provide feedback on the ease of use and logic of the survey. Survey.vt.edu provides only the most basic tools for survey making so conditional formatting and “skip” pages were not available⁷. Because the survey included a few questions in which the answer dictates the next question asked, the survey testers helped me to develop the most effective and least confusing way to indicate when a question needed to be skipped.

In addition to the text of the survey, graphics were also needed. Only one map that was used in the National Geographic Survey was available for use in this survey (the navigation map). The place identification maps and the choropleth map were created using ArcView GIS software and the isopleth map was obtained from the World Wide Web. Formatting issues, in particular color and font, were a main concern in creating the maps so that they would be easy to read regardless of the computer used to view the images.

Lastly, anticipating that survey participants would want to know the answers to the “quiz” sections of the survey, a webpage was designed with the questions and corresponding answers highlighted. So that participants could not access the answers while they were taking the survey, the link to the “answers” page was provided only after the survey was submitted, on the final screen which also thanked respondents for their participation.

⁷ Many commercial survey software packages are designed to allow certain questions to be automatically “skipped” when a question is answered a certain way and the participant is automatically connected to the next appropriate screen. For example, if there are questions that only women need to answer and a respondent indicates their sex as male, the computer will automatically skip the female questions and go directly to the webpage with the questions appropriate for men. Skip pages are an ideal way to avoid confusion as to which questions need to be answered by whom since only questions appropriate to the specific participant are viewed.

Perhaps the primary drawback to self-administered surveys in which the purpose is to assess knowledge about a subject is the potential for cheating. When a survey is administered in person, a participant would not have the opportunity to consult with other people, books, or websites to obtain the answers to questions. When administered on-line however, there is no way to know if a student consulted other sources for the answers. To reduce this risk, the e-mail that was sent to invite participants to take the survey made clear that the survey was anonymous and participants were not expected to get all the answers correct. The survey was not for a grade or extra class credit; nor would it have any influence on the participants' academic standing. The instructions stated that participants were not to consult any sources for the answers, nor were they to share the questions with other survey participants. When the link to the survey answers was provided after submission of the survey, they were requested not to provide the link to other survey participants.

Yet another potential problem with using an Internet survey is the possibility of a person taking the survey more than once (perhaps a tempting idea when participants are entered into a drawing for prizes). To eliminate this problem, participants in this survey were required to enter their unique Virginia Tech-issued personal identifier and password in order to access the survey. Each PID/password was allowed to enter the survey site one time. This protection measure had the additional benefit of ensuring that only Virginia Tech students could participate.

Participant Incentives

Providing a monetary or other incentive is an effective method for increasing survey participation (Dillman 2000). The large sample size and the limited amount of funds available prohibited compensation to each individual. Instead, each student who submitted a survey was entered into a drawing. The prizes consisted of one \$100 prize, two \$50 prizes, five \$20 prizes, and 20 beach ball globes and 20 U.S. maps.

Modifications to the Survey Instrument

The survey used for this study was divided into the same three sections (although titled differently) as those in the National Geographic Survey. The sections were: 1) attitudes and opinions, 2) the world and world events, and 3) background. The analysis presented here

examines responses to the second and third sections only because those are the sections which relate to my research questions.

The survey tested the most basic level of geographic knowledge. The majority of the questions were taken directly from the National Geographic Survey.

I attempted to maintain the structure of the National Geographic Survey, but modified a few of the questions, eliminated a few, and added some new ones. The question format was modified, in part, because the method of administration was changed from face-to-face to self administered. More importantly, convincing a large enough number of undergraduate students to take the survey was the primary concern taken into account when adapting the survey. I suspected a possible impediment to participation would be the length of time it took to complete the survey. After informal consultation with graduate students regarding the amount of time they would hypothetically volunteer, I decided that I should design the survey so that it did not take more than approximately 15 minutes to complete. This time constraint required shortening the survey. Furthermore, the content was modified to encompass a greater range of geographic concepts. The following section describes the modifications of the National Geographic Survey in sections two and three.

Section Two: The World and World Events

Similar to the National Geographic Survey, this section is divided into two parts: world knowledge/current events and map skills. The world knowledge/current events section of the National Geographic Survey, which was administered to the U.S. sample, consisted of 12 questions worth 16 points. In the survey used for this study, this section consisted of 14 questions worth 15 points (one question required two answers and thus was worth two points). Consistent with the National Geographic Survey, the questions were multiple choice, with only one free response question. As in the National Geographic Survey, participants were instructed to select the “don’t know” option of the answer choices, rather than taking a random guess, if the participant truly did not know the correct answer. This is so that actual geographic knowledge can be more accurately assessed. The following is a summary of the modifications made to the world knowledge/current events questions:

World knowledge/current event question deleted from the National Geographic Survey

- “Can you name four countries that officially acknowledge having nuclear weapons?”

This question was eliminated because during the time I was designing the survey, the media was reporting on possible nuclear weapons being created in North Korea, as well as the possible nuclear threat of Iraq. Because speculation was abundant in the media, I thought it would be difficult to accurately determine the correct answer.

New world knowledge/current event questions added

- “Increasing emissions of carbon dioxide could lead to which of the following environmental consequences?”

The aim of this question was to broaden the scope of geographic knowledge assessed, specifically to provide more questions regarding the physical environment.

- “Which of the following ethnic groups is the largest non-Arab minority in Iraq?”

This cultural geography question was also included to broaden the survey’s scope. The conflict in Iraq occurred at the time that the survey was developed and administered, promoting much media discussion about the Iraqi Kurds, which was readily available to the general public.

Modified world knowledge/current events questions

- A National Geographic Survey question asked participants to choose from a list two countries that have a population of at least one billion. But the list of countries was not included in the National Geographic Survey report and therefore I had to create my own list. Thus, it cannot be assumed that this question was identical to the National Geographic Survey. My list included twenty-four countries from North America, South America, Africa, Asia, and Europe.
- The National Geographic survey question based on the popular television show, *Survivor*, was updated to reflect the season of the show that was airing at the time the survey was administered.
- The final question modified was that asking which world region was the largest exporter of oil. The results of the National Geographic Survey showed that 81 percent of the U.S. respondents answered this question correctly; this score was higher than that of any other question in the world knowledge/current events section. I reworded the question in an

attempt to better assess students' knowledge of resource geography. The new oil-related question was: "Which of the following countries is *not* a major oil producer?" It is based on a question asked in Donovan's (1993) study of geographic literacy.

The second part of the World and World Events section of the survey covers map skills; this part has been greatly shortened compared to the National Geographic Survey, from 51 questions to 29. General differences between the two surveys are shown in Table 4.1

Table 4.1
Comparison of Number (n) and Type of Maps Skills and Place Identification Questions in Each Survey

| National Geographic Survey (n = 51) | Modified Survey (n = 29) |
|---|--|
| A. Map Skills <ul style="list-style-type: none"> • Navigation (n = 2) B. Place Identifications <ul style="list-style-type: none"> • World (n = 16) • U.S. (n = 10) • Asia (n = 11) • Europe (n = 12) | A. Map Skills <ul style="list-style-type: none"> • Navigation (n = 2) • Map Reading (n = 2) B. Place Identifications <ul style="list-style-type: none"> • World (n = 14) • U.S. (n = 5) • Middle East (n = 6) |

Source: *National Geographic (2002)* and *Survey of Geographic Literacy and World Knowledge* (author's survey instrument)

The navigation questions remain unchanged from the National Geographic Survey, and the same map image was used. Two map skills questions are unique to this survey and were included to assess students' ability to comprehend map legends and analyze maps using two different map formats: isopleth (contour) maps and choropleth maps. These two questions were added to provide a more well-balanced assessment of map skills because understanding maps requires more knowledge than simply knowing directions on a compass rose. The choropleth map was created using ArcView GIS, and the isopleth map was obtained from the World Wide Web.

The number of place identification questions was reduced almost by half (from 49 to 25) compared to the National Geographic Survey to reduce the focus on place location knowledge and to maintain the 15 minute time limit. The countries to be identified on the maps were also changed. For this survey, I used only three maps for place location: world, U.S., and Middle East. I eliminated the Europe map used in the National Geographic Survey primarily because of

time constraints, and I focused on the Middle East rather than all of Asia because of the media attention that the region was receiving at the time that the survey was conducted.

The world map country/place identification questions were reduced from 16 to 14. The National Geographic Survey appeared to be euro-centric, as the highest percentage of country identifications were of European countries. The world map identification was modified to provide better world-wide representation of countries, as well as to include countries receiving attention in the news at the time. Table 4.2 compares the countries to be identified on the world maps in each survey.

Table 4.2
Comparison of Countries Identified on World Map in Each Survey

| National Geographic Survey (n = 16) | Modified Survey (n = 14) |
|--|-----------------------------|
| United States | United States |
| Russia | Russia |
| Japan | Japan |
| France | France |
| Mexico | Mexico |
| United Kingdom | United Kingdom |
| Pacific Ocean | Pacific Ocean |
| Egypt | Egypt |
| Argentina | Argentina |
| Canada | India |
| Italy | North Korea |
| Sweden | Iraq |
| Germany | Nigeria |
| Afghanistan | Pakistan |
| Israel | |
| Cuba | |

Source: *National Geographic (2002)* and *Survey of Geographic Literacy and World Knowledge* (author's survey instrument)

I included Nigeria in order to provide more representation of Africa and because it was receiving attention in the news at the time regarding human rights issues. I added North Korea and India to provide better representation of Asia. At that time, North Korea received much media attention in regards to nuclear weapons. India was chosen because of the large percentage of Indian students at Virginia Tech. Iraq was chosen because the survey was administered during the 2003 conflict in Iraq.

The National Geographic Survey also included a map identification section covering Asia. For the purpose of this survey, the section focused on a smaller part of the continent: the Middle East. The Middle Eastern countries that were part of the Asia map on the National Geographic Survey (6 out of 11) were transferred to the Middle East section on this survey. The countries to be identified were: Pakistan, Saudi Arabia, Afghanistan, Israel, Iraq, and Iran. As with other sections, time constraint was the main reason for the reduction. The Middle East was chosen rather than, for example, the Far East, because of the current events at the time (the U.S. invasion of Iraq and the war on terrorism in Afghanistan).

The last map identification section in this survey asked respondents to identify states in the U.S. While the National Geographic Survey included ten state identifications, to maintain the time limit, I reduced it to five states on my survey. I kept the three states that contained the largest cities in the U.S. -- New York, California, and Illinois -- which were included on the National Geographic Survey, but the other two states were unique additions. I added Virginia because it is the current place of residence of students taking the survey and Nebraska, which was chosen for its rural character and lack of major urban area as a contrast to the other states to be identified.

Each of the three place identification maps used in this survey were created using ArcView GIS (the maps used in the National Geographic Survey were not included in their report). For the U.S. map, the states were labeled 1 through 50. The countries in the Middle East region map, (the western-most country being Turkey and the eastern-most being Pakistan) were labeled with the numbers 1 – 12. For ease of viewing, only 53 countries were numbered on the world map. While the majority of larger-area countries were labeled with a number, I did not label every country.

Section Three: Background

The background section of this survey was much more extensive than that in the National Geographic Survey. The National Geographic Survey compared the geographic literacy of young adults in nine countries. This survey is comparing various characteristics of a single population; thus more demographic/background information was needed in order to identify the variables associated with geographic literacy.

Most of the demographic questions asked in the National Geographic Survey were used for this survey. Questions that were included about age, gender, number of languages spoken, travel, media usage, and junior/high school geography education are similar to those from the National Geographic Survey.

A few of the variables measured by the National Geographic Survey were omitted in this study. Internet usage was eliminated as a variable because by taking the on-line survey, the participants were obviously accessing the Internet. I eliminated the question regarding the last grade of school completed because the survey was administered to college students; this question was replaced with one about their college class level (freshman, sophomore, junior, senior). Lastly, I eliminated a question asking which magazines were regularly purchased because it was not used in the analysis of the National Geographic Survey, and I think it was included for commercial purposes of the National Geographic Society.

Other variables were added either to determine certain characteristics, such as whether students were geography majors or study abroad participants, or because the variables were used in other similar surveys, such as number of countries visited and grade point average. A few variables were created to examine other potential influences on geographic knowledge that were not investigated by other researchers: number of international friends, completion of Virginia Tech's Core Curriculum Area 7 requirement (an aspect of "internationalizing" the curriculum), and location of high school. The measurement of these variables will be discussed in a later section in this chapter.

Sample Population

To address the research questions posed by this project, the survey was e-mailed to a sample of 1,943 undergraduate students at Virginia Tech. I compiled a large sample because the voluntary survey participation rate is notoriously low. I estimated a participation rate of 30 percent, which would result in 583 submitted surveys.

A random sample of 1,000 undergraduates obtained through the Virginia Tech Office of Institutional Research comprised the bulk of the sample. This general sample was selected to represent the widest range of college students and to provide a wide variety of variables to analyze.

To ensure that adequate data were available pertaining to certain variables to be examined, additional samples of several sub-populations were included. The sub-samples consisted of geography majors, international studies majors, international students, and study abroad participants. The survey was sent to all 61 geography majors and double majors. The geography sample was provided by the Department of Geography. The International Studies program provided its department ListServ membership roster, and thus all 223 international studies majors were included in the sample. The Office of Institution Research provided a sample of 400 undergraduate international students.

The most difficult sample to obtain and process was that of study abroad participants. The Virginia Tech Office of International Research, Education, and Development (OIRE) provided a list of students who had participated in semester or year-long study abroad trips. While OIRE provides management for much of the study abroad activities at the University, they are not involved in all such activities, primarily those short-term study abroad trips arranged through specific departments or individual faculty. Thus, for the purpose of this study, study abroad refers to semester or longer programs. Shorter trips were still measured through questions regarding travel in general. The list provided by OIRE consisted of 574 students who had participated in study abroad since the Spring 2000 semester. The list included the name of the student, the term of participation, and in some, but not all cases, the e-mail address. It did not indicate the academic level of the students. In order to verify that the student still attended Virginia Tech and to obtain their e-mail addresses, I obtained information on each student in the 2002-2003 Virginia Tech directory. Any student who was not in the directory was eliminated from the list; any student whose major was listed as veterinary science or public administration was eliminated because those departments offer only graduate programs and this research was limited to undergraduate students. After processing the OIRE lists in this manner, 304 students remained and were included in the study. Admittedly, the Virginia Tech directory method was not completely accurate because some graduate students were possibly included (because class level is not indicated in the directory) and some undergraduate students were probably omitted because their information was unlisted. However, with the resources available, it was the best means that I had to identify current undergraduate students who had participated in study abroad programs.

Lastly, the samples were cross-referenced to eliminate any duplicate entries (such as geography majors who participated in study abroad, or international students who were international studies majors); 45 students were found to be in multiple samples. Table 4.3 shows the structure of the samples.

Table 4.3
Components of Sampling Frame for Survey of Geographic Literacy and World Knowledge

| General (non-foreign) | Foreign Students | Geography Majors | International Studies Majors | Study Abroad Participants | Multiple Samples | Total Sample |
|------------------------------|-------------------------|-------------------------|-------------------------------------|----------------------------------|-------------------------|---------------------|
| +1000 | +400 | +61 | +223 | +304 | -45 | 1943 |

Source: author's research

Survey Administration

After receiving approval from the Institutional Review Board (IRB #03-172), the survey site was opened on April 17, 2003. The survey could be accessed through five different Web addresses. While the survey was exactly the same on all five sites, for organizational purposes, each sample (the sample populations will be described in the next section) was directed to a separate site.

The first solicitation e-mail was sent on April 17, 2003 (Appendix 2). The e-mail described the purpose of the study, explained the drawing, and included the statement of informed consent (Appendix 3) as required by the IRB. By selecting the link to access the survey, consent was implied. The e-mail also explained the procedure for withdrawing from the survey. Second and third reminder e-mails were sent on April 23, and May 7, respectively (see Appendix 4) to students who had not completed a survey or had not formally withdrawn from the study. The survey site was closed on May 9, 2003, the last day of spring semester classes at Virginia Tech.

The prize drawing was conducted on May 12, 2003, and winners were notified by e-mail. The participants were asked to provide their e-mail address on the survey in order to be notified if their name was drawn. Prizes were either picked up in person or mailed to an address specified by the winner. Additional winners were drawn for prizes that were not claimed after two weeks.

Glitches in Administration

After the first solicitation e-mail was sent out, several e-mails were returned due to typos in their e-mail addresses. After verifying the addresses, they were corrected and re-sent. Correct e-mail addresses could not be located for two students from the International Studies list.

After notification from several people that they were unable to access the survey site established for the general sample, I determined that the problem was too many people trying to access the site at the same time and thus overloading the site. To rectify the problem, I opened an additional site for the general sample. Students who contacted me about the problem were directed to the new site. In the following reminder e-mails, the general sample was split in half, each half receiving a web-link to a separate survey site. This appeared to work because I was not alerted to this problem again once the second site was established.

Four students also contacted me because their PIDs/passwords were not working, and they were not able to access the survey. For these students, I set up a site which did not require a PID/password to enter. After they submitted the survey, I verified their e-mail addresses against the sample list to ensure that they were Virginia Tech students; I also cross-checked their address against all other survey submissions to ensure that they did not submit multiple surveys.

Some students were unable to access the graphics on the survey because the graphics were not considered “secure.” The graphics could not be stored on the survey.vt.edu server and so were stored on another Virginia Tech server (filebox.vt.edu), which I later learned was not secure. When accessing the survey, participants were asked whether they wanted to view the unsecured data; if they selected “yes,” the images would appear, and if they selected “no,” the images would not appear. For students who contacted me because they were not comfortable opening the unsecure images, I created a separate website consisting solely of the survey graphics. In the follow-up e-mails, I explained the security issue and provided the address for the separate image-only website. It is unknown how many potential participants did not complete the survey due to this problem.

The last unforeseen issue that I encountered was that students who were invited to participate in the survey forwarded the survey link to friends. Furthermore, some students submitted different e-mail addresses from those that I had on my list, and thus I was unable to identify them as being among the selected sample. A total of 15 surveys were submitted from students either unidentifiable or not included on the sample list. Because it was a relatively

small number and because the sample was chosen to represent a broad range of characteristics, I included the 15 surveys in the final analysis.

Data Preparation and Analysis

Once the survey was closed, the participant input, which was collected and stored in survey.vt.edu, was exported into Microsoft Excel for processing. The background data were numerically coded, with each answer choice or category being assigned a different number (for example, male = 1 and female = 2 or ages 18 and under = 1, age 19 = 2, and so on). The World and World Events section was used to establish an aggregate score of correct answers. Each correct answer was worth one point; questions that required multiple answers were scored accordingly, one point per correct answer.

Only surveys that provided a completed World and World Events section were included in the analysis. Because it was not possible to determine if an answer was left blank due to technical problems (for example, the student was not able to view the maps) or because they did not know the answer, the question could not be scored and thus an aggregate World and World Events score could not be determined.

Once the data were coded in Excel, they were exported into SPSS 10.0 for statistical analysis. General descriptive statistics, such as frequency and mean, were used to describe the data. Using the Kolmogorov-Smirnov test of normality, I determined that the World and World Events scores were not normally distributed ($p < 0.05$) and thus did not meet the assumptions of parametric data. Therefore, two non-parametric tests were used to compare the scores based on the different student characteristics (the tests were chosen after consultation with the Virginia Tech Statistical Consulting Center). The Mann-Whitney test (comparable to the parametric t-test) was used to test the difference in means between two groups of students, while the Kruskal-Wallis test (comparable to the parametric analysis of variance) was used for comparison of more than two groups. A p -score within the 0.05 confidence interval was considered significant.

While these nonparametric tests are similar to their parametric counterparts, the main drawback in their use is that with nonparametric tests there is a greater chance of a type II error; that is, there is a greater chance of accepting that there is no difference among groups when there actually is (Field 2002, 49).

Selection of the Variables

Many of the variables I examine in my study are drawn from the literature on geographic literacy. These variables include gender, age, nationality, academic level, grade point average, previous geography education, travel experience, media usage, and languages spoken. Other factors I explore have not been previously examined in relation to geographic literacy. One such factor is participation in study abroad. Study abroad programs are promoted as an important component of internationalized education. Many study abroad programs differ from general travel in that students are immersed in a culture and live in the society rather than just visit it. Research has indicated that travel plays a role in geographic knowledge yet the immersion experience provided in study abroad has not been specifically examined. Also related to internationalized education, I explore the relationship between taking a Virginia Tech Area 7 course and geographic knowledge. Another factor I included in this study was the number of friends that a student has that are of a different nationality than their own. Having international friends may provide greater exposure to different cultures and place as well as stimulate an interest in international events.

Measurement and Coding of the Variables

In this section I discuss how the variables were measured and the method used to code them.

Demographics

Gender: Gender was coded as either male or female

Age: Age was measured in one-year intervals from 18 to 25. Due to the fact that so few respondents indicated that they were 24 or over, I aggregated the scores of all students aged twenty-three and higher.

Residency Status: Residency status (U.S. or International) was determined by the University administration. International students are those who are neither U.S. citizens nor permanent residents in this country.

High school location: The survey asked students to indicate whether they had graduated from high school in the U.S. Those who did graduate from a high school in the U.S. were asked to specify the county and state; those who did not were asked to identify the country in which they graduated high school.

There were not enough international graduates to form meaningful aggregated categories (such as by continent or region); thus, I combined them all into the single category of “students who graduated overseas.” A similar situation occurred with the out-of-state high school graduates. There were not enough students to form meaningful state or regional categories; thus, they too were combined into one category.

Educational Characteristics

Major: The survey collected data on the major and double major of students. Although some majors were well represented, many only had one or a very few students, which would not be useful for analysis. Therefore, I aggregated the majors by college⁸ because departments are assigned to colleges based on similar subject matter and methodologies. Geography and international studies majors were left as separate categories and were not included in their respective colleges (The College of Natural Resources and the College of Liberal Arts and Human Sciences). Additionally, students who had two majors, with each major in a different college, were categorized as double majors (and not assigned to a specific college).

Academic Class: Students were categorized as freshman, sophomores, juniors, seniors, or other.

Grade Point Average (GPA): There were originally five GPA ranges from which to choose; however, for this analysis, the lowest two categories were combined to form the lowest category of 2.49 and below.

Geography Grades 7-12 and Geography Requirement: Students were asked whether or not they had taken a geography class during junior/ high school (grades 7-12). If their answer was yes, they were asked if the course was required.

College Geography: On the survey, students could select as a choice up to ten or more geography classes; however, it was necessary to consolidate students taking two or more classes in order to provide a large enough category to analyze.

Area 7 Fulfillment, Geography Classes, and World Regions: Students were asked to indicate whether or not they had fulfilled Area 7 of Virginia Tech’s Core Curriculum. Students who had fulfilled Area 7 were also asked to identify which, if any, of the eight geography classes

⁸ Although this survey was administered prior to the University’s restructuring in July 1, 2003, I organized the majors into colleges according to the University’s new organization because the new restructured colleges provide more homogenous groupings of majors than did the previous university structure.

they had taken to fulfill Area 7. I was hoping to be able to compare the scores of students based on the specific geography class that they had taken; however, this was not possible because very few students had taken any of these classes. Therefore, I coded these data in two ways; first, by the number of Area 7 geography classes that they had taken and second according to whether or not they had taken world regional geography (at any college/university).

Travel and International Experience

Foreign Language: Students were asked to indicate the number, up to three or more, of languages spoken other than their native tongue.

International Friends: Data were collected on the number of friends of a different nationality, from none to five or more, that the students had. Students were allowed to define for themselves who constituted their “close friends.”

Study Abroad: The data collected in the survey indicated whether the student had participated in study abroad during high school, college, or both. To create meaningful categories, I had to combine the three study abroad choices into a single category.

Number of Countries Visited: The data were originally collected in intervals of one (from zero up to 10 or more countries), but the categories were aggregated in order to provide large enough categories to analyze.

Number of International Trips Taken: The data for this variable were also aggregated into larger categories for analysis.

Characteristics of Media Usage

Primary News Media Source and Least Used Media Source: The categories of news media were identical to those used in the National Geographic Survey, except that in this survey radio news was divided into two categories: commercial and public.

Average News Media Usage: Students were asked to estimate how often they accessed any type of news media. The categories ranged from never to every day.

Summary

I adapted the *National Geographic – Roper 2002 Global Geographic Literacy Survey* by shortening it and modifying some questions. I developed it into an on-line survey that was

administered to a sample of nearly 2,000 undergraduate students, including the general population, geography and international studies majors, international students, and study abroad participants. The survey data were numerically coded and the scores calculated in Excel before being exported into SPSS for nonparametric statistical analysis.

CHAPTER 5: SURVEY RESULTS AND STATISTICAL ANALYSIS

In this chapter I describe the survey participants and the characteristics of students scoring above and below the mean on the quiz. I also provide a detailed statistical analysis of the factors relating to geographic literacy. Significant results are reported at $p < 0.050$. The results and the implications for geographic literacy will be discussed in the next chapter.

Survey Participation and Description of the Participants

A total of 463 surveys were submitted. The majority of the surveys, 322, were submitted after the first e-mail was sent inviting students to participate in the study. The second e-mail elicited 96 responses, and the final reminder e-mail resulted in 45 more survey submissions. Three students formally requested to withdraw from the study. The response rate was only 23.8 percent, which was lower than hoped; however, by using such a large sample, even with a lower response rate, enough data were obtained for thoughtful analysis. Six surveys were omitted from analysis because the participants' responses indicated that they were either graduate students or alumni, making the total number of eligible surveys for this study 457. Of the eligible surveys, 29 were left out due to incomplete answers; thus, the total number of completed surveys analyzed for this study was 427.

Demographics (Table 5.1)

Gender: The sample includes slightly more men than women, 55 percent compared to 47 percent.

Age: The largest proportion of students, 24 percent, is 20 years old, followed by 21 year olds at almost 21 percent. The oldest and youngest students make up the smallest proportion of the sample; about 10 percent of the sample is 18 or younger, with the same proportion being 23 or older.

Residency Status: International students comprise almost 16 percent of the sample, while the majority of the sample (84 percent) are from the United States.

High school location: Most of the students in the sample (including some international students) graduated from high school in Virginia; 22 percent were out-of-state graduates, and nearly 15 percent graduated overseas (including a few U.S. students).

Table 5.1
Number and Percent of Survey Participants
by Demographic Variables

| | n | % |
|--------------------------------|-----|-------|
| Gender | | |
| Male | 222 | 52.0% |
| Female | 202 | 47.3% |
| Missing | 3 | 0.7% |
| Age | | |
| 18 or under | 43 | 10.1% |
| 19 | 79 | 18.5% |
| 20 | 103 | 24.1% |
| 21 | 88 | 20.6% |
| 22 | 69 | 16.2% |
| 23 and over | 44 | 10.3% |
| Missing | 1 | 0.2% |
| Residency Status | | |
| U.S. | 359 | 84.1% |
| International | 68 | 15.9% |
| Location of High School | | |
| Virginia | 268 | 62.8% |
| Out of State | 95 | 22.2% |
| Out of U.S. | 63 | 14.8% |
| Missing | 1 | 0.2% |

Source: results of author's *Survey of Geographic Literacy and World Knowledge*

Educational Characteristics (Table 5.2)

Major: The sample included students majoring in subjects from all seven of the University's colleges. Twenty-four geography majors (6 percent of all participants) and 53 international studies majors (12 percent of all participants) participated in the survey. A quarter of the sample consisted of engineering students, followed by business students and students majoring in subjects within the College of Liberal Arts and Human Sciences, comprising 14 and 12 percent of the sample, respectively. Majors within the College of Natural Resources and students who have not decided on a major had the least representation in the sample.

Academic Level: Nearly 38 percent of those who took the survey were in their senior year of college. Juniors came next with 23 percent, then sophomores with 20 percent, and almost 18 percent of the participants were freshman. A few students identified other undergraduate designations such as part-time or exchange student.

Grade Point Average (GPA): The most frequent response for GPA was 3.00–3.49, (32 percent). A little less than 27 percent of the sample had a GPA between 3.50 and 4.00, the same percentage as those in the 2.50–2.99 category. Only 14 percent of the students had a GPA below 2.50.

Geography Grades 7-12 and Geography Requirement: Half the survey participants took a geography course sometime during junior high/middle school and high school, and 87 percent of those who did take geography during junior high/middle school and high school took it because it was required.

College Geography: Most of the students (64 percent) had never taken a college-level geography class, 20 percent had taken one geography class, and 14 percent had taken two or more.

Area 7 Fulfillment, Geography Classes, and World Regions: Over two-thirds of the participants had fulfilled the Area 7 requirement of Virginia Tech’s Core Curriculum. Of the students who had fulfilled the Area 7 requirement, 70 percent had not taken an Area 7 geography course; 20 percent had taken one Area 7 geography course, and few had taken more than one. Of the 288 students who had taken an Area 7 geography course, 68 of them, or nearly 24 percent, had taken world regional geography in college.

Table 5.2
Number and Percent of Survey Participants by Educational Characteristics

| | n | % |
|---------------------------------|-----|-------|
| GPA | | |
| 2.49 or below | 58 | 13.6% |
| 2.50-2.99 | 115 | 26.9% |
| 3.00-3.49 | 136 | 31.9% |
| 3.50-4.00 | 113 | 26.5% |
| Do not know | 5 | 1.2% |
| Major/College | | |
| Natural Resources | 9 | 2.1% |
| Engineering | 108 | 25.3% |
| Business | 61 | 14.3% |
| Agriculture and Life Sciences | 34 | 7.3% |
| Sciences | 31 | 7.3% |
| Liberal Arts and Human Sciences | 53 | 12.4% |

Table 5.2 (continued)
Number and Percent of Survey Participants by
Educational Characteristics

| | | |
|--|-----|-------|
| Architecture and Urban Studies | 18 | 4.2% |
| University Studies | 12 | 2.8% |
| Double Major | 24 | 5.6% |
| Geography | 24 | 5.6% |
| International Studies | 53 | 12.4% |
| Academic Level | | |
| Freshman | 75 | 17.6% |
| Sophomore | 87 | 20.4% |
| Junior | 99 | 23.2% |
| Senior | 157 | 36.8% |
| Other | 8 | 1.9% |
| Missing | 1 | 0.2% |
| Geography Class in Grades 7-12 | | |
| Yes | 217 | 50.8% |
| No | 204 | 47.8% |
| Do not know | 6 | 1.4% |
| Requirement of Geography Class in Grades 7-12^a | | |
| Yes | 189 | 87.1% |
| No | 22 | 10.1% |
| Do not know | 6 | 2.8% |
| Number of College-Level Geography Classes Taken | | |
| 0 | 275 | 64.4% |
| 1 | 87 | 20.4% |
| 2 or more | 61 | 14.3% |
| Do not know | 4 | 0.9% |
| Fulfillment of Area 7 | | |
| Yes | 288 | 67.4% |
| No | 114 | 26.7% |
| Do not know | 24 | 5.6% |
| Missing | 1 | 0.2% |
| Number of Area 7 Geography Courses Taken^b | | |
| 0 | 204 | 70.8% |
| 1 | 58 | 20.1% |
| 2 or more | 16 | 7.5% |
| Do not know | 2 | 0.7% |
| Missing | 8 | 2.8% |

Table 5.2 (continued)
Number and Percent of Survey Participants by
Educational Characteristics

| Taken World Regional Geography^b | | |
|---|-----|-------|
| Yes | 68 | 23.6% |
| No | 209 | 72.6% |
| Do not know | 3 | 1.0% |
| Missing | 8 | 2.8% |

^a Calculated from sample of students who took a geography class during grades 7-12 (n=217)

^b Calculated from sample of students who fulfilled the Area 7 requirement (n=288)

Source: results of author's *Survey of Geographic Literacy and World knowledge*

Travel and International Experience (Table 5.3)

Foreign Language: Over half of the survey participants did not speak any language other than their native tongue. Thirty percent spoke one other language, and very few students spoke more than one other language.

International Friends: Most students indicated they had friends whose nationalities were different than their own. Thirty-one percent noted that they had one or two such friends, 13 percent reported that they had three or four such friends, and nearly a quarter of the participants indicated that they had five or more international friends. Only 31 percent noted that they had no friends of a different nationality.

Study Abroad: Of the students who graduated from high school in the United States, less than a quarter reported that they had participated in a semester or longer study abroad program.

Number of Countries Visited: The most frequently reported (35 percent) category in relation to number of countries visited was that between two and five. Only 13 percent indicated that they had never been to a foreign country, and 19 percent reported that they had been to ten or more countries.

Number of International Trips Taken: Over 40 percent of the sample reported taking between two to five trips outside their home countries, while only 15 percent indicated that they had never gone on an international trip. Over a quarter of the participants noted that they had taken six or more international trips.

Table 5.3
Number and Percent of Survey Participants by
Travel and International Experience

| | n | % |
|--|----------|----------|
| Number of Languages Spoken Other Than Native Language | | |
| 0 | 256 | 60.0% |
| 1 | 127 | 29.7% |
| 2 | 35 | 8.2% |
| 3 or more | 9 | 2.1% |
| Number of Friends from Different Country | | |
| 0 | 131 | 30.7% |
| 1 to 2 | 135 | 31.6% |
| 3 to 4 | 54 | 12.6% |
| 5+ | 101 | 23.7% |
| Do not know | 4 | 0.9% |
| Missing | 2 | 0.5% |
| Participated in Study Abroad* | | |
| Yes | 81 | 22.3% |
| No | 281 | 77.4% |
| Missing | 1 | 0.3% |
| Number of Countries Visited | | |
| 0 | 57 | 13.3% |
| 1 | 61 | 14.3% |
| 2 to 5 | 148 | 34.7% |
| 6 to 9 | 77 | 18.0% |
| 10+ | 81 | 19.0% |
| Do not know | 1 | 0.2% |
| Missing | 2 | 0.5% |
| Number of International Trips Taken | | |
| 0 | 64 | 15.0% |
| 1 | 72 | 16.9% |
| 2 to 5 | 174 | 40.7% |
| 6+ | 115 | 26.9% |
| Missing | 2 | 0.5% |

* Sample calculated from students who graduated from high school in the U.S. (n=362)
 Source: results of author's *Survey of Geographic Literacy and World Knowledge*

Characteristics of Media Usage (Table 5.4)

Primary News Media Source: Nearly one-third of the students who participated in the survey indicated that their primary source of news is cable news, and close behind is the Internet/World Wide Web. Fifteen percent of the sample relied on newspapers as their primary news source, and approximately the same percentage relied on network news. Commercial radio

was the least frequently cited primary news source, followed by news magazines and public radio.

Least Used News Media Source: Of the media sources used least to access the news, public radio was chosen most often, by over 40 percent of the sample, followed by news magazines with 22 percent, and commercial radio with nearly 19 percent. Similar numbers of students, between four and five percent, indicated that they used newspapers, Internet/World Wide Web, and cable news least for finding out about the news. Very few students reported network news as their least-used news media source.

Average News Media Usage: Over 40 percent of the sample noted that they accessed the news on a daily basis. Approximately half of the sample accessed news media in the range between every day news access and no news access at all.

Table 5.4
Number and Percent of Survey Participants by Characteristics of Media Usage

| | n | % |
|-------------------------------------|-----|-------|
| Primary News Media Source | | |
| newspapers | 64 | 15.0% |
| Internet/Web | 123 | 28.8% |
| cable news | 136 | 31.9% |
| network news | 64 | 15.0% |
| public radio | 10 | 2.3% |
| news magazines | 9 | 2.1% |
| commercial radio | 4 | 0.9% |
| other | 11 | 2.6% |
| do not know | 3 | 0.7% |
| missing | 3 | 0.7% |
| Least Used News Media Source | | |
| newspapers | 19 | 4.4% |
| Internet/Web | 18 | 4.2% |
| cable news | 20 | 4.7% |
| network news | 10 | 2.3% |
| public radio | 180 | 42.2% |
| news magazines | 92 | 21.5% |
| commercial radio | 79 | 18.5% |
| do not know | 6 | 1.4% |
| missing | 3 | 0.7% |

Table 5.4 (continued)
Number and Percent of Survey Participants by Characteristics of Media Usage

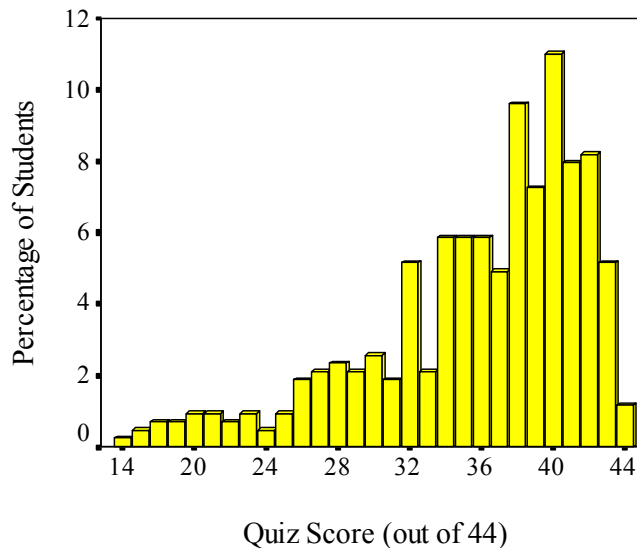
| Frequency of News Media Usage | | |
|--------------------------------------|-----|-------|
| Every day | 185 | 43.3% |
| 5 to 6 times/week | 61 | 14.3% |
| 3 to 4 times/week | 87 | 20.4% |
| 1 to 2 times/week | 69 | 16.2% |
| 1 to 2 times/month | 21 | 4.9% |
| Never | 1 | 0.2% |
| Do not know | 3 | 0.7% |

Source: results of author's *Survey of Geographic Literacy and World Knowledge*

Characteristics of Students Scoring Above and Below the Mean Quiz Score

Most students did well on the survey as the distribution of quiz scores is skewed towards the higher scores (Figure 5.1). The scores ranged from a low of 14 to a perfect score of 44. The mean quiz score for the 427 surveys used in the analysis was 35.77, or 81 percent (a “B-” on the traditional grading scale). Sixty-one percent of the students scored above the mean, and only 39 percent scored below the mean. In this section, I provide descriptive statistics of students with above and below mean quiz scores based on various characteristics; in subsequent sections of this chapter, nonparametric statistics will be used to examine the statistical significance of the differences in scores.

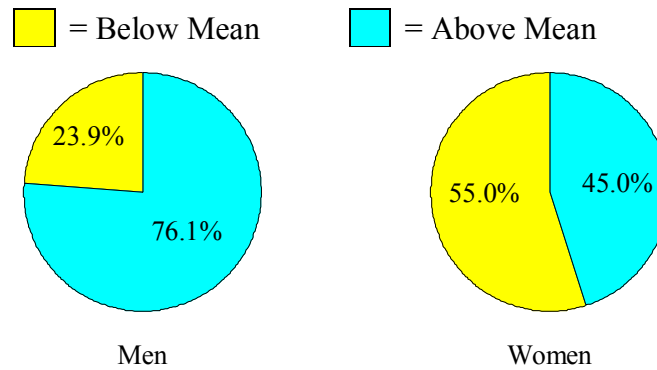
Figure 5.1
Distribution of Quiz Scores



Demographics

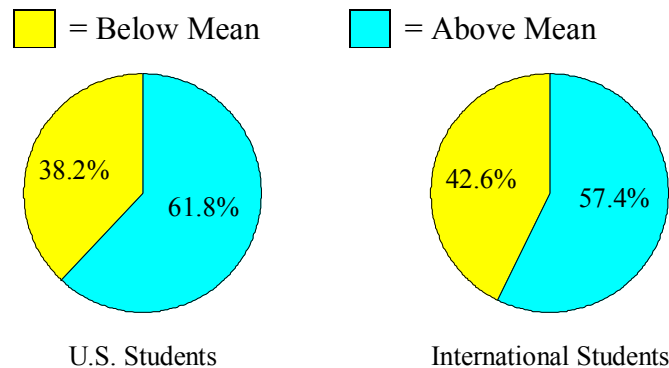
Gender: Over 75 percent of the men scored above the mean, compared to only 45 percent of the women (Figure 5.2). Of the 164 students who had a below-mean score, over two-thirds of them were women.

Figure 5.2
Percentage of Scores Above and Below Mean Quiz Score by Gender



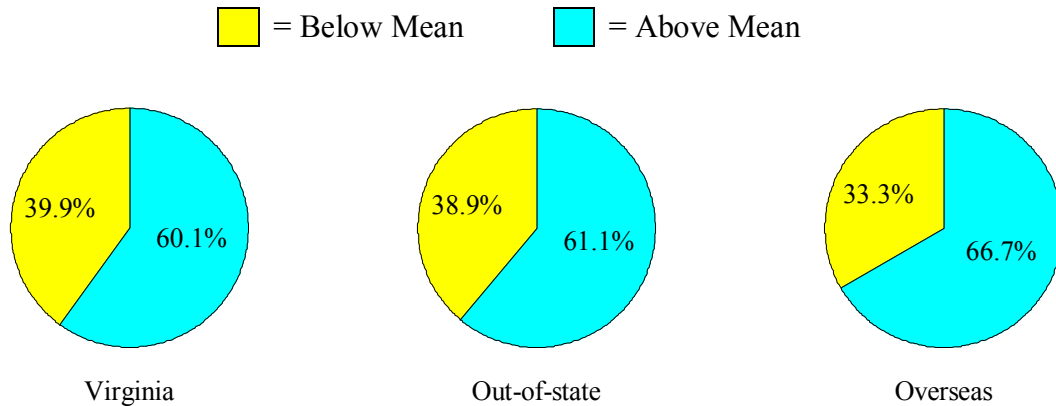
Residency Status: The percentage of U.S. and international students scoring above and below the mean was comparable; sixty-two percent of U.S. students scored above the mean compared to 57 percent of international students (Figure 5.3).

Figure 5.3
Percentage of Scores Above and Below Mean Quiz Score by Residency Status



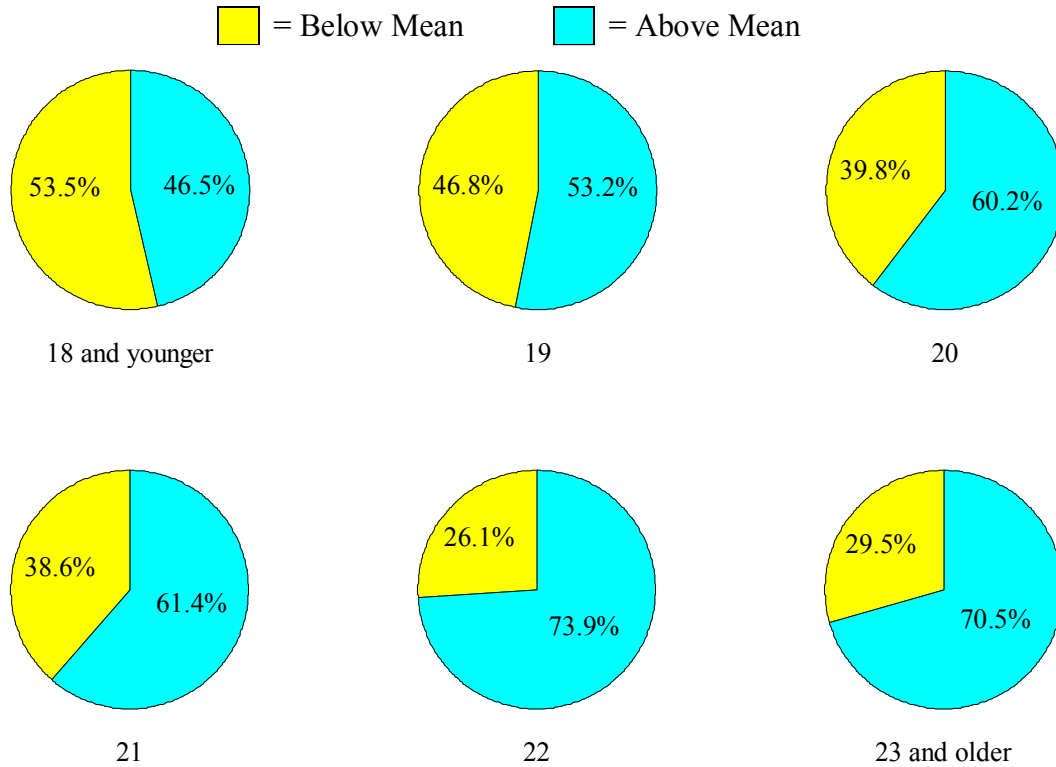
High School Location: Virginia and out-of-state high school graduates both had approximately 60 percent of their scores above the mean (Figure 5.4). Overseas graduates did slightly better, with nearly 67 percent of the students scoring above the mean.

Figure 5.4
Percentage of Scores Above and Below Mean Quiz Score by Place of High School Graduation



Age: Older students had a higher proportion of above mean scores (Figure 5.5). For example, of students 23 and older, 71 percent scored above the mean, while less than half of the students 18 or younger did. Twenty-two year olds had the highest proportion of above-average grades, with 74 percent.

Figure 5.5
Percentage of Scores Above and Below Mean Quiz Score by Age

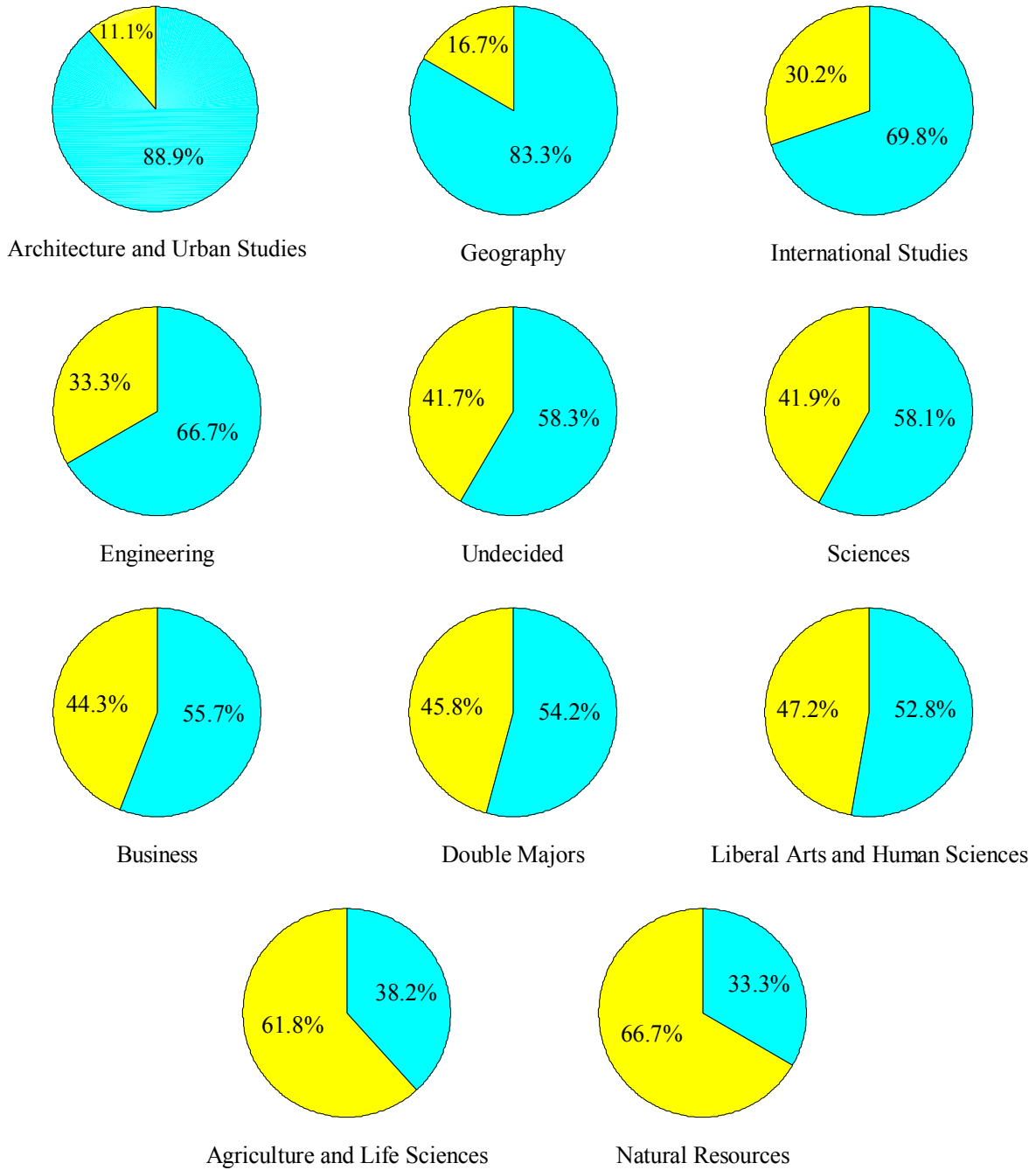


Educational Characteristics:

Major: Students in the college of Architecture and Urban Studies and Geography majors had the highest percentage of above average scores (89 and 83 percent, respectively) (Figure 5.6). Natural Resources and Agriculture and Life Sciences majors had the highest percentage of below average scores (67 and 62 percent, respectively). Among the remaining majors, approximately half to two-thirds of each major or college had above-average scores.

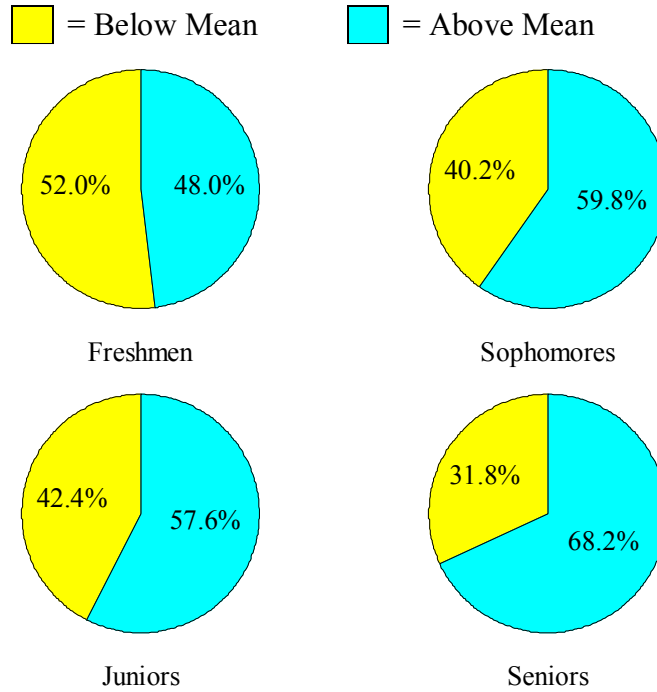
Figure 5.6
Percentage of Scores Above and Below Mean Quiz Score by Major/College

■ = Below Mean ■ = Above Mean



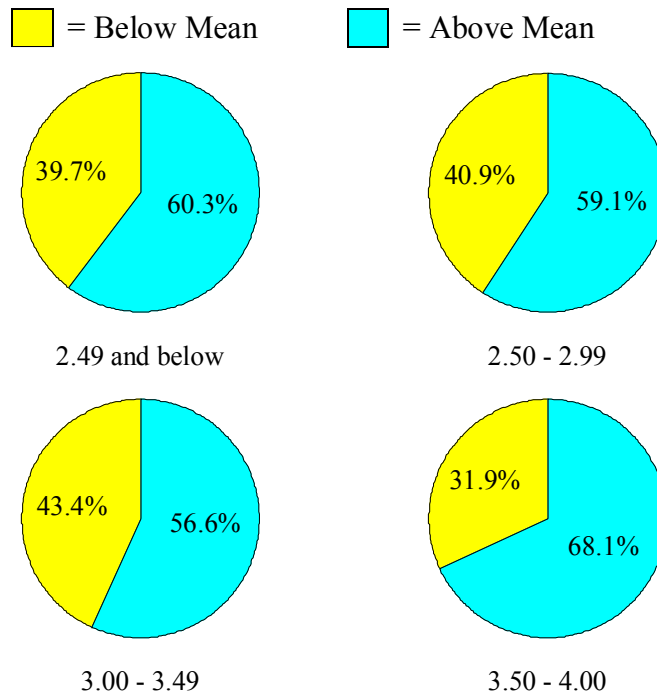
Academic Level: Over half of the sophomores, juniors, and seniors had above average scores (Figure 5.7). Seniors had the highest proportion, with 68 percent of senior students scoring above the mean. Among freshman, the scores were closely divided, with 48 percent scoring above average, and 52 percent scoring below average.

Figure 5.7
Percentage of Scores Above and Below Mean Quiz Score by Academic Level



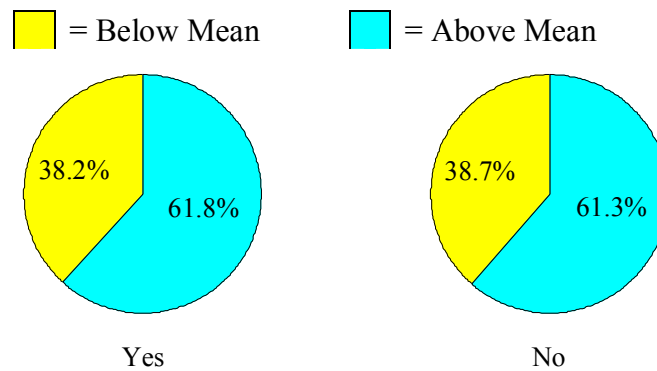
Grade Point Average: Among all GPA ranges, over half of the students scored above the mean (Figure 5.8). Students with a GPA of 3.50–4.00 had the highest proportion of above-average scores, with 68 percent, and students with GPAs between 3.00–3.49 had the greatest proportion of scores below average, with 43 percent (though the difference in scores compared to students with GPAs under 3.5–4.0 was slight).

Figure 5.8
Percentage of Scores Above and Below Mean Quiz Score by Grade Point Average



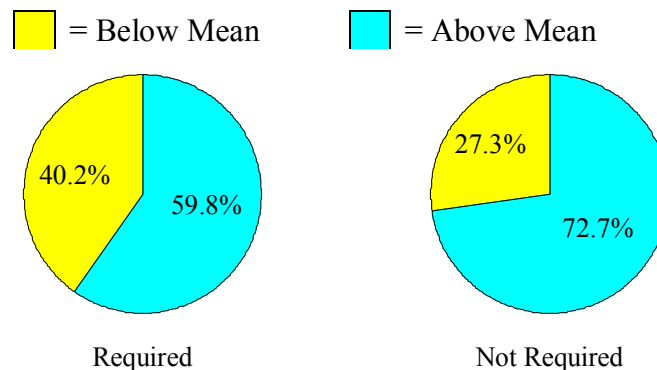
Geography Course Grades 7–12: The percentage of scores above and below the mean were nearly the same for both students who had and those who had not taken a geography class during grades 7–12 (Figure 5.9). Of those who had, 62 percent scored above the mean; and among those who had not, 61 percent had above-average scores.

Figure 5.9
Percentage of Scores Above and Below Mean Quiz Score by Geography Course in Grades 7–12



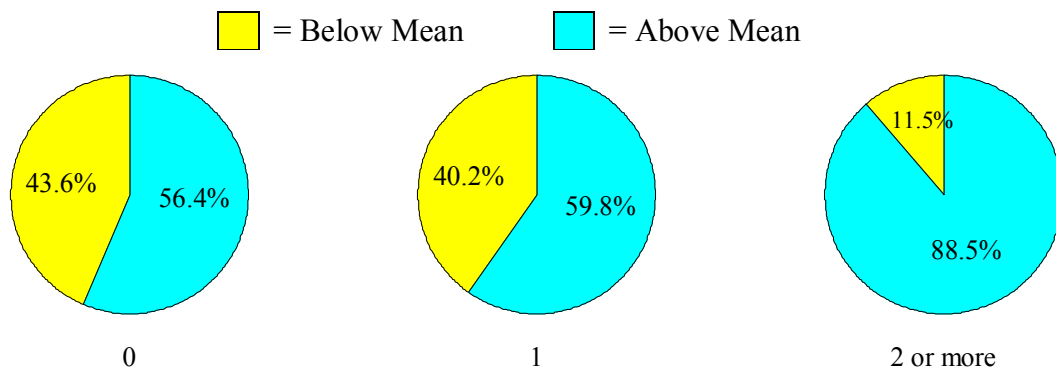
Requirement of Geography Course: Among students who had taken a geography class during grades 7–12, almost three-quarters who took it as an elective rather than as a required course scored above the mean. Less than 60 percent of those who took it because it was required had above-average scores (Figure 5.10).

Figure 5.10
Percentage of Scores Above and Below Mean Quiz Score by Requirement of Course (Students who had taken a Geography Course in Grades 7–12 Only)



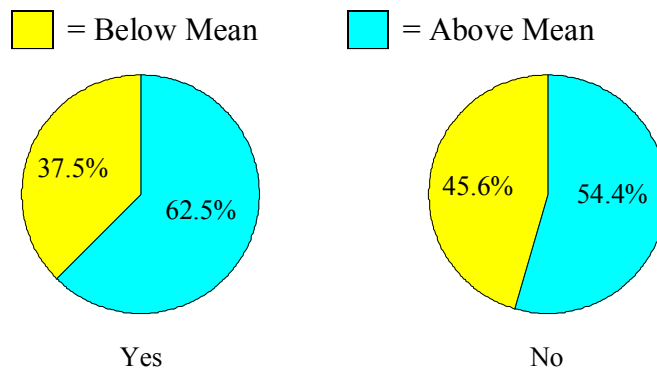
College Geography Courses: The highest proportion of above-average scores was received by students who had taken two or more geography classes in college; 89 percent of such students scored above the mean (Figure 5.11). Students who had never taken a college geography class and those who had taken just one had roughly similar percentages: approximately 60 percent above average and 40 percent below average, although the scores were slightly higher for students with one geography class.

Figure 5.11
Percentage of Scores Above and Below Mean Quiz Score by Number of College-Level Geography Classes



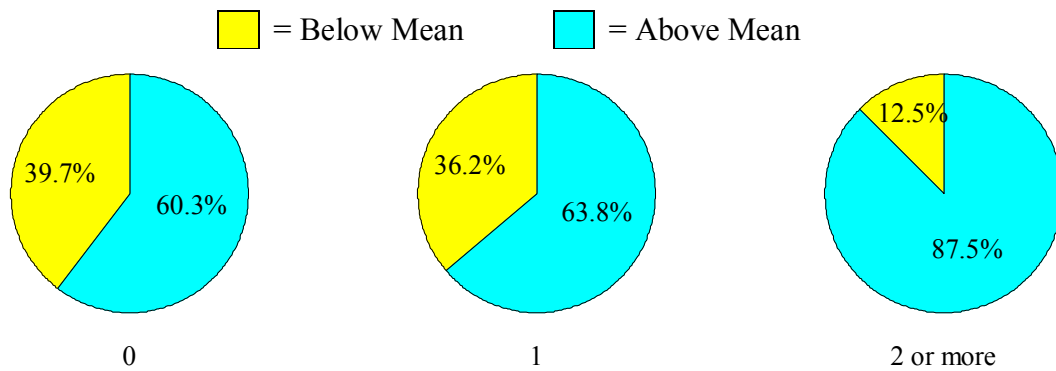
Area 7: Students who had fulfilled Area 7 of the University’s Core Requirement had a higher percentage of above-average scores (63 percent) than did students who had not fulfilled the requirement (54 percent) (Figure 5.12).

Figure 5.12
Percentage of Scores Above and Below Mean Quiz Score by Fulfillment of Area 7



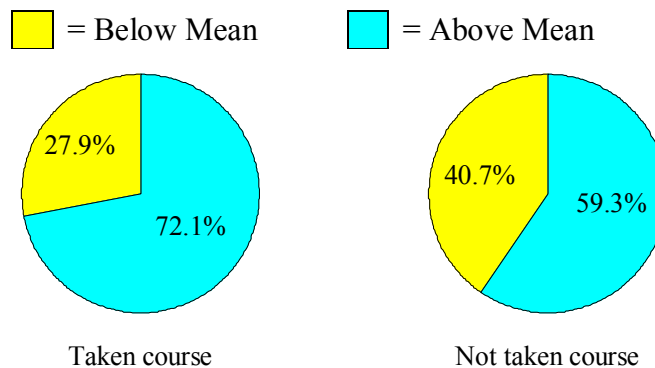
Area 7 Geography: Of the students who had fulfilled the Area 7 requirement, those who had taken two or more Area 7 geography classes had 88 percent of their scores above average compared to 64 percent for students who had taken one Area 7 geography class. Sixty percent of those who had taken none scored above the mean (Figure 5.13).

Figure 5.13
Percentage of Scores Above and Below Mean Quiz Score by Number of Area 7 Geography Courses (Students who Have Fulfilled Area 7 Only)



World Regions: Seventy-two percent of the students who fulfilled the Area 7 requirement and had taken world regional geography scored above average. In contrast, only 59 percent of those who had not taken a world regional geography course scored above average (Figure 5.14).

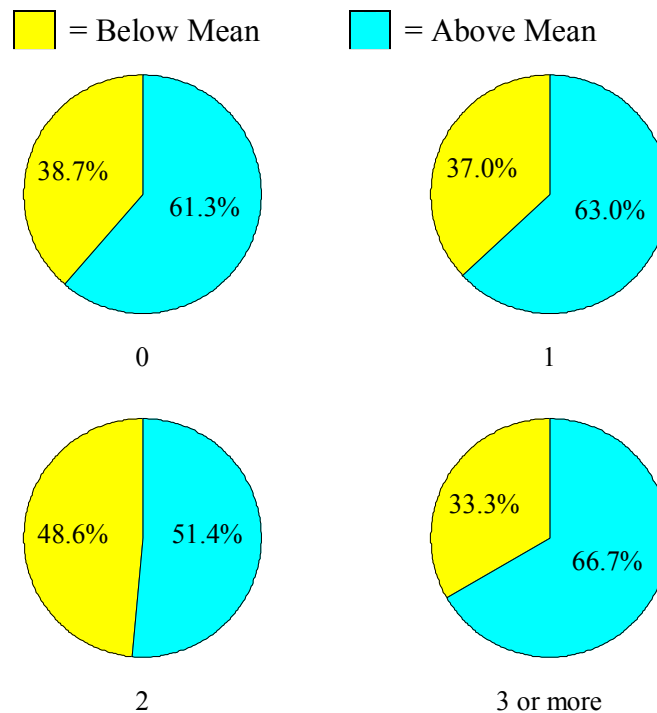
Figure 5.14
Percentage of Scores Above and Below Mean Quiz Score by World Regional Geography Course (Students who Have Fulfilled Area 7 Only)



Travel and International Experience:

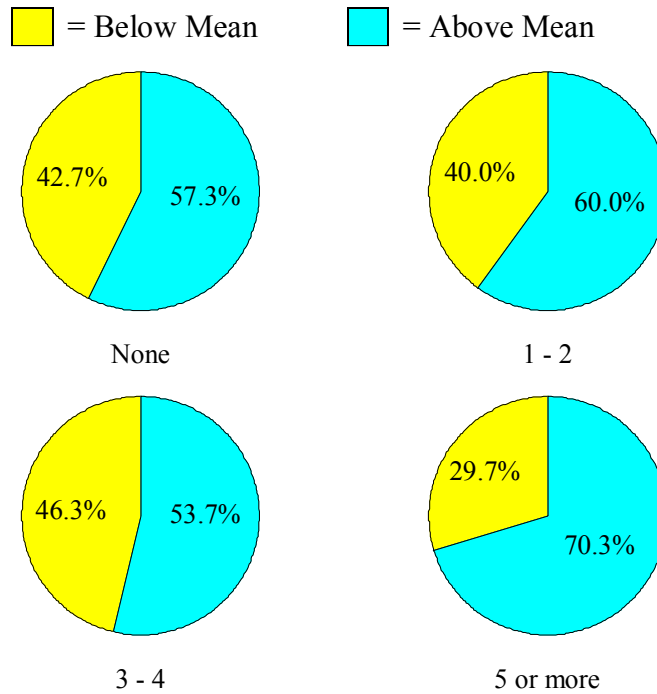
Foreign Languages: Among the students who spoke three or more languages other than their native tongue, 67 percent scored above average on the quiz, the highest percentage of any of the other language-related categories (Figure 5.15). Students who spoke two foreign languages had the highest percentage of below average scores, 49 percent. Those who spoke no foreign language or just one foreign language had similar proportions of above and below average scores -- approximately 60 percent above and 40 percent below the mean quiz score.

Figure 5.15
Percentage of Scores Above and Below Mean Quiz Score by Number of Foreign Languages Spoken



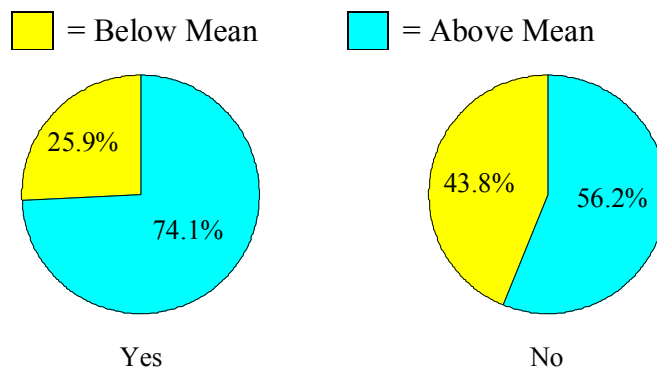
International Friends: At least half of the students in each category of this characteristic had above-average scores (Figure 5.16). Students who reported having five or more friends of a different nationality than that of themselves had the highest percentage, with 70 percent scoring above average. Students with three to four international friends had the lowest percentage, with 54 percent scoring above average. Students with no or one to two international friends scored in the middle, with 57 and 60 percent, respectively, scoring above average.

Figure 5.16
Percentage of Scores Above and Below Mean Quiz Score by Number of International Friends



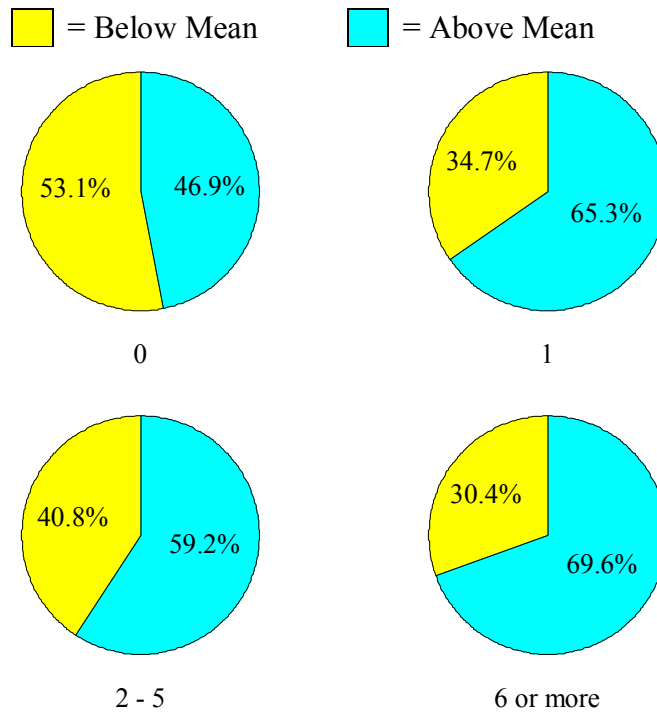
Study Abroad: Among students who graduated from high school in the U.S., those who participated in a semester or longer study abroad program during either college or high school had a higher proportion of above-average scores (74 percent) than did those who did not participate in study abroad (56 percent) (Figure 5.17).

Figure 5.17
Percentage of Scores Above and Below Mean Quiz Score by Participation in Study Abroad (U.S. High School Graduates Only)



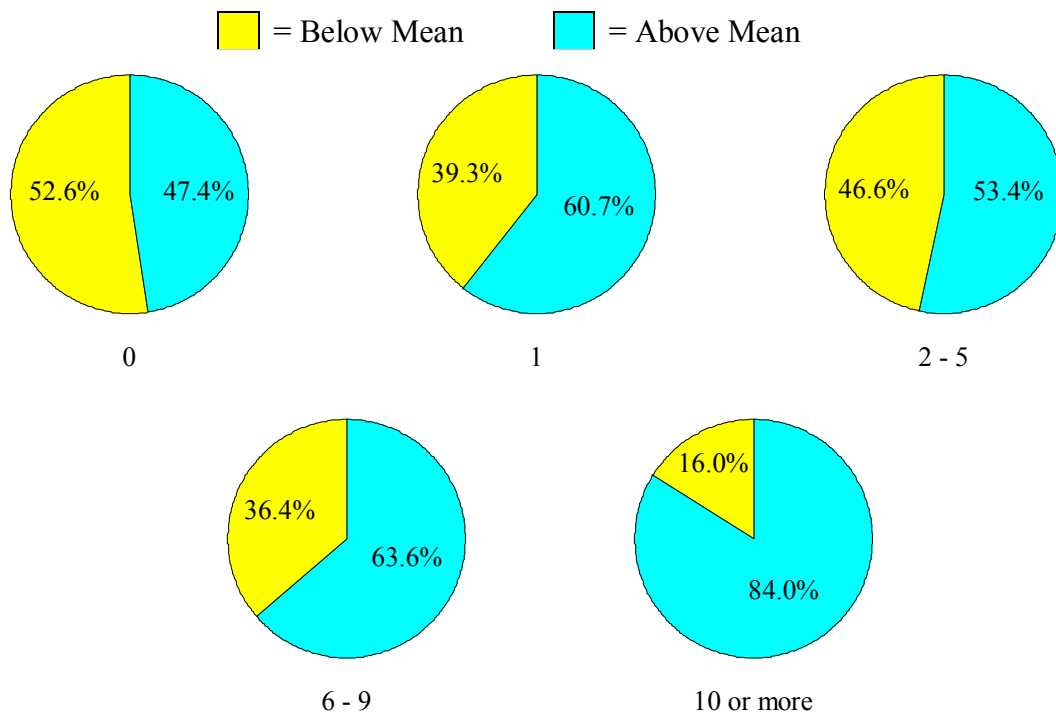
Number of International Trips: Seventy percent of the students who had taken six or more international trips had above average scores compared to 47 percent of the students who had never taken an international trip (Figure 5.18). Students who had gone on one trip had 65 percent of their scores above the mean; similarly, those who had taken two to five trips had 60 percent of their scores above average.

Figure 5.18
Percentage of Scores Above and Below Mean Quiz Score by Number of International Trips



Number of Countries Visited: Students who had visited at least one county had at least 50 percent of their scores above average (Figure 5.19). Among those who had never been to another country, 53 percent had below-average scores. Students who had visited the most countries, ten or more, had the largest proportion of above-average scores, 84 percent.

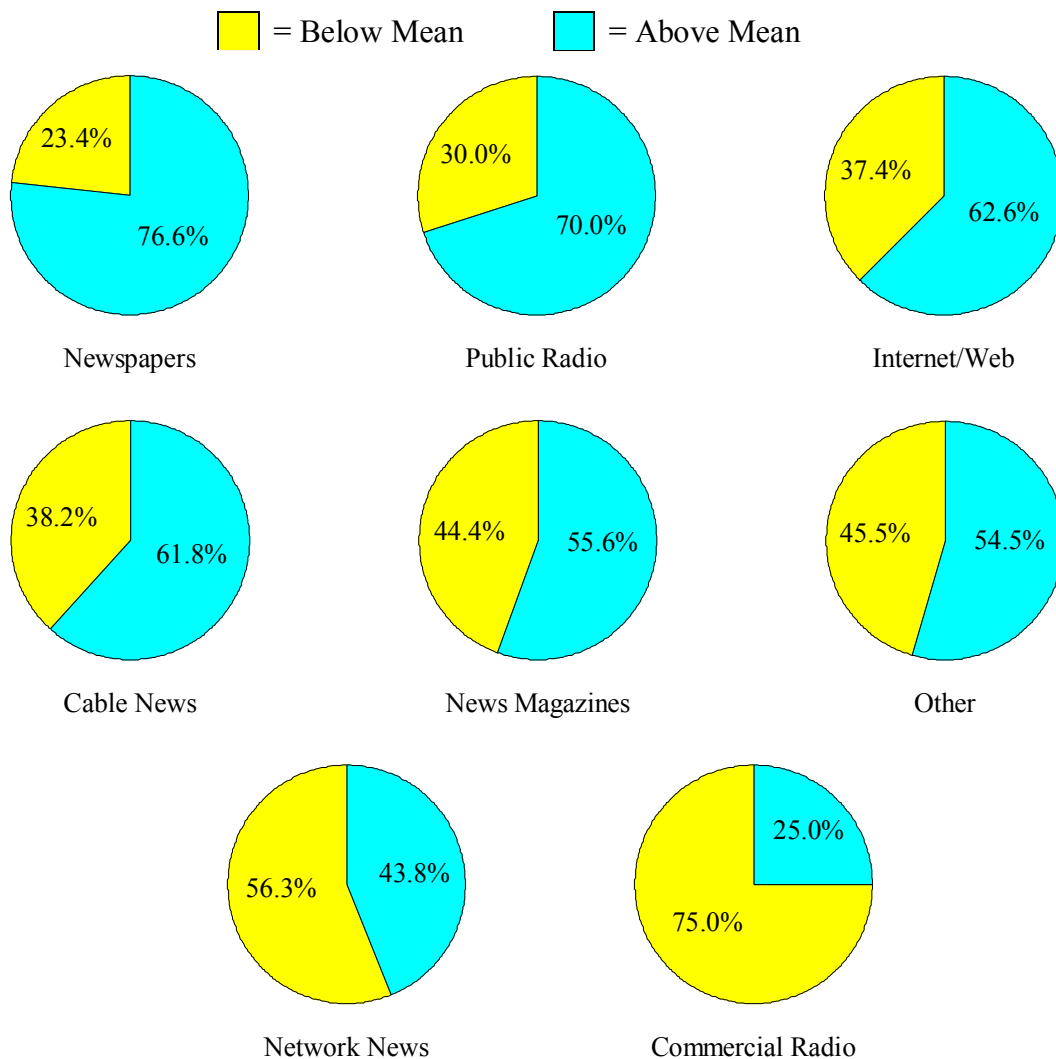
Figure 5.19
Percentage of Scores Above and Below Mean Quiz Score by Number of Countries Visited



Characteristics of News Media Usage:

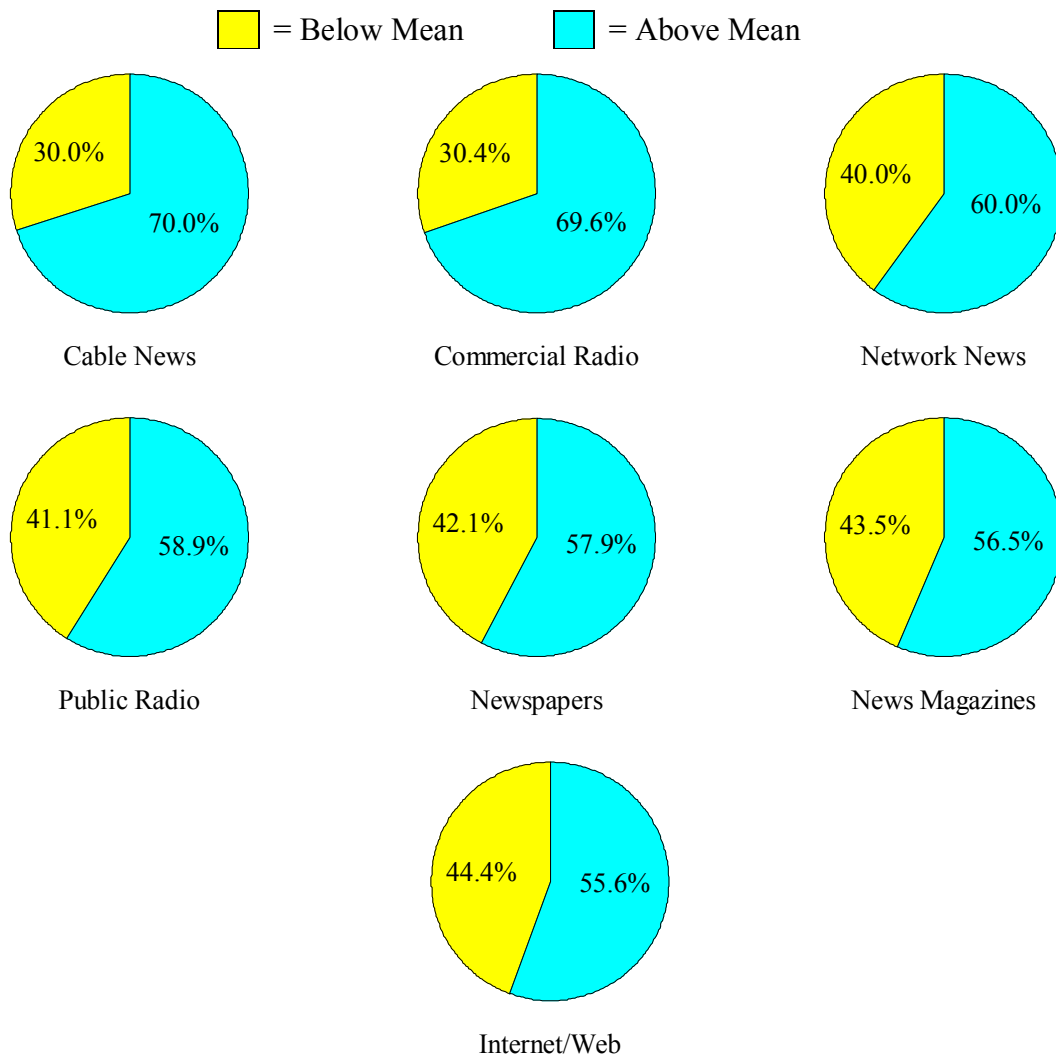
Primary News Media Source: Students who cited newspapers as their primary source of news media had the highest percentage of above-average scores (77 percent), followed by public radio listeners (70 percent) (Figure 5.20). Commercial radio listeners had the highest proportion of below-average scores (75 percent), followed by network news viewers with 56 percent. Those who selected the remaining news sources had between 55 to 63 percent above-average scores.

Figure 5.20
Percentage of Scores Above and Below Mean Quiz Score by Primary News Media Source



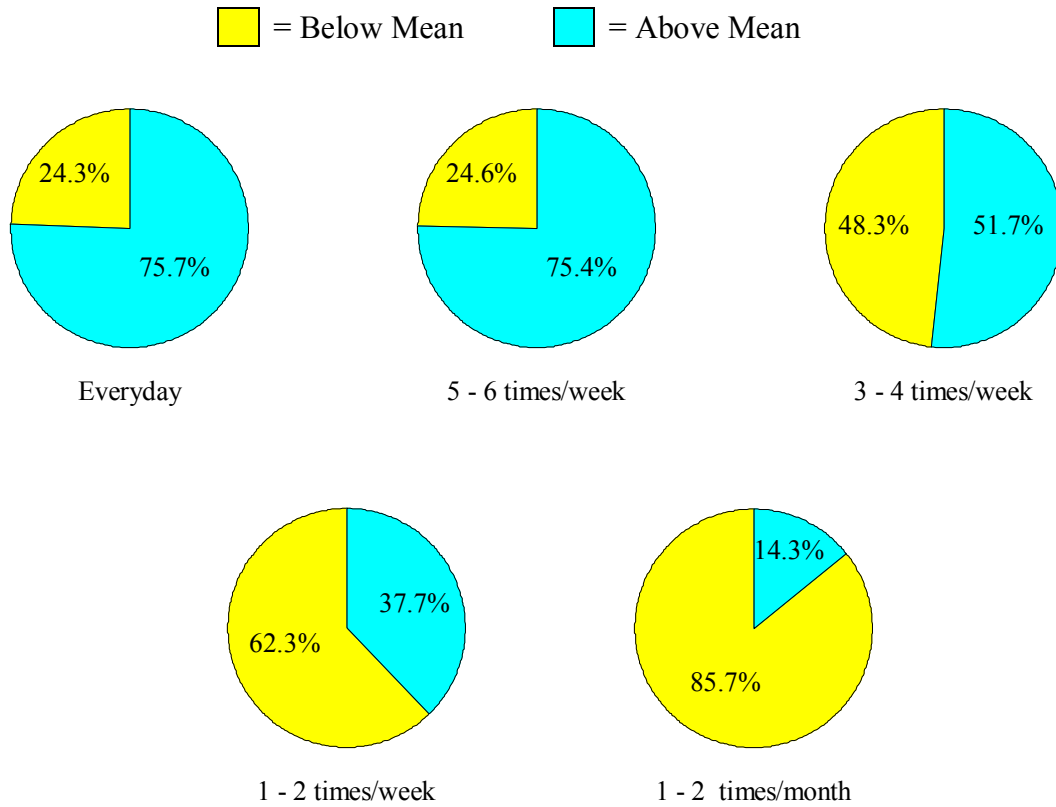
Least-Used News Source: Students who cited cable news or commercial radio as their least-used news media source had the highest percentage of above-average scores (70 percent) (Figure 5.21). Those who selected the remaining news sources had roughly similar proportions of above average scores, ranging between 56 to 60 percent.

Figure 5.21
Percentage of Scores Above and Below Mean Quiz Score by Least Used News Media Source



Frequency of News Media Usage: Three-quarters of the students who accessed the news on a daily basis or at least five to six times a week had above-average scores, while 14 percent of the students who accessed news just once or twice a month had above average scores (Figure 5.22). Approximately half of the students who indicated that they accessed news three or four times a week had above-average scores, and only 38 percent of students who accessed news once or twice a week had scores above the mean.

Figure 5.22
Percentage of Scores Above and Below Mean Quiz Score by Frequency of News Media Usage



Statistical Analysis to Determine Factors Relating to Geographic Literacy

In this section I use the Mann-Whitney U Test and the Kruskal-Wallis Test to determine if differences in the mean quiz scores of the students are statistically significant for the various characteristics examined. Significant results are indicated in **bold**.

Demographics

Gender: Men, with a mean score of 37.72, scored over four points higher than did women, who had a mean score of only 33.61. The results of the Mann-Whitney U Test indicate that the difference is highly significant (Figure 5.23 and Table 5.5).

Figure 5.23
Mean Quiz Scores by Gender (p<0.05)

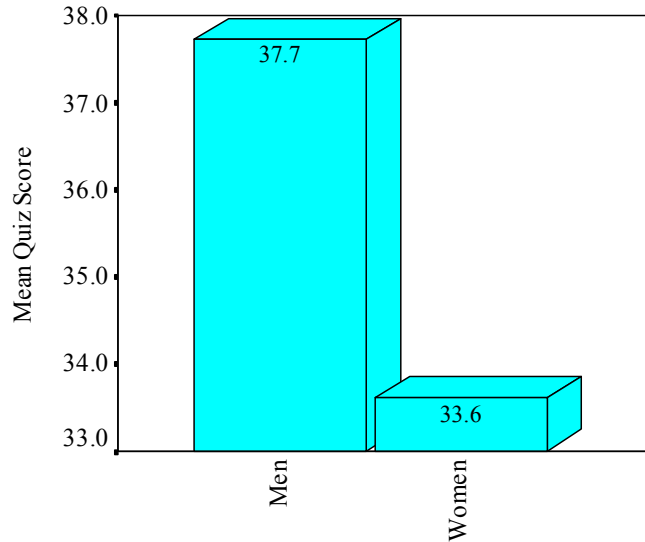


Table 5.5
Mann-Whitney U Test for Differences in Scores by Gender

| Gender | N | Mean Score | Mean Rank |
|----------------|----------|-------------------|------------------|
| Male | 222 | 37.72 | 255.79 |
| Female | 202 | 33.61 | 164.93 |
| Total | 424 | | |
| Mann-Whitney U | | 12812.000 | |
| Z-score | | -7.640 | |
| Probability | | 0.000 | |

Residency Status: With just over one point difference between the mean scores in favor of U.S. students over international students, there was no statistically significant difference between the scores. The statistics and results of the Mann-Whitney U test are shown in Figure 5.24 and Table 5.6.

Figure 5.24
Mean Quiz Scores by Residency Status (p=0.177)

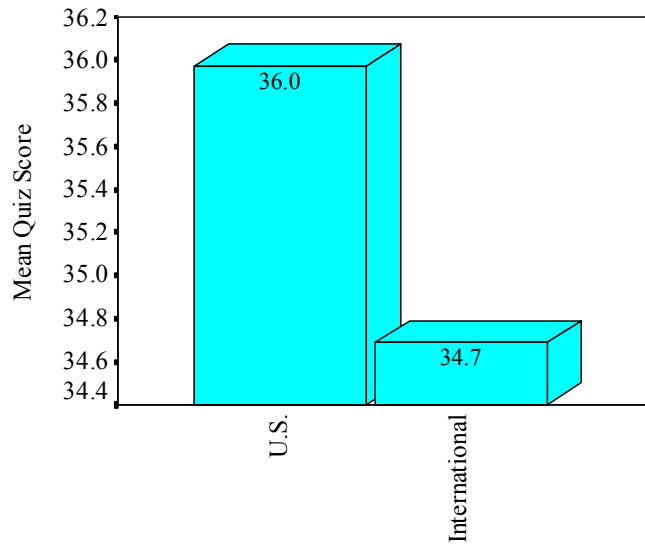


Table 5.6
Mann-Whitney U Test for Differences in Scores by Residency Status

| Residency Status | N | Mean Score | Mean Rank |
|------------------|-----|------------|-----------|
| U.S. | 359 | 35.97 | 217.5 |
| International | 68 | 34.96 | 162.51 |
| Total | 427 | | |
| Mann-Whitney U | | 10949.000 | |
| Z-score | | -1.350 | |
| Probability | | 0.177 | |

Location of High School: With mean scores between 35.48 and 35.91, results of the Kruskal-Wallis test confirm that there is no significant difference among the mean scores of Virginia, out-of-state, and overseas high school graduates. Results are summarized in Figure 5.25 and Table 5.7.

Figure 5.25
Mean Quiz Scores by Location of High School (p=0.913)

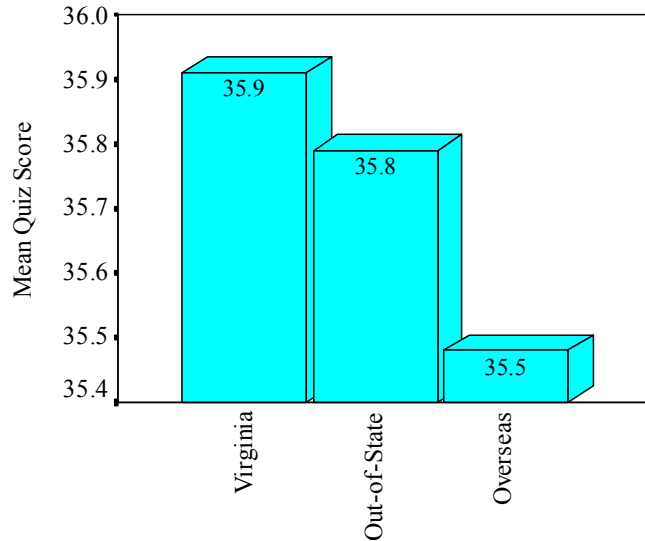


Table 5.7
Kruskal-Wallis Test for Difference in Scores by High School Location

| High School Location | N | Mean Score | Mean Rank |
|----------------------|-----|------------|-----------|
| U.S. | 268 | 35.91 | 212.34 |
| Out-of-state | 95 | 35.76 | 218.21 |
| Overseas | 63 | 35.48 | 211.35 |
| Total | 426 | | |
| Chi Squared | | | 0.183 |
| df | | | 2 |
| Probability | | | 0.913 |

Age: Results of the Kruskal-Wallis test indicate that there is a significant difference in the mean scores of students of different ages. In general, older students have higher mean scores than do younger students. Pairwise comparisons using the Mann-Whitney U test revealed that through the age of twenty-one, there were no significant differences in the scores and that twenty-two year olds had higher mean scores than the younger students; however, the mean scores of the oldest students, those twenty-three and older, were only significantly higher than students nineteen and under. The results are summarized in Figure 5.26 and Tables 5.8a and b

Figure 5.26
Mean Quiz Scores by Age (p<0.05)

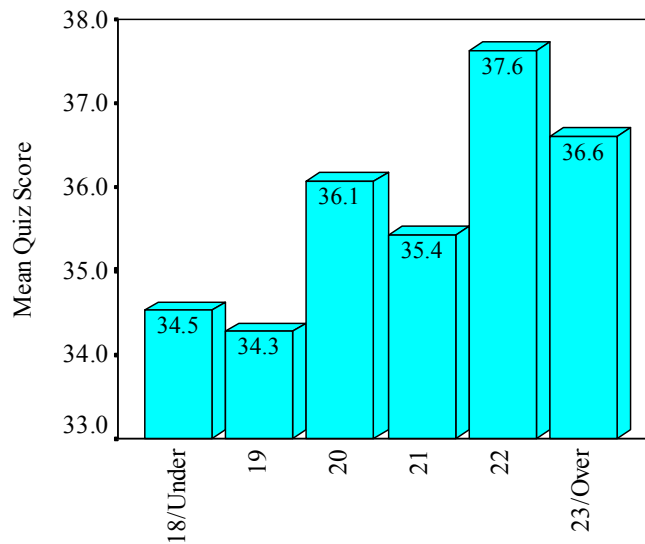


Table 5.8a
Kruskal-Wallis Test for Difference in Scores by Age

| Age | N | Mean Score | Mean Rank |
|-------------|-----|--------------|-----------|
| 18/Under | 43 | 34.58 | 184.10 |
| 19 | 79 | 34.25 | 188.55 |
| 20 | 103 | 36.07 | 215.47 |
| 21 | 88 | 35.43 | 205.47 |
| 22 | 69 | 37.62 | 253.57 |
| 23/Over | 44 | 36.61 | 235.64 |
| Total | 426 | | |
| Chi Squared | | 14.898 | |
| df | | 5 | |
| Probability | | 0.011 | |

Table 5.8b
P-Values from the Mann-Whitney U Test for Differences in Scores by Age
 (Significant differences indicated in **bold**)

| | 19 | 20 | 21 | 22 | 23/older |
|-----------------|-----------|-----------|-----------|--------------|-----------------|
| 18/Under | 0.859 | 0.144 | 0.373 | 0.005 | 0.039 |
| 19 | . | 0.131 | 0.357 | 0.002 | 0.043 |
| 20 | . | . | 0.54 | 0.037 | 0.322 |
| 21 | . | . | . | 0.015 | 0.218 |
| 22 | . | . | . | . | 0.411 |

Educational Characteristics

Major: Geography majors had the highest mean score of any major, with 39.67, followed closely by Architecture and Urban Studies majors with a mean score of 38.22, and International Studies majors with a mean score of 37.42. Natural Resource majors had the lowest mean score of 32.78, followed closely by the 33.41 mean score of Agriculture and Life Sciences majors. Results of the Kruskal-Wallis test indicate that there is a significant difference among the quiz scores of the different majors. The statistics are summarized in Figure 5.27 and Table 5.9a.

Further analysis using the Mann-Whitney U Test was conducted to compare mean scores of pairs of majors. The mean score of geography majors was significantly higher than that of all other majors except Architecture and Urban Studies and undecided majors. Architecture and Urban Studies majors scored higher than all but three majors, and International Studies majors scored significantly higher than most other majors. Engineering majors also has a mean score higher than many other majors. However, besides those already mentioned, there was little significant difference among the remaining majors. The *p*-values from the Mann-Whitney U test are shown in Table 5.9b.

Figure 5.27
Mean Quiz Scores by Major (p<0.05)

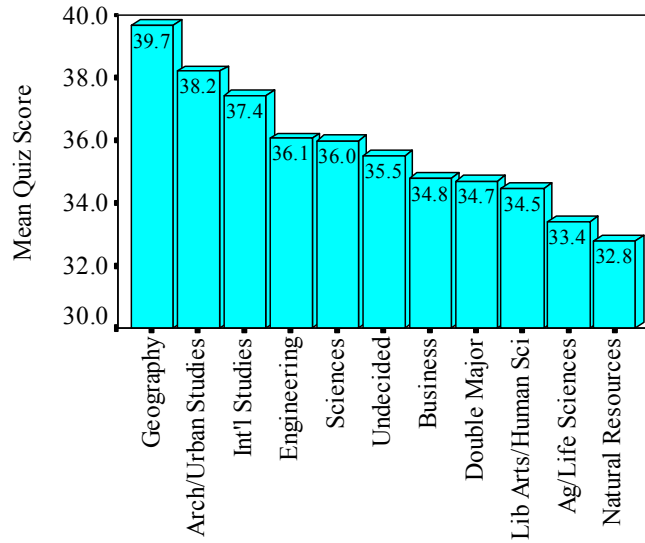


Table 5.9a
Kruskal-Wallis Test for Difference in Scores by Major

| Major | N | Mean Score | Mean Rank |
|----------------------------|-----|--------------|-----------|
| Geography | 24 | 39.67 | 300.97 |
| Architecture/Urban Studies | 18 | 38.22 | 277.83 |
| International Studies | 53 | 37.42 | 245.56 |
| Engineering | 108 | 36.07 | 223.80 |
| Sciences | 31 | 36.00 | 205.44 |
| Undecided | 12 | 35.50 | 199.79 |
| Business | 61 | 34.80 | 190.39 |
| Double Major | 24 | 34.67 | 189.81 |
| Liberal Arts/Human Sci. | 53 | 34.47 | 195.05 |
| Agriculture/Life Sciences | 34 | 33.41 | 159.09 |
| Natural Resources | 9 | 32.78 | 143.50 |
| Total | 427 | | |
| Chi Squared | | 35.427 | |
| df | | 10 | |
| Probability | | 0.000 | |

Table 5.9b
P-Values from the Mann-Whitney U Test for Differences in Scores by Major
 (Significant differences indicated in bold)

| | <i>International Studies</i> | <i>Engineering</i> | <i>Natural Resources</i> | <i>Business</i> | <i>Agriculture/Life Sciences</i> | <i>Sciences</i> | <i>Liberal Arts/Human Sciences</i> | <i>Architecture/Urban Studies</i> | <i>Undecided</i> | <i>Double Majors</i> |
|------------------------------------|------------------------------|--------------------|--------------------------|-----------------|----------------------------------|-----------------|------------------------------------|-----------------------------------|------------------|----------------------|
| <i>Geography</i> | 0.046 | 0.005 | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.442 | 0.292 | 0.004 |
| <i>International Studies</i> | . | 0.306 | 0.018 | 0.013 | 0.001 | 0.119 | 0.043 | 0.316 | 0.554 | 0.069 |
| <i>Engineering</i> | . | . | 0.046 | 0.092 | 0.008 | 0.423 | 0.178 | 0.081 | 0.494 | 0.245 |
| <i>Natural Resources</i> | . | . | . | 0.268 | 0.917 | 0.157 | 0.341 | 0.002 | 0.345 | 0.462 |
| <i>Business</i> | . | . | . | . | 0.243 | 0.554 | 0.903 | 0.007 | 0.876 | 0.934 |
| <i>Agriculture/Life Sciences</i> | . | . | . | . | . | 0.071 | 0.234 | 0.002 | 0.310 | 0.415 |
| <i>Sciences</i> | . | . | . | . | . | . | 0.626 | 0.023 | 0.862 | 0.535 |
| <i>Liberal Arts/Human Sciences</i> | . | . | . | . | . | . | . | 0.024 | 0.819 | 0.851 |
| <i>Architecture/Urban Studies</i> | . | . | . | . | . | . | . | . | 0.087 | 0.040 |
| <i>Undecided</i> | . | . | . | . | . | . | . | . | . | 0.804 |

Academic Level: With a mean score of just 33.76, freshman scored the lowest, and seniors, with a mean score of 36.75, scored the highest. Sophomores scored just a few tenths of a point lower than the seniors, and the juniors were closer in score to freshmen. Results of the Kruskal-Wallis test indicate the differences are statistically significant.

Pairwise comparisons using the Mann-Whitney U test confirmed the above findings; there were not significant differences between freshman and juniors, nor between sophomores and seniors. Freshman did score significantly lower than sophomores and seniors, and seniors also scored higher than juniors. The statistics are summarized in Figure 5.28 and Tables 5.10a and b.

Figure 5.28
Mean Quiz Scores by Academic Level ($p < 0.05$)

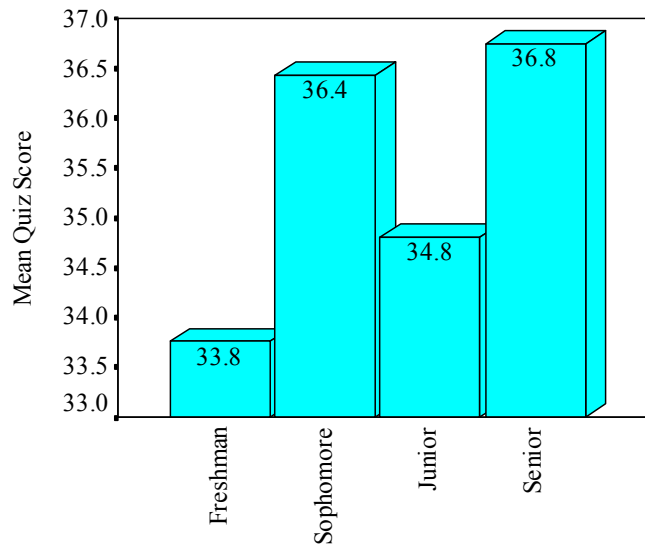


Table 5.10a
Kruskal-Wallis Test for Difference in Scores by Academic Level

| Academic Level | N | Mean Score | Mean Rank |
|-----------------------|----------|-------------------|------------------|
| Freshman | 75 | 33.76 | 175.07 |
| Sophomore | 87 | 36.43 | 222.03 |
| Junior | 99 | 34.81 | 191.26 |
| Senior | 157 | 36.75 | 230.51 |
| Total | 418 | | |
| Chi Squared | | 14.095 | |
| df | | 23 | |
| Probability | | 0.003 | |

Table 5.10b
P-Values from Mann-Whitney U Test for Differences in Scores by Academic Level
 (Significant differences indicated in **bold**)

| | Sophomore | Junior | Senior |
|------------------|------------------|---------------|---------------|
| Freshman | 0.016 | 0.337 | 0.001 |
| Sophomore | . | 0.095 | 0.658 |
| Junior | . | . | 0.009 |

Grade Point Average: An examination of mean quiz scores by grade point average (GPA) shows that there is a significant difference among the grade ranges; however, the differences are not very large. Students with the lowest GPA (2.49 and below) had a mean score of 35.97, while students with the highest GPA (3.50 – 4.00) had a mean of 36.96, not even a one point difference.

Furthermore, pairwise comparisons using the Mann-Whitney U test indicate that the significant difference is not between the lowest and highest GPAs, but between the two middle GPA ranges (2.50 – 2.99 and 3.00 – 3.49) and the highest GPA. The statistics are summarized in Figure 5.29 and Tables 5.11a and b.

Figure 5.29
Mean Quiz Score by Grade Point Average (p<0.05)

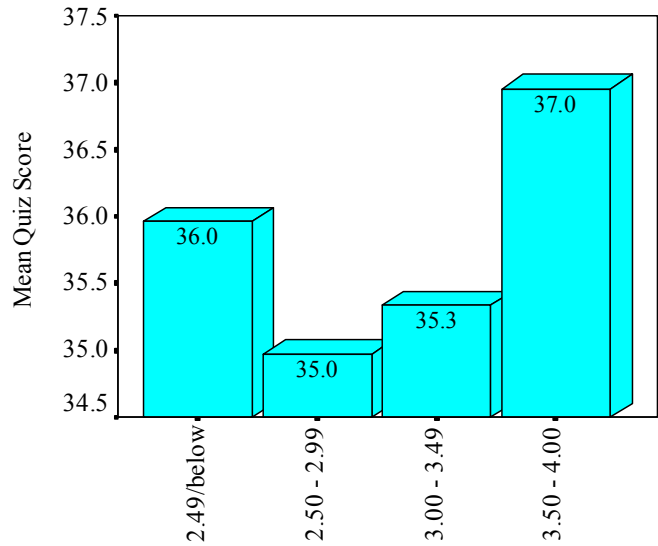


Table 5.11a
Kruskal-Wallis Test for Difference in Scores by GPA

| GPA | N | Mean Score | Mean Rank |
|---------------|-----|--------------|-----------|
| 2.49 or below | 58 | 35.97 | 211.47 |
| 2.50-2.99 | 115 | 34.94 | 195.91 |
| 3.00-3.49 | 136 | 35.34 | 200.69 |
| 3.50-4.00 | 113 | 36.96 | 240.38 |
| Total | 422 | | |
| Chi Squared | | 9.328 | |
| df | | 3 | |
| Probability | | 0.025 | |

Table 5.11b
P-Values from Mann-Whitney U Test for Differences in Scores by GPA
 (Significant differences indicated in **bold**)

| | 2.50 - 2.99 | 3.00 - 3.49 | 3.50 - 4.00 |
|---------------|-------------|-------------|--------------|
| 2.49 or below | 0.456 | 0.566 | 0.152 |
| 2.50 - 2.99 | . | 0.747 | 0.006 |
| 3.00 - 3.49 | . | . | 0.010 |

Geography in Grades 7-12 and Geography Requirement: Students who took a geography course sometime during junior/high school grades 7 – 12 scored slightly higher than did those who did not; however, this half point difference was not statistically significant.

Of the students who had taken a geography class in grades 7-12, those who took it as an elective had an average mean of nearly three points higher than those who were required to take the geography class. This difference was found to be significant using the Mann-Whitney U Test. The statistics are summarized in Figure 5.30 and Tables 5.12a and b.

Figure 5.30
Mean Quiz Score by Grade 7-12 Geography Course (p=0.987) and Requirement of Course (p<0.05)

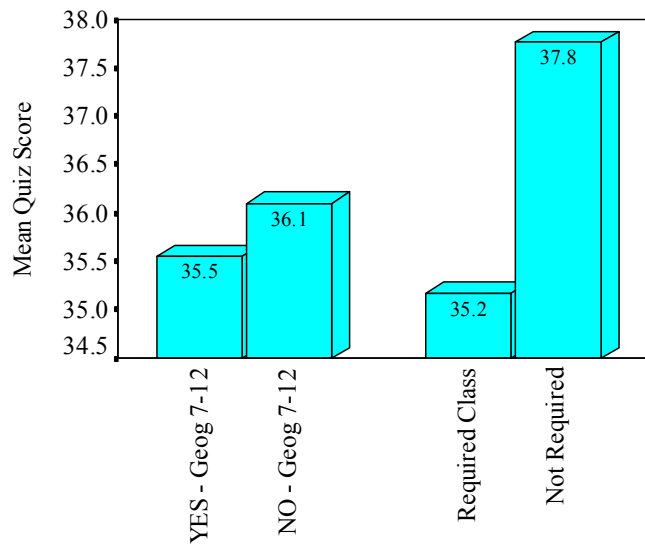


Table 5.12a
Mann-Whitney U Test for Differences in Scores by Completion of Geography Course in Grades 7-12

| Took Geography Class Grade 7-12 | N | Mean Score | Mean Rank |
|---------------------------------|-----|------------|-----------|
| Yes | 217 | 35.55 | 211.09 |
| No | 204 | 36.10 | 210.30 |
| Total | 421 | | |
| Mann-Whitney U | | 22114.000 | |
| Z-score | | -0.016 | |
| Probability | | 0.987 | |

Table 5.12b
Mann-Whitney U Test for Differences in Scores by Requirement of Geography Course in Grades 7-12

| Course Requirement | N | Mean Score | Mean Rank |
|--------------------|------|--------------|-----------|
| Required | 189 | 35.17 | 103.04 |
| Not Required | 22 | 37.77 | 131.43 |
| Total | 211* | | |
| Mann-Whitney U | | 1519.500 | |
| Z-score | | -2.070 | |
| Probability | | 0.038 | |

* Total does not include six students who indicated that they did not know if the course was required or not.

College Geography: The number of college-level geography classes taken was a statistically significant factor in the differing means of quiz scores. Students who have taken two or more college-level geography classes had a mean score of 39.41, a three and a half-point difference from the mean of students who have taken only one geography class and an over four-point difference from students taking no geography classes in college. Pairwise comparison using the Mann-Whitney U test show that there is no significant difference between taking one geography class and not taking any class, but differences in scores between those taking one or no class and those taking two or more are significant. The statistics are summarized in Figure 5.31 and Tables 5.13a and b.

Figure 5.31
Mean Quiz Score by Number of College Geography Classes ($p < 0.05$)

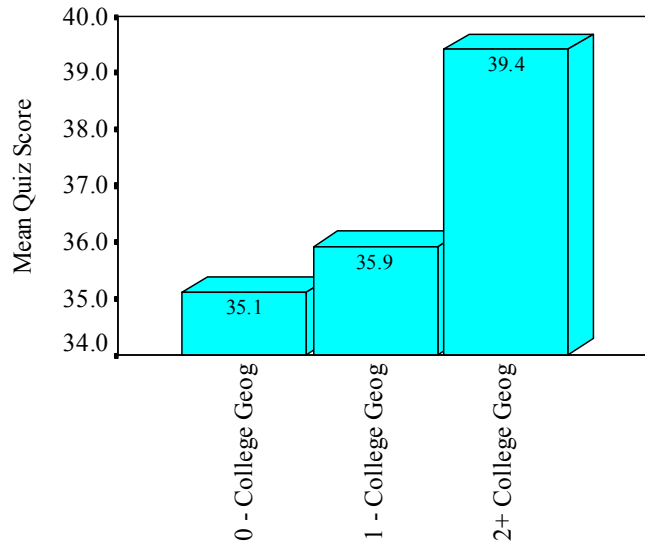


Table 5.13a
Kruskal-Wallis Test for Difference in
Scores by Number of College Geography
Classes

| Number of Classes | N | Mean Score | Mean Rank |
|------------------------------------|----------|-----------------------------|----------------------------|
| 0 | 275 | 35.11 | 194.93 |
| 1 | 87 | 35.91 | 208.65 |
| 2 or more | 61 | 39.41 | 293.75 |
| Total | 423 | | |
| Chi Squared | | 32.861 | |
| df | | 2 | |
| Probability | | 0.000 | |

Table 5.13b
P-Values from Mann-Whitney U Test
for Differences in Scores by Number of
College Geography Classes
 (Significant differences indicated in **bold**)

| | 1 | 2 or more |
|----------|----------|----------------------------|
| 0 | 0.360 | 0.000 |
| 1 | . | 0.000 |

Area 7 Fulfillment, Area 7 Geography, and World Regions: Students who have fulfilled the Area 7 requirement of Virginia Tech’s Core Curriculum had a mean score of 36.26, while students who have not yet fulfilled the requirement had a mean score of only 34.54. This almost two-point difference was found to be statistically significant with the Mann-Whitney U Test.

Of the students who have fulfilled Area 7, the number of Area 7 geography classes taken proved to be statistically significant. Pairwise comparisons indicate that students who have taken two or more Area 7 geography classes scored a significant 3.81 points more than did students who had not taken any Area 7 geography class. In addition, among those who have fulfilled Area 7, students who have taken world regional geography in college had a mean score of 38.03, which is over two points higher than the mean score of students who have not taken a world regions class. This difference was found to be statistically significant. Results are shown in Figure 5.32 and Tables 5.14a, b, c, and d.

Figure 5.32
Mean Quiz Scores by Fulfillment of Area 7 ($p < 0.05$), Number of Area 7 Geography Classes ($p < 0.05$), and Enrollment in World Regions ($p < 0.05$)

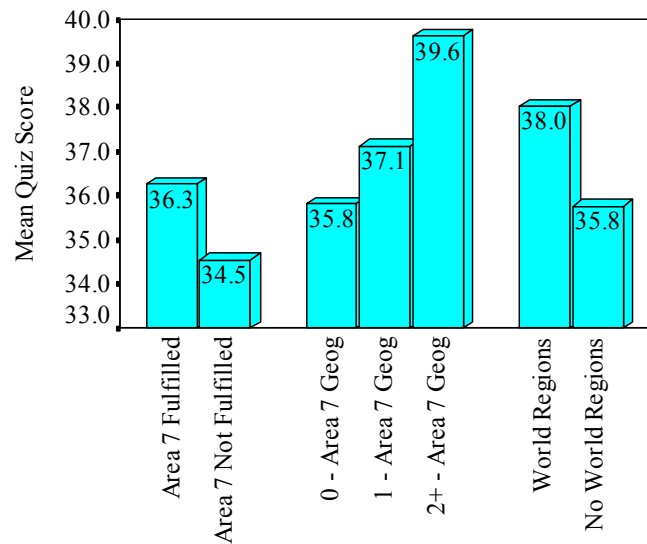


Table 5.14a
Mann-Whitney U Test for Differences in Scores by Fulfillment of Area 7

| Fulfillment of Area 7 | N | Mean Score | Mean Rank |
|------------------------------|----------|-------------------|------------------|
| Fulfilled | 288 | 36.26 | 211.43 |
| Not Fulfilled | 114 | 34.54 | 176.43 |
| Total | 402 | | |
| Mann-Whitney U | | 13557.500 | |
| Z-score | | -2.729 | |
| Probability | | 0.006 | |

Table 5.14b
Kruskal-Wallis Test for Difference in
Scores of Students who Fulfilled Area 7
by Number of Area 7 Geography Classes

| Number of Classes | N | Mean Score | Mean Rank |
|-------------------|-----|--------------|-----------|
| 0 | 204 | 35.82 | 132.38 |
| 1 | 58 | 37.17 | 151.28 |
| 2 or more | 16 | 39.63 | 187.50 |
| Total | 278 | | |
| Chi Squared | | 8.597 | |
| df | | 2 | |
| Probability | | 0.014 | |

Table 5.14c
P-Values from Mann-Whitney U Test
for Differences in Scores by Number of
Area 7 Geography Classes
 (Significant differences indicated in bold)

| | 1 | 2 or more |
|---|-------|--------------|
| 0 | 0.113 | 0.008 |
| 1 | . | 0.109 |

Table 5.14d
Mann-Whitney U Test for Difference in Scores of Students who Fulfilled Area 7 through a
World Regional Geography Class

| Taken World Regions | N | Mean Score | Mean Rank |
|---------------------|-----|--------------|-----------|
| Yes | 68 | 38.08 | 162.81 |
| No | 209 | 35.76 | 131.25 |
| Total | 277 | | |
| Mann-Whitney U | | 2487.000 | |
| Z-score | | -2.830 | |
| Probability | | 0.005 | |

When the same analysis was conducted on all students except geography majors, there was still a significant difference between students who had fulfilled Area 7 and those who had not. Similarly, among the non-geography majors who fulfilled Area 7, those who had taken world regional geography (whether at Virginia Tech or at another college/university) had a statistically significant higher mean score than that of those who had not, although with a *p*-value of 0.050 -- just on the cusp of significance. The number of Area 7 geography classes was not a significant factor when geography majors were excluded from the analysis. (See Tables 5.14e, f, and g)

Table 5.14e
Mann-Whitney U Test for Differences in Scores among Non-Geography Majors by Fulfillment of Area 7

| Fulfillment of Area 7 | N | Mean Score | Mean Rank |
|------------------------------|----------|-------------------|------------------|
| Fulfilled | 265 | 35.97 | 198.050 |
| Not Fulfilled | 113 | 34.49 | 169.344 |
| Total | 378 | | |
| Mann-Whitney U | | 12705.500 | |
| Z-score | | -2.336 | |
| Probability | | 0.019 | |

Table 5.14f
Kruskal-Wallis Test for Differences in Scores among Non-Geography Majors by Number of Area 7 Geography Classes

| Number of Classes | N | Mean Score | Mean Rank |
|--------------------------|----------|-------------------|------------------|
| 0 | 200 | 35.73 | 124.15 |
| 1 | 50 | 36.86 | 138.59 |
| 2 or more | 5 | 39.60 | 176.00 |
| Total | 255 | | |
| Chi Squared | | 3.713 | |
| df | | 2 | |
| Probability | | 0.156 | |

Table 5.14g
Mann-Whitney U Test for Differences in Scores among Non-Geography Majors by World Regions Class

| Taken World Regions | N | Mean Score | Mean Rank |
|----------------------------|----------|-------------------|------------------|
| Yes | 49 | 37.44 | 154.96 |
| No | 205 | 35.66 | 123.09 |
| Total | 254 | | |
| Mann-Whitney U | | 4118.000 | |
| Z-score | | -1.963 | |
| Probability | | 0.050 | |

Travel and International Experience

Foreign Language: While the mean quiz scores slightly declined with an increase in languages spoken, speaking one or more foreign languages did not result in any statistically significant difference. Even when taking residency status into account, the number of foreign languages spoken did not result in differences in mean quiz scores among the U.S. or the international student populations. The statistical results are shown in Figure 5.33 and Tables 5.15a, b, and c.

Figure 5.33
Mean Quiz Scores by Number of Foreign Languages Spoken (p=0.748)

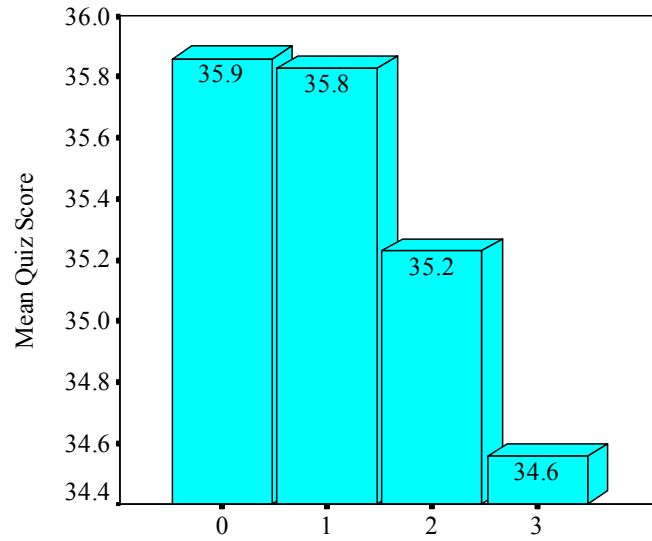


Table 5.15a
Kruskal-Wallis Test for Differences in Scores by Number of Foreign Languages Spoken

| Number of Languages | N | Mean Score | Mean Rank |
|---------------------|-----|------------|-----------|
| 0 | 256 | 35.86 | 213.13 |
| 1 | 127 | 35.83 | 221.35 |
| 2 | 35 | 35.23 | 198.06 |
| 3 or more | 9 | 34.56 | 197.11 |
| Total | 427 | | |
| Chi Squared | | 1.222 | |
| df | | 3 | |
| Probability | | 0.748 | |

Table 5.15b
Kruskal-Wallis Test for Differences in
Scores among U.S. Students by Number
of Foreign Languages Spoken

| Number of Languages | N | Mean Score | Mean Rank |
|---------------------|-----|------------|-----------|
| 0 | 253 | 35.81 | 175.23 |
| 1 | 92 | 36.32 | 192.32 |
| 2 | 14 | 36.79 | 185.29 |
| 3 or more | 0 | - | - |
| Total | 359 | | |
| Chi Squared | | 1.878 | |
| df | | 2 | |
| Probability | | 0.391 | |

Table 5.15c
Kruskal-Wallis Test for Differences in
Scores among International Students by
Number of Foreign Languages Spoken

| Number of Languages | N | Mean Score | Mean Rank |
|---------------------|----|------------|-----------|
| 0 | 3 | 40.33 | 54.00 |
| 1 | 35 | 34.54 | 34.11 |
| 2 | 21 | 34.19 | 32.21 |
| 3 or more | 9 | 34.56 | 34.83 |
| Total | 68 | | |
| Chi Squared | | 3.233 | |
| df | | 3 | |
| Probability | | 0.357 | |

International Friends: With mean scores ranging from 34.26 to 36.23 and students with three to four international friends having a mean score lower than that of students having no international friends, there was no discernable pattern in scores based on the number of international friends; neither were the differences in scores found to be statistically significant. The statistics are summarized in Figure 5.34 and Table 5.16a.

Figure 5.34
Mean Quiz Scores by Number of International Friends (p=0.276)

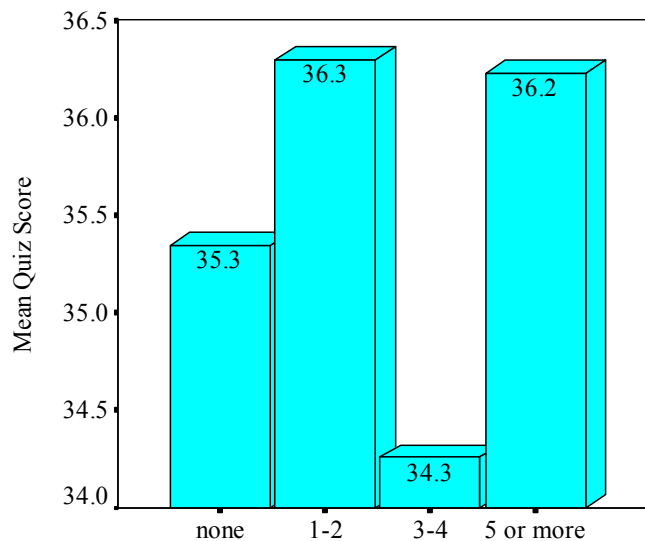


Table 5.16a
Kruskal-Wallis Test for Difference in Scores by Number of International Friends

| Number of Friends | N | Mean Score | Mean Rank |
|--------------------------|----------|-------------------|------------------|
| 0 | 131 | 35.34 | 200.66 |
| 1 - 2 | 135 | 36.30 | 218.63 |
| 3 - 4 | 54 | 34.26 | 192.71 |
| 5 or more | 101 | 36.23 | 223.99 |
| Total | 421 | | |
| Chi Squared | | 3.864 | |
| df | | 3 | |
| Probability | | 0.276 | |

When residency status was held constant, U.S. students who indicated that they had five or more friends of a different nationality from themselves scored roughly two to four points more than did students with fewer or no international friends. Statistical analysis using the Kruskal-Wallis test confirms this significant difference in mean scores. Among international students, a significant difference was not found based on the number of international friends. The results of the analysis are shown in Tables 5.16b and c.

Table 5.16b
Kruskal-Wallis Test for Differences in Scores among U.S. Students by Number of International Friends

| Number of Friends | N | Mean Score | Mean Rank |
|--------------------------|----------|-------------------|------------------|
| 0 | 128 | 35.34 | 166.45 |
| 1 - 2 | 126 | 36.33 | 179.94 |
| 3 - 4 | 49 | 34.33 | 159.87 |
| 5 or more | 51 | 38.04 | 216.16 |
| Total | 354 | | |
| Chi Squared | | 10.351 | |
| df | | 3 | |
| Probability | | 0.016 | |

Table 5.16c
Kruskal-Wallis Test for Differences in Scores among International Students by Number of International Friends

| Number of Friends | N | Mean Score | Mean Rank |
|--------------------------|----------|-------------------|------------------|
| 0 | 3 | 35.33 | 29.33 |
| 1 - 2 | 9 | 35.89 | 38.94 |
| 3 - 4 | 5 | 33.60 | 33.50 |
| 5 or more | 50 | 34.38 | 33.44 |
| Total | 67 | | |
| Chi Squared | | 0.801 | |
| df | | 3 | |
| Probability | | 0.849 | |

Study Abroad: Among U.S. high school graduates, students who had participated in a semester or longer study abroad program either in high school or in college had a statistically significant mean score 1.42 points higher than that of students who had not participated in study abroad. The results of the analysis are shown in Figure 5.35 and Table 5.17.

Figure 5.35
Mean Quiz Scores of U.S. Graduates by Participation in Study Abroad ($p < 0.05$)

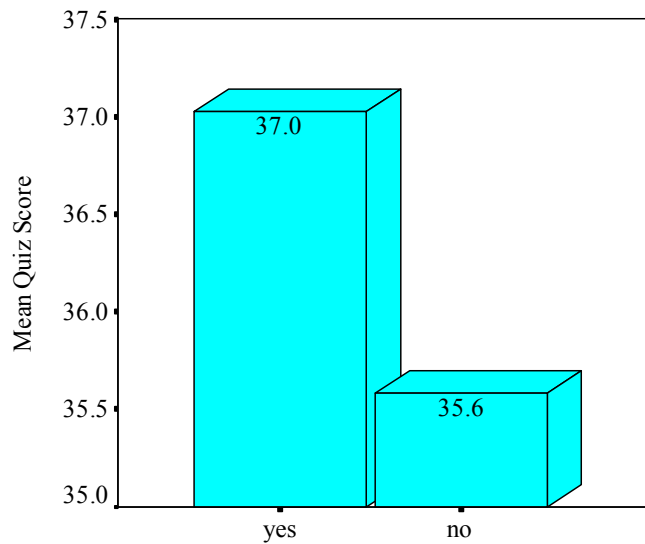


Table 5.17
Mann-Whitney U Test for Differences in Scores among U.S. High School Graduates by Participation in Study Abroad

| Participate in Study Abroad | N | Mean Score | Mean Rank |
|------------------------------------|----------|-------------------|------------------|
| Yes | 81 | 37.02 | 198.09 |
| No | 281 | 35.58 | 168.70 |
| Total | 362 | | |
| Mann-Whitney U | | | 5.279 |
| Z-score | | | 1.000 |
| Probability | | | 0.022 |

Number of Countries Visited: Students who have never visited another country had a mean score of 33.9, while those who had visited ten or more countries averaged a score of 38.5. Mean scores varied from 34.7 to 36.2 for students visiting from one to nine countries. The differences were found to be statistically significant using the Kruskal-Wallis test. Thus, further pairwise analysis was conducted with the Mann-Whitney U Test. The results of the analysis reveal that students who have visited ten or more countries had a significantly higher mean score than all other students. Students who have visited six to nine countries scored significantly higher than did those who had never left their home country. There was no significant difference among the mean scores of the remaining students. The statistics are shown in Figure 5.36 and Tables 5.18a and b.

Figure 5.36
Mean Quiz Scores by Number of Countries Visited ($p < 0.05$)

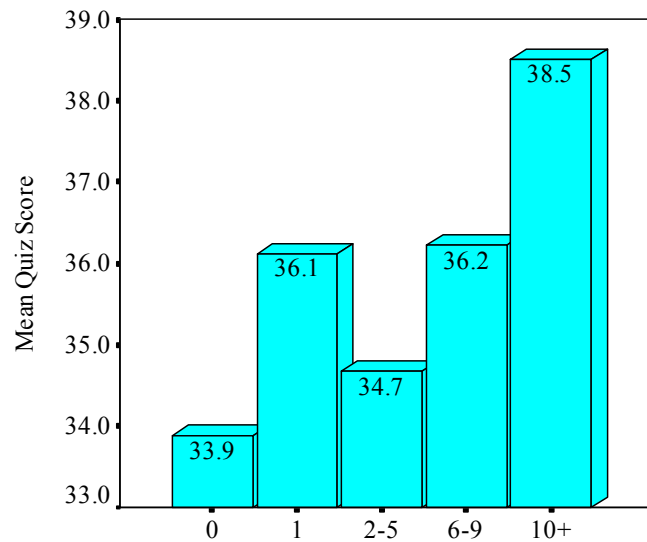


Table 5.18a
Kruskal-Wallis Test for Differences in
Scores by Number of Countries Visited

| Number of Countries | N | Mean Score | Mean Rank |
|---------------------|-----|--------------|-----------|
| 0 | 57 | 33.88 | 177.88 |
| 1 | 61 | 36.11 | 214.53 |
| 2 -5 | 148 | 34.67 | 189.80 |
| 6 - 9 | 77 | 36.22 | 221.80 |
| 10 or more | 81 | 38.51 | 267.96 |
| Total | 424 | | |
| Chi Squared | | 26.807 | |
| df | | 4 | |
| Probability | | 0.000 | |

Table 5.18b
P-Values from Mann-Whitney U Test
for Differences in Scores by Number of
Countries Visited
 (Significant differences indicated in **bold**)

| | 1 | 2 - 5 | 6 - 9 | 10+ |
|--------------|-------|-------|--------------|--------------|
| 0 | 0.114 | 0.484 | 0.042 | 0.000 |
| 1 | . | 0.167 | 0.744 | 0.008 |
| 2 - 5 | . | . | 0.062 | 0.000 |
| 6 - 9 | . | . | . | 0.019 |

Number of International Trips: Students who have never taken an international trip had the lowest mean score of 33.53. Students who had taken the most international trips, six or more, had a mean score of 36.77, which was actually a lower mean score than that of students who had only taken one trip. The differences were statistically significant. Pairwise comparison showed that students who had taken six or more trips scored significantly higher than all students except those who took one trip and that those who had taken one trip had higher mean scores than those who had taken no international trips. No significant differences were found among the remaining students. The analysis is shown in Figure 5.37 and Tables 5.19 a and b.

Figure 5.37
Mean Quiz Scores of U.S. Graduates by Number of International Trips Taken (p<0.05)

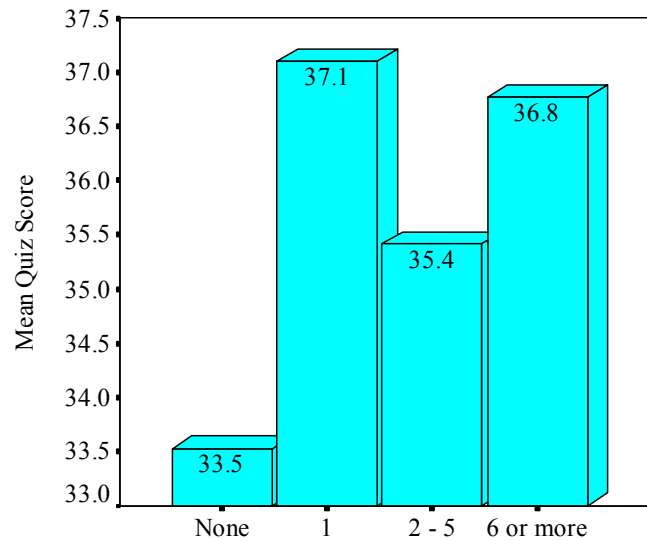


Table 5.19a
Kruskal-Wallis Test for Differences in Scores by Number of International Trips

| Number of Trips | N | Mean Score | Mean Rank |
|-----------------|-----|--------------|-----------|
| 0 | 64 | 33.53 | 172.15 |
| 1 | 72 | 37.10 | 235.87 |
| 2 -5 | 174 | 35.41 | 204.82 |
| 6 or more | 115 | 36.77 | 233.79 |
| Total | 425 | | |
| Chi Squared | | 13.704 | |
| df | | 3 | |
| Probability | | 0.003 | |

Table 5.19b
P-Values from Mann-Whitney U Test for Differences in Scores by Number of International Trips
 (Significant differences indicated in **bold**)

| | 1 | 2 - 5 | 6 or more |
|--------------|--------------|--------------|------------------|
| 0 | 0.003 | 0.061 | 0.001 |
| 1 | . | 0.069 | 0.881 |
| 2 - 5 | . | . | 0.046 |

Characteristics of News Media Usage

Primary News Media Source: Network news watchers received the lowest mean score, 32.84, followed by news magazine readers with a mean score of 34.00. Public radio listeners had the highest mean score of 38.00, followed by newspaper readers with 37.16. Students who cited their primary news source as the Internet/Web, cable news, commercial radio, or other source all had close mean scores between 36.06 and 36.36. The Kruskal-Wallis test showed that there were significant differences in mean scores among the news sources. Follow-up pairwise comparisons using the Mann-Whitney U test show that the only statistically significant differences are with network news watchers, who scored lower than newspaper readers, Internet/Web users, cable news watchers, and public radio listeners. All other differences were not found to be statistically significant. The results are shown in Figure 5.38 and Tables 5.20a and b.

Figure 5.38
Mean Quiz Scores by Primary News Media Source (p<0.05)

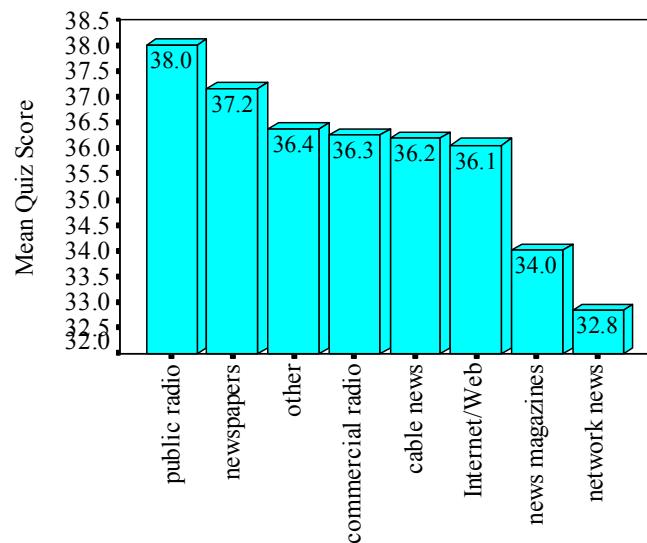


Table 5.20a
Kruskal-Wallis Test for Differences in Scores by Primary News Source

| News Media Type | N | Mean Score | Mean Rank |
|------------------------|----------|-------------------|------------------|
| public radio | 10 | 38.00 | 266.25 |
| newspapers | 64 | 37.16 | 240.35 |
| other | 11 | 36.36 | 218.95 |
| commercial radio | 4 | 36.25 | 197.00 |
| cable news | 136 | 36.18 | 214.72 |
| Internet/Web | 123 | 36.06 | 217.42 |
| news magazines | 9 | 34.00 | 186.72 |
| network news | 64 | 32.84 | 155.70 |
| Total | 421 | | |
| Chi Squared | | 20.026 | |
| df | | 7 | |
| Probability | | 0.006 | |

Table 5.20b
P-Values from Mann-Whitney U Test
for Differences in Scores by Primary News Media Source
 (Significant differences indicated in **bold**)

| | Internet/Web | cable news | network news | public radio | news magazines | commercial radio | other |
|-------------------------|---------------------|-------------------|---------------------|---------------------|-----------------------|-------------------------|--------------|
| newspapers | 0.232 | 0.149 | 0.000 | 0.446 | 0.215 | 0.472 | 0.679 |
| Internet/Web | . | 0.835 | 0.001 | 0.253 | 0.463 | 0.782 | 0.951 |
| cable news | . | . | 0.001 | 0.155 | 0.524 | 0.754 | 0.929 |
| network news | . | . | . | 0.015 | 0.523 | 0.537 | 0.141 |
| public radio | . | . | . | . | 0.156 | 0.374 | 0.512 |
| news magazines | . | . | . | . | . | 1.00 | 0.603 |
| commercial radio | . | . | . | . | . | . | 1.00 |

Least-Used Media Source: Given the small range in mean scores in relation to source of news media accessed the least, the differences were not statistically significant. Figure 5.39 and Table 5.21 display the statistical results.

Figure 5.39
Mean Quiz Scores by Least Used News Media Source (p=0.279)

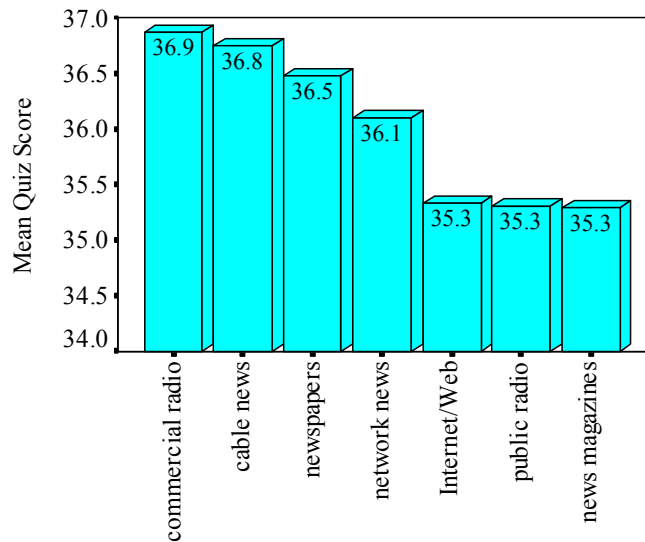


Table 5.21
Kruskal-Wallis Test for Difference in Scores by Least Used News Media Source

| News Media Type | N | Mean Score | Mean Rank |
|------------------|-----|------------|-----------|
| commercial radio | 79 | 36.89 | 239.42 |
| cable news | 20 | 36.75 | 229.88 |
| newspapers | 19 | 36.47 | 203.47 |
| network news | 10 | 36.10 | 200.10 |
| Internet/Web | 18 | 35.33 | 216.25 |
| public radio | 180 | 35.31 | 200.74 |
| news magazines | 92 | 35.29 | 197.38 |
| Total | 418 | | |
| Chi Squared | | 7.476 | |
| df | | 6 | |
| Probability | | 0.279 | |

News Media Usage: Only one student reported never accessing news media, and that student received a score of 34.0. With the exception of that one student and the 0.3 point difference between everyday users of news and those who access it 5 to 6 times a week, there was a general downward trend among the quiz scores; the less often news media were accessed, the lower the mean score. Students who indicated that they only accessed media once or twice a month had a mean score of 29.19, while those who reported that they accessed it on a daily basis had a mean score of 37.46. The differences were found to be statistically significant. Results of the Mann-Whitney U tests for pairwise comparisons indicate that there is no statistical significance in the differences of scores between students who access news everyday and students who access news media five or six times a week; neither is there such a difference between those who access it one to two times a week and three to four times. In sum, students who accessed news media at least five times a week had higher scores than did students who accessed it less. The results are summarized in Figure 5.440 and Tables 5.22a and b.

Figure 5.40
Mean Quiz Scores by Frequency of News Media Usage (p<0.05)

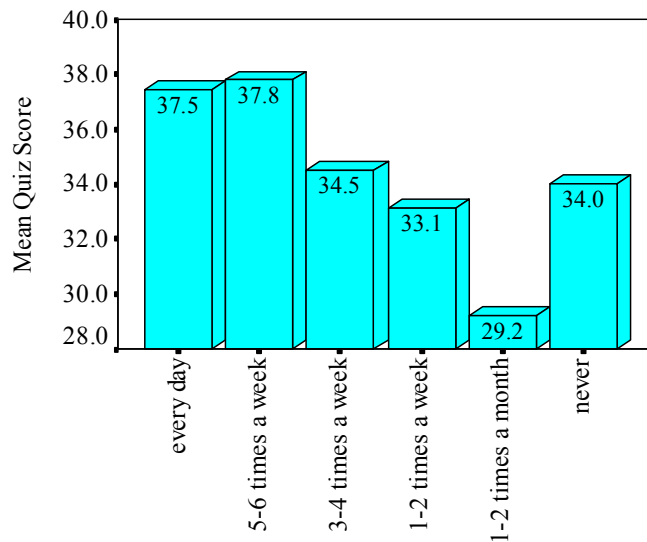


Table 5.22a
Kruskal-Wallis Test for Difference in
Scores by Frequency of News Media
Usage

| Frequency of Usage | N | Mean Score | Mean Rank |
|--------------------|-----|--------------|-----------|
| Everyday | 185 | 37.46 | 249.51 |
| 5-6 times/week | 61 | 37.80 | 254.83 |
| 3-4 times/week | 87 | 34.48 | 177.24 |
| 1-2 times/week | 69 | 33.12 | 157.29 |
| 1-2 times/month | 21 | 29.19 | 94.98 |
| Never | 1 | 34.00 | 128.50 |
| Total | 424 | | |
| Chi Squared | | 65.463 | |
| df | | 5 | |
| Probability | | 0.000 | |

Table 5.22b
P-Values from Mann-Whitney U Test
for Differences in Scores by Frequency of
News Media Usage
 (Significant differences indicated in bold)

| | 5-6 times/week | 3-4 times/week | 1-2 times/week | 1-2 times/month |
|----------------|----------------|----------------|----------------|-----------------|
| Everyday | 0.794 | 0.000 | 0.000 | 0.000 |
| 5-6 times/week | . | 0.000 | 0.000 | 0.000 |
| 3-4 times/week | . | . | 0.164 | 0.001 |
| 1-2 times/week | . | . | . | 0.019 |

Additional Analysis

In the previous section, I examined the results of the survey “quiz” based on a single variable. In this section I provide a more complex statistical analysis by comparing quiz scores in relation to various combinations of variables (for example, comparing male international students with male U.S. students). It would be nearly impossible to explore every combination of variables. Consequently, I selected a few in relation to the influence of gender and geography classes that are suggestive for future research.

Residency Status and Gender

Because I found a significant difference in quiz scores between men and women in general, I wondered whether differences in gender among U.S. students and international students impacted the mean score for those populations. As shown in Tables 5.23a and b, when taking into account both gender and residency status, there was a statistically significant difference between U.S. men, with a mean score of 38.44 and international men, with a mean score of 35.02, a difference of 3.52 points. However, there was no significant difference between U.S. and international women, who had nearly identical scores.

Table 5.23a
Mann-Whitney U Test for Differences in Scores among Men by Residency Status

| Residency Status | N | Mean Score | Mean Rank |
|------------------|-----|--------------|-----------|
| U.S. | 175 | 38.44 | 119.37 |
| International | 47 | 35.02 | 82.18 |
| Total | 222 | | |
| Mann-Whitney U | | 2734.5 | |
| Z-Score | | -3.54 | |
| Probability | | 0.000 | |

Table 5.23b
Mann-Whitney U Test for Differences in Scores among Women by Residency Status

| Residency Status | N | Mean Score | Mean Rank |
|------------------|-----|------------|-----------|
| U.S. | 183 | 33.63 | 101.17 |
| International | 19 | 33.42 | 104.68 |
| Total | 202 | | |
| Mann-Whitney U | | 1678.0 | |
| Z-Score | | -0.25 | |
| Probability | | 0.803 | |

Gender and Travel

Because students who had traveled to 10 or more countries had significantly higher scores than those of students who had traveled to fewer countries, I was interested to determine whether the gender gap remained even among this well-traveled population. While women still had a lower mean score than that of men, the less than two point difference was not statistically significant (Table 5.24).

Table 5.24
Mann-Whitney U Test for Differences in Scores among Students Who have Visited 10 or More Countries by Gender

| Gender | N | Mean Score | Mean Rank |
|----------------|----|------------|-----------|
| Male | 48 | 39.21 | 43.83 |
| Female | 32 | 37.59 | 35.50 |
| Total | 80 | | |
| Mann-Whitney U | | 608.000 | |
| Z-score | | -1.579 | |
| Probability | | 0.114 | |

Gender and Media Usage

Similarly, because students who accessed news media on a daily basis were found to have significantly higher scores than those of students who accessed it less frequently, I again was interested to explore whether the gender bias remained. The three point difference in scores (favoring the men) was found to be statistically significant (Table 5.25).

Table 5.25
Mann-Whitney U Test for Differences in Scores among Daily News Media Users by Gender

| Gender | N | Mean Score | Mean Rank |
|----------------|----------|-------------------|------------------|
| Male | 68 | 37.78 | 63.38 |
| Female | 44 | 35.16 | 45.88 |
| Total | 112 | | |
| Mann-Whitney U | | 1028.500 | |
| Z-score | | -2.797 | |
| Probability | | 0.005 | |

I also compared mean quiz scores for frequency of media usage separately by gender and the results were statistically significant. Overall, for both sexes, those who accessed the news media on a more regular basis had higher mean scores, though for the women, those who accessed the news 5 to 6 times a week had a slightly higher mean score than did those who accessed it everyday. The difference between those who accessed the news just once or twice a month and those who accessed it daily was much greater for men than for women. The difference for men was almost 10 points, while it was less than six for the women. The results are shown in Tables 5.26a and b.

Table 5.26a
Kruskal-Wallis Test for Differences in
Scores among Men by Frequency of News
Media Usage

| Frequency of Usage | N | Mean Score | Mean Rank |
|--------------------|-----|--------------|-----------|
| Everyday | 116 | 38.84 | 124.04 |
| 5-6 times/week | 23 | 38.27 | 120.41 |
| 3-4 times/week | 37 | 36.92 | 93.91 |
| 1-2 times/week | 37 | 35.57 | 80.50 |
| 1-2 times/month | 8 | 29.00 | 42.13 |
| Never | 0 | - | - |
| Total | 221 | | |
| Chi Squared | | 22.195 | |
| df | | 4 | |
| Probability | | 0.000 | |

Table 5.26b
Kruskal-Wallis Test for Differences in
Scores among Women by Frequency of
News Media Usage

| Frequency of Usage | N | Mean Score | Mean Rank |
|--------------------|-----|--------------|-----------|
| Everyday | 67 | 35.01 | 115.90 |
| 5-6 times/week | 24 | 37.08 | 134.23 |
| 3-4 times/week | 50 | 32.68 | 89.32 |
| 1-2 times/week | 45 | 31.84 | 84.94 |
| 1-2 times/month | 13 | 29.31 | 56.50 |
| Never | 1 | 34.00 | 90.00 |
| Total | 200 | | |
| Chi Squared | | 25.660 | |
| df | | 5 | |
| Probability | | 0.000 | |

College Geography and Travel

Taking two or more geography classes in college and traveling to ten or more different countries were both found to be indicators of higher mean quiz scores. I was interested in determining how those two variables interact – that is, whether taking geography classes makes a difference among students with less travel experience (traveled to less than ten countries) compared to those with more experience (traveled to ten or more countries). The results of the analysis indicate that among students who have traveled to fewer than ten countries, the number of college-level geography classes taken is statistically significant – those who had not taken any college geography had a mean score of 34.42 compared to a mean score of 39.33 for those who had two or more geography classes. However, among students who had traveled to more than ten countries, the slight increase in mean scores among those who had taken more geography classes was not found to be statistically significant. The results are summarized in Tables 5.27a and b.

Table 5.27a
Kruskal-Wallis Test for Differences in
Scores Among Students Who have Visited
Less Than 10 Countries by Number of
College Geography Classes

| Number of Classes | N | Mean Score | Mean Rank |
|-------------------|-----|--------------|-----------|
| 0 | 219 | 34.42 | 155.20 |
| 1 | 75 | 35.41 | 168.33 |
| 2 or more | 45 | 39.33 | 244.82 |
| Total | 339 | | |
| Chi Squared | | 31.388 | |
| df | | 2 | |
| Probability | | 0.000 | |

Table 5.27b
Kruskal-Wallis Test for Differences in
Scores among Students Who have Visited
10 or More Countries by Number of
College Geography Classes

| Number of Classes | N | Mean Score | Mean Rank |
|-------------------|----|------------|-----------|
| 0 | 54 | 38.06 | 38.52 |
| 1 | 11 | 39.09 | 46.36 |
| 2 or more | 16 | 39.63 | 45.96 |
| Total | 81 | | |
| Chi Squared | | 1.824 | |
| df | | 2 | |
| Probability | | 0.402 | |

College Geography and Major

Students who had taken two or more college geography classes had mean scores significantly higher than students who had taken fewer classes. Furthermore, geography majors had higher mean scores than all other majors. Since it is likely that geography majors have taken more geography classes than have non-geography majors, I re-analyzed the data excluding geography majors in order to determine whether the relationship between number of geography classes and quiz scores remained. Indeed, the differences in mean scores remained – non-geography majors who had not taken a geography class had a mean score of 35.11, whereas non-geography majors who had taken two or more geography classes had a mean score of 39.27 (Table 5.28).

Table 5.28
Kruskal-Wallis Test for Differences in Scores among Non-Geography Majors by Number of College Geography Classes

| Number of Classes | N | Mean Score | Mean Rank |
|--------------------------|----------|-------------------|------------------|
| 0 | 275 | 35.11 | 188.67 |
| 1 | 87 | 35.91 | 201.72 |
| 2 or more | 37 | 39.27 | 280.17 |
| Total | 399 | | |
| Chi Squared | | 20.633 | |
| df | | 2 | |
| Probability | | 0.000 | |

Summary

In this chapter I described the characteristics of the participants and summarized the results of the survey and compared the proportion of quiz scores which were above and below the overall mean for each factor measured in the survey. I used the Mann-Whitney U and Kruskal-Wallis tests to compare the quiz scores for each factor in order to determine which ones might influence geographic literacy. In the final chapter, I will discuss the results and relate them to the broader literature on geographic literacy.

CHAPTER 6: DISCUSSION AND CONCLUSIONS

In this final chapter, I discuss the results of the survey and their significance within the literature on geographic literacy and world knowledge. The discussion will be framed around the questions discussed in the first chapter. The chapter will conclude with my recommendations for the future of geography education and Virginia Tech's curriculum.

How Geographically Literate are Undergraduate College Students?

Contrary to the fear that the U.S. is a geographically illiterate population, the students who participated in this survey demonstrated a good level of geographic knowledge. There were students who performed poorly; however, with an average score of 81 percent correct, the geographic knowledge demonstrated by the college students was on the high end of the spectrum. A direct comparison of the scores of the U.S. participants of the National Geographic Survey with the undergraduate participants in this study can not accurately be made because the survey instruments were similar but not identical. Nevertheless, the results of this study suggest that the undergraduate participants have a greater degree of geographic and world knowledge than the overall U.S. 18 to 24-year old population. The participants in the National Geographic Survey answered less than half of the questions correctly (National Geographic 2002, 3).

The undergraduate participants in this study may not be representative of all college students. First, the sample came from a single university, and differences among students admitted to the multitude of universities across the U.S. are likely to affect students' level of geographic literacy. Second, the students were randomly selected for this study, but there may be differences between those who chose to participate and those who did not. In other words, students who were not interested in or not confident in their geographic skills may be the ones who did not participate, leaving the most knowledgeable students to take the survey, causing an inflated mean score.

Little research has directly compared the geographic literacy of college students to non-college students or the general population of similar age. The closest example is the study by Donovan (1993, 87), in which he found that among adults in Dublin, Ireland, those who attained the highest level of education had higher mean scores. The National Geographic Survey (2002, 8) also found that among U.S. participants, those with at least some college education answered

more questions correctly than did those with less education. It may be possible to infer then that the college students in this study performed better on the survey than would the general U.S. population of 18 to 24-year olds. Future research should examine this relationship in order to provide conclusive evidence.

Overall, the undergraduate college students included in this study were geographically literate, although there was still room for improvement. However, I cannot conclude that all undergraduate college student populations would perform as well.

What Factors May Influence Geographic Literacy?

Demographics

Consistent with nearly all research on geographic literacy, including the National Geographic Survey, men in this study showed a greater degree of geographic and world knowledge than did women. Much of the research on geographic literacy attributes the gender factor to causes such as differences in exposure to geography (Bein 1990, Henrie, et al. 1997), socialization differences (Eve, et al. 1994, Henrie, et al. 1997), or cultural acquisition (Donovan 1993). To further explore this occurrence, I examined gender while holding other factors constant.

In his study of university students in Indiana, Bein (1990, 264) found that even among the most frequent travelers, the gap in scores between men and women remained significant. The results of this study, however, do not support Bein's findings. While men who had traveled to at least ten different countries had slightly higher scores than those of the women with the same amount of travel experience, the differences in scores were not significant. The contradiction in findings may be the result of the way in which travel was measured; in Bein's study, all travel outside the home state was included, whereas in this study, only international travel was counted. The lack of significant differences in scores between men and women with greater travel experience optimistically suggests that the gender gap can be overcome when provided with similar opportunities for travel. This finding supports Kitchin's (1996, 285) conclusion that differences in geographic knowledge between men and women are limited when "given the same geographic training and spatial behavior."

Less optimistic was the finding that among students who access the news on a daily basis, men scored statistically higher than women. A possible interpretation for this result is that when

women access the news, they focus on different aspects of the news or different types of stories than men do. Additional research is needed to determine if this is the case. A positive finding would further support the idea that gender differences are due to external social/cultural differences and not to differences in innate geographic knowledge.

The National Geographic Survey (2002) compared the geographic literacy of U.S. participants to participants from eight other countries. That study found that the U.S. participants performed worse than participants from all other countries except Mexico. Based on these findings, I expected that international students in this study would have higher scores than the U.S. students. However, this was not the case, and this finding is not unprecedented. Torrens' (2001) study of the place location knowledge of students in Dublin found that there was no association between nationality and test score. The foreign-born students in the Eve, et al. (1994) study of geographic literacy also scored slightly lower than did the U.S. students, though, as in this study, the difference was not statistically significant. Even so, because this project was a modification of the National Geographic Survey, I was surprised by the differing results. One likely explanation is that the sample used in the National Geographic Survey, with the exception of samples in Mexico and Japan, consisted of people from highly developed Western countries. The international student participants in this study came from over 20 different countries from Europe, Asia, Africa, and South America, and, in particular, had a high proportion of students from India and China. With this being the case, the results are more in line with the findings of a comparative study by Saarinen and MacCabe (1995, 199) of world sketch maps. The authors found that students from Asia, Oceania, and South America had the highest proportion of "poor" quality maps, while students from Europe and North America had the highest proportion of "excellent" quality maps. It would be interesting to further explore differences in geographic knowledge among people from developed and less-developed countries.

In the analysis of residency status, U.S. men scored significantly higher than did international men, while the scores of U.S. and international women were not statistically different. These results suggest that nationality is, indeed, an influence on geographic literacy, but that the gender gap overrides its significance. In other words, similar social/culture/educational factors are at play both in the U.S. and internationally that obstruct women's acquisition of geographic knowledge; but among men, the difference in scores may be attributed to actual cultural differences.

The influence of age on geographic knowledge has not been conclusively determined in the literature. The theory is that the older a person is, the greater the opportunity to acquire geographic knowledge and thus the greater the level of geographic knowledge. In the Donovan study (1993), age was not a statistically significant factor. In Bein's study (1990), age was a significant influence on knowledge of physical and human geography, but not on place location knowledge. In the National Geographic Survey (2002), the 25–34 year-old U.S. participants performed better than did the 18–24 year-old participants on some, but not all of the questions. The results of my study are consistent with the results of the study by Eve, et al. (1994). That is, age was a statistically significant influence; however, the variations were not so much between successive years (there was no significant difference among the mean scores of students aged 18 to 21) but between older and younger students in general. In the Eve, et al. (1994, 422) study, the divide occurred around age 27. In this study, those 22 and older tended to perform significantly better than those under 22.

Educational Characteristics

With regards to major, this study included more detailed analyses in terms of the categories of majors than those in the two other studies that included college major in their analyses. This makes comparison difficult. For example, of the four categories Bein (1990, 261) measured, he found that Arts and Sciences majors had the highest level of geographic knowledge, followed by business students, "others," and lastly, education students (1990, 261). Bein's Arts and Sciences category would fall into two of my categories: the College of Sciences and the College Liberal Arts and Human Sciences. Furthermore, Bein's education students would be included under my Liberal Arts and Human Sciences category. This is similarly the case with Eve, et al.'s study (1994), which included separate categories for liberal arts and for social sciences, but in my study would be in one category. As with my study, however, college major, in whatever manner it was categorized, was found to be related to geographic knowledge.

Overall, my results indicate that geography majors had the highest scores, followed by students in the College of Architecture and Urban Studies and international studies students. The statistical significance was strongest when comparing geography and Architecture and Urban Studies students to the other majors. I had expected that geography and international studies majors would perform well on the quiz because the subject matter is the primary focus of their

university studies. I suspect that Architecture and Urban Studies students did so well due to the international focus of many of their classes, such as international development. Additionally, the architecture program has a well-established semester study abroad program at the university's campus in Switzerland. At the same time though, the business school also promotes a semester-long business program at the Swiss campus and the scores of the business students were significantly lower than those of the three top scoring majors. Engineering students performed at the higher end of the spectrum, though statistical significance was not strong in comparisons with most other majors. By and large, except for geography, international studies, and Architecture and Urban Studies students, there was almost no statistical difference among quiz scores of the other majors.

Unlike Bein's (1990) findings, my study indicates that academic level is not a reliable predictor of geographic literacy. While significant variation was found in the mean scores based on academic level, the scores did not follow the expected pattern of more advanced students scoring higher than the less advanced. Seniors did have significantly higher scores than freshman and juniors, but had nearly the same score as the sophomores, and neither did juniors score significantly higher than freshmen.

Virginia Tech, as do most educational institutions in the U.S., measures a student's academic performance through the use of grading and grade point averages (GPAs). I hypothesized that "better" students, those with higher GPAs, would also perform better on the quiz. The findings indicate that there is a significant variation in mean scores based on GPA; however, the relationship is not what was expected. Students with the lowest GPA (2.49 or below) did not score significantly different than did students with higher GPAs. The significant differences were only between those with the highest GPA (3.50–4.00) and GPAs of 3.00–3.49 and 2.50–2.99. These findings concur with the study by Eve, et al. (1994, 419), who concluded that "even respondents who are better students in general (as demonstrated by higher GPA) may not have equally strong geography skills."

The results of this study also indicate that there is no statistically significant difference between students who took a geography class in junior high or high school (grades 7-12) and those who did not. This supports the findings in Bien's (1990) study of geographic knowledge in university students. My study also found that among the students who did take a geography course in junior/high school, those who took the course as an elective scored slightly higher than

students who took it because it was required. Bein administered his survey to students in a college geography class and asked them if they took the course as an elective or as a requirement, and, as in my study, he found that students taking it as an elective scored higher. It was thought that students who take a course as an elective are actually interested in the subject and will therefore be more receptive to what is being taught than would students who are forced to take the course but may not care about the subject.

Junior/high school geography classes did not have any effect on geographic knowledge, but college geography did; specifically, students who had taken two or more college geography classes had a higher mean score than did students taking just one or no college geography class. I expected that the more geography courses that a student took, the greater the student's geographic knowledge. Because geography majors probably have taken more geography classes than other students, I examined the number of college geography classes taken by students who were not geography majors. The number of geography classes remained a significant factor for students having taken two or more such classes, meaning that the differences in scores were probably not due to an overabundance of geography majors in the sample; rather, any student who took two or more geography classes, regardless of major, had statistically significant higher scores. This finding supports Bein's (1990, 262) results, though in his sample taking just one college geography class provided a significantly higher score.

In analyzing mean scores based on the number of college geography classes taken while holding constant the number of countries visited, interesting results were found. Among students who had been to less than ten different countries, those who had taken two or more geography classes in college had significantly higher scores than those of students who had taken fewer geography courses. However, among more extensive travelers (those who had been to ten or more countries) the number of college geography courses was not a significant factor. These results suggest that students who travel more are able to acquire geographic knowledge informally through travel, whereas students with less travel experience gain a greater benefit from taking college geography courses.

Beyond examining variation in scores based on general educational factors, I also explored factors specific to Virginia Tech. Because Area 7 of the University's Core Curriculum is designed to provide students with a global perspective, I hypothesized that students who have fulfilled this requirement would therefore possess a greater degree of geographic and world

knowledge. The results of the analysis support this hypothesis. When geography majors were excluded from the same analysis, having taken an Area 7 course still proved to be statistically significant, though the score gap between those who had fulfilled the requirement and those who had not had slightly decreased.

Similar results were found when investigating the possible influence of taking a course on world regional geography on geographic literacy and world knowledge. Among the students who had taken an Area 7 class, those who had taken world regional geography had significantly higher scores than those of students who had not. The significance remained, though just slightly, even when geography majors were excluded.

However, while students who had taken two or more Area 7 geography classes had significantly higher scores than those of students who had not taken an Area 7 geography class, when geography majors were excluded from the analysis, the higher scores were not found to be statistically different. This result indicates that geography majors had higher mean scores than other students and that among non-geography majors, taking additional Area 7 courses has little affect on the mean score.

Travel and International Experience

I hypothesized that students who speak more languages would also display higher levels geographic and world knowledge. My hypothesis was based on the assumption that students who are interested enough in the world to learn another language would also be more knowledgeable about the places in which those languages were spoken. My results do not support the hypothesis. I assumed that international students spoke more languages than did U.S. students and because the mean scores of U.S. and international students were not significantly different, I re-analyzed the data for both U.S. and international students separately. I expected that fewer U.S. students would speak multiple languages so that those who did would perhaps have higher scores. This was not the case. In neither the U.S. nor international student populations was the number of languages spoken a significant factor. This is contrary to the results of the National Geography Survey (2002, 8) in which respondents who spoke more than one language did better than those who spoke only one language. This suggests that the difference in quiz performance may not be related to number of languages spoken, but to the place in which a person lives. The highest scoring respondents from the National Geographic

Survey were from European countries, and it was the European countries that had the greatest proportion of foreign language speakers. It was the international students from this survey who had the highest number of multilingual students so they should have had higher scores, but as was discussed earlier, they did not. Therefore, I suspect such a result is because the international students in this sample are from a multitude of primarily non-European countries, which is creating the differences in results between this study and those in the National Geographic Survey. Another potential explanation may be that my study included only college students while the National Geographic Survey included a broader population and within that broader population the number of languages spoken influenced the level of geographic knowledge.

The assumption behind measuring the number of friends of different nationalities than one's own is the expectation that friends will discuss their backgrounds with each other and will learn about cultures different than their own. Overall, the number of friends did not prove to be a significant factor. Neither were there significant differences in scores for international students based on number of international friends. The opposite was true; while not statistically significant, the results for students with three or more international friends were lower than scores for students with fewer international friends. However, among U.S. students, significant differences were found. Students who indicated that they had five or more friends of a different nationality had the highest mean score. But the pattern is not consistent because students with three or four international friends had the lowest mean score. This may relate to the difficulty respondents had interpreting what the variable "good friend" meant. It would be interesting to follow up with a more thorough investigation of the possible relationship between personal relationships and geographic knowledge because it has not been previously explored in the literature.

The influence of educational study abroad programs appears not to have been examined in the literature on geographic literacy. I expected that students who have participated in a study abroad program would display higher levels of geographic and world knowledge because the extended programs (for this research, defined as being a semester or longer) provide a substantial amount of time to learn about another culture and place and offer a student the opportunity to see the world and their home country from a different perspective. I assumed that students who chose to study abroad have at least a minimal interest in learning about other places. Study abroad was only measured among U.S. graduates (since overseas graduates, by definition, had

overseas educational experiences). Among the U.S. students sampled, those who had participated in study abroad, whether in high school or in college, had significantly higher scores, thus supporting my hypothesis.

The influence of travel on geographic knowledge has been measured in several studies, including the National Geographic Survey (2002, 8), which found that participants “who travel internationally...did better on the survey.” Donovan (1993, 87-88) measured this variable by the distance away from Ireland that the participants had traveled. A positive correlation was only found among the adult sample; the adults who traveled the farthest from Ireland demonstrated the highest level of geographic knowledge, and those who had never traveled outside of Ireland demonstrated the lowest level of geographic knowledge. I found only one study in which travel was not a statistically significant variable. The results of the research of Eve, et al. (1994, 422) research revealed that while students who had traveled outside of the U.S. three or more times scored higher than those who had not, the difference was not statistically significant. Bein (1990, 262-263) measured travel not just internationally, but to any place outside the student’s home state. For both number of times traveled and number of states and countries visited, the students who traveled more had higher scores. However, for number of times traveled, there was only a significant difference between those who had taken thirteen or more trips and those who had not traveled.

Similar to Bein’s study, I examined both the number of trips taken and the number of different places visited. However, I wanted to examine geographic knowledge at the world-wide level so I included only international travel in my study. Students who had been to ten or more different countries had significantly higher scores than students who had not. Among students who had traveled to less than ten countries, there were slight differences in scores but they were not statistically significant—a result similar to that in Bein’s study.

The results of analysis by number of trips taken indicate that students who had taken six or more international trips had significantly higher mean scores than those who had taken no trips or those who had taken two to five trips, but not in relation to students who had taken just one international trip. One possible explanation is that students who took just one international trip visited multiple countries on that trip, while some students who had taken more international trips took repeated trips to the same country. This would be especially true among international students who may frequently travel home and back to the U.S., but do not travel much outside of

those places. Bein (1990, 262) suggests that “frequent travelers who return to the same place repeatedly may be spending little time learning geography,” which may be relevant for my own results.

Characteristics of News Media Usage

My results indicate that there are significant differences in geographic knowledge based on the source of news media accessed most frequently by students. Further analysis reveals that network news watchers had significantly lower mean scores than those of public radio listeners, cable news watchers, Internet/Web users, and newspaper readers. This result may indicate that network news does not cover the same news events or provide the same depth of coverage as do these other sources. In contrast, Torrens (2001), found that neither newspaper reading nor radio listening had a significant influence on place location knowledge. While both Donovan (1993) and Torrens (2001) explored exposure to television, (Donovan found no relationship, but Torrens did), neither examined news-specific television viewing. This study also examined students’ least used source of news media, but there were no significant differences among scores.

The frequency of news media usage turned out to be a strong predictor of quiz scores, which was consistent with Donovan’s findings (1993) in which more frequent newspaper readers obtained the highest scores. There was no significant difference between the scores of those who reported that they accessed the news daily and those who accessed it five or six times a week, but there were significant differences in scores for each subsequent decrease in usage, concluding with students who access the news just once or twice a month having the statistically lowest mean score. Frequency of news access was also a significant factor when men and women were analyzed separately. These results are important because they suggest that regardless of the source of the news, regular access to the news is helpful in gaining geographic knowledge.

Conclusions and Recommendations

The students who participated in this study performed well in the assessment of geographic literacy and world knowledge. The overall mean score was 81 percent. While this survey is not directly comparable to the National Geographic Survey, the results suggest that the undergraduate participants in this survey had a greater degree of geographic knowledge than the

representative sample of 18–24 year old young adults in the U.S. Nevertheless, that 40 percent of the undergraduate students in this study scored below a “B” is still a cause for concern.

This study, as did most of the previous research, focused on the role of the formal education system in developing geographic literacy; however, the results of this study indicate that formal geography training may not be the only important factor. Taking a geography class in junior/high school did not make any significant difference on the mean scores. Taking college geography classes, particularly world regional geography, appeared to be helpful. But informal education through travel, interaction with people of other nationalities (at least for U.S. students), and keeping up with the news on a regular basis were all significant factors. In fact, extensive travel to over ten countries erased the prevailing gender gap between men and women. While this study does not prove causation, the results suggest that those who are interested in geography and world events, as exemplified by those students who chose to take geography courses, major in geography, travel to foreign countries, and keep up with the news on a regular basis, have a greater degree of geographic literacy.

Based on the results of this study, I would make the following recommendations to improve upon the formal education system:

Recommendations for K-12 educators:

- Get students interested in geography and world events at an early age
- Provide teachers with training in geography so they are able to teach and encourage interest in geography
- Encourage students to regularly access news media and teach students how to understand and analyze the news they access

Recommendations for universities:

- Actively promote, or if possible require, participation in study abroad programs
- Develop and require courses with an international focus
- Require all students to take world regional geography
- Encourage students to regularly access news media and teach students how to understand and analyze the news they access
- Infuse the university population with international students and faculty

Assessing geographic literacy and the factors which influence it is a complex process. This study shed light on a few factors, but certainly not every possible influence and much research is still needed. This study supported many of the existing studies of factors that influence geographic knowledge, but it also raised new questions for future research. Nearly all previous research has found that men demonstrate greater levels of geographic literacy. Additional research is needed to determine the contexts in which such gender differences are minimized.

It would also be worthwhile to continue the research on the effects of different types of news media on geographic literacy. It was interesting that network news watchers had significantly lower mean scores than cable news watchers. Is this because of differing news content or because of differences in the types of people who watch cable news rather than network news? It was interesting to note that even among students who accessed the news on a regular basis, the gender gap remained. Is this because men access different news sources than women or because women retain different aspects of the news than men do?

In conclusion, geographic literacy and world knowledge are important, if not absolutely necessary, in today's globalized society. Many factors work together to influence a person's geographic knowledge. By working within the formal education system and encouraging geographic activities outside of school, teachers, administrators, and parents can help students improve their knowledge of geography and the world in which we live.

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**APPENDIX 1:
SURVEY INSTRUMENT**
(Modified from webpage to fit in this document format)

Survey of Geographic Literacy and World Knowledge

Thank you for participating in this survey. If you have any questions about or problems with this survey, please contact me at jwinship@vt.edu.

Directions: For each of the questions below (unless otherwise specified) use your mouse to click on the one answer you wish to select. If you don't know an answer, select "don't know." *DO NOT consult any sources (including the internet) to obtain the answers.*

I. Attitudes and Opinions

There are no right or wrong answers to these questions; we are just interested in your own opinions. This information will help to interpret the factors related to geographic literacy.

Please indicate how important you think it is to have each of the following skills or abilities in today's world:

1. Use a personal computer

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

2. Use a calculator

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

3. Read a map

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

4. Write a business letter

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

5. Speak a foreign language

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

6. Know where countries in the world are located

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

7. Keep up with current events

Absolutely Necessary Important but not Absolutely Necessary Not Too Important Don't Know

II. The World and World Events

Do not consult other people or sources for the answers to these questions. You are not expected to know all of the answers. And remember, your answers will be kept strictly confidential.

8. Which of the following ranges contains the correct population of the United States?

- 10 million - 50 million
- 150 million - 350 million
- 500 million - 750 million
- 1 billion - 2 billion
- Don't know

9. Which of the following religions has the largest number of followers world wide?

- Christianity
- Islam
- Judaism
- Buddhism
- Hinduism
- Don't know

10. Where would you say most immigrants to the U.S. come from today? (type in your

answer below)

11. The Taliban and Al Qaeda movements were both based in which country?

- Iraq
- Pakistan
- Israel
- Albania
- Afghanistan
- Don't know

12. Which of the following organizations endorses the euro as the common currency for its members?

- World Trade Organization (WTO)
- North Atlantic Treaty Organization (NATO)
- European Union (EU)
- Organization of Petroleum Exporting Countries (OPEC)
- North American Free Trade Agreement (NAFTA)
- Don't know

13. The most recent installment of the popular television series *Survivor* was filmed in the rainforests along the Amazon River. On what continent is the Amazon located?

- Africa
- North America
- Australia
- Asia
- South America
- Europe
- Don't know

14. Which of the following countries is *not* a major oil producer?

- Japan
- Venezuela
- Iraq
- United States

Don't know

15. Which two countries have had a long-standing conflict over the region of Kashmir?

- Israel and Egypt
- India and Pakistan
- China and Russia
- Iran and Iraq
- Don't know

16. Periodically, drastic changes in ocean temperature cause weather changes around the world. What is the name of this phenomenon?

- El Niño
- Tornado
- Gulf Stream
- Global Warming
- Don't know

17. Which of the following has the highest percentage of its population infected with HIV, the virus that causes the disease AIDS?

- North America
- Central America
- South America
- Europe
- Africa
- Asia
- Australia
- Don't know

18. Which of the following is the only communist country in the Western Hemisphere?

- Haiti
- Dominican Republic
- Cuba
- Jamaica
- Don't know

19. Increasing emissions of carbon dioxide could lead to which of the following environmental consequences?

- Acid Rain
- Deforestation
- Global Warming
- Hurricane
- Don't Know

20. Which of the following ethnic groups is the largest non-Arab minority in Iraq?

- Serbs
- Kurds
- Palestinians
- Sikhs
- Don't Know

21. Which two countries in the world have a population of more than 1 billion? (click on two countries from the list below)

- United States Canada Mexico Nicaragua Brazil Argentina
- Kenya Nigeria South Africa Egypt Iran Saudi Arabia
- Afghanistan India Thailand Vietnam China Philippines
- Germany Russia United Kingdom Italy France Poland
- Don't know

Refer to Map A to answer questions 22 and 23:



source: www.nationalgeographic.com

Map A (fictional place)

22. What is the western-most city on this map?

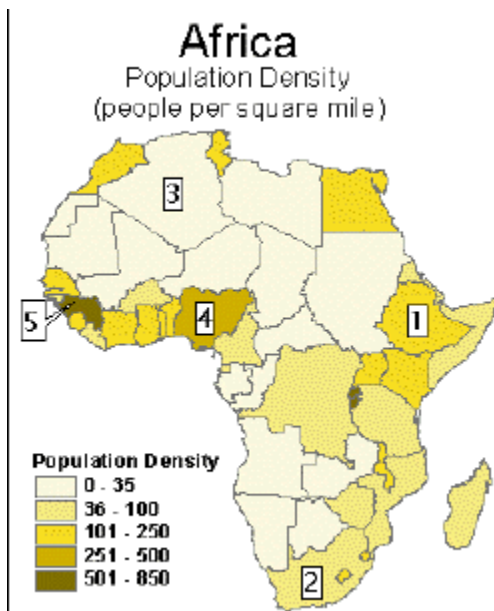
- City A
- City B
- City C
- City D
- City E
- City F
- City G
- City H
- City I
- City J
- City K
- Don't know

23. To travel from City B to City G you would need to go in which of the following directions?

- North

- South
- East
- West
- Northeast
- Northwest
- Southeast
- Northeast
- Don't know

Refer to Map B to answer question 24:

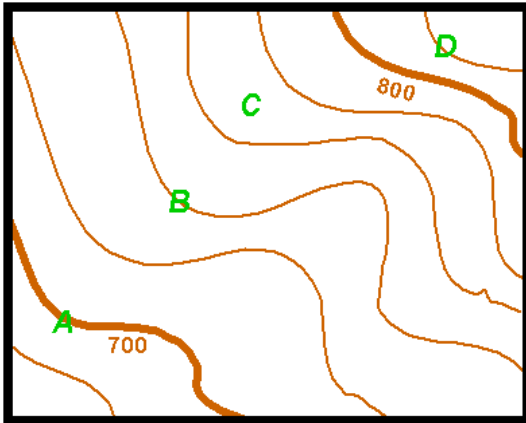


Map B (Africa)

24. Which of the following countries has the highest population density?

- Country 1
- Country 2
- Country 3
- Country 4
- Country 5
- Don't Know

Refer to map C to answer question 25:



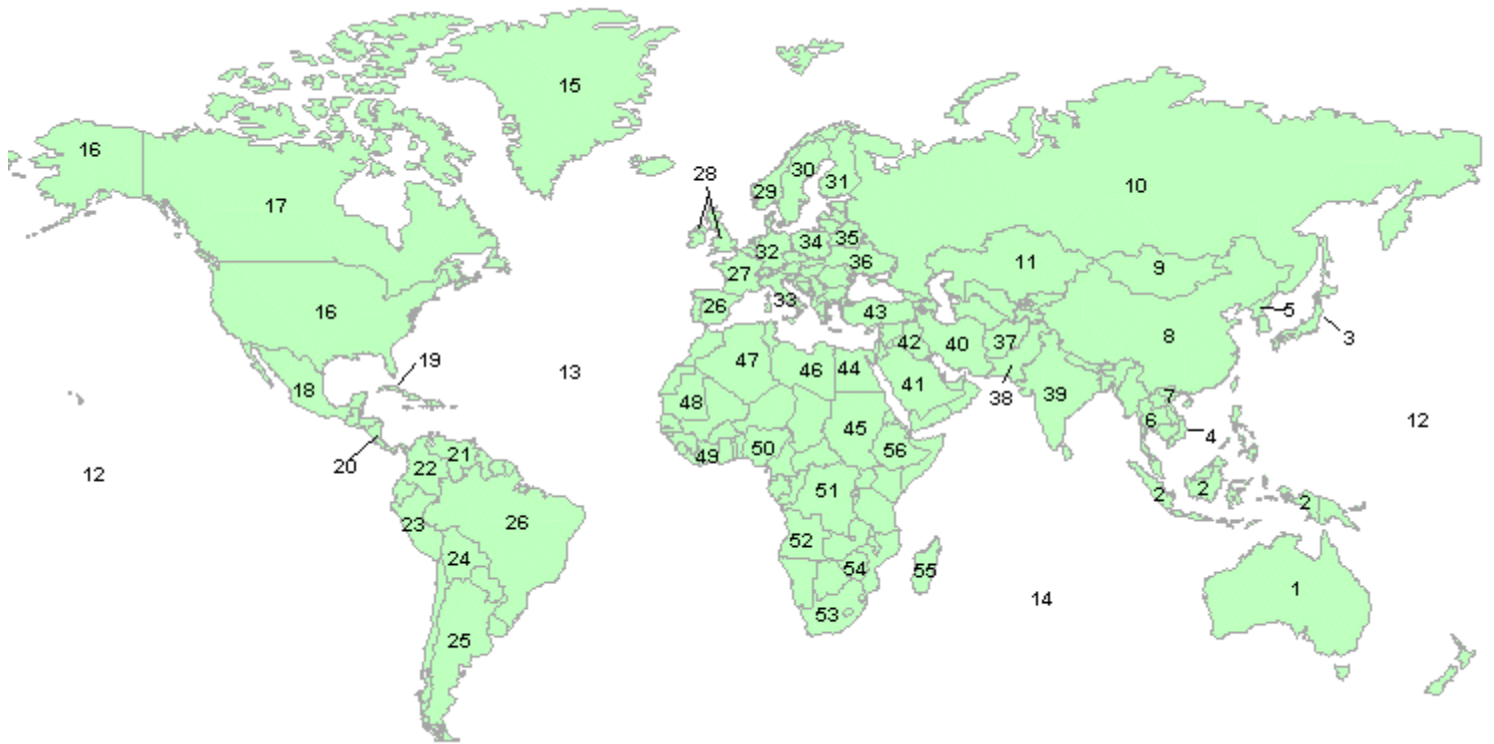
source:<http://raider.muc.edu/~mcnaugma/Topographic Maps/contour.htm>

Contour Interval = 20 feet

Map C (Elevation of fictional place)

25. Which of the following points is at the highest elevation?

- Point A
- Point B
- Point C
- Point D
- Don't Know



Map D (The World)

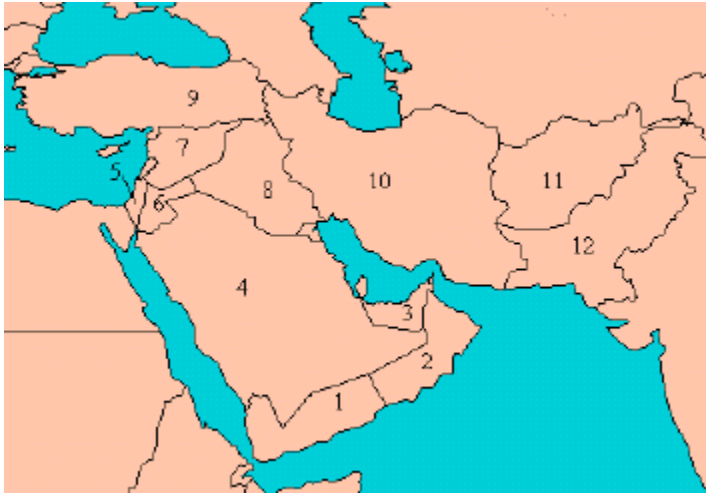
Refer to Map D to answer questions 26 - 40:

Locate each of the following places on the map and type in the corresponding number. If you don't know the answer, type in "99"

- 26. United States of America
- 27. Russia
- 28. Argentina
- 29. India
- 30. Mexico
- 31. United Kingdom
- 32. Iraq
- 33. Pacific Ocean
- 34. Germany
- 35. North Korea
- 36. Japan

- 37. Egypt
- 38. France
- 39. Nigeria
- 40. Pakistan

Refer to Map E to answer questions 41-45:

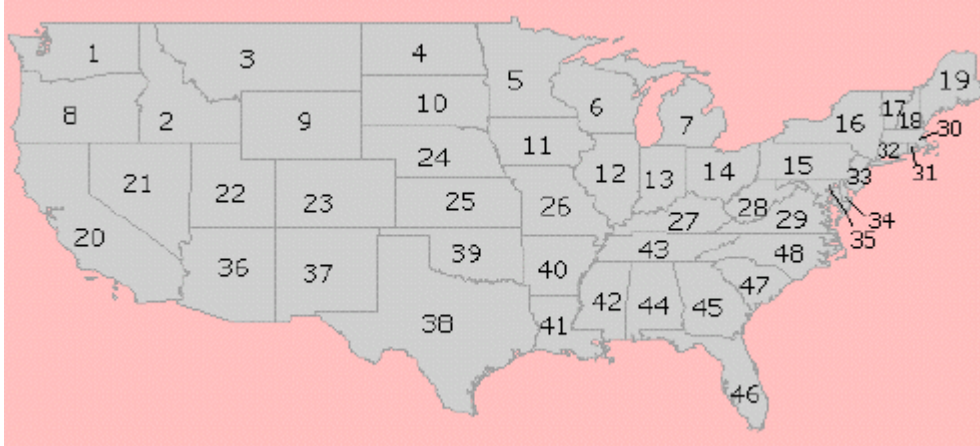


Map E (Middle East)

Locate each of the following countries on the map and type in the corresponding number. If you don't know the answer, type in "99"

- 41. Saudi Arabia
- 42. Afghanistan
- 43. Israel
- 44. Iraq
- 45. Iran

Refer to Map F to answer questions 46 - 50:



Map D (Continental United States)

Locate each of the following states on the map and type in the corresponding number. If you don't know the answer, type in "99"

- 46. New York
- 47. Virginia
- 48. California
- 49. Illinois
- 50. Nebraska

III. Background

The following questions are for background purposes only and will be used to help interpret the factors related to geographic literacy.

51. What is your age?

- 18 or under
- 19
- 20
- 21
- 22
- 23
- 24
- 25 or older

52. What is your sex?

- Male
- Female

53. What is your official class level? (Do NOT include credit hours taken during the Spring 2003 semester)

- Freshman (less than 30 credit hours)
- Sophomore (between 30 and 59 credit hours)
- Junior (between 60 and 89 credit hours)
- Senior (90 or more credit hours)
- other, please specify:

54. What is your major?

If double major, include both majors. (type in your answers below)

Major 1:

Major 2:

55. What is your overall QCA/GPA?

- 1.99 or below
- 2.00 - 2.49
- 2.50 - 2.99
- 3.00 - 3.49
- 3.50 - 4.00
- Don't know

56. Have you fulfilled the Area 7, Critical Issues in a Global Context, requirement of the Virginia Tech core curriculum?

- Yes
- No
- Don't Know

57. Have you taken any of the following geography classes? (include classes you are taking during the Spring 2003 semester)

Check all that apply:

- World Regions
- Geography of Global Conflict
- Geography of Global Economy

- Environmental Problems, Population and Development
- Medical Geography
- Geography of Resources

- I have not taken any of these classes
- Don't Know

58. How many college-level geography courses have you taken (at Virginia Tech, or any other college/university)?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or more
- Don't know

59. When you were in junior high and high school (grades 7-12), did you ever have a course devoted entirely to geography?

- Yes
- No --->If no, skip to question 61
- Don't know

60. Was that geography class a required class?

- Yes
- No
- Don't know

61. Did you graduate from secondary/high school in the United States?

- Yes

No ---> If no, skip to question 65

62. If you graduated in the U.S., where was your high school located? (type in your answers below)

State:

County:

63. Have you ever participated in a semester or year long (or longer) study abroad program?

- No
- Yes, in high school
- Yes, in college
- Yes, both in high school and in college

64. Excluding study abroad, how many times have you traveled outside of the United States?

(After answering this question, skip to question 67)

- Never
- 1
- 2
- 3
- 4
- 5
- 6 or more
- Don't Know

-----> skip to question 67

65. If you graduated from secondary/high school outside of the United States, in what country was your school located? (type in your answer below)

Country:

66. Excluding your current residency in the United States, how many times have you traveled outside your home country?

- Never
- 1
- 2
- 3

- 4
- 5
- 6 or more
- Don't know

67. To how many different countries have you traveled?

- 0
- 1
- 2-3
- 4-5
- 6-7
- 8-9
- 10 or more
- Don't know

68. How many languages can you speak fluently other than your native language?

- None
- One
- Two
- Three or more

69. Of your close friends, how many are from a different country than you?

- None
- 1 - 2
- 3 - 4
- 5 or more
- Don't Know

70. Which news source would you consider your *primary* source for keeping up with current world events?

- Newspapers
- Magazines (e.g. Time, Newsweek)
- Public Radio (e.g. National Public Radio)
- Commercial Radio

- Cable Television News (e.g. CNN, MSNBC)
- Network Television News (e.g. CBS, NBC, ABC)
- Internet/Web
- Don't know
- Other, please specify:

71. Which news source do you use the *least* frequently to keep up with current world events?

- Newspapers
- Magazines (e.g. Time, Newsweek)
- Public Radio (e.g. National Public Radio)
- Commercial Radio
- Cable Television News (e.g. CNN, MSNBC)
- Network Television News (e.g. CBS, NBC, ABC)
- Internet/Web
- Don't know
- Other, please specify:

72. On average, how often would you say that you access any news source to keep up with current world events?

- Every day
- 5-6 times a week
- 3-4 times a week
- 1-2 times a week
- 1-2 times a month
- Never
- Don't know

To be entered into the drawing to win up to \$100 cash, enter your e-mail address in the space below:

(Don't worry, your e-mail address will not be given out or sold to anyone and you won't get e-mail from me unless it's related to the research or you win a prize!)

If you are interested in a summary of the research results, check the box below. When the research is complete, an e-mail will be sent to the address above with a link to the report.

Yes, I would like to see the finished report.

Use the space provided below for any questions, comments or feedback that you may have about this survey.



When you've completed the survey, click on the button below to submit your responses:

**APPENDIX 2:
SOLICITATION E-MAIL**

Test your geographic knowledge! Win up to \$100!

I am a graduate student in the Department of Geography at Virginia Tech and I am conducting a study on geographic literacy among undergraduate students for my master's thesis. You have been randomly selected to participate in the study.

Participation involves completing an on-line survey which will take approximately 15 minutes to finish. The survey covers questions about geography and world knowledge as well as some background questions. You are not expected to know all the answers and all information that you provide is strictly confidential. Your participation in this survey will help to ensure that the results of this study are valid.

In appreciation of your time and effort, if you complete the survey you will be entered into a drawing to win **up to \$100 CASH!** The following prizes will be awarded based on a random drawing of survey participants: one grand prize winner will receive \$100, two first place winners will receive \$50 each, five second place winners will each get \$20, and 20 lucky winners will get a blow-up beach ball globe (just in time for summer!) and a U.S. map. Your chance of winning depends on the number of surveys submitted (less than 2000 students were asked to participate). The drawing will take place no later than May 12, 2003 and winners will be notified via e-mail.

If you would like to participate in this study, please take a minute to read through the informed consent material below.

By clicking on the URL to the survey below, you voluntarily agree to participate in the study and acknowledge that you have read and understand the Informed Consent material.

<http://survey.vt.edu/survey/entry.jsp?id=1046288313916>

(If the link will not open by clicking on it, cut and paste it into your web browser)

Thank you in advance for your participation!

Jodi Winship
Department of Geography
112 Major Williams Hall
jwinship@vt.edu

**APPENDIX 3:
STATEMENT OF INFORMED CONSENT**

Geographic Literacy and World Knowledge among Undergraduate College Students

I. Purpose of this Research/Project

The purpose of this research is to explore the level of geographic literacy and world knowledge among undergraduate college students.

II. Procedures

Participation in this study involves the completion of an on-line survey. The survey will take approximately 15 minutes to complete. You can only take the survey once. The survey will be available through May 9, 2003. The link to the survey can be found at the end of this message.

III. Risks and Benefits

Participating in this study will pose no significant risk. If you are uncomfortable answering any of the questions, you are free to skip those questions. Furthermore, you may choose not to submit your survey responses. If necessary, you may contact me and I will refer you to the Cook Counseling Center for assistance in handling your discomfort. These services are at no charge to you.

The benefit of participating in this survey is that your responses will help to determine the extent of world knowledge and geographic literacy among college students.

IV. Extent of Anonymity and Confidentiality

If you agree to participate in this study, your confidentiality will be maintained at all times. Only the researcher will have access to the names of the participants. The results of the survey will be aggregated and neither your name nor any other identifying information will be used in the report. All participant information will be secured in a locked file cabinet at the researcher's home, digital data will be password protected, and all data will be destroyed one year after the completion of the study.

V. Compensation

Those who choose to participate in the study and who submit a completed survey will be entered into a drawing for a chance to win one of twenty-eight prizes: 1 - \$100 prize, 2 - \$50 prizes, 5 - \$20 prizes, or 20 blow-up globes and U.S. maps. The researcher will contact the recipients of the prizes by e-mail. The drawing will occur no later than May 12, 2003.

VI. Freedom to Withdraw

As a voluntary participant, you are free to withdraw from this study at any time without penalty. You are free to not answer any questions that you choose not to without penalty. If you decide to withdraw from this study, please contact the researcher at the contact information provided below.

VII. Approval of Research

This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University (IRB 03-172), and by the Department of Geography.

VIII. Subject's Responsibilities

I voluntarily agree to participate in this study. I have the following responsibilities:

- Complete and submit an on-line survey on or before May 9, 2003.

IX. Subject's Permission

By clicking on the URL to the survey below, you voluntarily agree to participate in the study and acknowledge that you have read and understand the above information. If you have questions about this information before completing the survey, please contact Jodi Winship or any of the other individuals listed below.

I AGREE TO THE ABOVE INFORMATION.

To begin the survey, please click on the following link:

<http://survey.vt.edu/survey/entry.jsp?id=1046288313916>

(if the link will not open by clicking on it, please cut and paste it into your web browser)

X. Contacts:

Jodi Winship
Department of Geography
112 Major Williams Hall
540-961-4135
jwinship@vt.edu

Dr. Larry Grossman
Professor and Department Head
Department of Geography
115 Major Williams Hall
540-231-5116
lgrossmn@vt.edu

Dr. David M. Moore
Chair, IRB
Office of Research Compliance
Research and Graduate Studies
540-231-4991
moored@vt.edu

**APPENDIX 4:
FOLLOW-UP SOLICITATION E-MAIL**

***Last Chance!
Test your geographic knowledge! Win up to \$100!***

This is your last chance to participate in the survey of geographic literacy and world knowledge. In order to qualify for the drawing, surveys must be submitted by Friday, May 9. The drawing for prizes will take place this weekend. My apologies if you have already completed the survey and received this by mistake.

The survey will take approximately 15 minutes to complete. It covers questions about geography and world knowledge as well as some background questions. You are not expected to know all the answers and all information that you provide is strictly confidential.

In appreciation of your time and effort, if you complete the survey you will be entered into a drawing to win **up to \$100 CASH!** The following prizes will be awarded based on a random drawing of survey participants: one grand prize winner will receive \$100, two first place winners will receive \$50 each, five second place winners will each get \$20, and 20 lucky winners will get a blow-up beach ball globe (just in time for summer!) and a U.S. map.

If you would like to participate in this study, please take a minute to read through the informed consent material below. By clicking on the URL to the survey below, you voluntarily agree to participate in the study and acknowledge that you have read and understand the Informed Consent material.

<https://survey.vt.edu/survey/entry.jsp?id=1050602943902>

-If you get a blank page when you click on the link, you need to cut and paste the address into your web browser.

-If the maps do not appear on the survey, I have made them available at an alternate website. You'll still need to access the survey site to take the survey, but the maps will also be available here: http://filebox.vt.edu/users/jwinship/survey_graphics/Maps.html

Thank you in advance for your participation!

Jodi Winship
Department of Geography
112 Major Williams Hall
jwinship@vt.edu

VITA

Jodi M. Winship

Born in Minnesota, Jodi graduated from Hopkins High School in 1992. To be closer to Washington, D.C. and the political scene, Jodi moved to Virginia to attend Mary Washington College in Fredericksburg where she earned a B.A. in International Affairs in 1996. After spending nearly a year in St. John, U.S. Virgin Islands after graduation, Jodi returned to the real world and began coursework in high school social studies education at the College of Notre Dame of Maryland. However, Jodi was soon drawn back to Washington, D.C. where she began working at Hostelling International – U.S.A, an organization devoted to international and cultural understanding through the hostelling experience.

Jodi began her graduate education at Virginia Tech in August, 2000. During her four year career at the university she has been a graduate assistant for the Department of Geography, a Graduate Congressional Fellow in the U.S. House of Representatives, a graduate assistant for a special interdisciplinary project on critical media literacy, a research assistant at the Virginia Center for Housing Research, and an administrative assistant and student services specialist in the Department of Geography.

Jodi currently works for the Federal Election Commission in Washington, D.C. and completed her M.S. in Geography the fall of 2004.