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The Effect of the State Giant Traveling Map of Montana on the Geographic Literacy of Fourth Graders in Western Montana

Rebecca A. Kranitz
The University Of Montana

THE EFFECT OF THE STATE GIANT TRAVELING MAP OF MONTANA ON THE GEOGRAPHIC LITERACY OF FOURTH GRADERS IN WESTERN MONTANA

By

REBECCA ANNE KRANITZ

B.S. Geology, SUNY Plattsburgh, Plattsburgh, New York, 2014
B.S. Environmental Science, SUNY Plattsburgh, Plattsburgh, New York 2014

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APPROVED BY:

Scott Whittenburg, Dean of the Graduate School

Dr. Sarah J. Halvorson
Department of Geography

Dr. Heather Almquist
Department of Geography

Dr. Fletcher Brown
Department of Teaching and Learning

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Dr. Sarah J. Halvorson, Committee Chair

A complex set of factors and processes operating within the United States public education system contribute to high rates of geographic illiteracy in the majority of young adults. These factors include, but are not limited to, a lack of structured federal controls over state geography requirements, insufficient time to implement effective geography curricula, and inadequate assessment techniques. To raise rates of geographic literacy, the National Geographic Society (NGS) created the State Giant Traveling Maps (SGTM) to actively engage students in a geography education experience that simultaneously promotes positive attitudes towards geography while strengthening student map skills. The SGTMs incorporate a kinesthetic component into instruction that transforms the map into a multi-modality resource catering to all visual, auditory, and kinesthetic learners. This research evaluates the extent to which the kinesthetic component of the SGTM of Montana affects the attitudes and skills of a specific population of fourth graders in western Montana. Montana is a state that does not require geography to graduate middle or high school. Written surveys administered to 114 students before and after completing two lessons using the giant map revealed both an increase in positive attitudes towards geography and an increase in achievement levels on NAEP Standardized Geography Assessments. Furthermore, public school teachers who participated in this study enthusiastically endorsed use of the SGTM of Montana to engage students in geography. Based on the findings, the SGTM of Montana is a valuable resource to contribute to the geography education reform necessary to ensure a geographically literate population.

Key words: geographic literacy, geography education, fourth grade, Montana, active learning, kinesthetic learning modality, State Giant Traveling Map

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Chapter 1: Introduction

"The study of geography is about more than just memorizing places on a map. It's about understanding the complexity of our world, appreciating the diversity of cultures that exists across continents. And in the end, it's about using all that knowledge to help bridge divides and bring people together." – Barak Obama, 44th President of the United States, May 24, 2012.

In 2006, the National Geographic Society (NGS) commissioned Roper Public Affairs to conduct a geographic literacy survey to assess the geographic knowledge and skills of 510 Americans between the ages of 18 and 24. The survey revealed alarming results, indicating that the majority of young Americans are in fact geographically illiterate (Roper Public Affairs 2006, 6). Specifically, 63% of respondents could not find Iraq on a map, despite heightened news coverage for multiple years prior to the survey; 74% thought English was the most common language in the world, not Mandarin Chinese, and 50% could not find New York on a U.S. map (Roper Public Affairs 2006). Furthermore, results from the National Assessment of Educational Progress (NAEP) Geography Assessment for 1994, 2001, and 2010 exhibit that the percentage of students obtaining basic, proficient, and advanced scores remains relatively stagnant (Bednarz, Heffron, and Huynh 2013). These results indicated to NGS that while their efforts are worthwhile, they have not adequately increased rates of geographic literacy in the United States and further education reform is necessary.

There are a multitude of issues inhibiting consistent and effective geography education practices in the United States. To elaborate, only nine states (ID, NM, OK, AR, AL, GA, IN, OH, and MD) require a stand-alone geography course in middle school, 12 states do not require any geography course, and the remaining states allow local school districts to oversee geography course implementation (McClure and Zadrozny 2015). At the high school level, the number of

states requiring a stand-alone geography course drops from nine to four (UT, SD, MN, and MS), while 13 states require no geography at all (McClure and Zadrozny 2015). Interestingly, there are no states that require a standalone geography course in both middle and high schools (McClure and Zadrozny 2015). On top of inadequate geography requirements across public schools, geography education suffers from a lack of funding, insufficient pre-service teacher training, heightened emphasis on STEM curricula, and a deficiency in geographic education research (Brysch 2014). The combination of the aforementioned issues shed light on the weaknesses that plague geography education in our country.

Further explanation of our nation's sub-par performance in geography literacy lies within the interdisciplinary nature of the subject of geography. The structure of our public school education system supports curricula designed in a single discipline manner, maintaining distinctions between subject areas like Math, Science, English, History, and Geography. Geography, however, is fundamentally interdisciplinary and integrative, and attempting to teach its content separate from other subjects proves to be difficult for educators who must adhere to strict state and national content standards. Gershmel and Gershmel (2007b, 42) argue that, "there is ample evidence that our fuzzy image has cost a place at many pedagogical and policy tables where a geographic perspective would be a worthy addition." As such, treating geography as a single discipline limits its integration into public school curricula.

To help more students attain geographic proficiency, geography experts formed the Geography Education Research Committee made up of members from the National Geographic Society (NGS), the Association of American Geographers (AAG), the National Council for Geographic Education (NCGE), and the American Geographical Society (AGS). The committee developed a list of 13 recommendations for geographic education research and reform (Bednarz,

Heffron, and Huynh 2013). The recommendations called for an expansion of research in the following areas: learning progressions, curriculum reviews, effective teaching methods, effect of fieldwork, teacher preparation, interdisciplinary and multidisciplinary approaches, increase in sample sizes for large scale research projects, effective assessments, partnerships between formal and informal educators, and more frequent NAEP testing (Bednarz, Heffron, and Huynh 2013).

Since 1986, NGS has funded a Network of Geographic Alliances to help meet the mission of, "build[ing] a geographically literate society by leading systemic reform and supporting the continuous improvement of geographic education," (National Geographic 2017). The Network of Geographic Alliances are state-based partnerships between K-12 educators and university faculty. Each state alliance receives annual funding from NGS to fund national initiatives which function to provide geography education resources and professional development opportunities to educators. Universities serve as the host for the geographic alliances in each state, and the University of Montana in Missoula, Montana hosts the Montana Geographic Alliance (MGA).

In 2016, NGS launched a nationwide initiative with the Network of Geographic Alliances titled the State Giant Traveling Map (SGTM) program. This program draws on the success of the Giant Traveling Map Program, developed entirely by NGS, in which teachers sign up to receive gymnasium-sized floor maps of the continents, Pacific Ocean, and Solar System which promote an interactive, hands-and-feet-on learning experience for third and fourth graders. Contrasting slightly, the State Giant Traveling Maps are scaled down to classroom-sized floor maps, though the purpose to engage students in geography while promoting geographic literacy remains.

Each state alliance developed individual plans to implement the State Giant Traveling Maps within their respective states. In Montana, MGA sends the SGTM of Montana and

associated lessons and materials to teachers for one week at a time. Teachers can use the National Geographic State Giant Map Lesson Handbook or create their own lessons. MGA created one state-specific lesson to use with the giant map and is currently recruiting alliance members to contribute more lessons to the handbook. Last school year, MGA received extremely positive feedback from classroom teachers who participated in the SGTM program. It is now useful to evaluate the impact the SGTM of Montana had on Montana students.

Geographic literacy in our country will increase when students not only master geographical skills, but also learn to appreciate and value the need for a solid understanding of geographical concepts. Therefore, the purpose of the SGTM program is to not only increase students' map skills, but to also promote positive attitudes towards geography while providing teachers with an adaptive curriculum and new resource to be used in their classroom. NGS pilot tested the SGTM program in Colorado during the 2015/2016 school year, though results are not yet accessible to the public. This research will expand on their results while relating them to a specific population of fourth grade students in western Montana. Specifically, this research aims to address the following research question: *How does the State Giant Traveling Map of Montana affect students' attitudes and map skills?* This research question is broken down into three components: *(1) Can the SGTM of Montana positively change students' attitudes regarding geography; (2) Can the SGTM of Montana help develop students' map skills; and (3) What are teacher perceptions regarding the effectiveness and feasibility of implementing the SGTM of Montana as a resource to teach geography?* The results of this research question support the Geography Education Research Committee's call for research on exemplary programs and curricula (recommendation eight, "… researchers develop and study exemplary programs,

curricula, tasks, measures, and assessments to build the body of knowledge about effective geography teaching and learning," (Bednarz, Heffron, and Huynh 2013, 8).

Summary: The following sections present the previous research that influenced the development of the research question, the methodology used to answer the research question, the results of data collection, interpretations on the results, and suggestions for future research.

Chapter 2: Theoretical Framework

"What I hear, I forget.
What I see, I remember.
What I do, I understand." – Confucius, Chinese Philosopher, 551 BC – 479 BC.

This chapter outlines a few prominent theories shared between the fields of geography and education. These theories, specifically Piaget's Theory of Cognitive Development, Kolb's Experiential Learning Theory, and various learning modality theories, are essential to support research on the ability of the SGTM of Montana to promote positive attitudes towards geography, enhanced achievement on geography assessments, and ultimately geographic literacy. Additional explanations of frameworks used to develop NAEP assessments and National Geographic education resources are also provided.

Piaget's Theory on Cognitive Development

The work of psychologist Jean Piaget in the mid-1900s strongly influences eduactional resource and curricula design in the field of geography and is often used as the theoretical framework shaping geography education in the United States. Piaget's research aimed to answer the question of how the human brain acquired and retained knowledge (Smith 2000). His research interests developed from his simple observation that the minds of children and adults are inherently different. Before Piaget, the consensus on the relation between child and adult minds was that children's minds were the same as adults, simply less competent and capable. During his studies, Piaget recorded children's responses to simple questions as they attempted to logically explain their answers, regardless if they were right or wrong, noting that many complex thinking abilities were evident in the children's rationalizations (McLeod 2015). Through years

of research and analysis, Piaget drafted the Theory on Cognitive Development, which quickly integrated into geography education.

Piaget's research revealed significant insight into how the mind develops cognitively, and he published his theory in his seminal book entitled *The Child's Conception of Space* (Piaget and Inhelder 1967). In this publication, Piaget describes his studies on how children use spatial thinking skills to make sense of the world around them. The conclusion of his research indicated that children pass through four stages of cognitive development. Stage One lasts from birth to four years, Stage Two lasts from four to seven years, Stage Three lasts from seven to 11 years, and Stage Four lasts for 11+ years (Piaget and Inhelder 1967). Each stage is further broken down into periods.

Previous research conducted by Roger M. Downs and Lynn S. Liben provide evidence that supports Piagetian Theory as a framework to shape geography education. Numerous studies using Piaget's transferrable methodologies are cited with results that exhibit the credibility in Piagetian Theory (Downs, Daggs, and Liben 1988; Downs and Liben 1990; 1991; 1994; Liben and Downs 1992; 1997; Liben, Kastens, and Stevenson 2002). In conjunction with Piaget and Inhelder (1967), Downs and Liben (1994) argue that children are not capable of understanding spatial relations until they reach the concrete operational stage, or when they master the concept of projective space. To support this claim, Downs and Liben replicated experiments conducted by Piaget in the early 1900s. Children were evaluated based on their ability to interpret symbols and aerial photos, and to interpret and draw maps from an overhead perspective.

Students ranging in age from 5-12 received instruction to draw an overhead map of their classroom, and analysis revealed that students ages 5-8 (grades K-3) struggled significantly with this task. In this age group, maps typically had an oblique perspective rather than an aerial one,

while some maps referenced both perspectives (Downs and Liben 1994). Contrarily, most students aged 10-12 (grades 4-7) successfully drew an aerial map of their classroom (Downs and Liben 1994). This discrepancy indicates that students in fifth and sixth grade have a good grasp on projective concepts and that they are in the concrete operational stage of cognitive development. Piaget, Downs, and Liben believe that children can employ spatial thinking skills when they reach the concrete operational stage of development.

Downs and Liben willingly support Piagetian theory based on the premise that children are not adults; there is a significant difference in the cognitive abilities of children and adults (Liben and Downs 1997). They argue that geographic education suffers when teachers do not acknowledge which stage of cognitive development a student is in (Downs, Daggs, and Liben 1988; Downs and Liben 1991). To increase geographic literacy, educators must focus less on the presentation of their materials, and more on matching their instruction with the cognitive abilities of their students (Downs and Liben 1991). Downs and Liben argue that this is accomplished when Piagetian theory aligns with curriculum design and implementation.

Since the mid-1970s, developments in the field of psychology and geography led some researchers to believe that children possess spatial thinking skills at earlier ages than outlined initially by Piaget. Specifically, some preschool children display spatial thinking abilities years before Piaget predicted (Blaut 1997). In this regard, Piagetian theory frames children's ability to think spatially in a pessimistic light by suggesting they are not cognitively ready to develop spatial thinking skills at a young age (Blaut 1997). Blaut questioned if children necessarily had to be spatial thinking experts before they should start learning about maps (Blaut and Stea 1971). Attempts to replicate research conducted by Piaget, Downs and Liben produced results

indicating that mapping is an integral part of cognitive development because children as young as five possess the capability to develop geographic skills (Blaut and Stea 1971).

Though the arguments – pro-Piaget and anti-Piaget – utilized similar methodologies, their analysis leads to contrasting conclusions. Drawing on these interpretations, it seems fitting to suggest that while students may not be able to master spatial thinking concepts until older ages, waiting to introduce these concepts will not increase rates of geographic literacy, and the notion to start cultivating spatial thinking skills should begin at younger ages is reasonable. However, all players in this debate agree that geographic illiteracy is a problem that needs to be addressed through geography education reform.

Recent Advances in Spatial Thinking Research

The work of Gershmel and Gershmel (2007b; 2011) expands on spatial thinking research and provides new insight into the minds and abilities of children. Since the mid-1990s, significant advances in neuroscience technology fueled new research on brain function which revealed the complexities of spatial thinking. Specifically, it is now accepted that the brain contains specialized regions for thinking, and that spatial thinking occurs across multiple regions (Gershmel and Gershmel 2006; 2007a; 2007b). This discovery indicates that the ability to think spatially is much more complicated than originally thought by Piaget, and involves not only cognitive ability, but the ability to link different regions of the brain (Gershmel and Gershmel 2007a; 2007b; 2011).

Gershmel and Gershmel reviewed over 3,000 studies within the field of neuro- and cognitive science to generate a list of the eight different modes of spatial thinking. This list draws from existing lists on spatial thinking skills but expands to highlight the claim that spatial thinking is more complex than previously believed by academics and researchers. The existing

lists referenced include the "Five Themes" from the *Guidelines for Geographic Education-Elementary and Secondary Schools*, National Geography Standards, and a variety of lists within peer-reviewed literature (Gershmel and Gershmel 2006). The new list, "Eight Modes of Spatial Thinking," identifies eight distinct modes of spatial thinking skills and provides neuro-scientific evidence to support their claim that spatial thinking is complex and occurs across multiple regions of the brain (Gershmel and Gershmel 2006). The eight modes are: (1) Comparison; (2) Aura; (3) Region; (4) Hierarchy; (5) Transition; (6) Analogy; (7) Pattern; and (8) Association (Gershmel and Gershmel 2006; 2007b; 2011). In this list, Gershmel and Gershmel proceed to suggest the age at which students begin to understand these complex spatial thinking topics (Appendix A).

Research conducted by Gershmel and Gershmel helps identify the complex components involved in spatial thinking which in turn should encourage geography education reform. Gershmel and Gershmel (2007b) suggest that while Piaget's research on cognitive development has an important place within the field of geography education, it does not effectively capture the realistic spatial thinking abilities of young children. Essentially, Gershmel and Gershmel believe that the human brain can think spatially at a very early age, that spatial thinking activities should be introduced during early education, and that teachers must learn how to incorporate spatial thinking into lessons (2007b). However, children cannot master spatial thinking skills until they can link different modes of spatial thinking across different regions of their brains, and this linkage is fundamentally tied to cognition (Gershmel and Gershmel 2007a). Likewise, spatial thinking abilities respond to outside stimuli such as age, gender, socioeconomic status, language, and mobility (Gershmel and Gershmel 2007b).

Working with the notion that young children can think spatially, Gershmel and Gershmel partnered with five kindergarten and four first-grade classes at a school in Harlem, New York to develop geography lessons that promote spatial thinking at a young age. These lessons involved hands-on activities coupled with real-world experiences like going on field trips and interpreting local maps, atypical from conventional teaching methods but still within the realm of geography education (Gershmel and Gershmel 2007a; 2011). Their findings indicate the great potential for new curricula to focus more on spatial thinking abilities. Specifically, while reading and math scores of students did not go up after spatial thinking instruction, they also did not go down, indicating that no harm was done when schedules were reworked to include more geography education. Furthermore, most students began to rank geography within their top two favorite school subjects. Interestingly, when school administrators suggested appointing a geography specialist within their district, classroom teachers objected because the lessons drafted by Gershmel and Gershmel emphasized to teachers the importance of connecting different modes of spatial thinking. Ultimately, while Piaget's Theory on Cognitive Development can help develop geography education curricula that ensures students are cognitively ready to meet state and national standards, geography education can and should begin at earlier ages in the United States (Gershmel and Gershmel 2011).

Learning Style Theory

In addition to Piaget's theory, theories of learning style also play a pivotal role in creating and implementing experiential education curricula that engage students and promote positive attitudes towards education. Dunn (1984, p 11-12) acknowledged that cognitive style and learning style are similar concepts and provide clear definitions to distinguish the two; Cognitive style refers to, "how the mind actually process[es] information…", while learning style refers to,

"the way in which each person absorbs and retains information and/or skills." Since research on learning style theory began in the 1970s, multiple articles document increased student success when instruction accommodates multiple learning styles (Dunn 1984; Ballinger & Ballinger 1982; Cavanaugh 1981; K. Dunn 1981; Fiske 1981; Hodges 1982, 1983; Jenkins, 1982; Lemmon, 1982). These findings support the idea that learning style varies between students, and that under the same instruction, some students may succeed while others may struggle (Dunn and Dunn 1979). There are numerous theories on learning style, though this research focuses only on Kolb's Experiential Learning Theory and Modality Preference Theory because they are most relevant to the SGTM of Montana.

Kolb's (1984) Experiential Learning Theory draws on the work of Dewey, Lewin, and Piaget, stating that real-world experience is essential to the learning process (Kolb and Kolb 2011; Kolb and Kolb 2013; Kolb 1984). Lewin proposed that learning is a four-stage cycle with personal experience driving the cycle back and forth between observation and reflection. Dewey's Model of Learning parallels Lewin's theory by stating that observation and reflection are critical components of learning, but expands by adding a third component – action. Lastly, Piaget suggested that as students mature from children to adults, they pass through four distinct stages of cognitive development, and these stages are based on the child's ability to accommodate (process real world experiences) and to assimilate (relate new experiences to old experiences; Kolb 1984). Through his analysis, Kolb generated a foundation for this Experiential Learning Theory that includes six propositions for experiential learning (Appendix B).

In Kolb's (1984, p. 38) Experiential Learning Theory, he defines learning as, "the process whereby knowledge is created through the transformation of experience." This process, known as the Experiential Learning Cycle, is a four-step cycle that outlines the interplay between four

distinct learning styles: diverging, assimilating, converging, and accommodating (Kolb and Kolb 2013). Kolb's definition of learning style varies slightly from that of Dunn (1984) and states that learning style "describes individual differences in learning based on the learner's preference for employing different phases of the learning cycle" (Kolb and Kolb 2011, p 46). In other words, the learning cycle describes the different ways in which individuals construct knowledge through experience.

In this model, an individual's learning style – diverging, assimilating, converging, and accommodating – is dependent on how he/she grasps and transforms experiences (Kolb and Kolb 2011). The model contains two dimensions of learning, perceiving (y-axis) and processing (x-axis), and these dimensions intersect to form four quadrants. Each of the four learning styles sits within one of the four quadrants (Appendix C). Each dimension forms a continuum between two dialectically opposed modes of learning, with the perceiving continuum spanning between Concrete Experience (CE) and Abstract Conceptualization (AC), and the processing continuum spanning between Active Experimentation (AE) and Reflective Observation (RO) (Rayner and Riding 1997). Individuals can determine their experiential learning style by using Kolb's Learning Style Inventory, a self-reporting questionnaire in which individuals are ranked along the two continuums to reveal which learning style quadrant they fall under (Kolb and Kolb 2013; Rayner and Riding 1997).

Kolb's (1984) Experiential Learning Theory effectively outlines how students construct knowledge through real-world experiences, however, it does not effectively identify individual differences in learning modality preferences. Powell (2005, p. 62) defines learning modalities as, "how students use their senses in the learning process." In other words, learning modalities determine the modes in which students prefer to obtain new information. Learning modalities

include visual, auditory, tactile, and kinesthetic. Learning modalities are not specific to Kolb's four learning styles, and most students can learn using all learning modalities, though it is typical for students to prefer one modality over the rest (Powell 2005).

Learning modality preferences are identified in The Dunn and Dunn Learning-Style Model (1993). This model outlines at least 20 elements of learning style that are affected by various stimuli including environmental, emotional, sociological, physiological, and psychological, with learning modality preference falling under physiological stimuli (Dunn and Dunn 1979; Dunn 1984; Dunn 1990; Dunn et al. 2009). While developing this model, research conducted by Dunn and Dunn (1979) indicated that when teaching-style matched with learning-style, student motivation and academic achievement excelled. Additionally, their studies proved that students perform better when they are actively engaged in learning rather than passively absorbing lectures (Dunn et al. 2009). For clarification, active learning is, "any instructional method that engages students in the learning process," (Prince 2004, p 223) and is synonymous with experiential, non-traditional, and unconventional teaching, whereas passive learning involves traditional or conventional teaching methods like lectures and fact regurgitation.

The concept of modality preference is further explained through research conducted by Barbe, Milone, and Swassing. In their (1979) study, 1,000 students from California completed a modality preference assessment which involved recreating patterns that were communicated visually, auditorily, and kinesthetically. Results revealed that: 30% of learners prefer the visual modality, 25% of learners prefer the auditory modality, and 15% of learners prefer the kinesthetic modality (Barbe, Swassing, and Milone 1979). Additionally, modality preference changes with time, though for children between kindergarten and 6th grade, the visual and

kinesthetic modality dominate (Barbe, Swassing, and Milone 1979). For further clarification, visual learners learn best by reading and analyzing figures, auditory learners learn best through listening and speaking, and kinesthetic learners learn best when physical movement is incorporated into lessons (Gage 1995). An additional learning modality exists, known as tactile, in which students learn best when touching and manipulating three dimensional resources (Gadt-Johnson and Price 2000; Price and Dunn 1997; Semple and Pascale 1984).

The following quotation by Dunn and Dunn (1993, p 30) reveals their standpoint on instructional design with regards to learning styles: "If individuals have significantly different learning styles – as they appear to have – is it not unprofessional, irresponsible and immoral to teach all students the same lesson in the same way without identifying their unique strengths and then providing responsive instruction?" Further studies provide statistically significant results to confirm Dunn and Dunn's standpoint that student academic performance excels when instruction incorporates multiple learning modalities (Cruse 1993).

During the 1970s, teachers and researchers began acknowledging a disparity between the performance of students in the same class under the same instruction. Up until this point, conventional teaching methods promoted the use of lectures to convey information to students who listened and took notes (Gage 1995). Auditory learners benefit most from lecturing. Visual learners can benefit from lectures if notes and images are projected during instruction. However, conventional teaching methods typically overlook kinesthetic learners who make up 15% of the student population (Gage 1995; Barbe Swassing and Milone 1979). This statement refers to conventional classrooms which favor auditory and visual modalities, therefore auditory and visual learners excel over kinesthetic learners in these settings. As a result, visual and auditory

learners are often considered to be gifted as they excel under conventional teaching methods (Dunn and Dunn 2005).

The determination that many gifted students learn best through visual and auditory modalities leads into a discussion on students who are overachievers and those who are underachievers. Research proves that students excel when instruction matches their dominant learning modality. Interestingly, gifted students tend to prefer the auditory and visual modalities, while many special education students prefer the kinesthetic and tactile modality (Dunn and Dunn 2005). Therefore, it can be assumed that the learning modalities of underachieving students do not align with conventional teaching methods which cater to visual and auditory learners.

It is necessary to define the specific characteristics of kinesthetic and tactile learners in order to effectively design resources that promote learning for all students. These learners require hands-on activities that incorporate frequent movement, and therefore, the most effective educational resources get students out of their seats and onto their feet (Honigsfeld and Dunn 2009). When movement is not incorporated into instruction and visual/auditory tactics dominate, kinesthetic/tactile learners are likely to forget 70% of information that they read or hear (Honigsfeld and Dunn 2009; Restak 1979).

Resources that cater to auditory and visual learners should be three-dimensional so that students can feel and manipulate them during instruction (Gadt-Johnson and Price 2000; Price and Dunn 1997; Gage 1995; Semple and Pascale 1984). Examples of effective resource design also incorporate nontraditional measures of assessment. Multiple-choice exams and essays reflect visual and auditory modalities, and therefore are not accurate assessments of kinesthetic and tactile learners. For example, when testing a class on aspects of literature, Gage (1995)

provides many examples of how to engage kinesthetic and tactile learners in the assessment process. Specifically, he suggests that the use of dioramas, mobiles, role playing, and videotaping cater to kinesthetic learners because they involved more than simply memorizing facts (Gage 1995). Honigsfeld and Dunn (2009) expand on Gage's (1995) list and also suggest using task cards and floor or tabletop games.

Hundreds of existing studies highlight the strengths of teaching to multiple learning modalities. Lister (2004, 2005) taught social studies lessons with the same content using traditional and kinesthetic approaches, and found that her special education student scores improved significantly using the kinesthetic approach (Honigsfeld and Dunn 2009). In a study conducted by Cruse (1993), results indicate that of the three learning modalities that dominated his sample – visual, kinesthetic, and auditory – all students achieved cognitive and academic gains after completing lessons that promoted cooperative learning, movement, and interaction.

There is a void in research conducted in the United States on the application of kinesthetic teaching styles in geography education. However, within the broader field of Social Studies, Çalışkan and Kılınç (2012) conducted research on the relationship between the learning styles of students and their attitudes towards social studies courses. The researchers conducted surveys in a sample of 320 students spanning between fourth and seventh grade. Their results indicate that students with an auditory modality preference have the most positive attitudes towards social studies, followed by tactile-kinesthetic and then visual modalities.

Research proves that there are many benefits to active, or kinesthetic learning. In the real world, it is rare to be affected by only one stimulus at a time, and instead daily activities stimulate multiple senses at the same time (Shams and Seitz 2008). Multitasking occurs regularly and the human brain must already be adapted to dealing with multisensory stimuli (Shams and

Seitz 2008). If the human brain is accustomed to processing stimuli from multiple sources, then the structure of our education system should reflect that. Other researchers support this statement claiming that, "students should also be encouraged to strengthen their weaker learning styles because they become more versatile learners (Gadt-Johnson and Price 2000; Graham and Kershner 1996). Likewise, Guild and Garger (1985, p 64) argue that, "in terms of achievement, students with mixed modality strengths often have a better chance at success than do those with a single modality strength, because they can process information in whatever way it is presented.

History of NAEP

Many of the issues facing public school curricula became evident after 1964 once the National Assessment of Educational Progress (NAEP) began conducting systemic evaluations of student achievement levels. NAEP, also known as "The Nation's Report Card," developed assessments for 12 subject areas including geography, economics, civics, the arts, foreign language, mathematics, reading, science, technology and engineering literacy, U.S. history, world history, and writing (NCES 2017). To better comprehend the need for and value of the NAEP assessments, a detailed explanation of the history of public school education in the United States is necessary.

Following the development of the first Department of Education in 1867, public education began to gain funding in the United States. These funds helped develop and implement curriculum across the 50 states, however, no tools existed to measure if curricula met specified goals and objectives. In the 1960s, after skepticism of the federal government's involvement in public education became widespread, a new conversation on how to maximize public school education potential began (Vinovskis 1998).

Establishment of the first assessment committee, the Exploratory Committee on Assessing the Progress of Education (ECAPE), occurred in 1964. This organization intended to assess a small sample of students to determine their proficiency in a variety of subject areas. This plan did not gain full support by the public, as concerns arose that this was an attempt by the federal government to control the curriculum. Rather, the government simply aimed to gather data on what students learned during their public education. Public resentment towards the national assessment proposed by ECAPE subsided in 1969 when the Education Commission of the States (ECS) assumed control over assessment development. Under supervision of ECS, the NAEP project came to life and assessment results that highlighted national achievement became available. However, many educators expressed concern that results should be communicated at the state level because national achievement results did not provide details at a resolution high enough to enact significant policy change. Thus, ECS dissolved into the Educational Assessment Council (EAC) to oversee the NAEP assessments and report results at the state level for almost twenty years (Vinovskis 1998).

In 1988, a Senate bill prompted a transition of responsibilities from the EAC to the new National Assessment Governing Board (NAGB). NAGB began to design, supervise, and conduct NAEP assessments. In addition, the Senate mandated that the following subjects be included in the national assessments: reading, writing, mathematics, science, history, geography, and civics. NAGB established student performance standards for each subject to measure if curriculum met the intended goals. These performance standards, which first appeared on the 1990 NAEP assessments, ranked students as either proficient, advanced, or basic (Vinovskis 1998).

Currently, NAEP is still under the supervision of NAGB. Assessments take place in fourth grade, eighth grade, and twelfth grade classes. Of the 12 subject areas covered by NAEP

assessments, only about three or four subjects are assessed annually. This study utilized NAEP geography assessments which occurred in 1994, 2001, and 2010. NAEP issued a geography assessment again in 2014 though the results are not yet available to the public. NAEP does not provide a state-by-state breakdown of geography assessments results.

Framework for the 2010 National Assessment of Educational Progress (NAEP)

In 2010, NAGB published a framework to help design NAEP geography assessment questions and to evaluate results of the assessments for grades 4, 8, and 12. NAGB created the NAEP geography framework with the following mission statement in mind:

> "The purpose of geography education is to foster the development of citizens who will actively seek and systematically apply the knowledge and skills of geography in life situations. Geography education must be responsive to the abilities and needs of students and to the societal and workplace requirements of the community, the nation, and the world. Through rigorous instruction and an adaptable K-12 curriculum, geography education helps prepare students to cope with the complexities of contemporary life," (NAGB 2010, p vii).

A well-rounded geography curriculum provides students with a solid foundation of spatial thinking skills that they can utilize to think critically and function within our complex society.

While NAEP was in its early stages, a separate committee, the Joint Committee on Geographic Education, published the first set of national standards for geography in 1994. These standards, titled *Guidelines for Geographic Education-Elementary and Secondary Schools*, broke the subject of geography down into five main themes: (1) Location; (2) Place; (3) Human/Environment Interaction; (4) Movement; and (5) Regions. The NAEP Geography Assessment Framework functions in a similar way, but simplified the five instructional themes into three content areas: (1) Space and Place; (2) Environment and Society; and (3) Spatial Dynamics and Connections.

Content area one, Space and Place, outlines that students should be able to identify specific locations and recognize patterns that vary spatially. According to the framework, fourth grade students should be able to use basic geographic tools to examine the world through a spatial lens. Specifically, they should be able to use grids and scales and to measure topographic relief. In addition, they should have a basic understanding of map projections.

Content area two, Environment and Society, states that students should have a clear understanding of how humans rely on the environment, and how human action modifies the environment. Fourth grade students should be presented with basic, fundamental principles regarding weather and climate and other natural processes. They should also be able to identify major environmental issues and begin to understand that their actions could affect the environment on a global scale.

Content area three, Spatial Dynamics and Connections, is centered on the idea that there are complicated networks that connect people across a global scale such as transportation, economics, cultural diversity, politics, migration, disease, and tourism. Fourth-grade students should have a basic understanding of the effects of globalization. They should be able to identify and compare cultures and varying perspectives, and realize that environmental issues vary with space.

Each content area is broken down into three cognitive dimensions: (1) *knowing*; (2) *understanding*; (3) *applying*. In cognitive dimension one, *knowing*, students should be able to make observations and recall information. In cognitive dimension two, *understanding*, students should be able to attach meaning and context to their observations. In cognitive dimension three, *applying*, students should be able to synthesize their observations and understandings to classify, hypothesize, and use reasoning to solve geographic problems. These cognitive dimensions

follow a progression through the grade 4, 8, and 12 assessments. Grade 4 assessments heavily emphasizes *knowing*, and little attention is on *understanding* and *applying*. Comparatively, grade 12 assessments transition to focus mainly on *applying*. Conversely, there is no difference in the amount of questions per content area on the grade 4, 8, and 12 assessments.

In addition to content areas and cognitive dimensions, the NAEP geography framework also outlines three achievement levels: (1) *basic*; (2) *proficient*; (3) *advanced*. These achievement levels set a standard for what students should know about geography in grades 4, 8, and 12. Students at the *basic* achievement level exhibit rudimentary knowledge and thinking skills, but are capable of answering geographic questions adequately. Students at the *proficient* level are able to deal with complicated geographical concepts and exhibit a solid understanding of geography. Students at the *advanced* level exhibit critical thinking skills that allow them to analyze geographical data and apply that to solve real-world issues. According to NAGB, students at the *proficient* level have mastered the knowledge and skills they need to function in our globalizing society.

National Geographic Learning Framework

Similar to the guidelines produced by NAGB, NGS researchers developed a learning framework to guide the development of their resources. The purpose of the National Geographic Learning Framework is to, "… teach kids about the world and how it works, empowering them to succeed and to make it a better place," (National Geographic 2016b). Through this framework, National Geographic outlines the Attitudes, Skills, and Knowledge – aptly forming the acronym "ASK" – that students must master in order to, "respond to rapid change, understand connections, and make informed decisions," or in other words, to become an explorer (National Geographic 2016b).

Each category of the National Geographic Learning Framework – Attitudes, Skills, and Knowledge – breaks down into multiple components (Appendix D). In the Attitudes category, explorers exhibit curiosity about how the world works, responsibility for their actions that affect the living and non-living components of our planet and society, and empowerment to act on their feelings of curiosity and responsibility. In the Skills category, explorers make and document real world observations, communicate experiences and ideas through a wide variety of media outlets, collaborate with other students and explorers, and solve problems through careful decision making. In the Knowledge category, explorers display proficiency in our human story, our changing planet, and wildlife and wild places (National Geographic 2016). This framework supported the development of the SGTM of Montana.

The Giant Traveling Map Program: A Brief Overview

Researchers Audrey and Lindsey Mohan worked collaboratively with NGS to develop a document that outlines the spatial thinking abilities of children at the K-8 grade levels. This report, *Spatial Thinking About Maps* (2013), identifies the spatial thinking concepts that students are capable of understanding and those that still cause confusion across different grade levels. This report provides the necessary data to help develop appropriate geography curricula to increase the geographic literacy of American students.

In the report, *Spatial Thinking About Maps* (2013), Audrey and Lindsey Mohan analyzed over 80 books, journal articles, and reports that focused on the progression of spatial thinking skills that develop in children. They first frame their research by defining the concept of spatial thinking, "Spatial thinking involves knowing and understanding spatial concepts and relations, how we represent those concepts and relations in different ways, and also how we can reason with spatial information," (Mohan and Mohan 2013, p 4). They base their theoretical framework

on Piaget's work on cognitive development and his suggestion that spatial thinking concepts be taught through a constructivist lens.

Mohan and Mohan (2013) briefly summarized both sides of the debate regarding designing geographic curricula between Downs and Liben, and Blaut. Blaut and his colleagues believe that young children possess relatively sophisticated spatial thinking abilities without prior instruction. In contrast, Downs and Liben believe that spatial thinking skills in children younger than seven are severely limited and instruction is required to deal with complex topics. Mohan

and Mohan (2013) side with Downs and Liben.

Mohan and Mohan (2013) created a series of tables that outline the spatial thinking progression of children from pre-K through sixth grade. The tables describe the common understandings of children in age groups from 3-6, 7-9, and 10+, as well as common misconceptions about spatial thinking abilities and suggested lessons. These tables highlight the high variation observed in the spatial thinking abilities of children. National Geographic references these tables during State Giant Traveling Map lesson design and they are referenced in the State Giant Traveling Map Lesson Handbook (Appendix E).

The State Giant Traveling Maps and Lesson Handbook are unique in that NGS incorporated a kinesthetic component into resources and curriculum design. Students are physically standing and moving on the map while learning local geography and basic map skills. By doing this, NGS essentially created a multisensory resource which accommodates all learning styles. Honigsfeld and Dunn (2009) suggest the use of large materials like table-top maps, or even better, large floor maps, as a means to include kinesthetics in classroom resources. The classroom-sized State Giant Traveling Maps fit this specification. Additionally, the State Giant

Traveling Maps support Kolb's Experiential Learning Theory because the resource promotes a "real-world" experience that stands out from conventional education methods. Fundamentally, the State Giant Traveling Map of Montana is expected to help promote geographic literacy because it teaches to all learning styles through active and engaging experiences.

Summary: This chapter presented the main theories to support the SGTM of Montana as a resource to increase geographic literacy. Piaget's Theory of Cognitive Development identifies the age at which to begin formal geographic education. Kolb's Experiential Learning Theory explains how educational strategies that utilize real-world experiences promote deeper understanding of content. Learning modality theories describe the observed differences in an individual's preferred mode of perceiving and processing new knowledge. Further explanation of the NAEP Framework and the National Geographic Learning Framework provide necessary context understand how the unique design of the SGTM of Montana is capable of promoting geographic literacy.

Chapter 3: Methodology

"Tell me and I forget. Teach me and I remember. Involve me and I learn." – Xun Kuang, Chinese Confucian Philosopher, 312-230 BC.

This chapter presents the methodology utilized to gather data on the geographic literacy of fourth graders in the State of Montana using the SGTM of Montana. In this case, the SGTM of Montana acted as an educational treatment for students. Data collection occurred through the use of a quantitative student pre- and post-treatment assessment and a qualitative teacher survey. Results from pre- and post-treatment assessments and teacher surveys were tabulated in Microsoft Excel spreadsheets, and SPSS software was used to test for statistical significance.

Sample Population

The sample population consisted of a total of 114 fourth graders and four teachers from four public elementary schools in western Montana (Table 1). The study focused on fourth grade students for two reasons. First, the National Geographic curriculum associated with the SGTM of Montana aligns with the cognitive abilities of fourth graders. Second, the National Assessment of Education Progress (NAEP) administers a geography assessment to fourth, eighth, and twelfth graders, and the national results are accessible to the public. Phone calls acted as the main recruitment method for this study, and after speaking with school principals on the phone, they chose whether or not to grant permission for their teachers and classrooms to participate in this study. Schools were selected for initial contact based on proximity to Missoula, Montana, where the research took place. Of the 15 schools that were recruited, four school principals granted permission for their fourth grade classes to participate. Of the four schools that participated, three were in rural settings and one was in an urban setting, the majority of students were white in all

settings, and poverty rates ranged between 10.8-13.8 % (Table 2). School D falls within an urban setting but is the only school within the district, which is why the population within that school district seems as if it should be rural setting.

School	Total Number of Students from Each School that Took Both Pre- and Post-Treatment Assessments
School A	16
School B	48
School C	29
School D	21
n =	**114**

Table 1: Participating schools and number of students from each school (n = 114).

School	Rural or Urban	Population within School District	% White	% Native	% Black	% Other	Median Household Income ($)	% Poverty
A	Rural	3,364	93.88	0.41	0	5.71	42,985	10.8
B	Rural	1,052	96.76	0	0	3.24	40,000	13.8
C	Rural	775	96.05	0.62	0.26	3.07	42,471	12.6
D	Urban	3,277	97.07	0.58	0	2.35	56,125	12.9

Table 2: Demographic data of the four participating schools. Source: ProximityOne 2018 (census data from 2010).

Student Assessment Design

Students completed a pre-treatment assessment and an identical post-treatment assessment to evaluate how the SGTM of Montana affected their attitudes and skills (Appendix F). In this case, the treatment refers to the completion of two lessons using the SGTM of Montana. Students completed the post-treatment assessment three-weeks after completing the treatment. The pre- and post-treatment assessment contained eight questions: questions 1-4 measure students' attitudes towards geography and questions 5-8 measure students' skills.

Questions 1-4 were created specifically for this research while paying careful attention to proper Lexile content to ensure suitability for the fourth grade reading level. According to *The Lexile Framework for Reading* (2016), the Lexile content for Grade 4 should be between 480L and 830L (MetaMetrics 2016). An online application measured the Lexile content of questions 1-4 at 740L, which falls within the accepted range for fourth graders. For all attitude questions (1-4), choice A reflected a positive attitude towards geography, choice B reflected a negative attitude, and choice C reflected an indifferent attitude.

Questions 5-8 came directly from the NAEP Questions Tool for Grade 4 (NCES 2016). On the pre- and post-treatment assessments, the word choice and formatting of questions 5-8 is a direct replica from the NAEP assessments. The national results to questions 5-8 serve as the control in this project. Specifically, by comparing the sample population assessment results to the NAEP national results, it will be possible to determine whether the SGTM of Montana is more effective at teaching map skills over conventional methods.

Question 5 (Mark X on your State/District) is considered a short constructed response (SCR) question. This question falls under NAEP content area one, Space and Place, and has a difficulty rating of easy. Full credit, partial credit, and no credit responses are referred to by NAEP as *complete* (*2 points*), *partial* (*1 point*), and *inappropriate* (*0 points*) respectively. To receive a *complete* score, students needed to write the name of the state or district where they live and to mark an X on a map of the United States on the location of their state or district. *Partial* answers had an X marked in a different location as the written state or district. *Inappropriate* answers had an X in a different location as the written state or district, if the X was missing, and if the state or district was missing. *Omitted* answers had no response written.

Question 6 (Draw Map of Little Town) is considered an extended constructed response (ECR) question. This question falls under content area one, Space and Place, and has a difficulty rating of hard. In this question, NAEP broke up partial credit into two categories. Full credit, partial credit, and no credit responses are referred to by NAEP as *complete* (*3 points*), *essential* (*2 points*), *partial* (*1 point*) and *inappropriate* (*0 points*). The question provided students with a grid, a map key and a list of town features that they had to draw on the grid using the provided symbols. The list of town features instructed students to draw town borders that ran 4.0 miles east to west and 3.0 miles north to south and include Main Street, the school, a park, and a river. To receive a *complete* score, student maps needed to be drawn to scale with all four features in the correct location. *Essential* answers had all four features drawn in the correct locations but not to scale, or three features drawn in the correct location and to scale. *Partial* answers had two features drawn to scale in the correct location or three features drawn in the correct location but not to scale. *Inappropriate* answers had none of the features drawn in the correct location or to scale. *Omitted* answers had no response written.

Questions 7 and 8 were multiple choice (MC) questions worth one point each, and therefore students' answers could either be right or wrong (Table 4). Question 7 falls under content area one, Space and Place, and has a difficulty rating of hard. Question 8 falls under content area three, Spatial Dynamics and Connections, and has a difficulty rating of easy.

Webb's Depth of Knowledge (DOK) Levels were assigned to each of the four NAEP questions to clearly outline the level of knowledge each question assessed. Question 5, 7, and 8 are considered Level One (Recall) Questions, and students made simple measurements and identified locations. Question 6 is considered a Level Two (Skill/Concept) Question and students applied their knowledge of scales and symbols to draw their own map.

Two experimental controls were embedded in the pre- and post-treatment assessments, the first being the pre-treatment assessment results and the second being the NAEP Geography Assessment national average results. Pre-treatment assessment results acted as the base level of students' attitudes and skills to compare with post-treatment assessment results. Additionally, NAEP Geography Assessment results indicated whether the sample population results followed similar trends to the national average results for the selected NAEP questions.

Teachers administered the pre-treatment assessment, the two lesson map treatment, and the post-treatment assessment. The only people present during administration of the pre- and post-treatment assessments and the two map lessons were the students and their teacher. To protect students' privacy, teachers translated student names into codes on their assessments. Each unique code contained identifiers to indicate the school, teacher name, student number, and gender. For the purpose of comparison, students received the same exact code for their pre- and post-treatment assessment. Teachers then returned the assessments for data analysis. This method was pilot tested on fourth graders at a private school in Missoula, Montana. The pilot test results helped inform the process moving forward, and the results were not included in the final analysis.

Lesson Implementation

Teachers had the SGTM of Montana for one week and they chose the time, location, and order of lesson implementation. Overall, teachers administered two lessons using the SGTM of Montana and the National Geographic State Giant Maps Lesson Handbook (2016a). Each of the six lessons in this curriculum align with national geography education standards. National Geographic Society researchers pilot tested these lessons during the 2015/2016 school year in Colorado, though the results are not accessible at this time.

Teachers administered two lessons titled, *Lesson 4 – Cardinal Directions*, and *Lesson 5 – Map Scale and Measuring Distances* (Appendix E). Teachers administered only two lessons to minimize the time commitment necessary to meet the requirements for participation. Teachers followed the directions in the lesson book, though they also used supplemental directions with slight modifications to the two lessons. During pilot testing, teachers indicated that additional clarification would be appreciated. The pilot test also revealed that it took approximately 65 minutes to complete the two lessons using the SGTM of Montana.

The *Cardinal Directions* lesson objectives outlined that students should understand cardinal directions and how to use cardinal directions to navigate across the giant map to find specific locations in the state. To accomplish this task, students completed a relay game using cardinal directions. After breaking up into four equal groups, each group received a stack of cards with town names written on them. Each group nominated one *navigator* and one *explorer* to begin the lesson. The *navigator* drew a location card, read the location, and kept that location a secret from the rest of his or her group. The *navigator's* job was to guide the explorer to the correct location using only cardinal directions. The *explorer* walked out onto the map and the *navigator* told the *explorer* to take one step north, south, east, or west until the *explorer* reached the final destination. When the *explorer* was on the correct location, he or she placed a post-it note on the location signifying that the team successfully used cardinal directions to find the place. During this relay, students rotated roles. The *explorer* moved to the back of the line, the *navigator* became the *explorer*, and a new student took on the role of *navigator*. Once every group member acted as both an *explorer* and a *navigator*, the team sat down. The first team to complete this task won the relay. It took approximately 45 minutes to complete this lesson.

The *Map Scale and Measuring Distance* lesson objectives outlined that students should become familiar with using a scale bar to measure the distance between features on their state map. For this project, students only completed Part 2 of this lesson, and within Part 2, only steps 1 and 2 were completed. After breaking up into four equal groups, students formed pairs within those groups. Each pair received a *Map Measurement Table* to record their measurements. Student pairs made the following measurements: (1) Distance from their current location to the state capital; (2) Distance of any river; (3) Length of border to the east; (4) Length of border to the south; (5) Length of border to the west; (5) Length of border to the north. Students chose whichever method they wanted to use to make measurements on the giant map. For example, they could have used a piece of string, the length of their hand, or the length of their stride. It took approximately 20 minutes to complete this lesson.

Based on the lesson objectives, these two lessons introduced students to the specific skills they needed to answer questions 5-8 on their assessments. Specifically, the lesson, *Cardinal Directions*, prepared students to answer part of question six and all of question eight. The lesson, *Map Scale and Measuring Distance*, prepared students to answer part of question six and all of question seven.

Teacher Survey Design

A survey instrument gathered data on teachers' perceptions of the SGTM of Montana as a resource to teach geography (Appendix J). Survey questions called for short-answer responses, and they were qualitative in nature. In total, there were 13 questions, and some were broken down into multiple parts. Survey responses revealed if teachers enjoyed using the resource, if they would like to see changes made to the curriculum, and if they would recommend and use this resource again.

Data Analysis

This study utilized a mixed-methods approach for data collection and data analysis, with the student assessments analyzed quantitatively and the teacher survey analyzed qualitatively.

Student Assessment

Student pre- and post-treatment analysis took place over two parts, with questions 1-4 analyzed in Part 1 and questions 5-8 analyzed in Part 2. The Part 1 analysis revealed the ability of the SGTM of Montana to promote positive attitudes towards geography. The Part 2 analysis revealed the ability of the SGTM of Montana to teach students map skills and if this method of instruction altered student achievement levels as compared to the NAEP Geography Assessment national average results. SPSS software facilitated a chi-squared statistical analysis of the observed change between Part 1 and Part 2 results on the pre- and post-treatment assessments (Appendix I).

In the Part 1 analysis, student pre- and post-treatment assessment responses were transcribed into a spreadsheet using Microsoft Excel (Appendix H). For these questions, students could choose answers A, B, or C, and results in Excel follow the same letter convention. I totaled the number of students who answered A, B, and C on both assessments then compared pre- and post-treatment responses for each individual student. Total values for each answer choice on the pre- and post-treatment assessments were converted into percentages and graphed to reveal percent change between the pre- and post-treatment assessments for each answer choice.

In the Part 2 analysis, student pre- and post-treatment assessment responses were transcribed into a spreadsheet using Microsoft Excel. I replicated the exact scoring procedures outlined in the available NAEP scoring guides (Appendix G), and each question received a point value. Full credit answers for question five received two points, full credit answers for question

six received three points, and full credit answers for questions seven and eight both received one point for a total of seven points maximum.

Utilizing an identical graphing procedure as in Part 1, Part 2 graphs revealed the percent change between the pre- and post-treatment assessments for each answer in addition to the NAEP national average results. An additional graph displayed the percent change of individual students' Part 2 scores between the pre- and post-treatment assessments.

Teacher Survey

Teacher surveys were analyzed qualitatively by coding survey responses. The coding procedure followed did not require the use of any software. First I followed open coding procedures and thoroughly read through and transcribed each response. This first process helped familiarize myself with the survey responses. Second, I followed thematic coding procedures and read through each response to pull out words that appeared repeatedly and captured the major themes communicated through survey responses. After generating a list of codes, I translated the list of codes into themes and then expanded these themes into specific concepts. Coding revealed the common themes that were shared between responses. Did teachers enjoy using this resource? Would they use this resource again? What were some of the associated challenges with using this resource? The emerging themes disclosed if teachers believe that the State Giant Traveling Map of Montana is a useful and effective tool to teach geography.

Chapter 4: Results

"Our society needs the knowledge-and the understanding based on such knowledge-to cope with the problems and the opportunities of its industrial maturity, its now immutable dependence on foreign economies and money markets, and its political commitments over broad reaches of the world. The new purpose for geography is to help America understand globalism as it once helped us understand regionalism," Gilbert M. Grosvenor, Former Chairman of the National Geographic Society, November 1984.

This chapter includes an analysis of student pre- and post-treatment assessment results and teacher survey responses. Examples of student responses are presented in Appendix L. Pre- and post-treatment assessment data is presented through both descriptive and inferential statistics (chi-squared analysis). Teacher survey coding results are displayed in tabular form. Results indicate a significant difference ($p < 0.05$) in answers between the pre- and post-treatment assessments for questions 1-7 (Table 2).

H_o: The SGTM of MT has no effect on student attitudes and skills.		
H_a: The SGTM of MT does have an effect on student attitudes and skills.		
Question	**P-Value**	**Accept OR Reject**
1	$p < 0.05$	reject null
2	$p < 0.05$	reject null
3	$p < 0.05$	reject null
4	$p < 0.05$	reject null
5	$p < 0.05$	reject null
6	$p < 0.05$	reject null
7	$p < 0.05$	reject null
8	$p > 0.05$	accept null

Table 3: Chi-squared analysis results with corresponding p-values.

Attitude Questions (1-4)

Questions 1-4 revealed the capability of the SGTM of Montana to promote positive attitudes towards geography. Results for each question indicate the percent change between answer choices on the pre- and post-treatment assessments as well as a breakdown of exactly how answers on the post-treatment assessment changed from the pre-treatment assessment. The figures listed below indicate whether the map treatment supported a positive or negative attitudinal shift.

A chi-squared analysis of **question one** (In this school year, have you studied geography?) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. To determine whether the statistically significant change reflected an increase in positive attitudes towards geography requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who answered *yes* (*A*) increased by 18%, the percentage of students who answered *no* (*B*) decreased by 10%, and the percentage of students who answered *I don't know* (*C*) decreased by 8% (Figure 1). This indicates that initially, a lower percentage of students chose the positive answer choice, meaning the treatment supported an increase in positive attitudes. Specifically, this increase came from 8% of students who first answered *no* (*B*) and 15% who first answered *I don't know* (*C*). After using the SGTM of Montana, 23% of students switched their answer from a negative attitude to a positive attitude on the post-treatment assessment, and only 5% of students switched their answer from a positive attitude to a negative attitude on the post-treatment assessment. Overall, more students acknowledged that they studied geography during that school year in the post-treatment assessment than in the pre-treatment assessment (Figure 1).

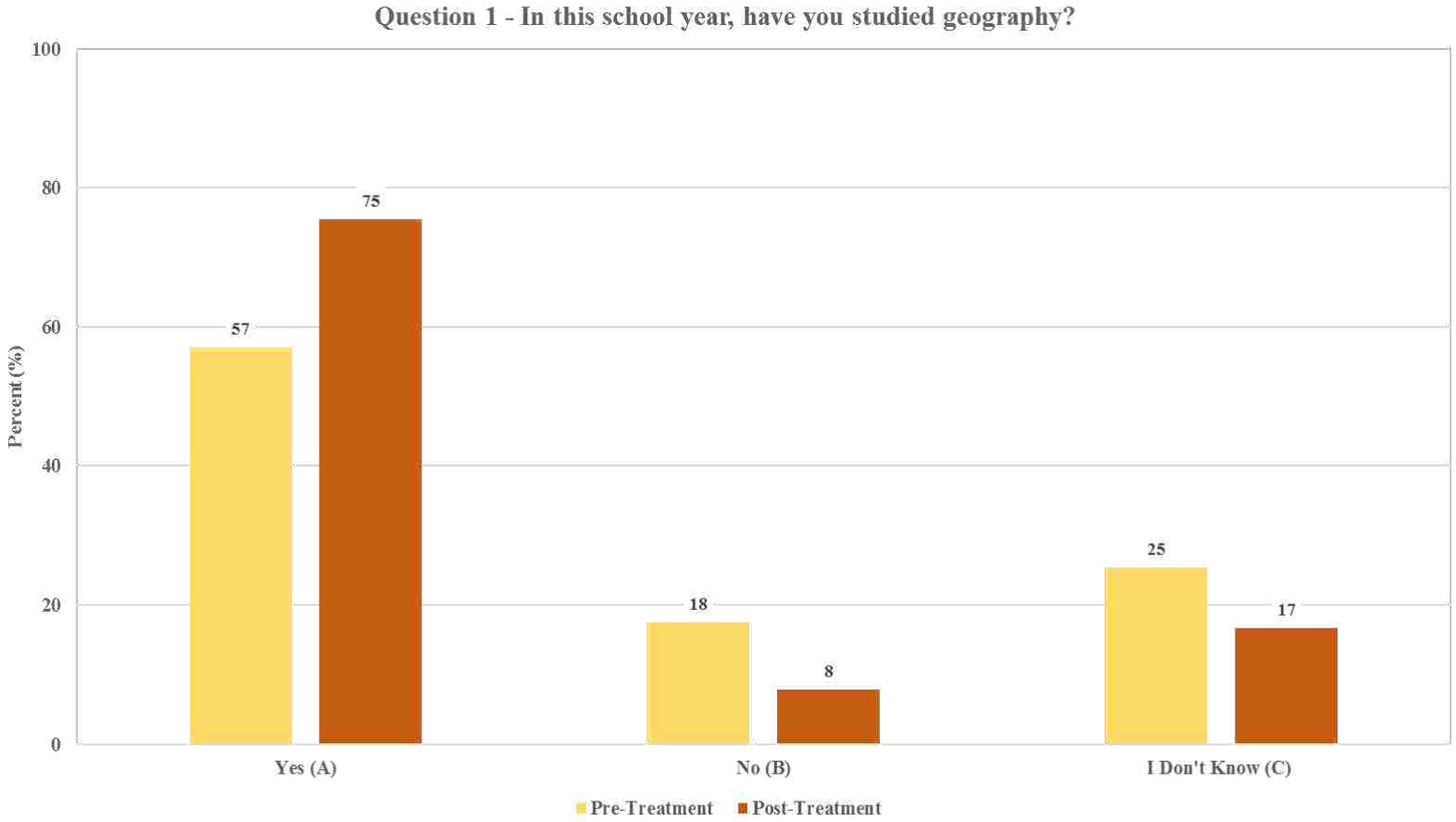

Figure 1: Percent change between responses on the pre- and post-treatment assessment results for Question 1 (*In this school year, have you studied geography*).

A chi-squared analysis of **question two** (How much do you like studying geography?) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. To determine whether the statistically significant change reflected an increase in positive attitudes towards geography requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who answered *favorite* (*A*) increased by 5%, the percentage of students who answered *like others better* (*B*) increased by 4%, and the percentage of students who answered *never studied* (*C*) decreased by 9% (Figure 2). This indicates that initially, a lower percentage of students chose the positive answer choice, meaning the treatment supported an increase in positive attitudes. Likewise, on the initial assessment, a lower percentage of students answered *like others better* (*B*), meaning the treatment also supported an increase in negative attitudes. The increase in positive attitudes came from 12% of students who first answered *like others better* (B) and 3% of students who first answered *never studied* (*C*). After using the SGTM of Montana, 15% of students switched their answer from a negative attitude on the pre-treatment assessment to a positive attitude on the post-treatment assessment, and 10% of students switched their answer from a positive attitude on the pre-treatment assessment to a negative attitude on the post-treatment assessment. Overall, the number of students who said geography was their favorite increased, while the amount of students who said the like others better also increased (Figure 2).

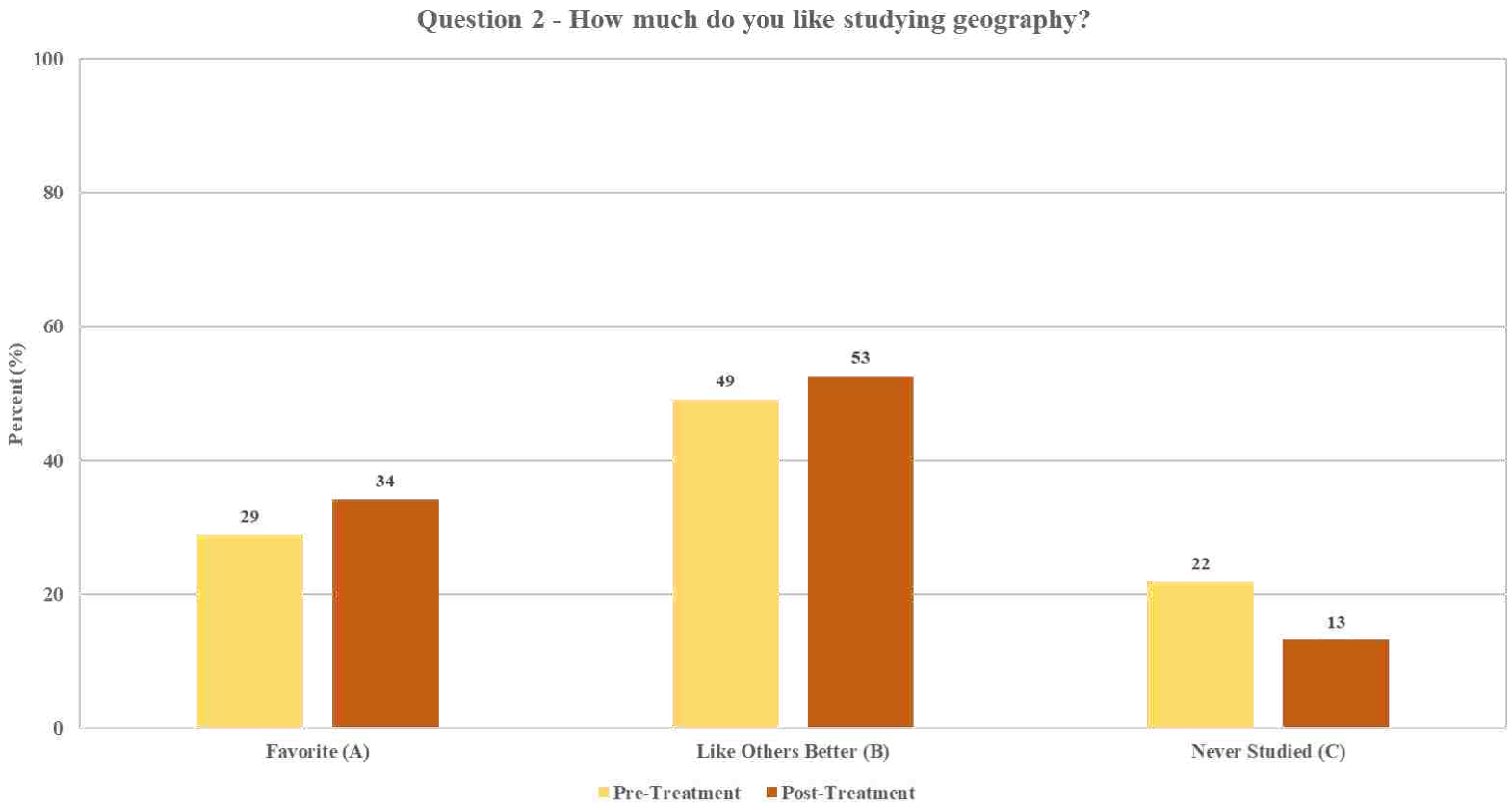

Figure 2: Percent change between responses on the pre- and post-treatment assessment results for Question 2 (*How much do you like studying geography*).

A chi-squared analysis of **question three** (Do you like learning about maps?) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. To determine whether the statistically significant change reflected an increase in positive attitudes towards geography requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who answered *yes* (*A*) increased by 9%, the percentage of students who answered *no* (*B*) decreased by 5%, and the percentage of students who answered *I don't know* (*C*) decreased by 5% (Figure 3). This indicates that initially, a lower percentage of students chose the positive answer choice, meaning that the treatment supported an increase in positive attitudes. Specifically, this increase came from 9% of students who first answered *no* (*B*) and 4% of students who first answered *I don't know* (*C*). After using the SGTM of Montana, 13% of students switched their answer from a negative attitude on the pre-treatment assessment to a positive attitude on the post-treatment assessment, and 4% of students switched their answer from a positive attitude on the pre-treatment assessment to a negative attitude on the post-treatment assessment. Overall, more students said they like learning about maps and less students said they did not or they did not know (Figure 3).

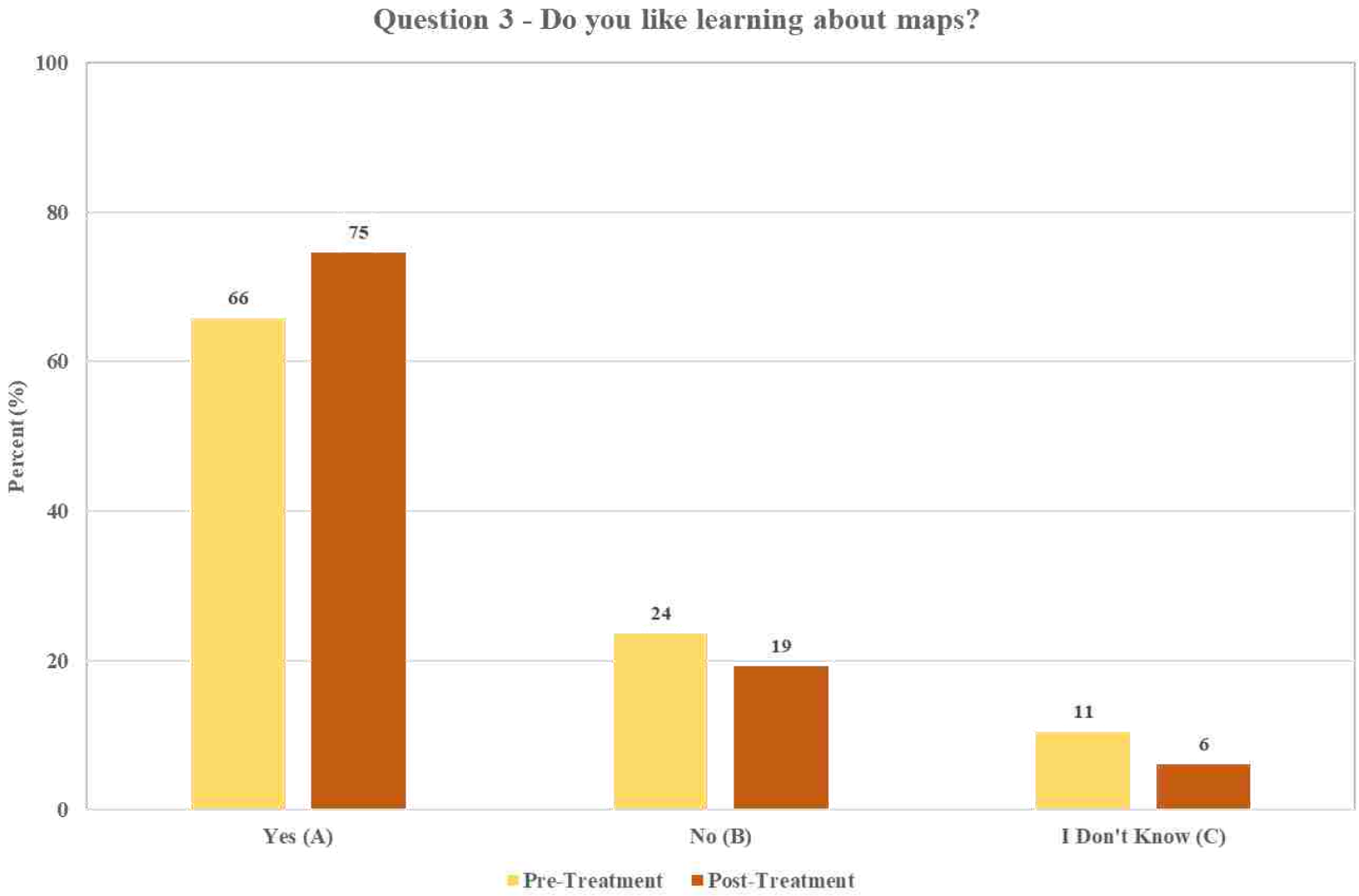

Figure 3: Percent change between responses on the pre- and post-treatment assessment results for Question 3 (*Do you like learning about maps*).

A chi-squared analysis of **question four** (Is knowing how to read a map a useful skill?) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. To determine whether the statistically significant change reflected an increase in positive attitudes towards geography requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who answered *yes* (*A*) decreased by 1%, the percentage of students who answered *no* (*B*) remained the same, and the percentage of students who answered *I don't know* (*C*) increased by 1% (Figure 4). This indicates that the map treatment had very little effect on student attitudes, both positive and negative ones. However, 3% of students who first answered *no* (*B*) switched to *yes* (*A*), and 4% first answered *I don't know* (*C*) switched to *yes* (*A*). After using the SGTM of Montana, 6% of students switched their answer from a negative attitude on the pre-treatment assessment to a positive attitude on the post-treatment assessment, and 7% of students switched their answer from a positive attitude on the pre-treatment assessment to a negative attitude on the post-treatment assessment. Overall, minimal change occurred between answers to the pre- and post-treatment assessments (Figure 4).

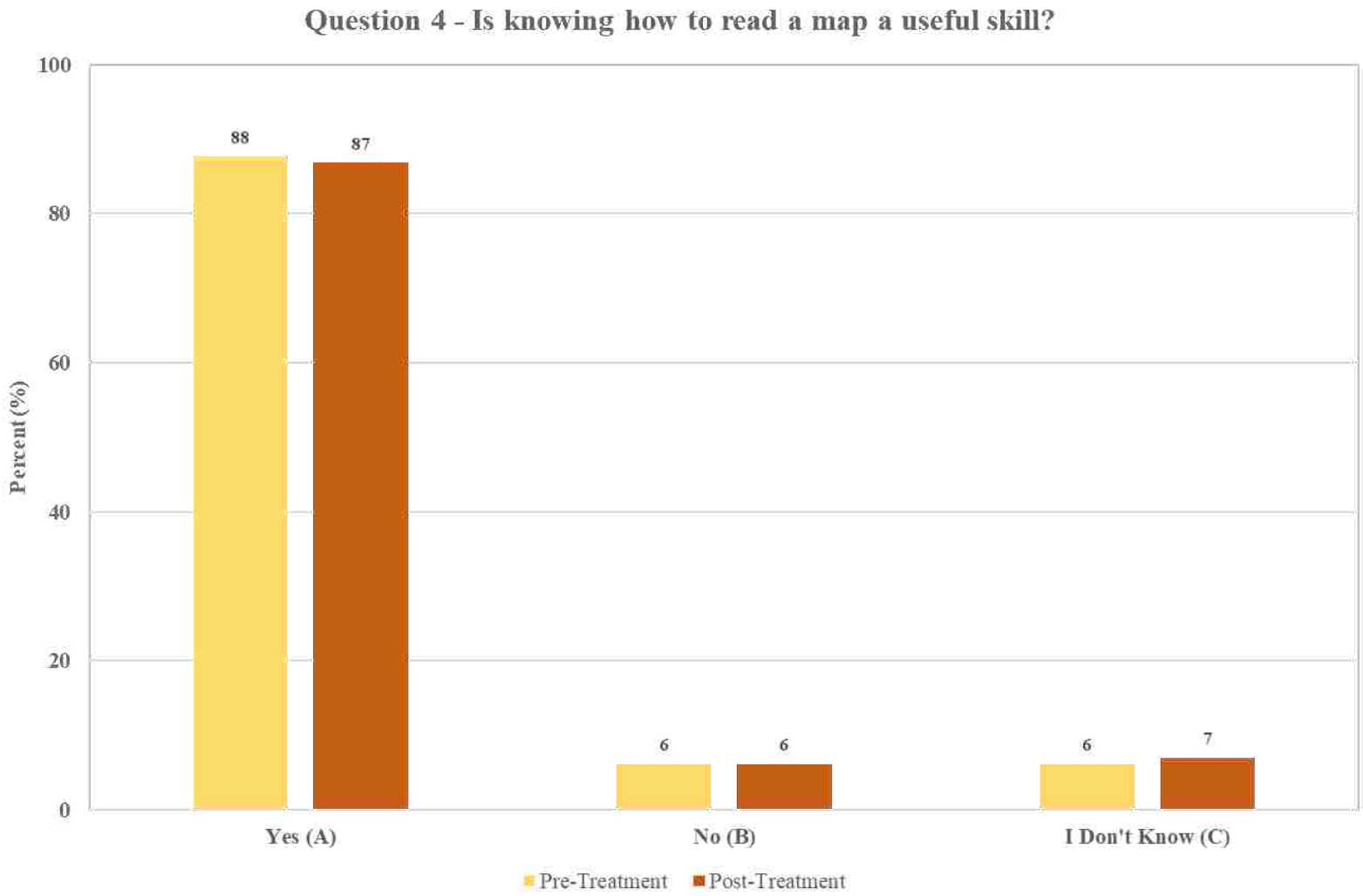

Figure 4: Percent change between responses on the pre- and post-treatment assessment results for Question 3 4 (*Is knowing how to read a map a useful skill*).

Skills Questions (5-8)

Questions 5-8 revealed the capability of the SGTM of Montana to teach students map skills like using a scale bar and coordinate grid, and interpreting different symbology. Results for each question indicate the percent change between answers on the pre- and post-treatment assessments as well as an answer-by-answer breakdown of individual changes between pre- and post-treatment assessment results. An additional comparison between post-treatment assessment results and the NAEP Geography Assessment results reveal whether the sample population scored better or worse than the experimental control.

(Results continue on the following page)

A chi-squared analysis of **question five** (Mark X on Your State/District) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. Answers to question five received a point value based on the exact NAEP Scoring Guide used to grade the national assessments (Appendix G). For this specific question, a *complete* response received two points, a *partial* response received one point, an *inappropriate* response received zero points, and an *omitted* response received zero points. To determine whether the statistically significant change reflected an increase in student ability to identify their state of residence requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who scored *complete* (*2 points*) increased by 4% between the pre- and post-treatment assessment, the percentage of students that scored *partial* (*1 point*) decreased by 2%, the percentage of students that scored *inappropriate* (*0 points*) decreased by 2%, and the percentage of students who chose to *omit* (*0 points*) the question decreased by 1% (Figure 5). This indicates that initially, a lower percentage of students did not yet understand how to identify their home state on a map of North America, meaning the treatment supported an increase in skills. Specifically, this increase came from 1% of students who first scored *partial*, 6% of students who first scored *inappropriate*, and 3% of students who first chose to *omit*. After using the SGTM of Montana 10% of students increased their score to a perfect score (*complete/2 points*), 11% of students' scores increased by at least 1 point, and 6% of students' scores decreased by at least 1 point (Figure 5). The sample population scored the same as the control group on both the pre- and post-treatment assessment, with the highest percentage of students attaining a *complete* score on both assessments.

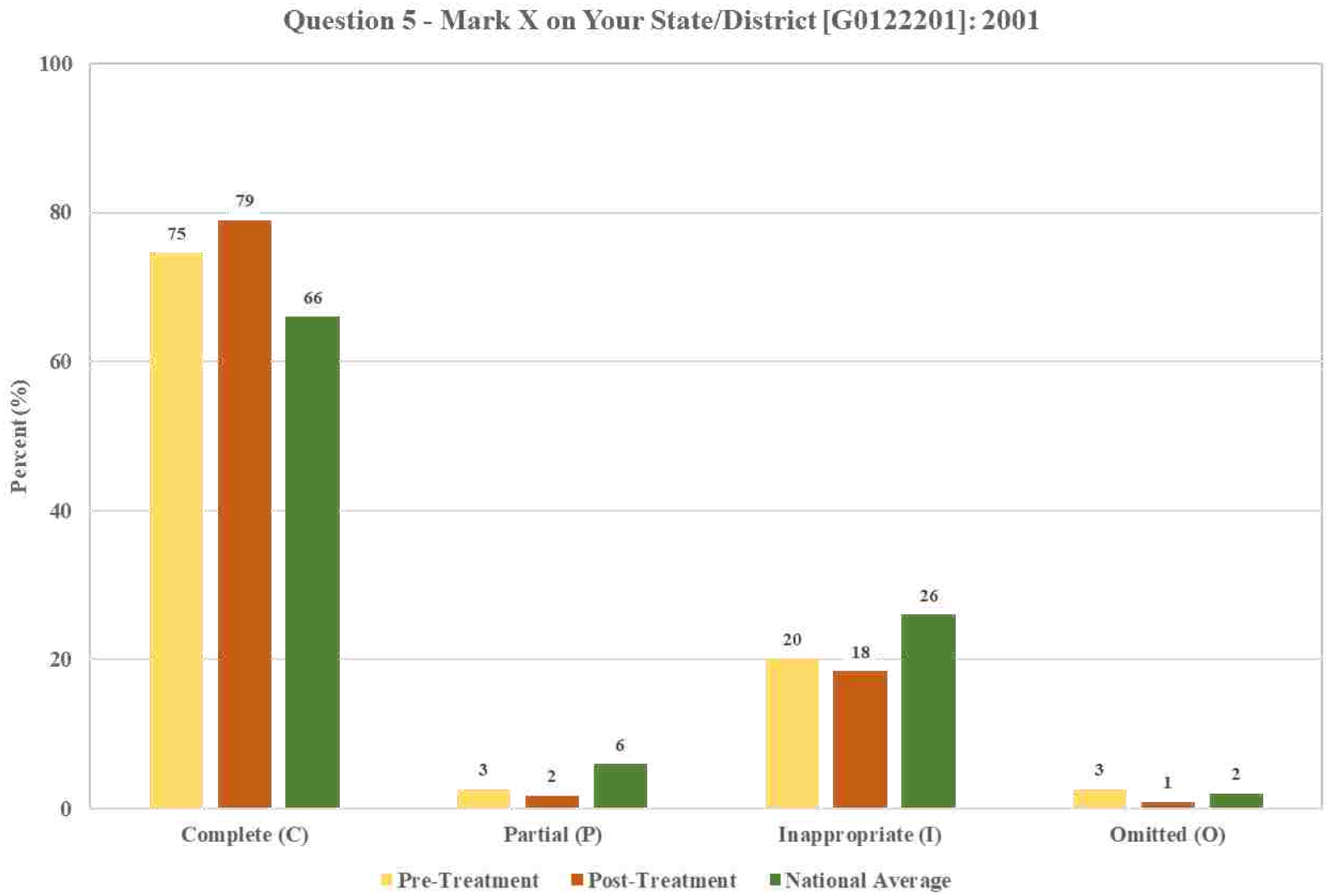

Figure 5: Percent change between responses on the pre- and post-treatment assessment results for Question 3 5 (*Mark X on your state/district [G0122201]: 2001*).

A chi-squared analysis of **question six** (Draw a map of Little Town) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. Answers to question six received a point value based on the exact NAEP Scoring Guide used to grade the national assessments (Appendix G). For this specific question, a *complete* response received three points, an *essential* response received two points, a *partial* response received one point, an *inappropriate* response received zero points, and an *omitted* response received zero points. To determine whether the statistically significant change reflected an increase in student ability to use a scale bar and compass rose, and to create their own map requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who scored *complete* (3 points) increased by 6%, the percentage of students who scored *essential* (2 points) decreased by 2%, the percentage of students who scored *partial* (1 point) decreased by 5%, the percentage of students who scored *inappropriate* (0 points) increased by 3%, and the percentage of students who chose to omit (0 points) decreased by 2% (Figure 6). This indicates that initially, a lower percentage of students did not yet understand how to use a grid, scale bar, and interpret different symbols, meaning the treatment supported an increase in skills. Specifically, this increase came from 5% of students who first scored essential, 2% who first scored partial, 1% who first scored inappropriate, and 1% who first chose to *omit*. After using the SGTM of Montana 9% of students increased their score to a perfect score (complete/3 points), 24% of students' scores increased by at least 1 point, and 17% of students' scores decreased by at least 1 point. The sample population scored the same as the control group on the pre-treatment assessment. On the post-treatment assessment, the sample population scored the same as the control group in the *inappropriate* category, but better than the control group in the *complete* category.

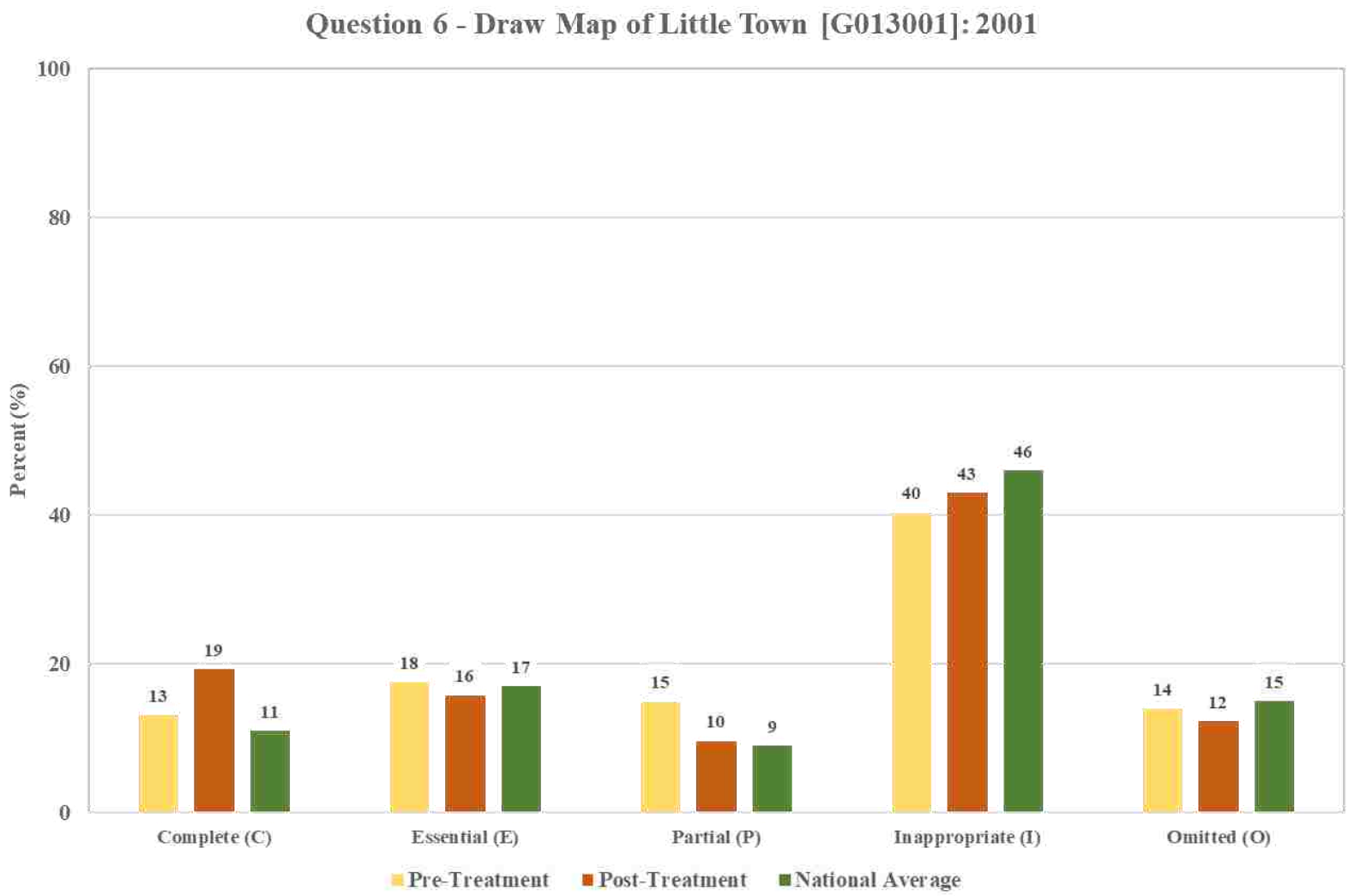

Figure 6: Percent change between responses on the pre- and post-treatment assessment results for Question 6 (*Draw map of Little Town [G013001]: 2001*).

A chi-squared analysis of **question seven** (Identify how far Lake Hood is from Lake Major) showed a statistically significant difference ($p < 0.05$) between the pre- and post-treatment assessment results. Answers to question seven received a point value based on the exact NAEP Scoring Guide used to grade the national assessments (Appendix G). For this specific question, choice *D* received one point, and all other choices received zero points. To determine whether the statistically significant change reflected an increase in student ability to use a scale bar requires a closer look at the data and the directional change of individual answers. On the pre- and post-treatment assessments, the percentage of students who answered *D* increased by 3%, the percentage of students who answered *A* remained the same, the percentage of students who answered *B* remained the same, the percentage of students who answered *C* decreased by 2%, and the percentage of students who chose to *omit* decreased by 2% (Figure 7). This indicates that initially, a lower percentage of students did not yet understand how to use a scale bar, meaning the treatment supported an increase in skills. Specifically, this increase came from 4% of students who first answered *A*, 4% who first answered *B*, 7% who first answered *C*, and 0% who first chose to *omit*. After using the SGTM of Montana, 18% of students who answered incorrectly on the pre-treatment assessment answered correctly on the post-treatment assessment, and 13% of students who answered correctly on the pre-treatment assessment answered incorrectly on the post-treatment assessment. The sample population scored the same as the control group, with the highest percentage of students choosing *D* as the correct answer on the post-treatment assessment.

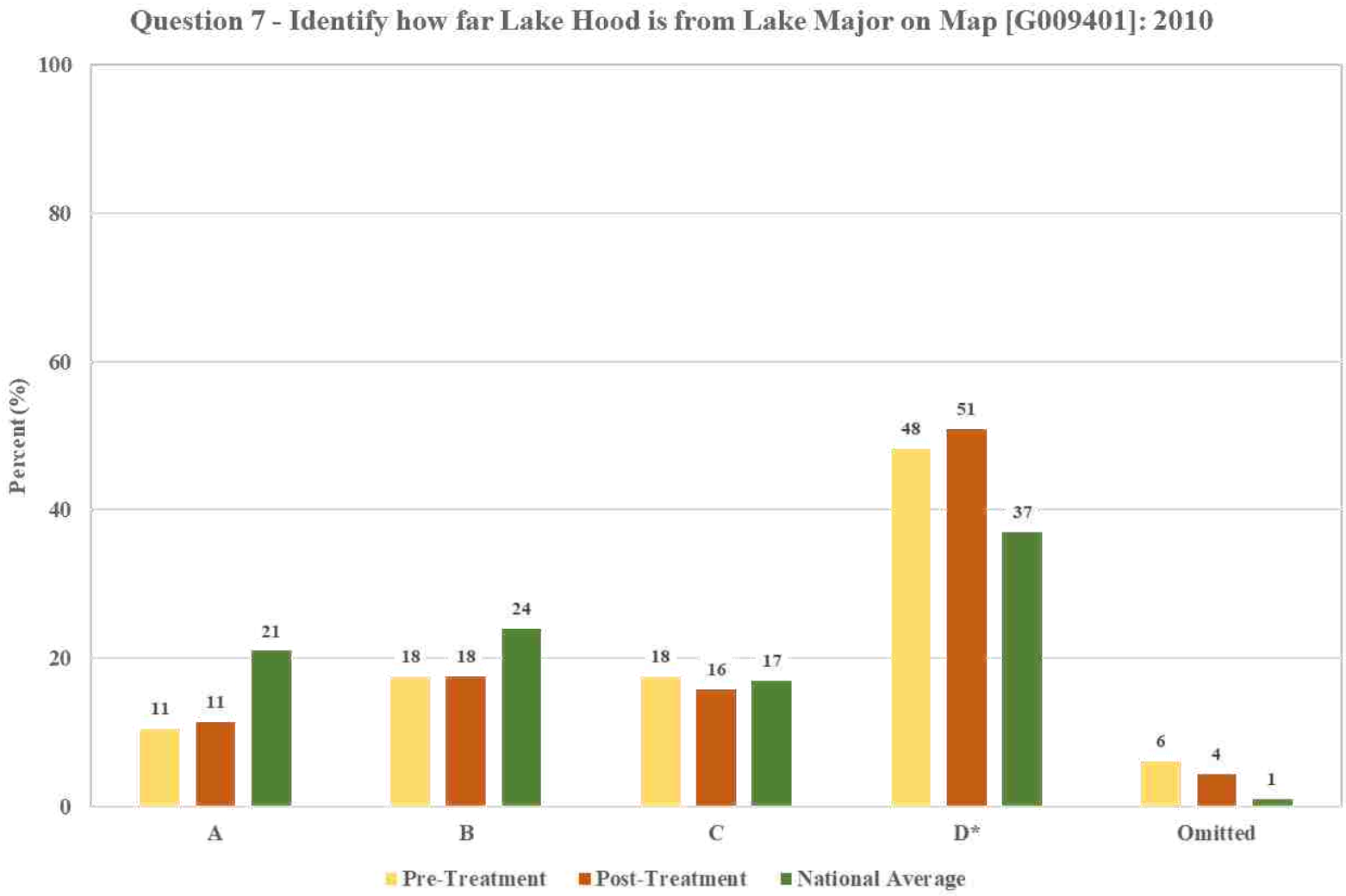

Figure 7: Percent change between responses on the pre- and post-treatment assessment results for Question 7 (*Identify how far Lake Hood is from Lake Major on map [G009401]: 2010*).

A chi-squared analysis of **question eight** (Map: Direction, LA to Salt Lake) did not show a statistically significant difference ($p > 0.05$) between the pre- and post-treatment assessment results. However, there is an observable change between answers on the pre- and post-assessment and to determine whether this change reflected an increase in student ability to use a compass rose requires a closer look at the data and the directional change of individual answers. Answers to question seven received a point value based on the exact NAEP Scoring Guide used to grade the national assessments (Appendix G). For this specific question, choice *C* received one point, and all other choices received zero points. On the pre- and post-treatment assessments, the percentage of students who answered *C* decreased by 3%, the percentage of students who answered *A* increased by 10%, the percentage of students who answered *B* increased by 5%, the percentage of students who answered *D* decreased by 2%, and the percentage of students who chose to *omit* decreased by 1% (Figure 8). This indicates that initially, a higher number of students understood how to use a compass rose compared to after the map treatment was administered, meaning the treatment did not result in an increase in skills. However, some students did in fact switch from the incorrect to the correct answer on the post-treatment assessment. Specifically, 4% of students first chose *A*, 9% first chose *B*, 8% first chose *D*, and 2% first chose to *omit*. After using the SGTM of Montana, 22% of students who answered incorrectly on the pre-treatment assessment answered correctly on the post-treatment assessment, and 25% of students who answered correctly on the pre-treatment assessment answered incorrectly on the post-treatment assessment (Figure 8). The sample population scored the same as the control group with the highest percentage of students choosing choice *C* as the correct answer on the post-treatment assessment.

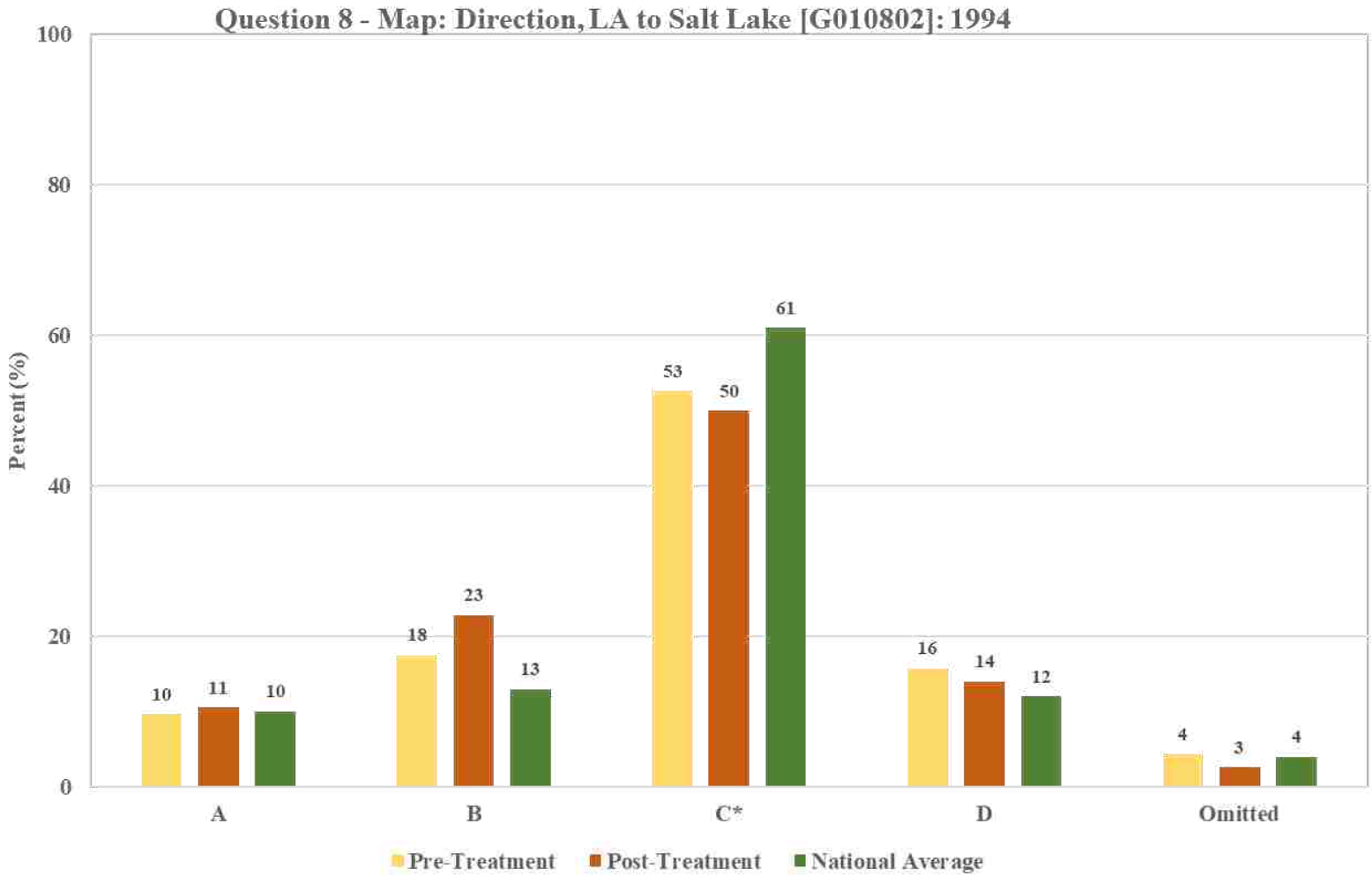

Figure 8: Percent change between responses on the pre- and post-treatment assessment results for Question 8 (*Mark X on your state/district [G0122201]: 2001*).

Questions five through eight received scores based on NAEP scoring guides. Overall, 42% of students received an increased score on the post-treatment assessment compared to the pre-treatment assessment, 31% of students' scores decreased, and 27% of students' scores did not change (Figure 9).

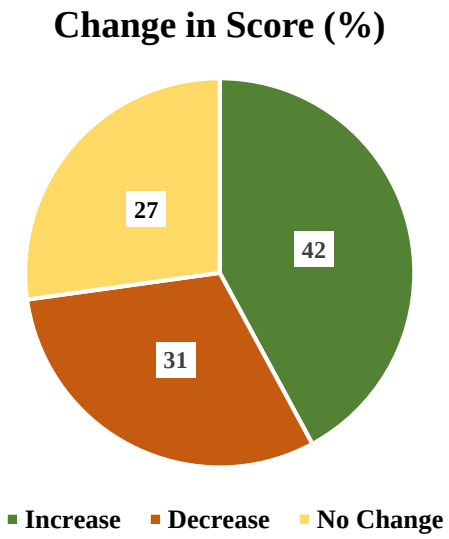

Figure 9: Change in score (%) between questions 5-8 on the pre- and post-treatment assessments.

Teacher Survey

Teacher surveys collected qualitative data on the effectiveness, ease of implementation, and overall teacher satisfaction with regards to the SGTM of Montana. Coding of six surveys in total revealed five emerging themes associated with the SGTM of Montana: (1) Teachers enjoy using the SGTM of Montana; (2) Students enjoy using the SGTM of Montana; (3) The SGTM of Montana has major strengths as a geography education resource; (4) The SGTM of Montana has some constraints associated with its use; and (5) The SGTM Lesson Handbook is easy to use (Table 4).

Themes	Codes	Concepts
Teachers enjoy using the SGTM of Montana.	1. Engaging 2. Interactive	Teachers enjoy using the SGTM of Montana because they like to see their students interacting and engaging in activities, and teachers want to use the map multiple times in one school year.
Students enjoy using the SGTM of Montana.	1. Excited 2. Active 3. Curiosity 4. Eager	Students get excited and curious when they first see the SGTM of Montana and are eager to begin an active exploration of the map.
The SGTM of Montana has major strengths as a geography education resource.	1. Engaging 2. Hands-On 3. Moving 4. Interactive	The SGTM of Montana presents information to students in a new and exciting way. Lessons are hands-on which in turn engages students and allows them to move and interact while learning about geography.
The SGTM of Montana has some constraints associated with its use.	1. Size 2. Content Standards 3. Overwhelming 4. Time	The large size of the SGTM makes it difficult to use because teachers must move around furniture every time they want to open the map. Content standards limit the amount of time that can be devoted to geography education. Students with behavioral issues are easily overwhelmed by the map.
The SGTM Lesson Handbook is easy to use.	1. Sequential 2. Clear 3. Outlined 4. Detailed	The clear, sequential, and outlined format of lessons in the SGTM Lesson Handbook presents material in a way that is easily implemented by teachers. It provides enough detail but not too much detail.

Table 4: Teacher survey data coding results.

Summary: This chapter presented the results from the student pre- and post-treatment assessment and the teacher surveys. The next chapter focuses on data interpretation and relates the observed results to the initial research question of the extent to which the SGTM of Montana affects student attitudes and skills while providing additional interpretation on teacher perceptions.

Chapter 5: Discussion

"We have not invested in helping children to understand the world the way they're going to need to understand it in their adult lives. We are at an inflection point. We have to make some decisions if we are a short-term culture that doesn't value well-reasoned decision making. Or we dramatically change the preparedness of our young people to make geographic and far reaching decisions throughout their lives." – Daniel Edelson, former Vice President of Education, National Geographic Society, May 2012.

This chapter outlines the interpretations of the results from the pre- and post-treatment assessments and the teacher surveys, and the extent to which these results support the hypothesis that the SGTM of Montana effectively promotes positive attitudes towards geography and increased achievement on geography assessments.

Results on the Attitude Questions

Results from questions one, two, and three support the claim that the SGTM of Montana promotes positive attitudes towards geography. After using the SGTM of Montana, more students acknowledged that they studied geography during the school year, more students claimed that geography was their favorite subject to study, and more students claimed to like learning about maps. Likewise, questions one and three saw a decrease in answers associated with negative attitudes towards geography and an increase in answers associated with positive attitudes. In question four, initial pre-treatment assessment results indicated that students already thought that knowing how to read a map was a useful skill, and negligible change occurred on post-treatment assessment results.

Analysis of responses to question two exhibited inconsistent results. While there was an increase in answers associated with positive attitudes on the post-treatment assessment, there was also an increase in answers associated with negative attitudes. These results contradict the

assertion that the SGTM of Montana promotes positive attitudes towards geography. What about the SGTM of Montana caused some students who initially answered that geography was their favorite to switch to liking others better? Data and observations during this research supports that the observed contradiction resulted from poor wording on the survey question. Specifically, question two asked students how much they like studying geography, not if geography was their favorite subject. The term "studying" holds a different connotation to a fourth grader as compared to a graduate student or university professor. For example, it is common for graduate students and professors to indicate their field of expertise by stating that they "study" that subject and have likely been "studying" the same subject for multiple years, though that does not necessarily mean that they sit at their desks and "study" all day. In contrast, a fourth grader likely interprets the term "studying" as the act of sitting down, concentrating, and preparing for an exam. In elementary school, "studying" typically takes place outside of school, where "learning" takes place in school. Students may like "learning" about geography, but that does not mean they like "studying" geography. That being said, by replacing the word "studying" with the word "learning," assessment results may have followed trends different than observed. This same discrepancy also explains why 8% of students said they never studied geography during the school year on the post-treatment assessment. These students might be aware that they learned about geography using the SGTM of Montana, but that does not mean they studied geography on their own time.

Results on the Skills Questions

Results from questions five, six, and seven support the claim that the SGTM of Montana is an effective resource to teach students map skills. These questions assessed students' abilities to identify their home state, use a scale bar and coordinate grid, and to interpret different

symbology. After using the SGTM of Montana, more students received complete answers than on the pre-treatment assessment on questions five, six, and seven. Likewise, question five saw a decrease in partial, inappropriate, and omitted answers, and question seven saw either a decrease or no change in the percentage of students who chose wrong answers. However, while question six saw an increase in complete answers, it also saw an increase in inappropriate answers. Similarly, question eight saw a decrease in the correct answer and an increase in the incorrect answers.

It is difficult to say what exactly caused these unexpected trends. The skills questions required much more thought than the attitude questions, and these questions mimicked exam questions, whereas attitude questions mimicked simple survey questions. While it was stressed to students that the assessments were not exams, some may have still felt intimidated by specific questions, causing them to skip the question entirely. Behavioral issues may also explain some of the observed inconsistences. For example, in question six, one student who scored complete on the pre-treatment assessment switched to inappropriate on the post-treatment assessment. Perhaps on the day of the post-treatment assessment, that particular student had a negative experience that affected his/her behavior so that he/she saw no importance in actually trying to answer the question correctly.

Disregarding these discrepancies, student assessment results paralleled national average results for each question (5-8). This supports that the SGTM of Montana is at least just as effective as traditional geography teaching methods. In no cases did the sample population score worse than the national average for the complete and/or correct responses. Unfortunately, NAEP does not provide a state-by-state breakdown of geography assessment results, so it was not possible to compare the sample population results to the Montana average results.

Additional evidence to support the claim that the SGTM of Montana is an effective resource to teach map skills comes from analysis of the changes in total points received by each student between the pre- and post-treatment assessments. After using the SGTM of Montana, 42% of students received a higher score than on the pre-treatment assessment. However, not all students increased their scores, and 31% of student scores decreased on the post-treatment assessment. This negative change may be associated with behavioral issues and lack of motivation by students to try their hardest to answer the question correctly, similar to the issues that arose in question six.

Teacher Survey

Teacher survey results support the claim that teachers like using the SGTM of Montana in their classrooms. Of the four teachers surveyed, all expressed interest in bringing the SGTM of Montana into their classroom multiple times during the school year and all said they would recommend this resource to other teachers. All teachers noted that the SGTM of Montana sparked curiosity and excitement within their students, and that students were very engaged in the two map lessons. In all classes, teachers administered the map lessons with no assistant teacher, and all teachers felt that they could handle this task without extra assistance. In some of the larger classes, teachers stated that all students did not participate equally in the map activities, however, they acknowledged that this likely occurred due to personal choice and poor attitude, and that lack of participation was not related to the map activities. No teachers gave any suggestions on significant changes to the SGTM of Montana, though some expressed interest in creating more Montana-specific lessons. The only problems teachers had with the SGTM of Montana involved its large size and the necessity to move furniture around each time they used the map. Likewise, all teachers agree that implementing SGTM of Montana lessons in Montana

will be difficult as there is little time to devote to geography education as a higher importance is placed on other subject areas. For example, the teacher from School C said, “Time is always an issue. I wish I had more time to devote to more in-depth geography education. Other subject areas often have to be prioritized.” Teachers must prioritize subjects that are more frequently assessed on standardized examinations and do not have excess time to include more geography education activities in their lesson plans.

The teacher survey design missed an opportunity to capture more useful information to support the claim that the SGTM of Montana has a positive effect on student knowledge and attitudes. Specifically, survey questions can be rewritten to capture information on individual teacher variation in regards to geography education. Did teachers undergo any sort of professional geography training prior to administering geography lessons using the SGTM of Montana? Were some teachers better suited to instruct geography lessons over other teachers? In addition to modified survey questions, in-class observations conducted by the researcher would provide additional context on classroom experience, teacher involvement, and teacher preparedness.

Summary: This chapter presented interpretations of the student pre- and post-treatment assessment word choice and results as well as the teacher survey. Analysis helped to determine whether or not the SGTM of Montana promoted positive attitudes towards geography and increased student achievement on the NAEP geography assessment. The final chapter concludes with a synopsis of large scale issues facing geography education that inhibit significant increases in geographic literacy.

Chapter 6: Conclusions and Recommendations

"Our progress as a nation can be no swifter than our progress in education. Our requirements for world leadership, our hopes for economic growth, and the demands of citizenship itself in an era such as this all require the maximum development of every young American's capacity. The human mind is our fundamental resource." – John F. Kennedy, 35th President of the United States, February 20, 1961.

This chapter addresses some of the shortcomings associated with the SGTM of Montana and how to address the issues. The SGTM of Montana does have some effect on the attitudes and map skills of fourth grade students in western Montana. However, variation in assessment results suggests that the SGTM of Montana did not affect all students in the same way. The SGTM of Montana alone may not be enough to influence substantial increases in geographic education. A better understanding of the status of geography education in the state of Montana, the structure of the NAEP assessments, and the strict Common Core requirements provides insight into issues that continue to inhibit geographic literacy.

Status of Geography Education in Montana

The Montana Office of Public Instruction published the *Montana Standards for Social Studies* in 2000 and includes geography as one component within these standards rather than offering geography as a standalone discipline. Specifically, geography surfaces in Montana Content Standard 3 which states that, "Students apply geographic knowledge and skills (e.g., location, place, human/environment interactions, movement, and regions)" (OPI 2000). This standard is an exact replica of the five main themes of geography outlined in *Guidelines for Geographic Education-Elementary and Secondary Schools*, which divides the subject of geography into five main themes: (1) Location; (2) Place; (3) Human/Environment Interaction;

(4) Movement; and (5) Regions (Natoli et al. 1984). The five themes outlined in the *Guidelines* "provide teachers with a recognizable conceptual base for organizing the structure of the core of geography in the schools" (Natoli 1994 p. 5). In Montana, the five themes are grouped together as one standard which fundamentally obscures the intricate relationships between each of the five themes. In contrast to the Montana Office of Public Instruction, the NAEP Geography Framework found value in maintaining distinct geography standards, yet modified the five themes slightly to create the three content areas covered on their geography examinations. Despite the fact that the five themes were condensed, the three NAEP content areas still capture the full essence of geography because they highlight the intricate relationship between people, the environment, and place.

The structure, or lack thereof, of Montana geography standards is not surprising considering that both middle and high schools in the state do not require a standalone geography course. Instead, local districts determine geography education requirements, meaning that there is no consistency in geography education across the state. For instance, of the four schools involved in this research project, no districts require geography as a standalone course. Instead, like most schools in Montana, geography is taught within Content Standard 3 of the Montana Standards for Social Studies. Thus, while each of the four districts involved claim to teach geography using Content Standard 3, there is no guarantee that each district uses the same techniques to teach the content and that each district devotes the same amount of time to geography education as the rest. If the Montana Office of Public Instruction prioritized geography as a core subject in Montana, then more infrastructure would be in place to ensure adequate instruction.

By merging geography with social studies, the Montana Office of Public Instruction (OPI) supports the idea that geography is not a distinct subject, and this opinion filters into the minds of teachers and students. The Montana Office of Public Instruction defines social studies as an, "integrated study of the social sciences and humanities designed to foster citizenship in an interdependent world," (OPI 2000). In comparison, the National Geographic Society (NGS) defines geography as the study of how, "human culture interacts with the natural environment, and the way that locations and places can have an impact on people," (National Geographic 2017b). The definition of social studies clearly lacks any reference to space and place. As a result, there is no way that social studies alone can capture the full essence of social and humanitarian issues because it disregards the fact that location matters. Gritzner (2002) attempts to delineate the difference between social studies and geography by suggesting that social studies operates on a temporal framework (i.e., when) while geography operates on a spatial framework (i.e., where). By merging geography with social studies, the spatial framework is obscured and the definition of geography is lost.

It comes as no surprise that students in Montana do not have a clear understanding of what the subject of geography entails as evidenced in results to assessment questions one and two. After using the SGTM of Montana, I anticipated that all students would acknowledge that they did in fact study geography during the school year; however, some students still could not identify that they did learn geography during that school year. The experience of using the SGTM of Montana should not be the only time that students studied geography during that school year, and even under traditional geography teaching methods that follow the Montana Standards for Social Studies, students were unable to attribute time with the SGTM of Montana as geography education.

Regional variability in geography course requirements exists, and in contrast to Montana, Idaho does require geography as a stand-alone course to graduate middle school. Idaho does not have standalone geography standards to complement their middle school requirement, and similar to Montana, geography standards are included within social studies standards. However, the Idaho geography standards contain multiple sub-standards that outline specific content areas in great detail and parallels recommendations set forth by the *Guidelines*, which is lacking in the Montana standards. In the Idaho Content Standards for Social Studies, geography falls under Standard 2 and is broken down into five goals: (2.1) Analyze the spatial organizations of people, places, and environment on the earth's surface; (2.2) Explain how human actions modify the physical environment and how physical systems affect human activity and living conditions; (2.3) Trace the migration and settlement of human populations on the earth's surface; (2.4) Analyze the human and physical characteristics of different places and regions; and (2.5) Explain how geography enables people to comprehend the relationships between people, places, and the environment over time (Idaho Department of Education 2016). This example illustrates the in-depth measures taken by Idaho to effectively integrate geography into its core curriculum, something that is lacking in Montana.

In theory, a more comprehensive list of content standards for geography should support a population of geographically literate students. Unfortunately, data on geographic literacy is not available on a state-by-state basis. Additional data collection is necessary to prove that geographic literacy is enhanced through instruction based on standards written with greater detail.

Issues with the NAEP Geography Assessment

For all Part 2 assessment questions, sample population results followed closely with NAEP national average results, indicating that students do not miss out on important geography instruction when taught using the SGTM of Montana. In fact, post-treatment assessment results for questions six indicate that a higher percentage of students in the sample population received a complete score over the control group. This observed difference in rates of achievement suggests that the SGTM of Montana has potential to improve student scores over national average results, though results from this research do not provide enough evidence to support that claim.

The NAEP Geography Assessment is the main tool utilized by the federal government to assess and restructure geography education in the United States. However, drawing on learning modality theories, the methods used to assess student achievement on the NAEP Assessments are multiple choice and short answer questions and therefore do not cater to all learning styles equally. Instead, this format favors visual learners who can process written words with ease. As such, students who favor kinesthetic learning modalities will likely preform worse on these assessments than their visual learning counterparts. The SGTM of Montana is an effective resource because it involves kinesthetic learners who are often at a disadvantage when taught under conventional methods. Assessments should be more dynamic to target kinesthetic learners instead of focusing mainly on visual learners.

Instructors express concern with creating lessons that engage all learners because they take a longer time to create, a longer time to implement in the classroom, and active learning resources are not easily accessible (Rao and DiCarlo 2001). The same can be said about designing assessments to actively engage all learners. Teachers are reluctant to transition away from traditional assessments because multiple choice exams significantly simplify the grading process (McConnell, Steer, and Owens 2003). Since NAEP assesses hundreds of thousands of

students yearly, modifying the assessment to focus less on multiple choice questions is not realistic, however, there are other changes that NAEP can make to assist curriculum developers in their goal to develop a population of geographically literate high school graduates.

NAEP assesses students in the following subject areas: the arts, civics, economics, geography, mathematics, reading, science, technology and engineering literacy, U.S. History, and Writing (NCES 2017). For each of the 10 subject areas listed, national average results are available to reference. However, a state-by-state breakdown of assessment results are only available for four out of the 10 subject areas, including only mathematics, reading, science, and writing. As a result, it is impossible to determine where Montana stands in relation to national achievement levels on the NAEP Geography Assessment, and also impossible to determine if the sample population scored better than the rest of Montana students after learning geography using the SGTM of Montana. If NAEP Geography Assessment results were available on a state-by-state basis, then the Montana Office of Public Instruction could better understand how their geography requirements affect student achievement by comparing this data with states who require geography as a standalone course supported by highly detailed content standards.

In addition to modifying assessment styles, assessments should also be administered to younger students to gather data on cognitive development in relation to geographical skills. In Piaget's Theory on Cognitive Development, he hypothesized that students cannot begin to think spatially until reaching the concrete operational stage of development which occurs around age nine. In public schools, the first geography assessment is administered during fourth grade, when students are expected to be able to begin thinking spatially based on Piaget's theory. However, there is no data available on the geographic literacy of children younger than fourth grade. Assessing students' ability to think spatially at earlier ages will provide information to support or

refute Piaget's claim that geography education should wait until students reach the concreate operational stage of cognitive development. Lowering the age at which geography assessments begin also supports the claim made by Gershmel and Gershmel (2006; 2007a; 2007b, 2011) that geography education should begin at an earlier age.

The Constraints of Common Core

Common Core Standards, first developed in 2009, provide consistent standards across all states to ensure that all students receive effective instruction within public schools to assure they can successfully transition into higher education and the workforce (CCSSI 2017). Individual states can decide whether or not to adopt the Common Core Standards, and those that do choose to adopt the standards theoretically also decide how to implement the standards (CCSSI 2017). NAEP assessment frameworks influenced the development of the Common Core Standards so that the new standards paralleled expectations set forth in the national assessments (CCSSI 2017). In theory, Common Core Standards are beneficial to public education in the United States because they ensure consistency in content standards across state boundaries so that all students entering higher education receive adequate equitable preparation.

Surveys conducted between 2013 and 2015 evaluated teachers' opinions on the new Common Core Standards and associated tests. Surveys revealed an increase in teacher opposition to the Common Core Standards and associated tests, from 12% in 2013 to 40% in 2014 to 50% in 2015 (Henderson, Peterson, and West 2016). Likewise, analysis of Common Core Standardized Test results for five states revealed that the number of students reaching proficiency on the new Common Core Standardized Tests saw a decline from the first assessment (Sullivan 2016).

The State of Montana adopted the Common Core Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects in 2011. The largest teachers' union in Montana, MEA-MFT, openly supports Common Core as an appropriate curriculum to maintain consistency across state boundaries (Schontzler 2014). However, since 2011, some Montana educators and parents have acted apprehensive towards new requirements. In fact, concerned citizen Debra Lamm founded Montanans Against Common Core (MACC) in May 2013 to unite educators and parents as one group to speak out against the implementation of Common Core in the state; and to support local control over curriculum (MACC 2016). Teachers who participated in this research project feel incredibly limited in time available to teach geography lessons in their classroom since there is heightened stress to teach only content assessed in Common Core Standardized Tests, as indicated in teacher survey responses. Their concern were underscored when the first district that was invited to participate in this research rejected the invitation based on concerns that participation would demand or require too much of a time committment. However, the largest teachers' union in Montana, MEA-MFT, openly supports Common Core as an appropriate curriculum to maintain consistency across state boundaries (Schontzler 2014). While Common Core may continue to persist within the realm of public education in Montana, ongoing evaluation of teacher perceptions and student achievement will guide modifications to existing Common Core curricula and provide insight on how to integrate geography into the new standards.

Suggestions for Future Research

While this research produced data that supports the claim that the SGTM of Montana promotes positive attitudes towards geography and increases students' map skills, modifications to future pedagogical techniques will strengthen this conclusion. I proceed to provide some

suggestions on how to improve and enhance data collection and analysis in regards to evaluating a geographic education resource such as the SGTM of Montana.

National Geographic created the State Giant Maps Lesson Handbook (2016a) based on the cognitive ability of third and fourth graders. As such, this thesis evaluated the effect of the SGTM of Montana on fourth grade students' attitudes and skills. Drawing on arguments made by Gershmel and Gershmel (2006; 2007a; 2007b; 2011), researchers should conduct spatial thinking research projects on younger populations of students to assist in efforts to increase geographic literacy. This research will stimulate the creation of new curricula to teach spatial thinking skills to younger children. For example, this kind of research can be referenced to create additional SGTM lessons for kindergarten through second grade students.

The State Giant Maps Lesson Handbook (2016a) functions as an adaptive curriculum and there is no specified sequence to complete the six map lessons. This condition made it possible to only include two of the six lessons in this research. To reiterate, requiring teachers to administer only two lessons ensured a reasonable time commitment, and completing six lessons would be cumbersome. Perhaps limiting instruction to two lessons inhibited students from retaining the newly learned skills, whereas treating the State Giant Maps Lesson Handbook as an adoptive curriculum and requiring teachers to administer all six lessons may support increased retention of skills. Likewise, it may be more effective to complete each lesson more than once to guarantee each student had ample time to process and perceive the new information.

Four teachers from separate schools participated in this project, and while all teachers specialized in elementary education, variation between teaching styles is unavoidable. As such, these distinctions can translate into a lack of consistency in lesson administration. If time allowed, data collection could be limited to one class taught by the same teacher over a time

frame of multiple years. New students would be assessed yearly, while teaching style would remain consistent over the course of data collection. This method requires a significant time commitment to assure a large enough data set to run statistical analyses on.

Another limitation to this study is the small sample size of teachers who participated in this study. Based on survey results, it is clear that these four teachers value geography education; however, this interest or enthusiasm is not likely for all teachers. Teachers themselves may be geographically illiterate, especially if they did not receive formal geographic education during their time as public school students. As such, states should expand professional development opportunities for teachers to enhance their pedagogical approach to geography education.

The student assessment can be restructured in a way that mimics the ability of lessons taught using the SGTM of Montana to actively engage students. For instance, instead of assessing student map skills using a traditional multiple choice format, assessments can occur directly on the map. In this format, assessment will cater to all learning modalities, thus producing more inclusive results. The following instruction outlines an example of how the SGTM of Montana could be used for performance assessment: have students pick one town in the northeast region of the state and another in the southwest region, then have students measure the distance between the two locations. This assessment evaluates students' ability to orient themselves and employs compass directions as well as their ability to make measurements using a scale bar in a similar manner to the NAEP student assessment questions 6, 7, and 8. However, an assessment completed entirely on the SGTM of Montana will ensure that kinesthetic learners have an equal opportunity to excel as visual learners do on multiple choice assessments.

The chi-squared statistical analysis completed in this research provided clear evidence that the SGTM of Montana had some effect on student attitudes and map skills; however, the

analysis did not capture the exact component of each question that resulted in the statistically significant change. For example, results to question two saw a statistically significant change between the pre- and post-assessments, but visual evaluation of that change reveals change in both the positive and negative answer choices. A more in-depth statistical analysis such as logistic regressions would allow for conclusions to be made on exactly which part of each question experienced statistical significant change.

Lastly, in responding to concerns expressed by teachers, future research must work to evaluate the effectiveness of Common Core standards. Specifically, research should focus on the ability of the Common Core standards to promote geographic literacy. Do Common Core standards effectively incorporate spatial thinking into instruction so that students develop the skills needed to think critically on issues in our globalized world? If not, are there ways to restructure Common Core to ensure that spatial thinking topics are not overlooked? With the current assumption that Common Core will remain in place for many years to come, additional research is essential to ensuring the curricula encompass the critical components of what it means to be geographically literate.

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Appendices

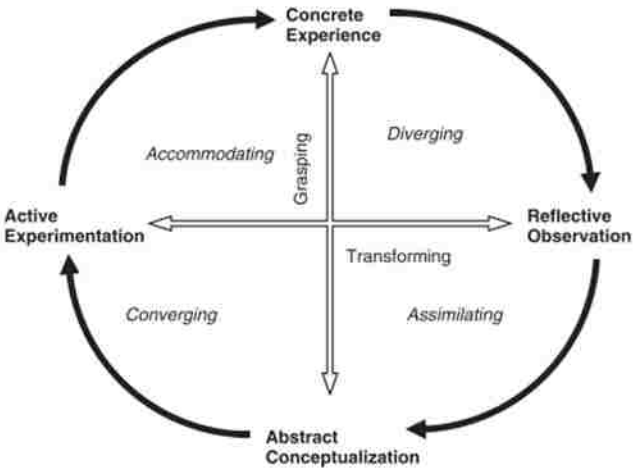
Appendix A: Descriptions of the eight modes of spatial thinking and the age at which children are capable of first understanding each of the eight modes. (Gershmel and Gershmel 2007b; 2011).

Mode	Description	Age of first understanding
Comparision	Ability to relate new places to ones that are more familiar (2007b p 184).	Kindergarten
Aura	"Zone of influence around an object," (2007b p 184).	End of primary school
Region	"Group of adjacent locations that have similar conditions or connections," (2007b p 185).	First grade
Hierarchy	"A set of smaller areas that are inside of a larger area," (2011 p55).	Early childhood
Transition	"Change from one place to another," (2007b p 186).	Early childhood
Analogy	"A statement about two places that have similar positions," (2011 p 56).	Early childhood
Pattern	"An arrancement of things that is not random… that can be seen and described," (2007b p 187).	Early childhood
Association	"A pair of features that tend to occur together in the same location," (2007b p 187).	Early childhood

Appendix B: Six propositions of Experiential Learning Theory (Kolb and Kolb 2005).

Proposition	Explanation
1. "Learning is best conceived as a process, not in terms of outcomes," (p 2).	The primary focus of instruction should be to engage students in a series of relatable real-world expereinces.
2. "All learning is relearning," (p 2).	Learning should be a process that pushes students to reflect on what they already know and to integrate new concepts with old concepts.
3. "Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world, " (p 2).	Learning occurs when students move back and forth between reflection, action, thinking, and feeling.
4. "Learning is a holistic process of adaptation to the world," (p 2).	Learning is more than just cognition and is affected by a person's thoughts, feelings, perceptions, and behaviors.
5. "Learning results from synergetic transactions between the person and the environment," (p 2).	Learning happens when assimilation of new experiences promotes new concepts and accomodation of existing concepts leads to new experiences.
6. "Learning is the process of creating knowledge," (p 2).	Constructivist learning theory states that knowledge is created by the learner instead of being transmitted by a teacher.

Appendix C: Kolb's Experiential Learning Theory (Kolb and Kolb 2011).



Appendix D: National Geographic Learning Framework (National Geographic 2016b).

A — attitudes

CURIOSITY. An explorer is curious about how the world works. An explorer is adventurous, seeking out new and challenging experiences.

RESPONSIBILITY. An explorer has concern for other people, cultures, and the planet. An explorer considers multiple perspectives and respects others regardless of differences.

EMPOWERMENT. An explorer acts on curiosity, respect, responsibility, and adventurousness and persists in the face of challenges.

S — skills

OBSERVATION. An explorer notices and documents the world and is able to make sense of those observations.

COMMUNICATION. An explorer is a storyteller, communicating experiences and ideas effectively through language and media. An explorer has literacy skills, interpreting and creating new understanding from spoken language, writing, and a wide variety of visual and audio media.

COLLABORATION. An explorer works effectively with others to achieve goals.

PROBLEM SOLVING. An explorer is able to generate, evaluate, and implement solutions to problems. An explorer is a capable decision-maker—able to identify alternatives and weigh trade-offs to make a well-reasoned decision.

K — knowledge

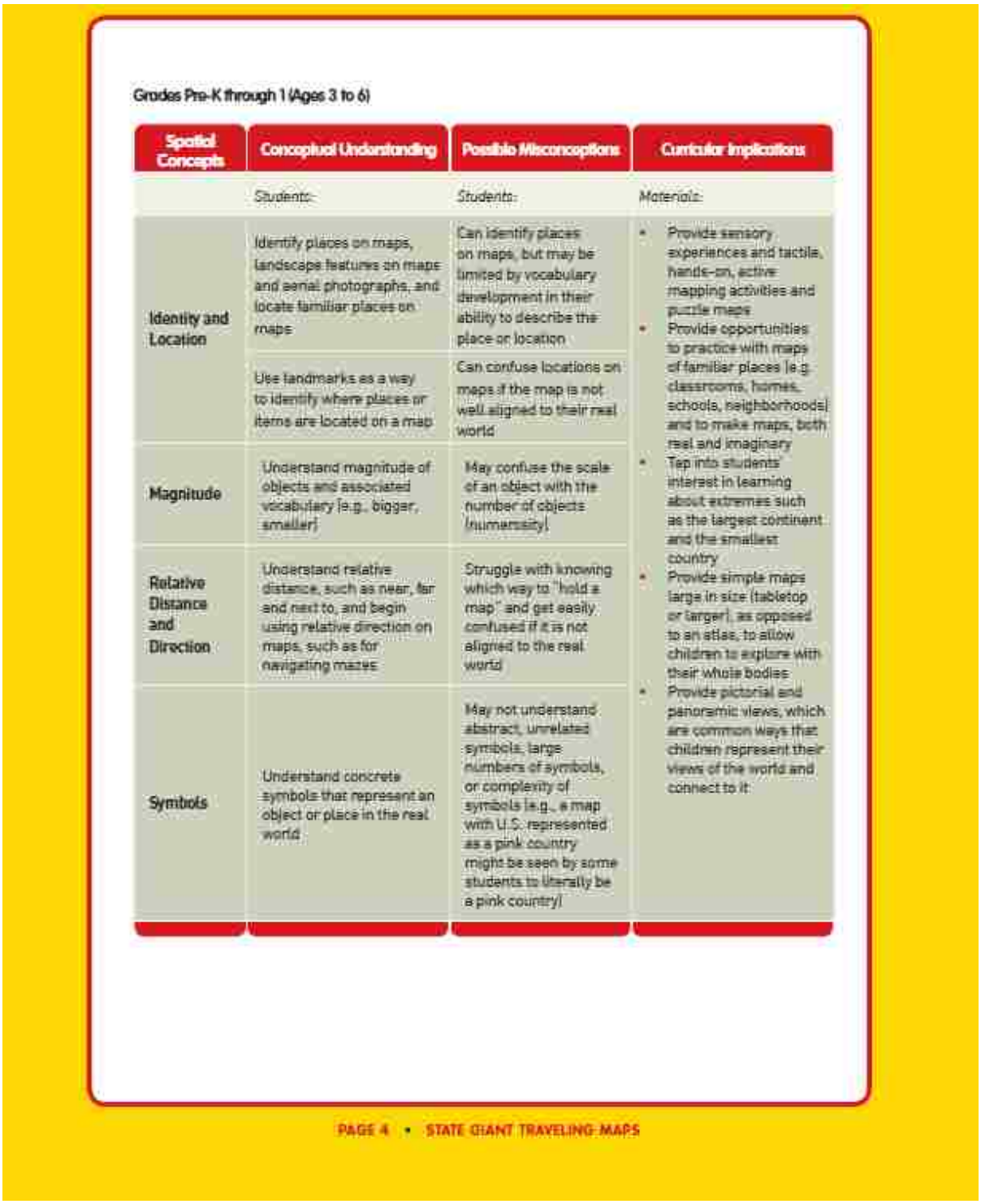
In addition to the skills and attitudes of an explorer, people need a certain knowledge set to understand how the world works. National Geographic expresses this critical knowledge through our key focus areas:

OUR HUMAN STORY. Exploring where we came from, how we live today, and where we may find ourselves tomorrow.

OUR LIVING PLANET. Understanding the amazing, intricate, and interconnected systems of the changing planet we live on.

CRITICAL SPECIES. Revealing, celebrating, and helping to protect the amazing and diverse creatures we share our world with.

Appendix E: Selection from the National Geographic State Giant Traveling Maps Lesson Handbook (National Geographic 2016a) including the Spatial Thinking Abilities Tables in *Spatial Thinking About Maps* (Mohan and Mohan 2013) and the two lessons completed in this project. The full version of the lesson handbook is available online.



Grades Pre-K through 1 (Ages 3 to 6)

Spatial Concepts	Conceptual Understanding	Possible Misconceptions	Curricular Implications
	Students:	Students:	Materials:
Identity and Location	Identify places on maps, landscape features on maps and aerial photographs, and locate familiar places on maps	Can identify places on maps, but may be limited by vocabulary development in their ability to describe the place or location	• Provide sensory experiences and tactile, hands-on, active mapping activities and puzzle maps • Provide opportunities to practice with maps of familiar places (e.g. classrooms, homes, schools, neighborhoods) and to make maps, both real and imaginary • Tap into students' interest in learning about extremes such as the largest continent and the smallest country • Provide simple maps large in size (tabletop or larger), as opposed to an atlas, to allow children to explore with their whole bodies • Provide pictorial and panoramic views, which are common ways that children represent their views of the world and connect to it
	Use landmarks as a way to identify where places or items are located on a map	Can confuse locations on maps if the map is not well aligned to their real world	
Magnitude	Understand magnitude of objects and associated vocabulary (e.g., bigger, smaller)	May confuse the scale of an object with the number of objects (numerosity)	
Relative Distance and Direction	Understand relative distance, such as near, far and next to, and begin using relative direction on maps, such as for navigating mazes	Struggle with knowing which way to "hold a map" and get easily confused if it is not aligned to the real world	
Symbols	Understand concrete symbols that represent an object or place in the real world	May not understand abstract, unrelated symbols, large numbers of symbols, or complexity of symbols (e.g., a map with U.S. represented as a pink country might be seen by some students to literally be a pink country)	

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Grades 2 through 4 (Ages 7 to 9)

Spatial Concepts	Conceptual Understanding	Possible Misconceptions	Curricular Implications
	Students:	*Students:*	*Materials:*
Identity and Location	Accurately locate places and landscape features on a map, but perform better with familiar locales rather than foreign locales Demonstrate improvement with map alignment issues	Inconsistently use landmarks to verify locations	• Expose students to a broader world beyond the familiar. Begin including birds'-eye views of maps, but a combination of pictorial and panoramic views • Encourage students to explore the world but at the continent and country level • Include maps that use grid systems with limited amounts of information • Provide active and hands-on activities that allow children to manipulate maps when possible • Introduce more complex spatial concepts but provide explicit support in doing so as many concepts are not yet learned • Encourage students to produce their own maps and use maps and models that allow active exploration (e.g., 3-D topo maps, landscape models, "layers" found on a map)
Distance and Direction	Transition from topological concepts of distance to metric measurements and scale Readily use metric distances and scale by the end of Grade 4 Use landmarks and relative direction, but are ready to learn cardinal directions	Still need guidance to transition to metric measurements	
Symbols	Transition from iconic real-world symbols to abstract symbols	Still may make errors and need explicit guidance on what symbols mean Inconsistently use landmarks to verify locations	
Reference Frames	Can begin to understand grid systems (the coordinate system) and absolute location	Still need guidance with map features; they may become distracted by features that are not useful and may neglect useful features on maps	
Hierarchies	Do not yet have a well established concept of hierarchy (or nesting)	Should be introduced to the concept of hierarchy with close guidance	

Grades 5 through 6 and Beyond (Ages 10 and Older)

Spatial Concepts	Conceptual Understanding	Possible Misconceptions	Curricular Implications
	Students:	*Students:*	*Materials:*
Identity, Location, Distance and Directions	Need to be primed to use all the resources available to determine locations. They should be encouraged to explain decisions in order to prompt their thinking about landmarks, distances, and directions	May not readily use map scales, metric distances, and cardinal directions to help determine locations, but are able to do so with some guidance	• Explore and compare different projections and viewing angles • Use measured distances, cardinal directions and abstract symbols with support including the introduction of longitude and latitude • Use multiple map formats (e.g., reference maps, thematic maps, digital maps) at multiple scales • Introduce more complex spatial concepts, such as projection and overlay • Allow students to begin to confidently navigate the world
Symbols	Use abstract symbols and understand symbols do not always "look like" the referent		
Overlay and Complex Spatial Concepts	May incidentally understand the concept of overlay without formal instruction (about half of all Grade 6 students do so)	May not understand "layers" without direct instruction, support, and guidance	
	Can move on to complex spatial concepts such as distribution, patterns, overlays, and projection with support if mastery of the basic spatial concepts of location, distance, direction, boundaries, and regions is achieved		

LESSON 4

CARDINAL DIRECTIONS

Guiding Questions:

How do you orient yourself on a map?

EDUCATOR BACKGROUND INFORMATION

To know where places are in relation to one another, people use a system for telling direction. Cardinal directions are one set of directions that people around the world use. The four cardinal directions are north, south, east and west. These directions use the rising and setting of the sun as reference points. Because the Earth rotates from west to east, the sun appears to rise in the east and set in the west. The Poles, North and South, also provide directional reference points.

RECOMMENDED GRADES: 3, 4

TIME NEEDED: 45 MINUTES

Objectives

- Students will understand cardinal directions: north, south, east, and west; be able to orient themselves to each one on the map
- Students will use cardinal directions to locate places within their state

Materials

- Cones
- Copy of Compass Rose (provided)
- Cardinal Direction Clues (see instructions in Preparation below)
- Lanyards (4 colors to correspond to the 4 colors of the corner Base Camps)

Preparation

- Place the Compass Rose copy in the appropriate place/direction on your State Giant Traveling Map (do not tape the sheet to the map). You may wish to use the image on your state's tabletop map, located at http://education.nationalgeographic.org/topics/state-mapmaker-kits/ to determine how best to place the Compass Rose.
- Create 32 Cardinal Directions Clues for the game. Use index cards or other similar paper for these clue cards. In advance of the activity, select 32 locations on the giant map and put the name of one on each of the 32 clue cards.
- Divide the Cardinal Directions Clues into four stacks—one clue per player—and place the stacks face down next to the each of the Base Camps (colored circles in the corners of the map).

Rules

Shoes are not allowed on the map. Please have students remove shoes

No writing utensils

DIRECTIONS

Students learn the cardinal directions and play a fun relay game! "Navigators" give directional clues to "Explorers" to help them find locations on your state map. The winning team is the first to correctly mark each of its locations with a cone.

ACTIVITY

1. Introduce or review cardinal directions with students. Tell students that these are the four principal directions—north, south, east, and west—on the compass rose you have placed on the map.
2. Have the entire class spread out on the map. Lead them in taking two steps north, then two steps south, east, or west as you command and lead.
3. Divide the class into four teams—red, yellow, green, and blue—and instruct each team to line up along the yellow border behind their "Base Camp" (the colored circles in the corners of the map). Give each team their colored lanyards—all members of a team should have lanyards of the same color. As the game is a relay race, each team should have the same number of players. If a team is short a player, one player on that team will play twice. The first student in line is the first Navigator. The second student in line is the first Explorer. (Roles will rotate during game play.)
4. When the game begins, each Base Camp's Navigator must draw one Cardinal Directions Clue from the stack you have placed on the Base Camp. Give the Navigator time to find the location on the map—silently and without going onto the map (or the Navigator will give away the location!). The Navigator may not show the card to the Explorer. Using only cardinal directions and the team color, the Navigator must guide the Explorer to the location indicated on the card. The Explorer may only take one step per instruction. For example, Yellow Team draws "Denver." The Navigator calls out, "Yellow, north." The Explorer takes one step north. The Navigator calls "Yellow, east," and the Explorer takes one step east.
5. The Navigator continues to direct the Explorer one step at a time until he or she steps on the Denver location. The Navigator then confirms that he has successfully directed the Explorer by calling out, "Have you reached Denver?" The Explorer responds, "Yes, I have reached Denver!" The Explorer places his or her cone on the location and returns to Base Camp.
6. When the Explorer returns to Base Camp, he or she tags the Navigator and rejoins his or her teammates at the end of the line on the yellow border. When tagged, the Navigator steps onto the team's circle and becomes the Explorer. The next team member in line on the yellow border steps forward to become the Navigator.
7. Explorers may not touch each other while on the map. Explorers who touch each other must return to their Base Camp and begin again. The teacher referees the activity on the map.
8. Each player has an opportunity to be a Navigator and an Explorer. The winning team is the first to correctly mark each of its locations with a cone and return to Base Camp.

TIPS

This game may be a little more difficult for the Yellow and Blue Teams, as their Base Camps are at the north end of the map. It may help to advise Explorers on these teams to face north before they begin taking steps, so that their orientation—north is forward, south is backward—is the same as that of the Green and Red Teams.

CARDINAL DIRECTIONS

STANDARDS

National Geography Standard

Geography Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information (4th grade).

NCTM Principles and Standards for School Mathematics

Algebra (3-5) Standard 2: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

National Social Studies Standard

People, Places, and Environments (Early grades): Learners will understand concepts such as: location, direction, distance, and scale.

VOCABULARY

Cardinal directions: One of the four main points of a compass: north, east, south, west

Compass rose: Symbol indicating the cardinal directions (N, S, E, W)

LESSON 5

MAP SCALE AND MEASURING DISTANCE

Guiding Questions:

How do we know the size of or distance between locations?
How do we determine how far apart locations are from one another?

EDUCATOR BACKGROUND INFORMATION

Scale
Geographers study things at local scales (for example, microclimates of cities) and at global scales (for example, changes in world climate). As one well-known geographer has said, "Awareness of scale is of great importance, for in geographic work, concepts, relationships, and understandings that are found to have meaning at one scale may not be applicable when the same problem is examined at another scale." (Jerome Fellmann)

RECOMMENDED GRADES: 3, 4

TIME NEEDED: 45 MINUTES

Objectives

- Students will use two maps with different scales to compare equal distances
- Students will use a scale bar to measure features found in their state

Materials

- State one-page maps (one per student or small group; see Preparation below)
- Map Measurement Table (one per student)
- String (provided) – or use another way (feet, hands, objects) to measure distance on the map

Preparation

- Print copies of the one-page map of your state for each student. Access the one-page maps at http://education.nationalgeographic.org/mapping/outline-map/?map=USA and select your state from the STATE dropdown menu. To print, click Download This Map in the lower right corner of the map box, download, and print.
- Print copies of the Map Measurement Table (last page in this lesson).
- Select and write down several locations (towns, cities, features) that are included on both the one-page map and the Giant State Traveling Map. You will use this in the activity below. You may want to write the names of these locations on flip chart or poster paper so that everyone will be able to see them when you do the activity.

Rules  Shoes are not allowed on the map. Please have students remove shoes  No writing utensils

DIRECTIONS

ACTIVITY - Part 1: Maps of different sizes

1. Give each student a copy of the state one-page map. Ask students if they have seen other maps of your state. (Students might say they have seen the state map in an atlas or as a foldable road map.)
2. Point out the scale bars on the one-page map. Explain: *Scales help you determine actual land distances for places that have been reduced to fit on a smaller area.* Demonstrate how the scale bars work. Tell students that they are going to use scale to help them determine actual distances of features in their state. Explain that the scale bar includes both miles and kilometers and that 1 mile is 1.6 times larger than 1 kilometer.
3. Ask students to find one of the locations you preselected on their one-page maps. Then have them find another of your preselected locations on their maps. Ask students to use a measurement tool (ex.- pieces of paper, rulers, fingers) and the map scale to determine the distance between these two points. Depending on your students' familiarity with map scale, you may need to demonstrate how to do this for the first set of locations. After you and the students have found the distance, repeat for several other sets of locations.
4. Now, introduce students to the State Giant Traveling Map. Point out that this map is both the same as and different from the one-page maps in several ways. Have students spend some time walking around the giant map, comparing it to the one-page map. Then ask:
   - *In what ways are the maps the same? (Students might say that the state has the same shape and many of the same features, including some of the same towns and cities.)*
   - *In what ways are the maps different?* (Students might say that one map has more towns and cities than the other. They might also realize that one map has certain features, such as a state park, that the other doesn't have. Ask for as many examples as you have time for.) Tell students that different maps show things differently for many reasons, including the size of the map or the purpose of the map.
5. Point out the map scale bars on the giant map. Ask students how this scale is different from the scale bars on the one-page map. Tell students that, although the scales are different, they will measure distances the same—they will find this out soon!
6. Tell students they will be working together to prove that the distances between points on the giant map are the same as the distances between those points on the small map. Remind them that they used tools to measure distances on the small map and ask them what sorts of tools they think they will need to use on the giant map. Let them know that they won't be able to use regular measuring tools like yardsticks or tape measures in this activity, and that they can't have utensils of any kind (such as pencils) on the giant map. Provide long pieces of string as one possible tool for this activity, but encourage students to use non-traditional measurement methods such as feet or hands.
7. Have students form small groups and have the groups take turns finding the pairs of the locations they worked with in step 3 above—this time on the giant map. Have them use the map scale on the giant map to measure the distances. When the groups have finished their measurements, ask: *How do these distances on this map compare with the distances you measured on the one-page map? Are they the same? Are they different?*

ACTIVITY – Part 2: Extending the Learning

1. Have students work in pairs or small groups to measure and record on the Map Measurement Table various distances on the map. (Use these or modify to add your own.)
   - Distance from their current location to the state capital
   - Distance of any river
   - Length of border to the east
   - Length of border to the south
   - Length of border to the west
   - Length of border to the north
2. (Remind students that because they are not allowed to use writing utensils on the map, they must complete their tables off the map.)
3. Have one group of students take a journey through your state. Tell them to write down the cities they would pass. Explain that they will need to lay down their piece of string to outline this journey. Once their string is in place, have the students determine the distance they would travel. As an extension, tell students to calculate the time it would take to complete their journey if they were traveling at 60 miles per hour for the entire trip. Another option would be to have students follow the course of a river that flows through your state, measuring the distance using string to outline the course.

TIPS

- Show students how to measure distances that are not straight lines by curling the string along the feature.
- Point out the scale bar in each corner of the giant map. Break the class into small groups and have them examine a scale in each corner.
- Have students work individually or in small groups, depending on time available and the size of the class.

MODIFICATIONS

- For small group work or another example of scale, use the State Tabletop Map for your state. Find yours at http://education.nationalgeographic.org/topics/state-mapmaker-kits/.
- Have students also record in centimeters or inches the distances they measured.
- Have students decide on other distances to measure.
- Have students create a circle around your city or town by giving them a particular distance as their radius and having them use the scale bar to measure this in all directions.

STANDARDS

National Geography Standard

Geography Standard 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information (4th grade).

Common Core State Standards: Math

Grade 4 = Measurement & Data
CCSS.MATH.CONTENT.4.MD.A.1: Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

MAP SCALE AND MEASURING DISTANCE

NCTM Principles and Standards for School Mathematics

Algebra (3-5) Standard 3: Use mathematical models to represent and understand quantitative relationships.
Geometry (3-5) Standard 2: Specify locations and describe spatial relationships using coordinate geometry and other representational systems.

Next Generation Science Standards

Crosscutting Concept 3: Scale, proportion, and quantity.

National Social Studies Standard

People, Places, and Environments (Early grades): Learners will understand concepts such as: location, direction, distance, and scale.

The College, Career & Civic Life (C3) Framework for Social Studies State Standards

Geographic Representations: Spatial Views of the World: D2.Geo.3.3-5
Use maps of different scales to describe the locations of cultural and environmental characteristics.

VOCABULARY

Map scale: relationship between distance on a map and distance on the ground.

Measurement: process of determining length, width, mass (weight), volume, distance or some other quality or size.

MAP MEASUREMENT TABLE

Feature	Distance (miles)	Distance (kilometers)
Distance from your current location to the state capital		
Distance of any river		
Length of north state border		
Length of south state border		
Length of east state border		
Length of west state border		

Appendix F: Student Pre- and Post-Treatment Assessment.

Name:

State Giant Traveling Map of Montana Assessment

*This questionnaire is **NOT A TEST**. You will not lose points for wrong answers. Please try your best to answer all questions, but do not worry if you do not know the answer to some. *

1. In this school year, have you studied geography?
   a. Yes
   b. No
   c. I don't know.

2. How much do you like studying geography?
   a. It is one of my favorite subjects.
   b. I like most other subjects better.
   c. I have never studied geography.

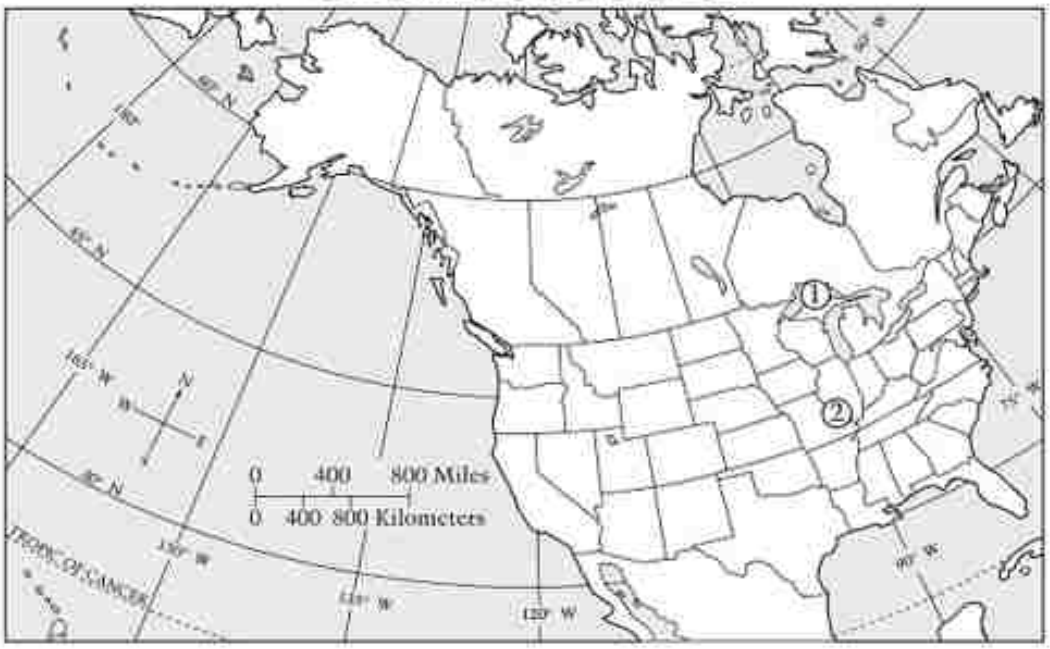
3. Do you like learning about maps?
   a. Yes
   b. No
   c. I don't know.

4. Is knowing how to read a map a useful skill?
   a. Yes
   b. No
   c. I don't know.

Student Code: _____ (Teacher Use Only)

5. Question refers to the map below.

UNITED STATES AND CANADA



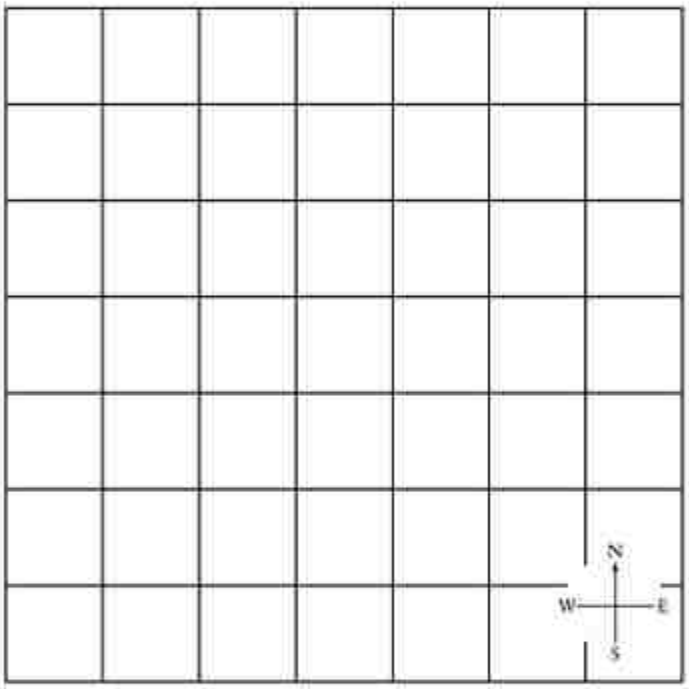
Write down the name of the state or district where you live.

I live in _____.

Directly on the map, draw an "x" on the state or district where you live.

Student Code: _____ (Teacher Use Only)

6. On the grid below, each square is one mile wide and one mile long. Draw a map of Little Town on the grid. Draw the town's borders. Then, use the symbols in the key below to draw the features listed above.
    - Width: 4.0 miles east to west.
    - Length: 3.0 miles north to south.
    - Main Street runs east to west through the town.
    - The school is on the northeast side of town.
    - Phelps Park is on the southwest side of town.
    - Runt River runs north to south through the town.



Scale

_____ = 1 mile

Key

(S) School

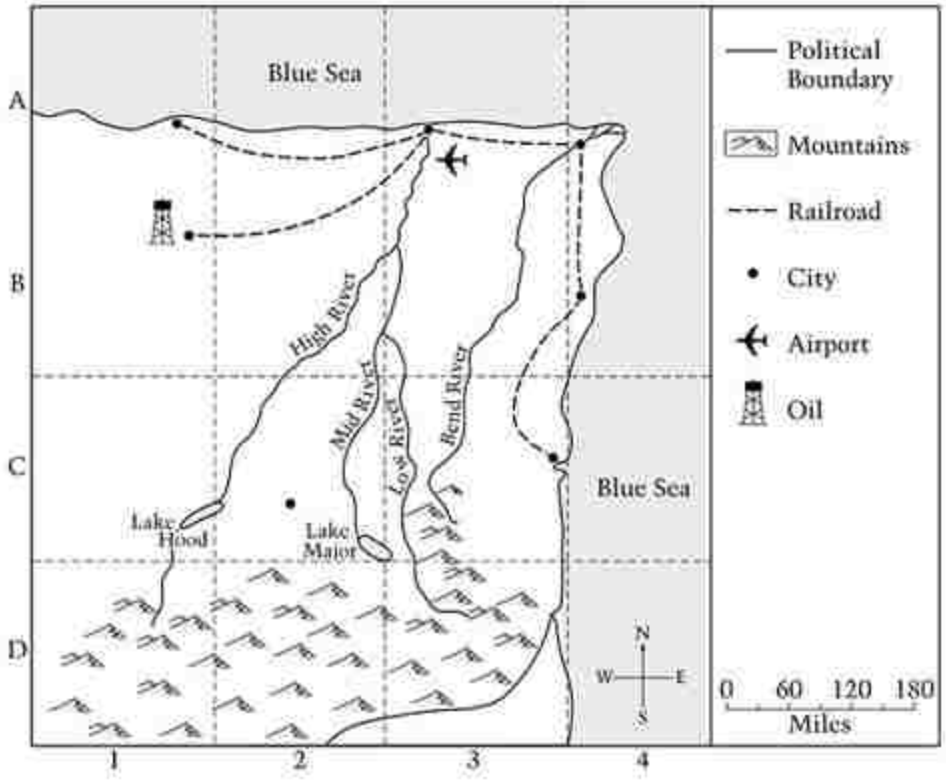
Street

(P) Park

River

Student Code: _____ (Teacher Use Only)

7. Question is based on the map below.



About how far is Lake Hood from Lake Major?

a. 5 miles
b. 60 miles
c. 80 miles
d. 140 miles

Student Code: _____ (Teacher Use Only)

8. Question is based on the highway map below:

Table by NYSTROM Division of Herff Jon

To drive from Los Angeles to Salt Lake City in the most direct way, one would travel

a. Southeast
b. Southwest
c. Northeast
d. Northwest

Student Code: _____ (Teacher Use Only)

Appendix G: NAEP Scoring Guides used to score questions 5-8 on the pre- and post-treatment assessments.

Multiple Choice (MC) Scoring Guide				
Assessment Question Number	**Question ID**	**Content Area**	**Difficulty**	**Answer**
7	2010-4G5 #6 G009401	Space and Place	Hard	d. 140 miles
8	1994-4G6 #13 G010802	Spatial Dynamics and Connections	Easy	c. northeast

Constructed Response Scoring Guide				
Assessment Question Number	Question ID	Content Area	Difficulty	Answer
5	2001-4G8 #1 G012201	Space and Place	Easy	**Complete:** the X correctly locates the state or district written on the line.
				Partial: The X does not point to precisely the correct point but is in the correct region, meaning a bordering state in most areas of the country. Could credit a nonbordering state in areas of New England where the states are more difficult to locate. OR: Response indicates a city and correctly marks the map. Scorers should consult an atlas if needed to determine if the X is appropriately placed.
				Inappropriate: The X is not located in the state or district identified, the state is written with NO X PROVIDED or the x is marked and NO STATE PROVIDED.
6	2001-4G8 #15 G013001	Space and Place	Hard	**Complete:** The response correctly locates all four features and draws the length and width to scale in the correct directions.
				Essential: The response correctly locates four features but not to scale, or correctly locates three features and has the scale correct.
				Partial: The response locates only one or two features and has the scale correct, or locates three features with an incorrect scale.
				Inappropriate: The response correctly locates none of the features, and makes major errors in scale and direction, or has scale correct only, or locates one or two features with incorrect scale.

Appendix H: Raw Data from Student Pre- and Post-Treatment Assessment.

Question	1		2		3		4		5		6		7		8		Score	
Student	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
SA-01-M	A	A	B	A	A	A	A	A	C	C	I	I	D	A	C	D	4	3
SA-02-M	C	A	B	B	C	C	A	A	C	C	C	I	D	C	C	B	7	2
SA-03-F	C	C	B	B	C	A	A	A	C	C	I	I	A	B	C	A	3	3
SA-04-M	C	A	B	B	A	A	A	A	C	C	I	I	B	D	C	C	2	3
SA-05-M	A	A	A	A	A	A	A	A	P	I	P	I	D	D	A	C	4	1
SA-06-M	C	C	C	C	A	A	B	C	I	P	O	O	C	A	D	C	1	2
SA-07-M	A	A	A	B	A	A	A	B	O	C	O	O	O	A	C	C	0	2
SA-08-F	A	B	B	C	A	C	A	A	I	I	I	P	C	B	C	C	0	1
SA-09-M	C	B	C	B	C	C	C	C	C	C	C	C	D	D	C	C	7	7
SA-10-F	C	C	C	B	C	B	A	C	I	I	I	I	A	D	C	B	0	1
SA-11-M	A	A	B	A	A	A	A	A	O	C	O	I	O	A	C	B	0	2
SA-12-M	A	A	A	A	A	A	A	A	C	C	I	I	B	D	C	B	2	4
SA-13-F	A	A	A	B	A	A	A	A	I	I	I	I	B	A	B	C	1	0
SA-14-F	C	C	C	A	A	A	A	A	I	I	O	O	B	B	D	B	0	0
SA-15-M	B	B	C	C	A	A	A	C	C	C	I	O	D	O	C	C	4	2
SA-16-M	A	A	B	B	A	A	A	A	C	I	I	I	D	B	A	D	4	0
SB-01-M	B	A	C	B	C	B	A	B	C	C	I	I	O	O	C	O	3	2
SB-02-F	A	A	A	B	A	B	A	B	C	C	I	I	C	D	D	D	3	4
SB-03-M	B	A	C	B	C	B	C	B	C	C	O	C	D	D	A	C	3	7
SB-04-F	A	A	A	A	A	A	A	A	C	C	C	C	D	D	D	C	7	7
SB-05-M	C	A	B	B	B	B	A	A	C	C	O	I	D	D	C	C	4	4
SB-06-M	A	A	B	B	B	B	B	B	I	C	O	O	D	D	O	C	1	4
SB-07-M	B	B	B	B	B	B	A	C	I	I	O	O	B	A	C	B	1	0
SB-08-M	A	A	B	B	B	B	B	A	C	C	P	E	B	O	C	O	4	4
SB-09-F	A	A	B	B	B	B	A	A	C	C	I	I	D	D	B	C	3	4
SB-10-F	A	A	B	A	B	A	A	A	C	C	P	E	B	B	C	C	4	5

SB-11-M	C	A	C	B	C	B	A	A	C	C	E	C	D	D	C	C	6	7
SB-12-M	C	A	B	B	B	B	A	C	C	C	I	I	D	C	C	C	4	3
SB-13-F	C	A	C	A	B	A	A	A	I	I	E	E	A	D	D	C	2	4
SB-14-F	C	A	B	B	B	B	A	A	I	C	E	P	D	D	B	C	3	5
SB-15-F	B	A	B	A	B	A	A	A	C	C	I	E	B	D	C	D	3	5
SB-16-M	B	A	C	A	C	A	A	A	I	O	I	I	O	O	D	B	0	0
SB-17-M	C	A	B	B	B	B	A	A	C	C	E	I	B	C	D	D	4	2
SB-18-F	A	A	B	B	B	B	B	B	I	I	I	I	D	D	C	B	2	1
SB-19-M	A	A	B	A	B	A	B	A	I	I	I	P	B	O	B	B	0	1
SB-20-F	A	A	A	A	A	A	A	A	C	C	C	E	D	D	C	B	7	5
SB-21-F	C	A	B	B	B	B	A	A	C	C	I	I	D	D	B	C	3	4
SB-22-M	C	A	B	B	B	B	A	A	C	C	I	I	C	D	C	A	3	3
SB-23-M	A	A	A	A	A	A	A	C	C	C	C	C	D	C	C	C	7	6
SB-24-M	A	A	A	A	A	A	B	C	C	I	O	O	A	A	C	C	3	1
SB-25-F	C	A	B	B	B	B	A	A	C	C	E	E	D	D	C	D	6	6
SB-26-F	B	B	A	A	A	A	A	A	C	C	I	I	B	B	C	C	2	3
SB-27-M	A	A	O	B	B	A	A	A	O	C	O	O	D	D	O	C	1	4
SB-28-F	A	A	A	B	A	A	A	A	I	I	O	P	D	A	C	B	1	1
SB-29-F	B	A	B	A	A	A	A	A	C	C	E	E	C	D	C	C	5	6
SB-30-M	C	C	B	C	A	A	A	A	C	C	E	E	D	D	A	A	6	7
SB-31-F	B	B	C	C	A	A	A	A	P	C	E	P	C	C	C	C	3	3
SB-32-M	C	A	B	B	B	A	A	A	I	C	O	I	C	B	C	C	0	2
SB-33-F	A	A	B	B	A	A	A	A	C	C	C	E	C	D	C	C	6	5
SB-34-M	B	C	C	C	A	A	A	A	I	C	I	I	C	B	C	B	1	3
SB-35-M	C	C	A	B	A	A	C	A	I	C	I	I	D	D	C	C	2	4
SB-36-F	B	C	C	C	A	A	A	A	I	C	P	I	D	D	A	B	3	4
SB-37-F	A	A	B	A	A	A	A	A	C	C	E	C	D	D	C	B	5	7
SB-38-M	B	C	B	B	A	A	A	A	I	I	I	I	A	B	C	C	0	0
SB-39-M	A	C	B	B	B	C	C	B	I	I	O	O	A	B	O	A	0	0
SB-40-M	B	B	C	C	A	A	A	A	C	C	I	O	A	A	D	D	3	3

SB-41-F	B	A	A	B	A	A	A	A	P	I	O	I	D	B	C	C	2	1
SB-42-M	A	C	B	B	A	A	A	A	C	C	I	P	C	D	B	B	2	4
SB-43-F	B	A	C	B	C	A	A	A	C	C	I	O	A	D	O	A	2	3
SB-44-F	A	A	B	B	A	A	A	A	C	C	I	I	O	B	A	C	2	2
SB-45-M	A	C	A	B	A	A	A	A	C	C	I	I	D	C	C	D	4	3
SB-46-F	A	A	A	C	A	B	A	A	C	I	I	I	B	C	O	A	2	0
SB-47-M	C	C	B	B	B	B	B	A	C	C	P	P	O	A	C	O	4	4
SB-48-M	B	A	C	B	A	C	A	A	C	C	E	C	C	D	C	B	5	7
SC-01-M	A	A	B	A	C	A	A	A	C	C	P	E	D	D	D	C	4	6
SC-02-M	A	A	B	B	A	A	A	A	C	C	I	I	B	D	B	C	2	4
SC-03-M	A	A	A	A	A	A	A	A	C	C	C	C	D	D	B	D	7	7
SC-04-F	A	A	B	A	A	A	A	A	C	C	C	C	D	D	C	D	7	7
SC-05-F	A	A	A	A	A	A	A	A	C	C	C	C	D	D	C	C	7	7
SC-06-M	A	A	A	A	A	A	A	A	C	C	E	I	D	D	B	D	6	3
SC-07-F	A	A	B	B	B	A	C	A	C	P	P	I	A	D	B	B	4	2
SC-08-F	A	A	B	B	A	A	A	A	C	C	I	O	D	D	C	B	3	3
SC-09-F	A	A	B	B	B	A	A	A	C	C	I	P	D	C	C	C	3	3
SC-10-F	A	A	A	A	A	A	A	A	C	C	I	I	B	B	C	C	2	2
SC-11-M	A	A	A	A	A	A	A	A	C	C	I	I	D	D	C	C	4	4
SC-12-M	A	A	B	B	A	A	A	A	C	C	I	I	A	D	B	C	2	3
SC-13-M	A	A	A	B	A	A	A	A	C	C	P	I	C	C	B	B	3	2
SC-14-M	A	C	B	C	B	B	A	A	I	I	I	I	C	B	A	B	1	0
SC-15-F	A	A	A	A	A	A	A	A	C	C	C	C	D	D	C	C	7	6
SC-16-M	A	A	B	B	B	A	A	A	C	C	P	E	D	D	D	C	5	5
SC-17-M	A	A	B	A	A	A	A	A	C	C	E	P	D	D	A	D	5	4
SC-18-M	A	A	A	A	A	A	A	A	C	C	C	C	D	D	A	D	7	7
SC-19-F	A	A	A	A	A	A	A	A	C	C	I	I	B	D	D	D	2	3
SC-20-F	C	A	B	A	A	A	A	A	I	I	I	I	A	A	B	B	0	1
SC-21-M	A	A	A	B	A	A	A	A	C	C	P	I	D	D	C	A	4	4
SC-22-F	C	A	B	A	A	A	A	A	C	C	E	E	D	C	C	B	5	4

SC-23-F	A	A	A	A	A	A	A	A	I	I	I	I	C	B	C	A	1	1
SC-24-F	A	A	B	B	A	A	A	A	C	I	P	P	O	A	B	D	3	2
SC-25-M	A	A	A	A	A	A	C	A	C	I	E	I	B	B	C	C	5	0
SC-26-M	A	A	B	B	A	A	A	A	C	C	C	C	D	C	B	A	7	6
SC-27-M	A	A	A	A	C	A	A	A	C	C	I	I	D	A	D	C	3	2
SC-28-M	A	A	B	A	A	A	A	A	C	C	I	I	B	C	D	C	3	3
SC-29-F	A	A	A	A	A	A	A	A	I	C	I	E	C	D	D	B	1	6
SD-01-M	A	A	B	A	A	A	A	A	C	C	I	I	C	B	C	C	2	2
SD-02-M	C	C	C	C	C	C	A	A	C	C	P	C	D	D	C	B	4	7
SD-03-M	A	A	A	B	A	B	A	A	C	C	E	C	D	D	C	C	6	7
SD-04-F	A	A	B	B	A	A	A	A	C	C	O	O	B	B	B	C	3	3
SD-05-M	C	C	C	C	A	A	A	A	C	C	P	C	C	D	D	D	3	6
SD-06-F	A	A	A	A	A	A	A	A	C	C	I	I	C	C	D	C	2	2
SD-07-M	A	A	B	B	A	A	A	A	C	C	C	C	D	D	C	C	7	6
SD-08-F	B	B	C	C	B	A	A	A	C	C	E	E	D	D	C	C	5	6
SD-09-F	B	A	C	B	A	A	A	A	C	C	E	C	D	D	D	B	6	7
SD-10-F	C	A	B	B	B	B	A	A	C	C	P	E	C	C	A	A	4	5
SD-11-F	A	A	B	B	A	A	A	A	C	C	I	I	B	C	C	A	2	3
SD-12-M	B	C	C	C	A	A	A	A	C	C	I	C	D	D	B	C	4	7
SD-13-F	A	A	A	A	A	A	A	A	C	C	C	C	D	D	C	C	6	7
SD-14-M	A	B	B	C	A	A	A	A	C	C	E	E	D	D	C	C	6	5
SD-15-F	C	A	C	B	A	A	A	A	C	C	P	E	D	C	B	C	4	4
SD-16-F	A	A	B	B	A	A	A	A	C	C	C	C	D	C	C	C	6	7
SD-17-F	C	C	B	B	A	A	A	A	C	C	O	O	B	B	D	C	2	3
SD-18-F	C	C	C	B	A	A	A	A	C	C	P	P	A	B	C	A	4	3
SD-19-F	B	A	C	B	B	C	C	A	C	C	E	C	D	D	B	B	6	6
SD-20-M	A	A	A	A	A	A	A	A	C	C	E	E	D	D	B	C	6	5
SD-21-M	C	A	B	B	A	A	A	A	C	C	P	I	C	C	A	C	4	3

Appendix I: Raw Data from SPSS Chi-Squared Analysis.

	Attitude Questions (1-4) Percent (%) Change per Question			
Change in Answer	**1**	**2**	**3**	**4**
A to A	51	18	60	79
B to A	8	12	9	3
C to A	15	3	4	4
A to B	2	9	3	3
B to B	5	34	13	2
C to B	1	10	4	2
A to C	4	1	2	4
B to C	4	4	2	2
C to C	10	9	3	1

	Skills Questions (5-6) Percent (%) Change per Question	
Change in Answer	**5**	**6**
C to C	70	11
E to C	-	5
P to C	1	2
I to C	6	1
O to C	3	1
C to E	-	2
E to E	-	7
P to E	-	5
I to E	-	2
O to E	-	0
C to P	1	0
E to P	-	3
P to P	0	3
I to P	1	4
O to P	0	1
C to I	4	1
E to I	-	3

Change in Answer	5	6
P to I	1	5
I to I	12	31
O to I	0	4
C to O	0	0
E to O	-	0
P to O	0	0
I to O	1	0
O to O	0	9
	Skills Questions (7-8) Percent (%) Change per Question	
Change	**7**	**8**
A to A	3	2
B to A	2	1
C to A	1	5
D to A	3	0
O to A	4	3
A to B	4	2
B to B	6	5
C to B	5	12
D to B	2	4
O to B	1	0
A to C	0	4
B to C	4	9
C to C	4	28
D to C	8	8
O to C	0	1
A to D	4	3
B to D	4	3
C to D	7	4
D to D	35	4
O to D	0	0
A to O	0	0
B to O	2	0
C to O	0	3
D to O	1	0

Appendix J: Teacher Survey.

State Giant Traveling Map of Montana
Teacher Satisfaction Survey

Directions: There are two types of questions in this survey – yes or no questions, and open ended questions. For the yes or no questions, please circle your answer. For the open ended questions, please answer in your own words.

1. How many students are in your class?

1a. How many males?

1b. How many females?

1c. What is the age range?

2. Do you work with any assistant teachers? **Y** or **N**

2a. Did they help give directions and answer questions during the study?

2b. Do you think that having an assistant teacher have been beneficial?

3. How much time did it take your class to complete the lesson **Cardinal Directions**?

4. How much time did it take your class to complete the lesson called **Map Scale and Measuring Distance**?

1

5. Did you enjoy using the State Giant Traveling Map of Montana and associated lessons? **Y** or **N**

5a. What did you like about it?

5b. What did you not like about it?

6. Do you think that the lesson directions were easy to follow? **Y** or **N**

6a. What made them easy to follow?

6b. What made them difficult to follow?

7. Do you think that all of the lesson objectives were met? **Y** or **N**

7a. Which objectives were met?

7b. Which objectives weren't met?

8. Did all of your students participate equally in the map activities? **Y** or **N**

8a. Do your students typically work well in groups?

8b. Why do you think some students were left out?

9. Would you be interested in bring the State Giant Traveling Map of Montana to your classroom again? **Y** or **N**

9a. How often do you think you would want to utilize this resource?

9b. Why would you not want to use this resource again?

10. Is there anything you would change about the State Giant Traveling Map of Montana and associated lessons? **Y** or **N**

10a. What would you change?

10b. What were the strengths of the State Giant Traveling Map of Montana and associated lessons?

11. Would you recommend this resource to other teachers? **Y** or **N**

11a. Why would you recommend that other teachers use this resource?

11b. Why would you not recommend this resource to other teachers?

12. Do you have any suggestions on content that you would like to see covered in additional lessons that will be written by members of the Montana Geographic Alliance?

13. Please leave any closing comments, questions, and/or concerns.

Appendix K: Raw data from Teacher Survey.

Question 1	
School	**1. How many students are in your class?**
School A	16
School B	26
School B - 2	25
School C	19
School C - 2	10
School D	21
	1a. How many males?
School A	10
School B	14
School B - 2	14
School C	11
School C - 2	5
School D	9
	1b. How many females?
School A	5
School B	12
School B - 2	11
School C	8
School C - 2	5
School D	10
	1c. What is the age range?
School A	9-10 years
School B	9-10 years
School B - 2	9-10 years
School C	9-10 years
School C - 2	9-10 years
School D	9-10 years
Question 2	
School	**2. Did you work with any assistant teachers?**
School A	No
School B	No
School B - 2	Yes
School C	No
School C - 2	No

School D	No
	2a. Did they help give directions and answer questions during the study?
School A	-
School B	0
School B - 2	They were not present.
School C	-
School C - 2	-
School D	-
	2b. Do you think that having an assistant teacher would have been beneficial?
School A	Any time you get more help you never complain.
School B	No, the lessons went very well.
School B - 2	-
School C	Maybe. In my case, I didn't feel a need for one.
School C - 2	Perhaps in a larger class.
School D	-
Question 3	
School	**3. How much time did it take your class to complete the lesson Cardinal Directions?**
School A	40 minutes
School B	45 minutes
School B - 2	45 minutes
School C	60 minutes
School C - 2	50 minutes
School D	55 minutes
Question 4	
School	**4. How much time did it take your class to complete the lesson called Map Scale and Measuring Distance?**
School A	35 minutes
School B	40 minutes
School B - 2	80 minutes
School C	60 minutes
School C - 2	50 minutes
School D	50 minutes
Question 5	
School	**5. Did you enjoy using the State Giant Traveling Map of Montana and associated lessons?**

School A	Yes
School B	Yes
School B - 2	Yes
School C	Yes
School C - 2	Yes
School D	Yes
	5a. What did you like about it?
School A	I liked the way the students' eyes light up when I opened the door to the room.
School B	The students were very engaged and seemed to enjoy the lessons. They were eager to get started with each lesson and were able to be fairly independent with it.
School B - 2	That it gets the students involved. It is hands on which draws a lot of the students to it.
School C	Gets kids moving, interacting, engaging.
School C - 2	Very engaging; interactive.
School D	I liked the excitement and curiosity it sparked in my students. The students have been exposed to maps all year long, however, the SGTM of MT allowed the students to interact and explore in a way they had not before.
	5b. What did you not like about it?
School A	Packing it up.
School B	With a small room and 26 kids desks it was a little difficult to git in the room but this wasn't a huge problem.
School B - 2	Early in the year with a difficult class it was hard to not be distracted for some students. A lot going on intitially, but students adapted quickly.
School C	Nothing! It was great!
School C - 2	Nothing I didn't like.
School D	The setup and take down made transitions to other classes difficult. Although the lessons weren't particularly long/extensive, my classroom had to be cleaned an setup again for my next class. Other large rooms/areas were not available during the lesson times.
Question 6	
School	**6. Do you think that the lesson directions were easy to follow?**

School A	Yes and No
School B	Yes
School B - 2	Yes
School C	Yes
School C - 2	Yes
School D	Yes
	6a. What made them easy to follow?
School A	They were written in traditional educational style that we are all familiar with.
School B	Well organized and detailed without getting too much detail.
School B - 2	Outlined explanation.
School C	Clear language, step-by-step.
School C - 2	Very clear and sequential.
School D	The lessons were outlined in the lesson handbook and again on your directions sheet for administering the lessons.
	6b. What made them difficult to follow?
School A	Leaving out parts or only doing parts of the map scale activity got a little confusing.
School B	Not having had the chance to use it before, took a bit to get comforatble, but by the second lesson it was very easy.
School B - 2	-
School C	-
School C - 2	-
School D	The lesson directions were clear to the teacher, however, students did struggle initially with the table. They struggled identifying/measuring the borders and rivers. A table that had more practice measuring between towns/cities would have helped before extending to borders and rivers, etc.
Question 7	
School	**7. Do you think that all of the lesson objectives were met?**
School A	-
School B	Yes
School B - 2	No
School C	Yes
School C - 2	Yes
School D	No
	7a. Which objectives were met?

School A	-
School B	All - lesson broke concepts into easy to manage parts. Very well made.
School B - 2	Teaching about map scales and cardinal directions.
School C	Students knew & applied cardinal directions to locate places on the map. Students will use a map scale to measure distances on the map.
School C - 2	Underastanding/using cardinal directions and using map scales.
School D	Cardinal Directions: both objectives were met.
	7b. Which objectives weren't met?
School A	-
School B	None. Very well constructed lesson.
School B - 2	Recognizing locations in Montana (difficult to find towns).
School C	-
School C - 2	Some students hadn't quite mastered the map scales. I think the math was hard for some of my students.
School D	Map Scale and Measuring Distance: objective 1 was not met, but was not included in the lesson. Objective 2: students were not able to use the scale bar with ease (see above 6b).
Question 8	
School	**8. Did all of your students participate equally in map activities?**
School A	Yes
School B	Yes
School B - 2	No
School C	Yes
School C - 2	Yes
School D	No
	8a. Do yout students typically work well in groups?
School A	Yes, they are familiar with working in groups and get along well.
School B	Not usually. This however kept them engaged enough that for the most part they were able to work well together.
School B - 2	No, not this group.
School C	Yes. It's a very tight group of kids; kind and considerate.
School C - 2	Yes.

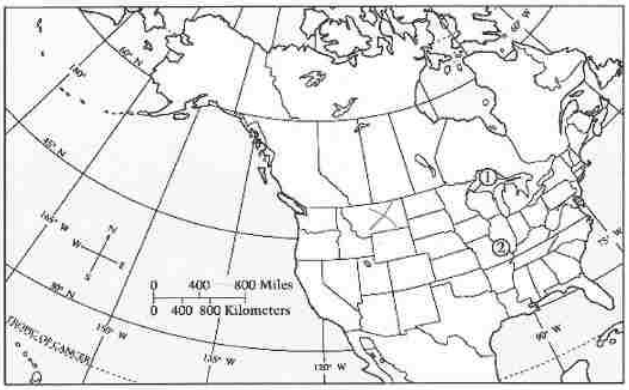
School D	It depends upon the activity, class, group dynamics, and other factors.
	8b. Why do you think some students were left out?
School A	-
School B	General attitude of students - behavioral issues that make group work/peer interactions more difficult than most other students in the class. Nothing related to the activity.
School B - 2	Most by choice, frusturated they couldn't just play on the map.
School C	-
School C - 2	-
School D	1) Personal choice. 2) Poor attitude - struggling to share. 3) Struggled with the material/understanding.
Question 9	
School	**9. Would you be interested in bringing the SGTM of MT to your classroom again?**
School A	Yes
School B	Yes
School B - 2	Yes
School C	Yes
School C - 2	Yes
School D	Yes
	9a. How often do you think you would want to utilize this resource?
School A	Every year.
School B	Once or twice per quarter at least.
School B - 2	About once or twice a month at least.
School C	Once a year for a week or two weeks.
School C - 2	1-2 times per year
School D	I would like to use it in the Fall and again in the Spring.
	9b. Why would you not want to use this resource again?
School A	-
School B	Moving desks/rearranging classroom can become a bit of a problem with so many students.
School B - 2	A bit overwhelming for some of my students. Need things at a very low/basic skill level.
School C	-
School C - 2	-

School D	-
Question 10	
School	**10. Is there anything you would change about the SGTM of MT and associated lessons?**
School A	No
School B	No
School B - 2	No
School C	No
School C - 2	No
School D	No
	10a. What would you change?
School A	-
School B	-
School B - 2	-
School C	-
School C - 2	-
School D	-
	10b. What were the strengths of the SGTM of MT and associated lessons?
School A	All kids love crawling around on the floor and the map gets them out of their desks & moving.
School B	Gets the kids moving and presents the material in a new and different way which gets them more engaged.
School B - 2	Got students moving and active. Students love hands on work.
School C	It was so engaging for the students to interact with the map. "Doing" (movement) the lessons through the map had an impact.
School C - 2	It is so engaging. All of my students were excited, active participants.
School D	The lessons provided opportunities for cooperative learning. The activities were hands-on/interactive.
Question 11	
School	**11. Would you recommend this resoucre to other teachers?**
School A	Yes, I did.
School B	Yes
School B - 2	Yes
School C	Yes
School C - 2	Yes

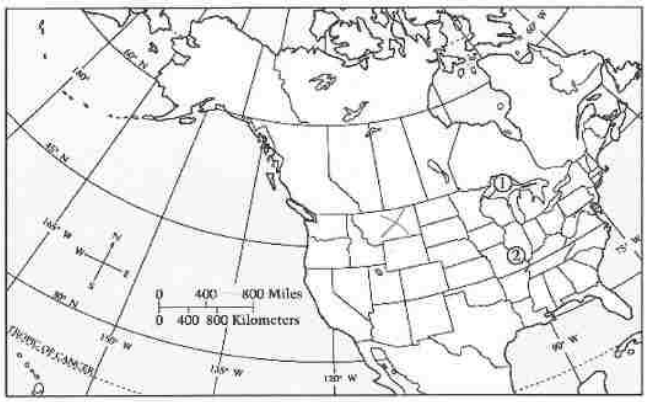
School D	Yes
	11a.Why would you recommend that other teachers use this resource?
School A	All of the teachers in our elementary got the opportunity to use the map more than once and they all enjoyed it.
School B	It is a different way to teach geography that gets the students engaged. It is a great way to show the scale of different states/areas.
School B - 2	Gets students excited, hands on, something different for students than they are used to which leads to more desire to use it.
School C	Engaging, interactive, fun.
School C - 2	It engages students in topics that they might otherwise find boring.
School D	The SGTM of MT can be used as an additional teaching resource as it ties into many of the lessons I teach as part of the fourth grade curriculum.
	11b. Why would you not recommend this resource to other teachers?
School A	-
School B	-
School B - 2	-
School C	-
School C - 2	-
School D	-
Question 12	
School	**12. Do you have any suggestions on content that you would like to see covered in additional lessons that will be written by members of the Montana Geographic Alliance?**
School A	-
School B	Lessons around Lewis and Clark or the reservations.
School B - 2	-
School C	Lewis & Clark based lessons would be awesome.
School C - 2	Maybe a lesson involving the journey of Lewis and Clark in Montana.
School D	-
Question 13	

School	13. Are there persistent educational concerns that have affected geography education in Montana? If so, what are they?
School A	TIME.
School B	-
School B - 2	Students don't use maps at other points in their day/year outside of school.
School C	Time is always an issue. I wish I had more time to devote to more in-depth geography education. Other subject areas often have to be prioritized.
School C - 2	Time. Major focus on some content areas due to testing, but not much on social studies.
School D	-
Question 14	
School	**14. Please leave any closing comments, questions, and/or concerns.**
School A	Thank you!
School B	Thank you for this opportunity! It was a great experience for the kids and something that I would like to incorporate into my teaching in future years.
School B - 2	Thank you! My class was so excited to use the map. They wanted to keep doing all their mapping activities on it.
School C	Thank you! I'm glad we were able to participate.
School C - 2	Thank you!!
School D	Thank you!

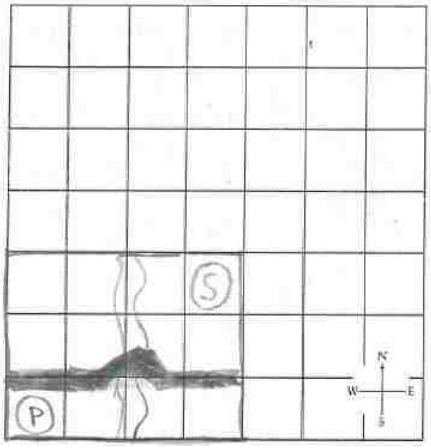
Appendix L: Examples of Student Responses to Assessment Questions 5 and 6



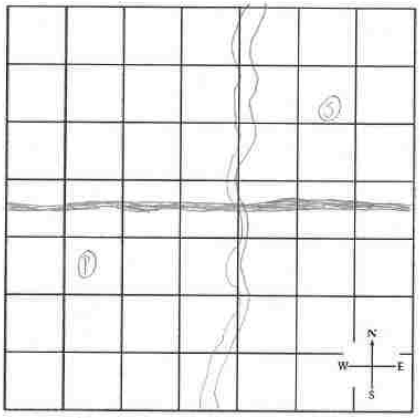
Example of complete answer to question 5.



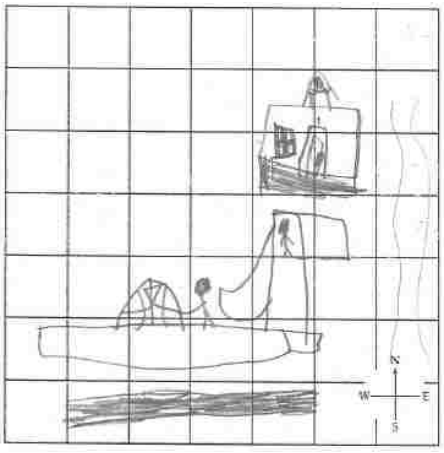
Example of inappropriate answer to question 5.



Example of complete answer to question 6.



Example of essential answer to question 6.



Example of inappropriate answer to question 6.