

EVIDENCE FROM NAEP 8th GRADE GEOGRAPHY DATA:
IDENTIFYING AND FILLING THE ACHIEVEMENT GAP
EQUITABLY FOR RACE AND GENDER

by

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DEDICATION

Marshall Dean Smith – Eternally grateful for your unwavering love and support – Thank you for helping me recycle all the National Geographic Magazines!

Christine N. Mix –I wish you could celebrate with me as I cross this finish line.

Jeffrey W. Mix – Bangarang!

Robert Wayne Mix – Grandpa, I'm a teacher! I still have all those old National Geographic Magazines...just electronically!

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The administration, board, and especially the students of Karl G. Maeser Preparatory Academy who supported me. They empower and inspire me to think critically, learn continually, and communicate effectively through the Socratic Method to better myself and my community.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS.....	ix
ABSTRACT.....	x
 CHAPTER	
I. INTRODUCTION AND RESEARCH OBJECTIVES	1
II. LITERATURE REVIEW.....	5
History of Geography Education Reforms	5
NAEP: Overview of Geography Reports and Research Results	8
Educational Equity	11
Emerging Trends in Geography Curriculum: A Focus on Diversity, Equity, and Inclusion	16
III. METHODS	19
IV. RESULTS	24
V. DISCUSSION	29
VI. CONCLUSIONS	33
REFERENCES	36
APPENDIX SECTION.....	42

LIST OF TABLES

Table	Page
1. Example of a NAEP question dissected and categorized	21
2. Percentage of KGMPA test participants by ethnicity and gender compared to NAEP.	22
3. The five most commonly missed questions for KGMPA and NAEP.....	27
4. Pre-intervention results compare to post-intervention.....	28
5. Comparison of changes in test scores greater than 30% for males and for females	29

LIST OF FIGURES

Figure	Page
1. Illustration of Equity	2
2. NAEP average scale scores for grade 8 geography by Gender for jurisdiction: 2018, 2014, 2010, and 1994.....	9
3. NAEP average scale scores for grade 8 geography by Race/ethnicity used to report trends, school-reported for jurisdiction: 2018, 2014, 2010, 2001, and 1994	10
4. Urbanization question	22
5. Heat Island question.....	23
6. Demographic comparison of KGMPA to NAEP by gender	25
7. Demographic comparison of KGMPA to NAEP by ethnicity/race	26

LIST OF ABBREVIATIONS

Abbreviation	Description
AAG	American Association of Geographers
AGS	American Geographical Society
CPE	Center for Public Education
FERPA	Family Educational Rights and Privacy Act
GENIP	Geography Education National Implementation Project
KGMPA	Karl G. Maeser Preparatory Academy
NAEP	National Assessment of Educational Progress
NAGB	National Assessment Governing Board
NCES	National Center for Education Statistics
OTL	Opportunity to Learn
PDK	Powerful Disciplinary Knowledge
SWKABAT	Students Will Know And Be Able To

ABSTRACT

Existing National Assessment for Education Progress (NAEP) data, specifically for eighth-grade Black, Hispanic, Asian, and Female students at the NAEP Advanced, Proficient, and Basic levels, were analyzed using the NAEP question tool, data explorer and item maps. For each student group, geography achievement was identified at each NAEP performance level. In addition, a pre-test using released NAEP world geography questions, correlated with identified deficiencies, was given to all ninth-grade world geography students at Karl G. Maeser Preparatory Academy (KGMPA). Results were compared to national results.

Supplemental curriculum was designed as an intervention strategy to address the identified deficiencies. Two world geography classes at KGMPA received these lessons. A post-test was then administered to all students. Direct comparisons of the pre and post-tests of identified student groups were made.

Results showed that KGMPA and NAEP gender demographics were similar, but race/ethnicities were not. Four of the five most commonly missed questions were the same for both groups confirming the selection of knowledge and skill for the supplemental lessons. The intervention was successful for the general KGMPA test population. Disaggregated data was inconclusive regarding the advantage of supplemental lessons for the various groups because the sample size was small, and the results could not be determined to be statistically significant.

I. INTRODUCTION AND RESEARCH OBJECTIVES

From Minding to Filling the (Achievement) Gap

Students enter ninth-grade world geography classrooms having geographic educational backgrounds as varied as the students themselves. Educational and non-educational factors have been attributed to achievement differences. Within-school factors include teacher quality, instructional time, curriculum content, and organization, which may be school, district, or state-controlled. Student-level characteristics associated with achievement include but are not limited to socioeconomic status, ethnicity, and level of parents' education. Researchers note tools such as Powerful Geography and GeoCapabilities have the potential to enhance the quality of geography teaching and potentially reduce inequality in student achievement (Bustin, 2020; Lambert et al., 2015). Several Opportunity to Learn (OTL) studies using the NAEP data explorer examined “relationships between geography achievement and different categories and types of OTL variables” (Solem, 2021, p.198).

It is and will be necessary for teachers to be aware of the nature of the geography content and skills that define what some student groups are more likely to know and be able to do compared with other student groups. Teachers who identify gaps in content and skills can reflect and begin to adapt the curriculum to fill student gaps through lesson design and choice of instructional practices. Instructional scaffolding, learning accommodations, and various ways of conceptualizing and contextualizing the subject matter may be necessary to tailor student-learning experiences to improve the outcomes of lower-achieving students and close the educational gap with their peers, thus providing equity in education. The proverbial equity illustration in Figure 1 of three students of

differing heights writing on the chalkboard was implemented in this directed research project using data from the National Assessment of Educational Progress (NAEP).

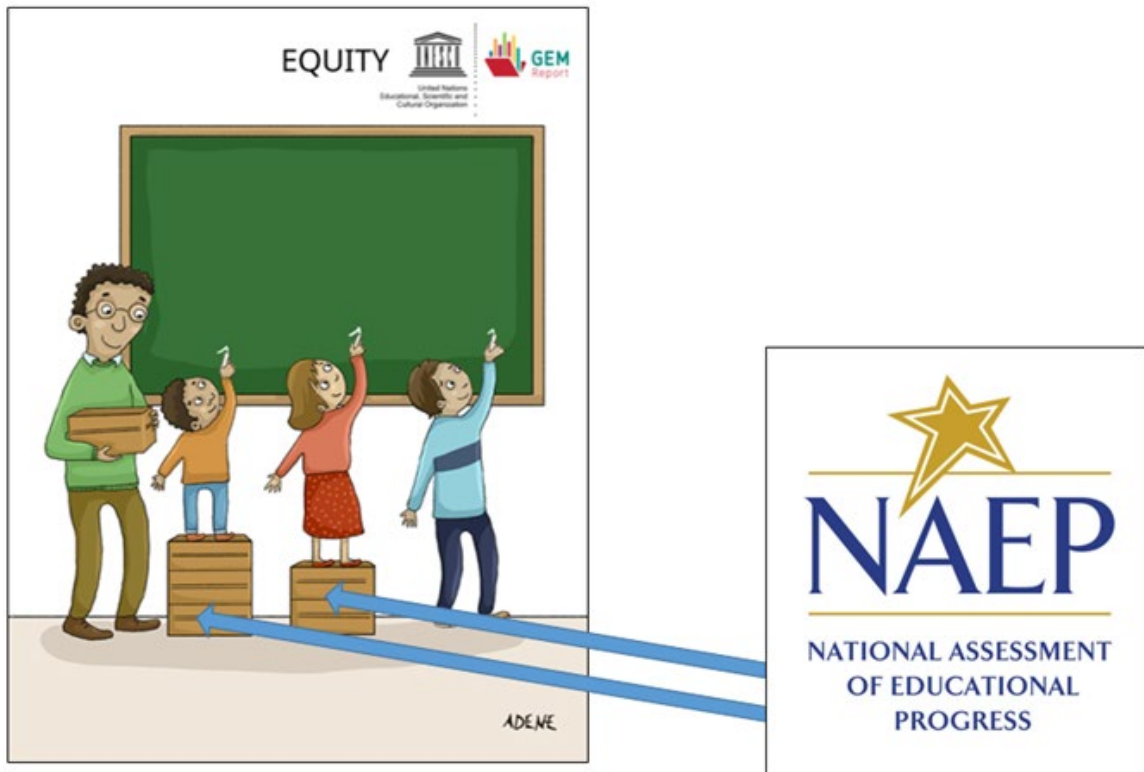


Figure 1. Illustration of Equity

SOURCE: <https://www.arisenetwork.eu/en/about-initiative/equity-education/>
Modified by the author.

In Utah, world geography is a required 0.5-semester credit needed for high school graduation. Ninth-grade students in urban school districts typically have the choice between World Geography and AP Human Geography. In rural school districts, students rarely have a choice. Overall, most students choose regular World Geography over AP Human Geography. My current classroom experience involves teaching World Geography to ninth graders at a public charter school for grades 7-12. The student body size is approximately 615 students. Students commute from all over Utah County (2,003 square miles) (Utah.gov, n.d.), which means their educational geography backgrounds are

varied. Several times during the first few weeks of class, I have said, “This will be a review for some of you and brand new for some of you.” My classroom experiences inspired my interest in developing a way to determine students’ missing geographical knowledge and skills so that I make the best curriculum decisions and optimize valuable time.

NAEP data were new to me as I began my Master of Applied Geography in Geography with a concentration in Geographic Education journey. I knew of the Nation’s Report Card but not the framework for assigning the grades. Several questions came to mind. Why is it so important? What can be learned from NAEP data? How will exploring NAEP data support a ninth-grade World Geography teacher who wishes to empower students and improve their outcomes in geography education? How might it change instructional practices or the content I teach? Could large data be applied to improve geography achievement? Do NAEP data identify factors that may fill the proverbial gap in what students know and can do?

As described by Solem, “NAEP provides an unparalleled data set to support empirical research into the extent that students are accessing and acquiring the knowledge necessary to understand the distinctive nature of the thinking processes specific to geography” (Solem, 2022, p. 2). “Since 1994, the NAEP program has issued five reports on geography achievement in the United States: in the fourth, eighth, and twelfth grades in 1994, 2001, and 2010, and eighth grade only in 2014 and 2018” (Solem, 2022, p.2) Since NAEP data exposed gaps in knowledge over time, identifying the nature of the gaps could guide geography teachers in curriculum choices bringing equity to the geography classroom. However, in the summer of 2019, the National Assessment

Governing Board (NAGB), the nonpartisan entity that oversees NAEP policy, announced that Geography, Economics, Arts, and Foreign Language would not be assessed as part of the already scheduled 2022 NAEP assessment (Solem & Stoltman 2020). Several reasons were cited, one being the lack of research using existing NAEP geography data to address questions about the factors responsible for achievement gaps and how to improve student outcomes.

This directed research aimed to analyze the world geography knowledge and skills that incoming ninth-grade students “know and do” and the extent to which achievement gaps were present for Black, Hispanic, Asian, and Female students. The assessment tool was a modified NAEP test based on released questions. The test groups were the World Geography classes at KGMPA. Once gaps were identified, an intervention strategy was implemented that consisted of supplemental lessons. The goal was to determine the extent to which specialized lessons successfully filled the gap for students in the comparison groups.

Research Questions:

1. What is the nature and amount of geography that KGMPA students know coming into ninth-grade world geography, and how does this level of knowledge vary between student groups?
2. How can information about students’ varying geography knowledge and skill levels be applied to instructional strategies, scaffolding, and learning accommodations to fill these gaps?
3. To what extent were the instructional interventions successful in filling the knowledge and skills gaps for identified comparison groups?

II. LITERATURE REVIEW

History of Geography Education Reforms

Reforms in geography education started in the 1960s and had two primary focuses: 1) to improve the status of geography in the school curriculum and 2) to improve student outcomes in geography. Geography does not always get the same emphasis as other subjects, so reforms were intended to place value on geography education. Several national and international organizations helped reform geography education to its current state.

The first formal reform of geography education was documented in the High School Geography Project of the 1960s. Two national organizations, the Association of American Geographers (AAG) and the National Council of Geographic Education (NCGE), formed a joint committee “whose main purpose was to improve the status of geography in education and to suggest practical ways in which this might be done” (Graves, 1968, p. 68). The outcome was a series of educational units taught to control groups, from which recommendations were collected. Pratt reflected on those studies and noted “a concern for the academic discipline as school subject and concern for the rather sad state of geographic knowledge in the U.S.” (Pratt, 1976, p. 10).

In 1984, a joint committee of the NCGE and AAG published Guidelines for Geographic Education: Elementary and Secondary Schools. “This 28-page booklet informed educational decision-makers about the need to enrich geography programs in the schools of the United States through the introduction of five organizing themes.” (*About GENIP | GENIP*, n.d.). As a result, guidelines “that improved the teaching and learning of geography” became available nationwide (*About GENIP | GENIP*, n.d.). In

1985, another collaboration among four national geography organizations –AAG, American Geographical Society (AGS), NCGE, and National Geographic Society was formed. They created The Geographic Education National Implementation Project (GENIP). Its purpose is “as a coordinating committee for a consortium of geographic associations committed to improving the status and quality of geography education in the United States...on issues, initiatives, projects, and activities related to advancing K-12 geography education” (*About GENIP* | *GENIP*, n.d.).

A decade later, in 1994, *Geography for Life: National Geography Standards* published voluntary standards and introduced Americans to the Six Essential Elements (Bednarz, Downs & Vender, 2003; Boehm, 1997; National Geography Education Standards Project, 1994). The six essential elements (The World in Spatial Terms, Places and Regions, Physical Systems, Human Systems, Environment and Society, and Uses of Geography) have remained the same and have been expanded into 18 standards for current K-12 geography education.

Also, in 1994, the National Assessment of Educational Progress (NAEP) administered the first nationwide geography assessment. Results provided a baseline for future NAEP geography assessments. “NAEP Geography results have been used as a benchmark to track student learning and, over time, have consistently yielded results that indicate U.S. students continue to fall short of adequate levels of achievement in geography” (Education Policy | *GENIP*, n.d.). These results spurred GENIP to take action as they helped “the education community and policymakers understand the impact of decreased instructional time and teacher professional learning in geography, and also to

provide critical information about what students do and do not learn in geography”
(Education Policy | GENIP, n.d.)

The Second edition of *Geography for Life* (GFL2) was published in 2012 and provided updates from 1994 and included messages that began to emphasize the use of more technology and spatial thinking skills in the classroom teaching of geography (Heffron & Downs, 2012). Both publications promoted national geography standards and encouraged individual states to create their state standards using national geography standards as a guide.

National geographic organizations issued statements of concern but little else each time NAEP geography results were published. The latest headlines from 2018 include: “US Kids’ Grades Dip in History and Geography” (Associated Press, 2020), “8th Graders Don’t Know Much About History, National Exam Shows” (Sparks, 2021), “Eighth graders’ U.S. History and geography scores decline.” (Associated Press News, 2020). The same concerns about academic discipline as a school subject and the sad state of geographic knowledge in the U.S. still exist.

Geography education recently took a turn toward an international framework based on the ideas of powerful knowledge and human capability. The international GeoCapabilities project has produced extensive literature on why it matters for young people in school to acquire the powerful knowledge necessary to think geographically and apply geography to examine, interpret, and solve complex social and environmental problems (Bustin, Lambert, and Tani, 2020). GeoCapabilities is a fresh way of dealing with the challenges facing geography teachers in school. It inspired efforts such as Powerful Geography that move past national standards to focus on subject matter that is

more supportive of state and local curricula, student diversity, and workforce opportunities and needs. Powerful Geography aims to assist teachers in making more conceptually rigorous and inclusive instructional decisions informed by the empirical perspectives of the students they teach and how applied geography can help young people pursue their life and career aspirations (Boehm, Solem, & Zadrozny, 2018).

NAEP: Overview of Geography Reports and Research Results

Over the years, there have been various assessment methods to measure student achievement. The National Assessment of Educational Progress (NAEP) is the “largest nationally representative and continuing assessment of what America’s students know and can do in various subjects” (National Center for Education Statistics, n.d.). NAEP assessments evaluate proficiency levels in Civics, Reading, Mathematics, Geography, Economics, Science, Technology and Engineering, US History, and Writing. Solem (2022) stressed the value of the NAEP framework to measure the knowledge of world geography in three content areas – space and place, environment and society, and spatial dynamics and connections; and three cognitive areas – knowing, understanding, and applying. The framework also outlined what geography knowledge and skills students should have to reach *NAEP Basic*, *NAEP Proficient*, and *NAEP Advanced* achievement (Solem, 2022).

NAEP Geography results are reported for groups of students as average scale scores that range from 0 to 500. Scores are based on the percentages of students who correctly and completely answered each item (Solem, 2022, p.3). All five NAEP Geography reports show that the majority of eighth graders are not “proficient” in geography even though geography is such an important aspect of life across all facets,

especially in the modern workforce. (Government Accountability Office, 2015)

Figure 2 depicts male and female average geography scores over time and for eighth grade. Figure 3 shows achievement data for students by race and ethnicity (White, Black, Hispanic, Asian/Pacific Islanders, American Indian/Alaska Native, and Two or More Races).

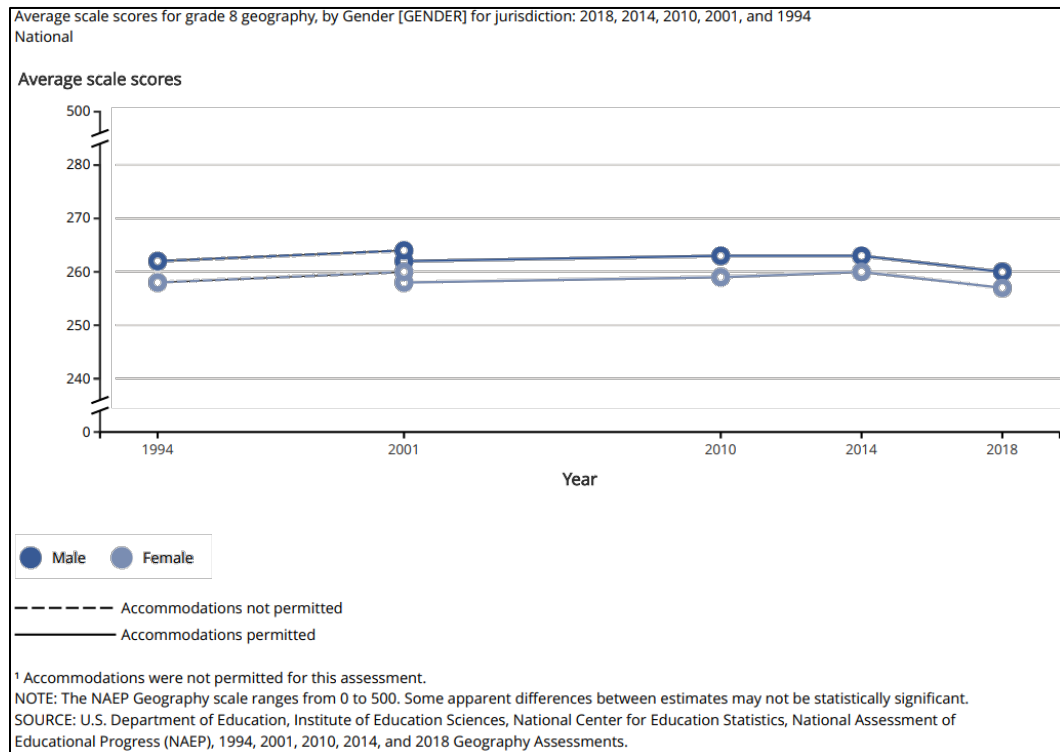


Figure 2. NAEP average scale scores for grade 8 geography by Gender for jurisdiction: 2018, 2014, 2010, 2001, and 1994

Source: <https://www.nationsreportcard.gov/ndecore/xplore/NDE>

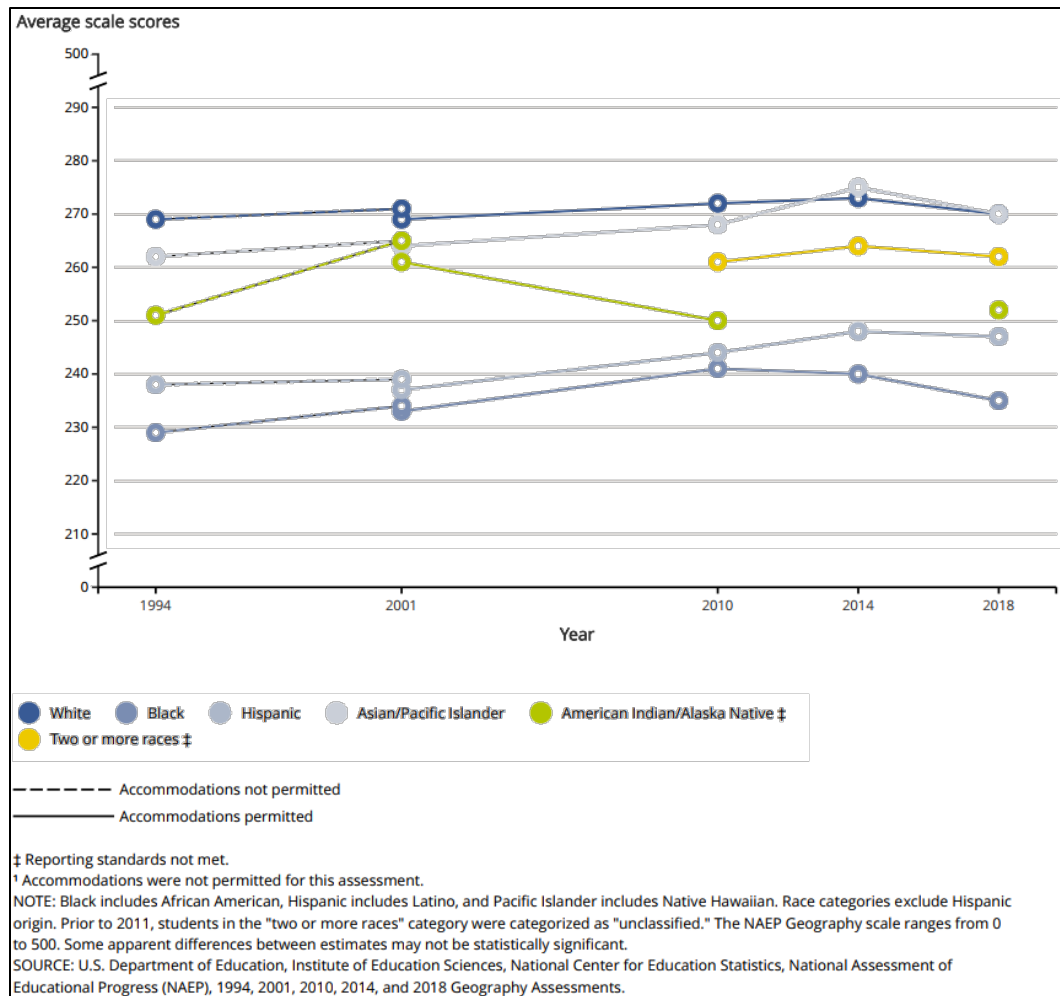


Figure 3. NAEP average scale scores for grade 8 geography by Race/ethnicity used to report trends, school-reported for jurisdiction: 2018, 2014, 2010, 2001, and 1994.

SOURCE: (n.d.). <https://www.nationsreportcard.gov/geography/results/scores/>

In July 2019, the National Assessment Governing Board announced a decision to eliminate geography, economics, arts, and foreign language assessments from the NAEP testing schedule through 2029. Dr. Solem and Dr. Stoltman explained why the National Assessment Governing Board decided to forgo geography testing for the foreseeable future. Reasons included the lack of NAEP geography data being utilized and the expense associated with administering the assessment. Interested parties were encouraged to use NAEP geography data and make their voices heard by stakeholders (Solem and Stoltman,

2020).

Studies utilizing NAEP data exist for standard school subjects such as math, English, and science. Until recently, this was not the case for geography. A recent special issue of the *Journal of Geography* presents current research as well as a preview of upcoming research plans (Solem, 2021). The issue included studies examining relationships between geography achievement and different opportunities to learn (OTL) variables. For example, Paulus and Nolan “found geography achievement was higher for those who took geography in 6th and 7th grade.” (2021, p.213). Rueschhoff & Palma linked teacher quality, e.g., years of teaching experience, to student achievement (2021). Choi identified another factor that contributed to student success: access to technology (Choi 2021). Students with access to technologies at school and home had higher scores on the NAEP assessment. Technology provides students access to internet-dependent tools that are helpful in geography education. Choi referred to Heafner and Fitchett (2015), who described this achievement gap more accurately as an opportunity gap. Choi used NAEP data and presented the findings in a usable way for a classroom teacher suggesting NAEP data could be evaluated to close the opportunity gap (2021).

Educational Equity

This section gives a brief overview of educational equity and its importance. In 1954, almost 70 years ago, the U.S. Supreme Court decided *Brown v Board of Education* and declared that “separate but equal” schools was unconstitutional. The opinion stated that education was “a right which must be made available to all on equal terms” (Brown V. Board of Education, 1954). That was the first pivotal event to open the door for equality and equity in education.

Equity and equality are sometimes used interchangeably but have different meanings. Equal means the same, while equitable means fair or impartial. Legislation has typically considered how to make educational opportunities equal. On the other hand, education professionals look at how to achieve an equitable outcome. This review will touch lightly on key legislation since equity is more important than equality in this research.

Legislative efforts to make education available “on equal terms” began in 1965 with the Elementary and Secondary Education Act. Funds were allocated to low-income students, but the efforts never achieved the desired results. It was replaced by the No Child Left Behind Act of 2001 or “An act to close the achievement gap with accountability, flexibility, and choice so that no child is left behind” (No Child Left Behind Act of 2001). Key to the act was funding for disadvantaged students and assessments. That law was repealed in 2015 and replaced with the Every Student Succeeds Act or “An original bill to reauthorize the Elementary and Secondary Education Act of 1965 to ensure that every child achieves” (Every Student Succeeds Act of 2015). Responsibility for equality was returned to the states.

Defining and funding equal education has been controversial. Given the various legislative efforts, many of those controversies were answered by lawsuits. Augenblick et al. (1997) reviewed the history of funding and several attempts to provide an adequate education as well as some of the resulting litigation. The work of funding an equal education continues today.

Defining and measuring an equitable education has been the subject of much research. Non-profit think tanks have sought to define equity. In 2006 the Center for

Public Education (CPE) was established after discussions between the National School Boards Association and member state school boards. They identified the need to inform the public regarding the status of public education and provided the following definition of equity. “Educational equity is the intentional allocation of resources, instruction, and opportunities according to need, requiring that discriminatory practices, prejudices, and beliefs be identified and eradicated” (*Center for Public Education*, n.d.). They provided educators and policymakers with a common ground to start equity discussions. The CPE published a research brief identifying the issues surrounding equity. The report sought to provide an outline for policymakers within the education system to address issues of educational equity. Their research showed the top 4 equity issues today: 1) funding, 2) high-level curriculum, 3) good teachers, and 4) discipline policies concerning attendance (Barth 2016).

Another non-profit organization, The National Academies of Sciences, Engineering, and Medicine, published a study measuring equity in 2019. *Monitoring Educational Equity* delved into why it was important to have indicators and measures, the framework for creating such indicators, and recommendations on how to do this. Change is challenging without identifying and collecting information regarding individual students’ family backgrounds and the differences in conditions and structures in the education system. The recommendations backed by data were intended to inform policymakers, school boards, superintendents, educators, and researchers. The relevance of this book to my directed research project was the division of domains by influence and responsibility. What is the family, teacher, and education system responsible for? What factors can the teacher influence in providing educational equity?

The National Academies of Sciences, Engineering, and Medicine also published research about the changing demographic of students and educators, along with recommendations on how to respond. They acknowledged significant shifts over the last two decades regarding expectations for K-12 teachers and addressed issues arising from them. Some shifts included: 1) the unchanged composition of the teacher workforce; 2) ever-increasing demands and expectations placed on teachers today to see content achievement and mastery; 3) expectations of teachers are increasing due to changing learning standards, changing student demographics, and changing student needs; 4) teacher education in-service and preservice needs to evolve to meet these changes successfully; and 5) requirements and ways to become a teacher have changed drastically. Some issues from these shifts are still being studied. Such as the impact of online teacher education and the effects on students of professional development opportunities for teachers (*Changing Expectations for the K–12 Teacher Workforce: Policies, Preservice Education, Professional Development*, 2020).

One additional effort worth mentioning is the Social, Emotional, and Cultural Anchor Competencies Framework published by the Center for Reaching & Teaching the Whole Child (CRTWC). This framework stemmed from *Teaching with a Social, Emotional, and Cultural Lens* by Markowitz and Bouffard (2020). They shared five goals and laid out an Anchor Competencies Framework: the four highest-priority issues, seven anchor competencies, and fourteen conclusions (*Center for Reaching & Teaching the Whole Child – Financially Sponsored by Community Initiatives*, n.d.). Further, Markowitz and Bouffard discussed the changing landscape of K-12 education and the benefit of preservice and in-service support. Essentially, the student population is more

diverse than previous generations, and teachers must adapt to create equitable learning for all.

Despite efforts over the years to provide an equitable education, there is still a long way to go. Alderman issued a call to arms in 2021. Published in the *Journal of Geography*, he described the implications of social disparities relating to NAEP student outcomes. He noted “how far the discipline of Geography still must go to address issues of diversity, equity, and inclusion” (Alderman, 2021, p.244).

A former president of AAG, Alderman commented on the “disparities in NAEP student outcomes with respect to geography” (Alderman, 2021, p.244). He called for paying attention to the greater diversity of 8th graders while noticing the missing narratives of females and underrepresented ethnicities in geography. This requires conversations and planning for “whom the learning of geography matters and why, and a commitment to decolonize curriculum and pedagogical approaches” (Alderman, 2021, p.244). A further charge was for geographic education to increase “responsiveness to social difference and justice” (Alderman, 2021, p.244). He encouraged members of the wider geography professional community to pay attention to pedagogical practices at many grade levels, especially in the school districts where they live and vote, and to engage their professional organizations to support these changes in geographic education.

Emerging Trends in Geography Curriculum: A Focus on Diversity, Equity, and Inclusion

Leaders in geography education have created curriculum frameworks through the years that built on each other: Five Themes, Geography for Life, and GFL II. Now, with even more opportunity due to global connectedness, and interdisciplinary dependencies, geography researchers have presented a new framework that can open possibilities for students much more significant than microcosmic views can fathom – Powerful Geography.

The lead-up to Powerful Geography began decades ago. In 1988, Nussbaum and Sen organized a socio-economic conference that focused on the quality of life and if it could be measured. The first section of the proceedings focused on “Life and Capabilities” (Nussbaum & Sen, 1993, p.7). In 2007, Young introduced the concept of “powerful knowledge,” referring to what knowledge can do – new ways of looking at the world that could only be taught in the classroom (Young, 2007, p.14). In 2011, Nussbaum continued her philosophical work with the Capabilities Approach, which examined abilities and environment to determine opportunity. She encouraged an interdisciplinary approach (Nussbaum, 2011). In 2012, the GeoCapabilities project led by AAG considered the Capabilities Approach on an international level and combined the Powerful Knowledge concept to begin laying the foundation for a new framework for geography education (Solem, Lambert, and Tani, 2013). In 2015, an article was published that provided “the theoretical underpinnings for an innovative international collaborative project in the field of geography education named GeoCapabilities” (Lambert et al., 2015, p.1). In 2018, Boehm et al. described this approach as being created “by threading

together human capabilities, powerful disciplinary knowledge, and liberating curriculum” (Boehm et al., 2018,b p.125).

Powerful Geography aims to “...produce academically and rigorous national and state standards in geography that address the goals/aspirations of individual students” (Boehm et al., 2018b, p.126). This was to be accomplished by the four domains of the framework: “human geography, physical geography, environmental and society, and places and regions” (Boehm et al., 2018b, p.132). The expected outcome was for students to be able to “think geographically about the myriad social and environmental problems defining modern times” (Boehm et al., 2018b, p.128). Owing to the diversity of student backgrounds (social, economic, racial, and cultural) and given the ever-changing-geo-political world, Powerful Geography must necessarily adapt and be adaptable. Teachers, who are non-specialists, must be enabled to provide vision and impart tools to make students successful in a global society.

The GeoCapabilities project continued to develop the Capability Approach in education over the last decade. The first phase (2013-2015) focused on understanding capabilities and what should be taught or the “‘powerful disciplinary knowledge’ (PDK) of geography” (*Three Phases of GeoCapabilities | Geocapabilities*, n.d.). The second phase (2015-2018) provided professional development materials so teachers could build a curriculum. Finally, the third phase (2018-2021) tested the application of GeoCapabilities instruction.

One case study of the GeoCapabilities project has been published. An instructional module was taught about migration with a focus on social justice. The concepts used in instruction were: agency, distributive justice, relational justice, and

mutuality/misrecognition. The study sought to examine if “GeoCapabilities ‘works’ for teachers serving communities in challenging socio-economic circumstances” (Biddulph et al., 2020, p.260) They concluded that “with appropriate support for teachers the social justice dimension of GeoCapabilities could be realized” (Biddulph et al., 2020, p.260) Future work will involve helping teachers develop their own knowledge and curriculum to impart knowledge to their students.

NAEP is a significant assessment tool that could be better utilized in future research. Solem urged researchers of NAEP data to look beyond the achievement data and analyze the “contextual information about the students, teachers, and schools participating in the assessment” (Solem, 2021, p. 196). NAEP data, categorized by race, gender, school lunch program, parent education level, disability, and English language learners, are an excellent source for identifying achievement gaps and executing a plan to close the gaps.

I was inspired by the NAEP special issue of the *Journal of Geography* and Dr. Solem’s direction to explore relationships between geography achievement and different categories of OTL variables. This directed research was conducted to analyze the extent to which supplemental lessons reduced achievement gaps associated with gender and ethnicity at KGMPA.

III. METHODS

Given the stated purpose of this research to identify and close knowledge gaps and knowing that extensive data existed from the NAEP assessments, the methods employed in this directed research project involved comparisons to the NAEP data, instruction, and testing. First, a modified NAEP test was designed and administered to KGMPA students. Second, KGMPA demographic data were compared to the NAEP data. Third, tailored instruction was designed to address identified knowledge inequalities. Fourth, knowledge was reassessed.

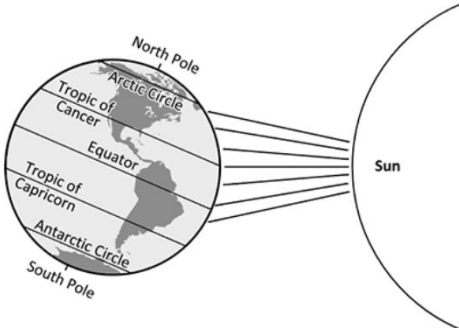
The first step was to design a test that students could take within a time constraint to measure geography knowledge. The 2018 NAEP assessment evaluated geography knowledge based on three broad categories: 1) Space and Place, 2) Environment and Society, and 3) Spatial Dynamics and Connections. NAEP assigned each of the 39 questions a difficulty value based on a 0–500-point scale that measured what students should know and an associated cognitive skill or what they had to do to arrive at an answer. NAEP also determined proficiency levels based on the scaled score: Basic = 242, Proficient = 282, and Advanced = 315. The 8th-grade NAEP geography assessment was analyzed to determine the knowledge and skills being assessed by NAEP. An example question with the analysis is shown in Table 1. Questions from each proficiency level within a knowledge category were selected for testing at KGMPA. Word coding was also used to evaluate each cognitive skill adequately. See Appendix A for a table showing how each NAEP question was categorized and why each question was selected for KGMPA testing. The KGMPA test is found in Appendix B.

Table 1. Example of a NAEP question dissected and categorized.

Identify that the tilt of earth's axis affects the seasons—Complete (MC)

Subject: Geography, Grade: 8, Year: 2018
Content Classifications: Space and Place, Knowing, Type: MC, Difficulty: Easy

Question ID:2018-8G1 #1 G018901



Look at the diagram. The tilt of the Earth's axis has a direct effect on the

A ☐ distance of the Earth from the Sun

B ☐ length of the year

C ☐ speed of the Earth's rotation

D ☐ seasons of the year

Clear Answer

<u>Proficiency</u>	<u>Category</u>	<u>Know</u>	<u>Do</u>
260 (Basic)	Space and Place	direct effect Tilt Axis how seasons work	interpret diagram apply knowledge

The KGMPA assessment was administered in three stages: screening, pre-intervention, and post-intervention. Pre-intervention and post-intervention groups were the same populations so as not to introduce another variable into the results. Attached to the assessment was a demographic survey to help identify students by race/ethnicity and gender. The NAEP categories for ethnicity were used: White, Black, Hispanic, Asian/Pacific Islander, American Indian/Alaska Native, and Two or More Races. Table 2 shows the demographic breakdown for each of the assessments in comparison to NAEP.

The screening test was used to determine knowledge gaps and cognitive skill gaps. Comparisons were made between KGMPA data and the NAEP data and the five most commonly missed questions were determined. The subject matter for two those

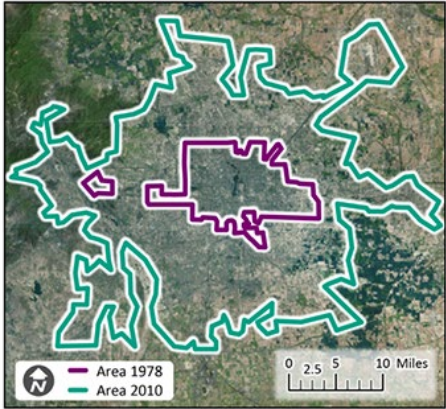
Table 2. Percentage of KGMPA test participants by ethnicity and gender compared to NAEP.

	<u>Screening</u> <u>Group</u> (n=103)	<u>Intervention</u> <u>Group</u> (n=25)	<u>NAEP</u>
White	67	52	49
Black or African American	2	4	14
Hispanic	7	16	27
Asian	12	16	6
Native Hawaiian or other Pacific Islander	1	4	1
Two or more Races	12	8	3
Male	54	52	51
Female	46	48	49

questions were targeted for intervention strategies including supplemental instruction.

The first question was about urbanization and is shown in Figure 3. The second question dealt with heat islands and is shown in Figure 4. The cognitive skills identified for supplemental instruction were interpreting a map and drawing conclusions along with dissecting a question.

The image shows the expansion of Beijing, China, from 1978 to 2010.



0 2.5 5 10 Miles

Area 1978
Area 2010

Give one positive effect and one negative effect that this expansion could have on the quality of life of Beijing residents.

Positive:

Negative:

Figure 4. Urbanization question

SOURCE: <https://www.nationsreportcard.gov/nqt/searchquestions>

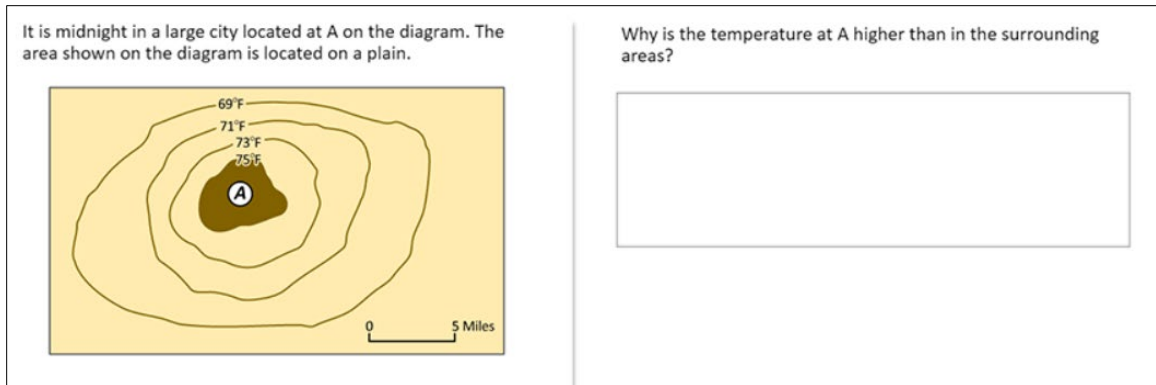


Figure 5. Heat island question

SOURCE: <https://www.nationsreportcard.gov/nqt/searchquestions>

The question about urbanization fell under the Spatial Dynamics and Connections category and required knowledge about the effects of urbanization on quality of life. In-class instruction was planned to fill the knowledge gap of “impact to daily life”, which appeared to be key to answering the question but was not a focus of the regular instruction. KGMPA is far away from a mega-city so, to help the students contextualize growth issues, we examined aerial photos of the local area from 1953 and 2022. Next, we talked about the growth over the last 69 years and how their own neighborhoods had changed. To better relate to mega-city growth, we discussed what would have happened if the growth period had been shortened to 20 years or even 5 years. If the growth had occurred over 5 years, what would have happened to employment, to the environment, and to housing? How would their lives be different? The subject of urbanization appears multiple times in different units. The supplemental lessons were taught over two days in the South American unit and then reinforced with subsequent units.

The heat island question was categorized as Environment and Society and required knowledge of heat retention by man-made structures and skills to interpret isoline maps and temperature gradients. To fill the knowledge gap for this question, students needed to know about urban heat islands: what they are, where they are, what

causes them, and how they are represented on a map. To make the issue relevant to the students we discussed a parade on a hot summer day. Is it hotter under a tree in a park or marching down the parade route as a participant? We also discussed why the meteorologist gives one temperature reading for downtown and a separate reading for the airport. Discussions happened organically as students shared their “why’s.” The knowledge concept was fairly basic and was typically excluded from regular instruction. The supplemental instruction was added to an urbanization discussion about big city growth over one class period.

Interpreting isolines was identified as a very specific skill that required special instruction. At the beginning of the semester students were introduced to basic maps and map features. Isolines were presented at that time. Owing to the fact that the isothermal question was missed by KGMPA and NAEP, a special lesson was prepared for the climate and micro-climate module. They learned that isolines can represent anything that is concentrated and diffuses like altitude and temperatures but, more importantly, they learned to interpret an isoline map. The early instruction was reinforced with the special lesson over the course of one day. The supplemental lesson resources used to teach the knowledge and skills are in Appendix B.

The last step was to administer a post-intervention test. The analysis involved comparing pre-intervention data to post-intervention data. All tests (screening, pre-, and post-) were the same to avoid introducing another variable. Results are reported and discussed in the next section.

IV. RESULTS

The demographics reported by KGMPA were similar to the populations tested by NAEP. The percentages of males and females were similar, with KGMPA having 54% males compared to 51% for NAEP. Results are shown graphically in Figure 6.

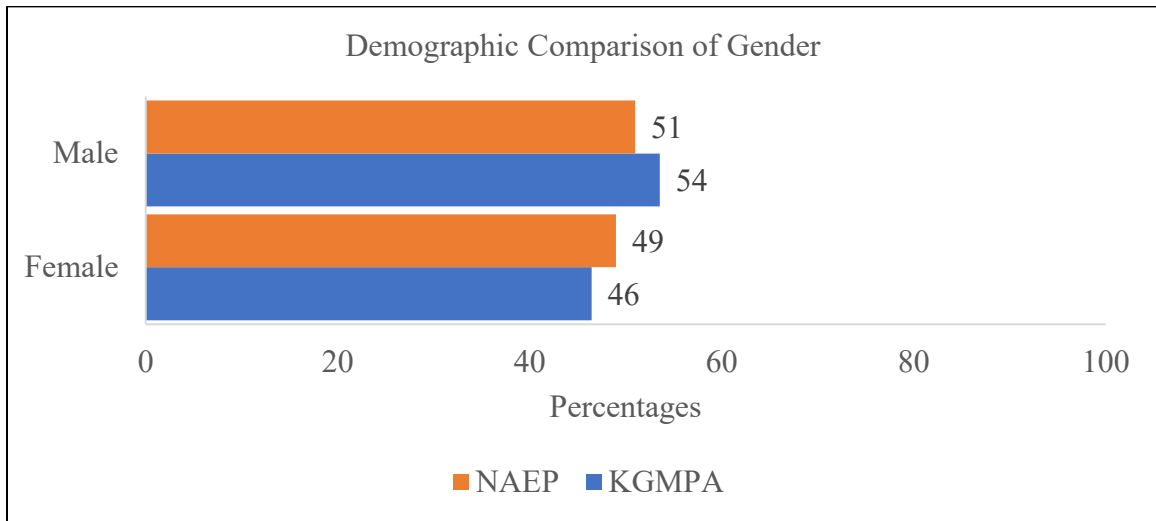


Figure 6. Demographic comparison of KGMPA to NAEP by gender.

Source: GAO analysis of National Assessment of Education Progress (NAEP) Geography Assessment data for 1994-2010, and 2014 I GAO 16-7

There were variances between the ethnic groups, but the majority of respondents for both assessments were White. KGMPA had 15% more White at 67% when compared to NAEP. Those who identified as Black at KGMPA were significantly lower than NAEP at 2% compared to 14%. The Hispanics at KGMPA totaled 7%, 20% lower than NAEP. More KGMPA students identified as Asian/Pacific Islander than the NAEP data at 13% compared to 6%, a difference of 7%. No KGMPA students self-identified as American Indian/Alaska Native. The final group, Two or More Races, showed a difference of 9%, with KGMPA at 12% and NAEP at 3%. A graphical representation of the demographic comparison between KGMPA and NAEP is shown in Figure 7.

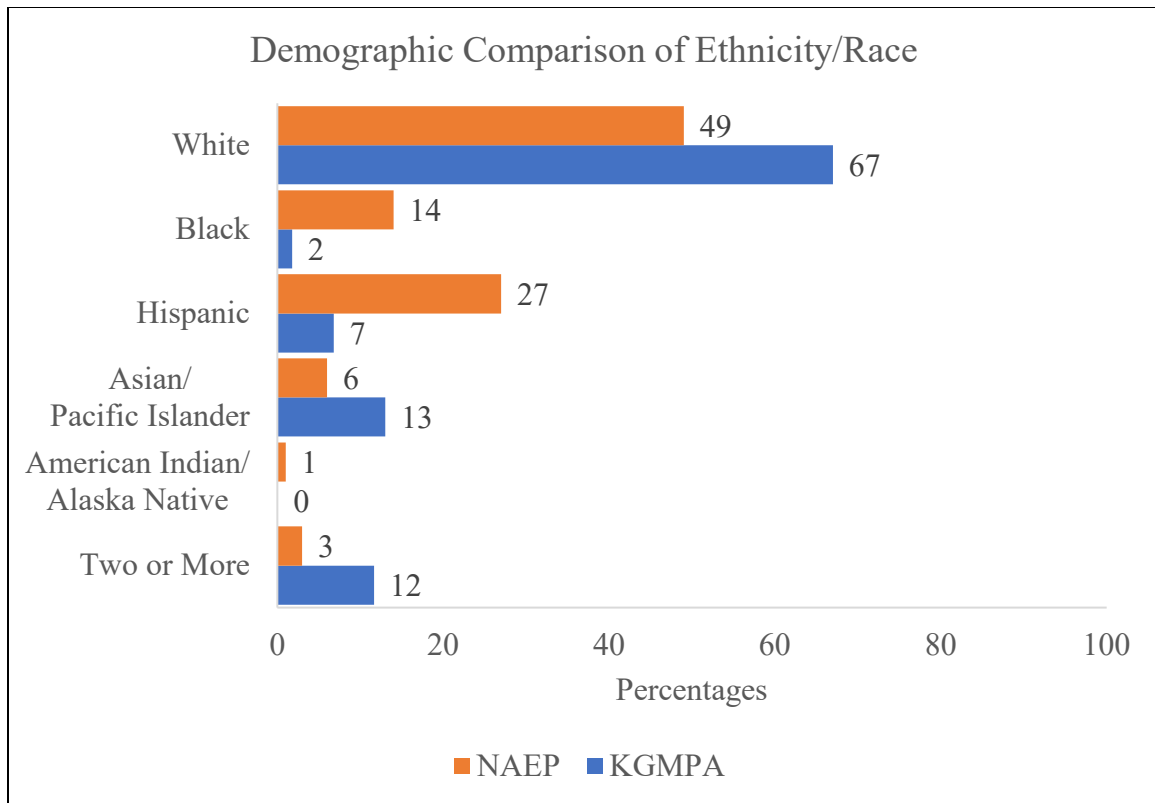


Figure 7. Demographic comparison of KGMPA to NAEP by ethnicity/race.
Source: GAO analysis of National Assessment of Education Progress (NAEP)
Geography Assessment data for 1994-2010, and 2014 I GAO 16-7

Another comparison between KGMPA data NAEP data was the most-missed questions. Table 3 shows that four of the five questions missed by KGMPA were the same as those reported by NAEP. The national average for question #4, naming cultural features of immigrants, was much lower than the KGMPA average. KGMPA students were worse at drawing conclusions from a map per question #11. The knowledge areas for special instruction were determined to be: culture features and migration, historical language patterns, urbanization, temperature gradient map, how built environments reflect climate, and cultural regions. The cognitive skills that needed improvement were: interpreting a map/figure/diagram, discussing impacts, photo analysis, and explaining how. Supplemental material used in instruction is included in Appendix B.

Table 3. The five most missed questions for KGMPA and NAEP. Bold indicates that the comparison group did not miss the question. The percent correct for all questions are in Appendix C.

<u>Question</u>	<u>KGMPA</u> <u>% Correct</u>	<u>NAEP</u> <u>% Correct</u>
4. When immigrant groups migrate from one place to another, they often bring along features of their traditional culture, such as food or sports. Name TWO other cultural features that immigrant groups bring with them during a migration.	50	22
10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer.	5	2
11. The map best supports which two of the following conclusions?	23	45
15. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	18	8
18. Why is the temperature at A higher than in the surrounding areas?	5	1
20. List TWO features that indicate that the village shown in the photograph is located in an area with a hot, dry climate. Explain how those features indicate that the climate is hot and dry.	19	9

The performance of most students improved as a result of the specialized lessons. The three questions with the most significant score increase and the largest score decrease are shown below in Table 4. The knowledge areas that showed the most significant score improvements were: the expense of railroad routes, urbanization, and railroad networks. The skills included: reasoning, then supporting choice, drawing a conclusion, interpreting a map, and explaining “why.” The three questions marked by poorer performance were constructed response questions and dealt with interpreting a figure and giving an explanation.

Table 4. Pre-intervention results compared to post-intervention. The top three and bottom three difference scores reported. The percent correct for all questions are in Appendix D.

<u>Question</u>	<u>KGMPA</u>	<u>KGMPA</u>	<u>Difference</u>
	<u>Pre-</u> <u>% Correct</u>	<u>Post-</u> <u>% Correct</u>	
23. Look at the map below, which shows three possible routes for a railroad line that will be built to connect Red City with Blue Town. Which route would be the least expensive to construct? Give two reasons why the route you chose would be the least expensive.	0	44	44
15. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	19	56	37
19. This map shows a railroad network linking major cities in the Midwest. Describe how a blizzard in the railroad hub city might affect the regional railroad network.	31	68	37
10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer.	8	3	-5
11. The map best supports which two of the following conclusions?	42	29	-13
7. What type of land use is shown in the photograph? Why is it important?	77	60	-17

Comparing test scores based on gender gave mixed results. The most significant improvement was 52% for question #19, on which the Female scores improved to 75% correct. Male scores also improved. Question #15, a constructed response question, saw improvements for both males and females. Male responses increased from 38% to 62% correct. Female scores improved to 50% correct, a 27% improvement. There were mixed results for question #16, a multiple-choice question about climate. Table 5 shows changes in scores greater than 30%.

Table 5. Comparison of changes in test scores greater than 30% for males and females.

<u>Question</u>	<u>KGMPA</u>	<u>KGMPA</u>
	<u>Male</u>	<u>Female</u>
	<u>% Change</u>	<u>% Change</u>
15. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	38	27
16. How is climate different from weather?	31	-26
19. This map shows a railroad network linking major cities in the Midwest. Select the most important rail hub city on the map. Describe how a blizzard in the railroad hub city might affect the regional railroad network.	23	52

Results based on ethnicity were mixed. The number of students that received supplementary instruction was small, and some populations were not represented adequately. The scores of the White population increased the most on questions #4, #15, and #19. All of those questions were constructed response. Hispanic scores improved on questions #5, #14, and #17. Those questions were multiple choice and involved analyzing a map or figure.

V. DISCUSSION

Ethnicity reporting was subject to error. NAEP originally obtained ethnicity information from school records. The categories changed in 2011 to separate Asian from other groups and to add Two or More Races. The NAEP classification of Hispanic included students who also identified as another race/ethnic group. The KGMPA assessment relied on students to self-report, as NAEP does now, and some students struggle to declare race. Many “Two or More Races” would be identified as Hispanic on school records. Additionally, many of the KGMPA students are transplants, so the data does not necessarily provide a good understanding of the local school system and other regional factors.

Some demographic categories used by NAEP could not be identified on a student survey due to the Family Educational Rights and Privacy Act (FERPA). For example, questions could not be asked about disabilities/accommodations, English language learners, or school lunch assistance. Reason leads one to think those students would most likely benefit from supplemental instruction to provide an equitable education. The NAEP data provided a better snapshot of those populations and their needs than this project could assess.

Scaled scores, the key data points reported by NAEP, could not be used for comparison because the KGMPA assessment considered 23 questions, and NAEP scoring methods were unknown. Item Maps showed learning concepts next to scaled scores, and inferences were drawn between learning concepts and test questions. Any references to the achievement levels of Basic, Proficient, and Advanced and the cutoff scores were subject to interpretation, so they were not used. However, they were used to create the

KGMPA assessment along with the difficulty levels of Easy, Medium, and Hard.

Another scoring dilemma was partial credit. NAEP classified partial credit at a particular scaled score/proficiency level, while complete credit was classified at a higher level. The KGMPA evaluation also considered partial credit for one answer and complete credit for two, but only complete credit was reported. The value of partial credit was not examined. Question 10 about historical language patterns was a prime example of how the value of partial credit was missed. Complete credit increased by 8%, but partial credit increased by 40%. Partial credit would be considered on a scored test.

Some comparisons between KGMPA and NAEP gave surprising results, while others were expected. In general, KGMPA pre-intervention scores were higher than NAEP. That may have been because KGMPA is a public charter school and students want to learn or because the test was administered to KGMPA 9th graders and NAEP assessed 8th graders. One noteworthy exception to that general rule was that KGMPA students did not know how to interpret a map and eliminate two irrelevant answers about Spanish-speaking radio stations. However, KGMPA students were much better (28%) at listing two cultural features of immigrant groups. The knowledge was there, but the cognitive skills were lacking.

Supplemental instruction generally helped students gain knowledge and learn cognitive skills. For example, the knowledge of urbanization improved by 37%, and the knowledge of heat islands improved by 4% due to the supplemental lessons. Surprisingly, very few students learned that man-made structures generally retain heat. Regarding cognitive skills, some students learned to read the question carefully and reason through an answer. For example, 44% more students analyzed a map and determined what would

add cost to building a railroad. In addition, 37% more students interpreted a map showing a railroad hub. Railroads are not as common as other transportation modes in the Intermountain West, but students had the skills to interpret the maps and answer the questions correctly despite limited knowledge.

Many of the KGMPA gender-based results matched NAEP results. There were a few exceptions on multiple-choice questions. Female scores dropped on the climate question, while male scores improved by 31%. On a question about hurricanes, Female scores dropped 17%, while Male scores improved by 23%. It seems that female students did not have that knowledge and guessed correctly the first time.

Results from ethnic groups were limited due to the sample size of students that received supplemental instruction. No knowledge results were notable, but Whites improved on constructed responses, and Hispanics improved on multiple-choice questions. That is an indirect statement about the progressive order of thinking skills in an equitable education: identify, describe, and explain. One additional note about ethnicity, the general population of Asians and “Native Hawaiian or other Pacific Islanders” scored high on question #14, which asked about hurricanes. Even a loose association with the ocean brings knowledge all its own.

By design, the NAEP assessments were intended for knowledge evaluation, but they were not intended to be achievement tests or to provide a guide for curriculum. Extracting specific information from NAEP was difficult. Evaluating a test patterned after NAEP questions was challenging. Proficiency levels and scaled scores, key information reported by NAEP, were disregarded due to unknown scoring methods. Despite the challenges of measuring a NAEP-based test, valuable information was

collected question-by-question. Comparisons to NAEP data should be considered with the caveat that any assessment is better than none, and any assessment will have room for improvement.

VI. CONCLUSIONS

This directed research aimed to analyze the world geography knowledge and skills that incoming ninth-grade students “know and do” and to the extent that achievement gaps were present for Black, Hispanic, Asian, and Female students. This study posed the following questions: 1) What is the nature and amount of geography that KGMPA students know coming into ninth-grade world geography, and how does this level of knowledge vary between student groups? 2) How can information about students’ varying geography knowledge and skill levels be applied to instructional strategies, scaffolding, and learning accommodations to fill these gaps? 3) To what extent did the instructional interventions successfully fill the knowledge gap and the skills gaps for identified comparison groups?

To answer these questions, I utilized NAEP data and made comparisons to KGMPA data. Demographically, there were more similarities than differences. KGMPA had more White students and fewer Black and Hispanic students. However, the gender breakdown for both groups was similar. Due to demographic similarities and because both KGMPA and NAEP groups shared four out of five most missed questions, the NAEP data were determined to be valid for comparison.

Intervention strategies were developed to help close the gap between missing content knowledge and cognitive skills. Supplemental lessons were taught about urbanization and heat islands, along with map interpretation and other cognitive skills. Knowledge was then re-tested using the same assessment.

The general results showed improvements. The three questions with the most significant positive and negative changes were noted. The difference in score

improvements was more significant than the difference in declining scores. Students improved at answering constructed response questions if they had the knowledge. Despite instruction about interpreting a map, in very few cases, test scores decreased, indicating that knowledge and skill were unchanged.

Gender results were mixed. Any change more significant than 30% between pre- and post-intervention assessments was noted. Female student scores improved along with Male scores in most cases. In one case, a multiple-choice question, Females guessed wrong more frequently on the post-test.

Disaggregating data by ethnicity produced limited results. Unfortunately, classes changed during the approval process, and the final sample size was small, so the data were not statistically significant. In fact, the test group only included one Black student. However, there were a few interesting notes. White students improved at constructed response questions. Hispanic students improved on multiple-choice questions. Both improvements were due to intervention strategies and were indicative of skill progression.

In general, this study was very informative and very educational. As an educator, I recognize the value of NAEP data in identifying gaps and devising a plan to close those gaps for a certain demographic. Although not intended for that purpose, utilization of NAEP data would simplify finding and filling the gap for any teacher. Regarding classroom instruction, tools such as contextualizing and scaffolding with concentrated effort on specific knowledge and cognitive skills could help students realize their capabilities. In fact, future geography education research could focus on modifying lesson plans based on known gaps to include specific intervention strategies. Maybe

someone will benefit from my work on contextualizing the effect of urbanization on individual quality of life.

Some limitations of the study were the sample size and how the assessment was analyzed. Comparison of KGMPA data to NAEP data was worthwhile but would have been more valuable had ethnicities been represented. Then, the results could have been considered statistically significant. That might require multiple schools from multiple regions. Regarding the method of analysis, mine did not consider partial answers. A different reporting method might report partial answers so results could be compared. Another option would be to have a method to scale scores so overall scores could be compared similarly to scores shown on NAEP data maps.

Future studies might consider the effect of regional knowledge on student scores and further separate content knowledge from cognitive skills. Indeed, regional knowledge is equalized on a national test and due diligence is exhaustive. For my specific test group, I could see that regional knowledge influenced responses and could be considered in future assessments. Cognitive and test-taking skills were another matter. It seems the score differences were more closely related to improved skills rather than increased knowledge.

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APPENDIX SECTION

APPENDIX A: Categorization of NAEP questions	42
APPENDIX B: NAEP pre, student, and post-questions	46
APPENDIX C: Supplemental lessons	53
APPENDIX D: KGMPA Screening data compared to NAEP data.....	62
APPENDIX E: Comparison of KGMPA pre-intervention and post-intervention test scores.....	64
APPENDIX F: NAEP 8 th grade SWKABAT's	66
APPENDIX G: Item Maps.....	68
APPENDIX H: IRB passive consent letter to parents/guardians.....	71
APPENDIX I: IRB approval letter	72

APPENDIX A: Categorization of NAEP questions

KGMPA #	# on full list	Question	Score	ID #	Description	Grade	Year	Block	Difficulty	Type	Content Classification	Online	Know	Do-Task - Verb	Do	Diagram/ Photograph
1	1	1. Look at the diagram. The tilt of the Earth's axis has a direct effect on the	260	2018-8G1 #1	Use diagram to identify effect of Earth's tilt	8	2018	8G1	Easy	MC	Space and Place	No	Interpret diagram, tilt of earth, axis, seasons, effect	Interpret/Identify tilt	Identify	Diagram-Earth in relation to Sun
2	2	2. Heat from the Sun is important in the water cycle because it causes	201	2018-8G1 #2	Identify a key aspect of water cycle	8	2018	8G1	Easy	MC	Space and Place	No	Interpret diagram, Water cycle, heat from sun causes evaporation, aspect	Interpret/identify heat causes evaporation	Interpret/identify	Diagram-Water Cycle
3	94	3. What would a scientist probably study to predict where acid rain would fall?		1994-8G4 #3	How to Predict Where Acid Rain Falls	8	1994	8G4	Hard	MC	Environment and Society	Yes	acid rain, wind patterns, predict	Predict where	Predict	-
4	24	4. When immigrant groups migrate from one place to another, they often bring along features of their traditional culture, such as food or sports. Name TWO other cultural features that immigrant groups bring with them during a migration.	331	2018-8G6 #4	Name two other cultural features that immigrant groups bring with them during a migration	8	2018	8G6	Medium	SCR	Spatial Dyn. & Connections	No	Cultural features, immigrant, migration	Name two Cultural Features	Identify	-
5	6	5. What major beneficial effect does the summer monsoon have on the economy of India?	287	2018-8G1 #6	Use map to explain effect of a climate pattern on weather	8	2018	8G1	Hard	SCR	Environment and Society	No	Interpret map, summer monsoon, India's economy	Identify benefit	Identify	Map - Illustration-India Monsoon
6a	106	6a. This map would be most useful to a		1994-8G4 #16	Arctic Circle Map: Who is it Useful to	8	1994	8G4	Medium	MC	Space and Place	Yes	Interpret map, Arctic Circle, projection, great circle route, who would use it	Identify who	Identify	Map-Polar Planar
6b	107	6b. Latitude on this map is represented by		1994-8G4 #17	Arctic Circle Map: How is Lat. Shown	8	1994	8G4	Medium	MC	Space and Place	Yes	Interpret map, Arctic Circle, projection, Lat/Long, represented	Identify	Identify	Map-Polar Planar
7a	27	7a. What type of land use is shown in the photograph?	237	2018-8G6 #7	Identify land use (agriculture) from a photo	8	2018	8G6	Easy	SCR	Spatial Dyn. & Connections	No	Interpret photograph, land use, its importance	Identify land use & Explain	Identify& Explain	Photograph
7b	27	7b. How is this kind of land use important to society?	287	2018-8G6 #7	Identify land use (agriculture) from a photo	8	2018	8G6	Easy	SCR	Spatial Dyn. & Connections	No				
8	114	8. In the mid-nineteenth century, before railroads were constructed, people in the United States transported commercial materials, such as timber and coal, over long distances primarily by means of		1994-8G6 #7	Identify Pre-Rail Transporters	8	1994	8G6	Medium	MC	Spatial Dyn. & Connections	Yes	Mid-nineteenth century, pre-rail, transporters,	Identify	Identify	-
9	29	9. Based on the map, which of the following areas of Illinois has the densest population?	276	2018-8G6 #9	Analyze population density in Illinois based on map of congressional districts	8	2018	8G6	Easy	MC	Space and Place	No	Congressional districts, population density	Interpret/Analyze population density	Analyze	Map-Illinois Congressional Districts

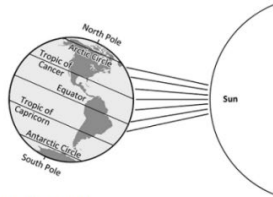
KGMPA #	# on full list	Question	Score	ID #	Description	Grade	Year	Block	Difficulty	Type	Content Classification	Online	Know	Do-Task - Verb	Do	Diagram/ Photograph
10	105	10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer.		1994-8G4 #15	Map: Explain Language Patterns	8	1994	8G4	Hard	ECR	Spatial Dyn. & Connections	No	Historical trends, language patterns,	Explain pattern	Explain	Map-Latin America Historical Language Families
11	31	11. The map best supports which two of the following conclusions?	286	2018-8G6 #11	Interpret map of Spanish language radio stations to draw conclusion about cultural influences	8	2018	8G6	Easy	MC	Space and Place	No	Interpret map, cultural influences, draw conclusion	Support conclusions	Interpret & support	Map-US Spanish-Language Radio Stations
12a	32	12. If it is 3:15 pm on August 2 in Anchorage, Alaska, what DATE is it in Miami Florida?	309	2018-8G6 #12	Understand time zones	8	2018	8G6	Medium	SR	Space and Place	No	Interpret Map, time zones, International Date Line, Interpret map	Determine Time Zones/dates	Determine	Map – Time zone/International Date Line
12b	32			2018-8G6 #12	Understand time zones	8	2018	8G6	Medium	SR	Space and Place	No				
13	33	13. Which of the following statements best explains the characteristics of this landscape?	258	2018-8G6 #13	Terracing for agriculture	8	2018	8G6	Easy	MC	Space and Place	No	Terraced farming, landscape, explain	Explain characteristics	Explain	Photo
14	34	14. Select the quadrant in which the storm is likely to cause the most damage.	244	2018-8G6 #14	Analyze satellite image of hurricane to identify strongest quadrant	8	2018	8G6	Easy	SR	Space and Place	No	Satellite image, hurricane, destructive, quadrant	Analyze Satellite Image	Analyze	Satellite Image
15a	35	15a. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	373	2018-8G6 #15	Discuss impacts of urbanization	8	2018	8G6	Hard	SCR	Spatial Dyn. & Connections	No	Positive, negative, effect, expansion, quality of life, Beijing, impacts of urbanization	Describe effect	Describe	Map Urbanization of Beijing
15b	35		373	2018-8G6 #15	Discuss impacts of urbanization	8	2018	8G6	Hard	SCR	Spatial Dyn. & Connections	No				
16	36	16. How is climate different from weather?	304	2018-8G6 #16	Climate and weather difference	8	2018	8G6	Medium	MC	Space and Place	No	Climate v. weather	Identify Differences	Identify	-
17	37	17. The dark-shaded areas on the map represent which of the following bioregions (biomes)?		2018-8G6 #17	Identify a biome on a map	8	2018	8G6	Hard	MC	Space and Place	No	Biome, identify	Identify Biome	Identify	Map - Biome
18	18	18. Why is the temperature at A higher than in the surrounding areas?	342	2018-8G1 #18	Use temperature gradient map to explain impact of human activity	8	2018	8G1	Hard	SCR	Environment and Society	No	Temperature gradient map, impact, human activity	Explain impact	Identify	Map-Temperature gradient
19a	39	19a. This map shows a railroad network linking major cities in the Midwest. Select the most important rail hub city on the map.	280	2018-8G6 #19	Describe how a blizzard in Chicago might affect the railroad network	8	2018	8G6	Easy	SCR	Spatial Dyn. & Connections	No	Rail hub, network, disruption, cities, Midwest, important	Identify a Rail Hub and explain affects of disruption	Locate	Map-Railroad network
19b	39	19b. Describe how a blizzard in the railroad hub city might affect the regional railroad network.		2018-8G6 #19	Describe how a blizzard in Chicago might affect the railroad network	8	2018	8G6	Easy	SCR	Spatial Dyn. & Connections	No				

<u>KGMPA</u> #	# on full list	Question	Score	ID #	Description	Grade	Year	Block	Difficulty	Type	Content Classification	Online	Know	Do-Task - Verb	Do	Diagram/ Photograph
20	20	20. List TWO features that indicate that the village shown in the photograph is located in an area with a hot, dry climate. Explain how those features indicate that the climate is hot and dry.		2018-8G1 #20	Use photo to explain how built environment reflects climate	8	2018	8G1	Hard	SCR	Environment and Society	No	Hot dry climate, features, built environments-how they reflect climate	Analyze	Analyze	Photo
21	38	21. Select the portion of the map that contains the Cajun region.		2018-8G6 #18	Use a map to identify a cultural region of the US	8	2018	8G6	Hard	SR	Space and Place	No	Cultural region, Cajun is	Identify cultural region	Identify or explain	Map-US Regions
22	11	22. Which crops grow only in a tropical climate?		2018-8G1 #11	Identify crops that grow in a particular climate	8	2018	8G1	Easy	MC	Space and Place	No	Crops, climates-types of	Identify crops	Identify	Identify
23	88	23. Look at the map below, which shows three possible routes for a railroad line that will be built to connect Red City with Blue town. Which route would be the least expensive to construct? Give two reasons why the route you chose would be the least expensive.	253	2001-8G8 #14	Draw Train Route on Map	8	2001	8G8	Easy	SCR	Spatial Dyn. & Connections	No	Interpret map, Railroad Route, expense of building,	Choose, give reasons	Support	Explain

APPENDIX B: NAEP pre, student, and post questions

Pre, Student & Post Questionnaire	
<p>There are three sections to this questionnaire. First, the pre-questions- in this section you will tell us about yourself and your family. The second section includes the actual geography questions. Finally, the third section, the post-questions - In this section you will tell us about your experience with geography in school and your experience taking this test.</p>	
<p>* Required</p>	
<p>Pre Geography Student Questionnaire</p>	<p>In this section you will tell us about yourself and your family. Please answer questions about your home based on where you live most of the time during the school year. The section has 12 questions.</p>
<p>1. 1. Are you Hispanic or Latino? Select ALL that apply. *</p> <p>Check all that apply.</p> <p><input type="checkbox"/> A. No, I am not Hispanic or Latino.</p> <p><input type="checkbox"/> B. Yes, I am Mexican, Mexican American or Chicano.</p> <p><input type="checkbox"/> C. Yes, I am Puerto Rican or Puerto Rican American.</p> <p><input type="checkbox"/> D. Yes, I am Cuban or Cuban American.</p> <p><input type="checkbox"/> E. Yes, I am from some other Hispanic or Latino background.</p>	
<p>2. 2. Which of the following best describes you? Select ALL that apply. *</p> <p>Check all that apply.</p> <p><input type="checkbox"/> A. White</p> <p><input type="checkbox"/> B. Black or African American</p> <p><input type="checkbox"/> C. Asian</p> <p><input type="checkbox"/> D. American Indian or Alaska Native</p> <p><input type="checkbox"/> E. Native Hawaiian or other Pacific Islander</p>	
<p>3. 3. About how many books are there in your home? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. Few (0-10)</p> <p><input type="radio"/> B. Enough to fill one shelf (11-25)</p> <p><input type="radio"/> C. Enough to fill one bookcase (26-100)</p> <p><input type="radio"/> D. Enough to fill several bookcases (more than 100)</p>	
<p>4. 4. Is there a computer at home that you use? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	
<p>5. 5. Do you have the following in your home? Select ALL that apply. *</p> <p>Check all that apply.</p> <p><input type="checkbox"/> A. Access to the Internet</p> <p><input type="checkbox"/> B. Clothes dryer just for your family</p> <p><input type="checkbox"/> C. Dishwasher</p> <p><input type="checkbox"/> D. More than one bathroom</p> <p><input type="checkbox"/> E. Your own bedroom</p>	
<p>6. 6. About how many pages a day do you have to read in school and for homework? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. 5 or fewer</p> <p><input type="radio"/> B. 6-10</p> <p><input type="radio"/> C. 11-15</p> <p><input type="radio"/> D. 16-20</p> <p><input type="radio"/> E. More than 20</p>	
<p>7. 7. How often do you talk about things you have studied in school with someone in your family? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. Never or hardly ever</p> <p><input type="radio"/> B. Once every few weeks</p> <p><input type="radio"/> C. About once a week</p> <p><input type="radio"/> D. Two or three times a week</p> <p><input type="radio"/> E. Every day</p>	<p>10. 10. How far in school did your father go? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. she did not finish high school</p> <p><input type="radio"/> B. She graduated from high school.</p> <p><input type="radio"/> C. She had some education after high school.</p> <p><input type="radio"/> D. She graduated from college.</p> <p><input type="radio"/> E. I don't know.</p>
<p>8. 8. How many days were you absent from school in the last month? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. None</p> <p><input type="radio"/> B. 1 or 2 days</p> <p><input type="radio"/> C. 3 or 4 days</p> <p><input type="radio"/> D. 5-10 days</p> <p><input type="radio"/> E. More than 10 days</p>	<p>11. 11. How often do people in your home talk to each other in a language other than English? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. Never</p> <p><input type="radio"/> B. Once in a while</p> <p><input type="radio"/> C. About half of the time</p> <p><input type="radio"/> D. All or most of the time</p>
<p>9. 9. How far in school did your mother go? *</p> <p>Mark only one oval.</p> <p><input type="radio"/> A. she did not finish high school</p> <p><input type="radio"/> B. She graduated from high school.</p> <p><input type="radio"/> C. She had some education after high school.</p> <p><input type="radio"/> D. She graduated from college.</p> <p><input type="radio"/> E. I don't know.</p>	<p>12. 12. Do the following people live in your home? *</p> <p>Check all that apply.</p> <p><input type="checkbox"/> A. Mother</p> <p><input type="checkbox"/> B. Stepmother</p> <p><input type="checkbox"/> C. Foster mother or other female legal guardian</p> <p><input type="checkbox"/> D. Father</p> <p><input type="checkbox"/> E. Stepfather</p> <p><input type="checkbox"/> F. Foster father or other male legal guardian</p>
<p>Questions</p> <p>You will have 20 minutes to answer a series of questions about geography. You should think carefully about your answers, and you should use the entire 20 minutes to complete the questions.</p> <p>You will be asked to respond to several different types of questions. Some of the questions will require you to choose the best answer. For other questions, you will be asked to write short answers. Also, you may be asked to answer other questions by writing longer, more detailed responses.</p> <p>Think carefully about each question and make your answers as complete as possible, using as many lines as you need.</p> <p>If you finish before time is called, be sure to read your work again and change anything that you think will make your answers better.</p>	

13. 1. Look at the diagram. The tilt of the Earth's axis has a direct effect on the *

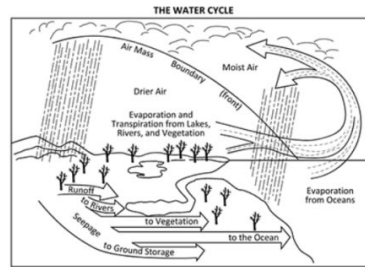


Mark only one oval.

- ☐ A. distance of the Earth from the Sun
☐ B. length of the year
☐ C. speed of the Earth's rotation
☐ D. seasons of the year

14. 2. Heat from the Sun is important in the water cycle because it causes *

Question refers to the following diagram.



Mark only one oval.

- ☐ A. evaporation
☐ B. ground storage
☐ C. runoff
☐ D. seepage

15. 3. What would a scientist probably study to predict where acid rain would fall? *

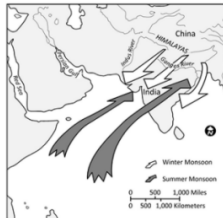
Mark only one oval.

- ☐ A. the atomic structures of sulphur, nitrogen, and oxygen
☐ B. mass-transit systems that serve major cities
☐ C. wind patterns that prevail over major manufacturing areas
☐ D. the location of sewage-treatment plants

16. 4. When immigrant groups migrate from one place to another, they often bring along features of their traditional culture, such as food or sports. Name TWO other cultural features that immigrant groups bring with them during a migration.

17. 5. What major beneficial effect does the summer monsoon have on the economy of India? *

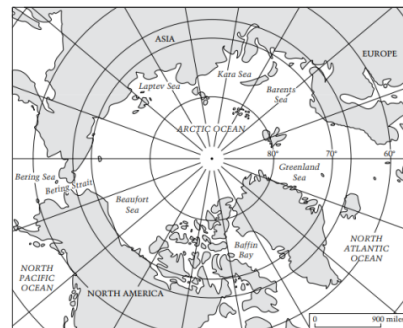
Question refers to the following map.



Mark only one oval.

- ☐ A. It aids mineral extraction.
☐ B. It is profitable for tourism.
☐ C. It is profitable for the fishing industry.
☐ D. It brings rain for the crops.

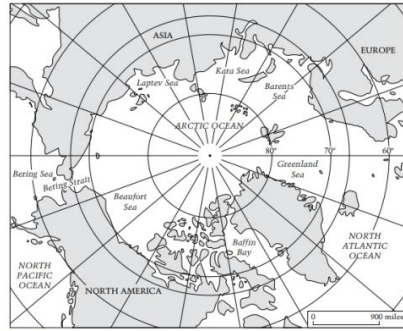
18. 6a. This map would be most useful to a *



Mark only one oval.

- ☐ A. pilot flying from Europe to South America.
☐ B. pilot flying from Canada to Scandinavia.
☐ C. person sailing to Antarctica.
☐ D. person sailing in tropical seas.

19. 6b. Latitude on this map is represented by *



Mark only one oval.

- ☐ A. circles.
☐ B. shaded areas.
☐ C. straight lines.
☐ D. convergent lines.

20. 7a. What type of land use is shown in the photograph? *

The photograph shows a type of land use.



21. 7b. How is this kind of land use important to society? *

The photograph shows a type of land use.



22. 8. In the mid-nineteenth century, before railroads were constructed, people in the United States transported commercial materials, such as timber and coal, over long distances primarily by means of

Mark only one oval.

- ☐ A. rivers and canals.
☐ B. turnpikes and freeways.
☐ C. pack horses and mule trains.
☐ D. ox carts and Conestoga wagons.

23. 9. Based on the map, which of the following areas of Illinois has the densest population? *

Illinois Congressional Districts, 2011



Mark only one oval.

- ☐ A. Northeast
☐ B. Southeast
☐ C. Northwest
☐ D. Southwest

24. 10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer. *



25. 11. The map best supports which two of the following conclusions? *

The map shows the distribution of Spanish-language radio stations in the United States.



Check all that apply.

- ☐ A. The majority of the Spanish-speaking population in the United States lives in Florida.
☐ B. The southwestern border states are culturally influenced by Mexico.
☐ C. Many people in central and southern California speak Spanish.
☐ D. The Spanish settled in the Northeast during the colonial period.

26. 12a. If it is 3:15 pm on August 2 in Anchorage, Alaska, what DATE is it in Miami Florida? *



Mark only one oval.

- ☐ A. August 1
☐ B. August 2
☐ C. August 3
☐ D. August 4

27. 12b. If it is 3:15 pm on August 2 in Anchorage, Alaska, what TIME is it in Miami Florida? *



Mark only one oval.

- ☐ A. 11:15 am
☐ B. 1:15 pm
☐ C. 5:15 pm
☐ D. 7:15 pm

28. 13. Which of the following statements best explains the characteristics of this landscape? *

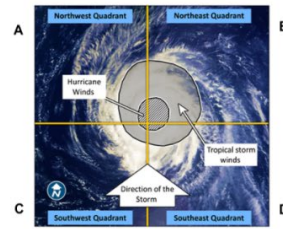
The photo shows a landscape in Vietnam.



Mark only one oval.

- ☐ A. Animals have eaten the plants and exposed the soil.
☐ B. The land has eroded, and parts of the mountain have disappeared.
☐ C. People have created small areas of flat land for terraced farming.
☐ D. Trees cannot grow on the mountain, so rock layers are exposed.

29. 14. Select the quadrant in which the storm is likely to cause the most damage. *

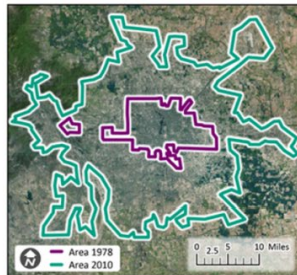


Mark only one oval.

- ☐ A. Northwest Quadrant
☐ B. Northeast Quadrant
☐ C. Southwest Quadrant
☐ D. Southeast Quadrant

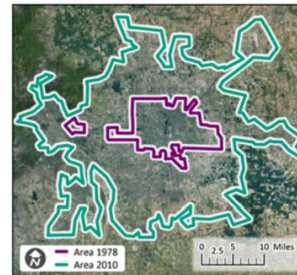
30. 15a. Give one POSITIVE effect that this expansion could have on the quality of life of Beijing residents. *

The image shows the expansion of Beijing, China, from 1978 to 2010.



31. 15b. Give one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents. *

The image shows the expansion of Beijing, China, from 1978 to 2010.

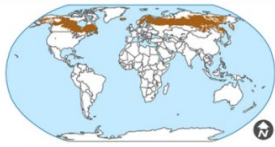


32. 16. How is climate different from weather? *

Mark only one oval.

- ☐ A. Climate is a pattern of weather over a long period of time.
☐ B. Weather is a pattern of climate over a long period of time.
☐ C. Climate is a pattern of weather that occurs within a small geographic area.
☐ D. Weather is a pattern of climate that mostly occurs in tropical areas.

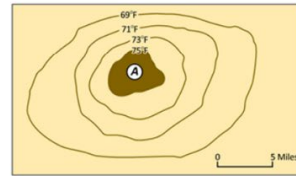
33. 17. The dark-shaded areas on the map represent which of the following bioregions (biomes)?



Mark only one oval.

- ☐ A. Desert
☐ B. Grassland
☐ C. Rain forest
☐ D. Boreal forest

34. 18. Why is the temperature at A higher than in the surrounding areas?



It is midnight in a large city located at A on the diagram. The area shown on the diagram is located on a plain.

35. 19a. This map shows a railroad network linking major cities in the Midwest. Select the most important rail hub city on the map.



Mark only one oval.

- ☐ Minneapolis
☐ Milwaukee
☐ Chicago
☐ Grand Rapids
☐ Detroit
☐ Toledo
☐ Kansas City
☐ Springfield
☐ Saint Louis
☐ Indianapolis
☐ Cincinnati

36. 19b. Describe how a blizzard in the railroad hub city might affect the regional railroad network.



37. 20. List TWO features that indicate that the village shown in the photograph is located in an area with a hot, dry climate. Explain how those features indicate that the climate is hot and dry.



38. 21. Select the portion of the map that contains the Cajun region.



Mark only one oval.

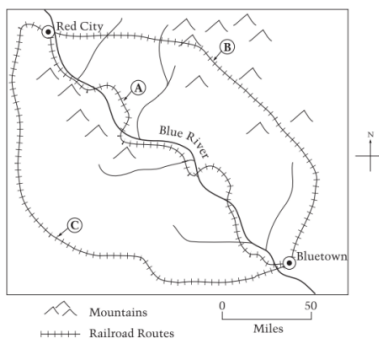
- ☐ A
☐ B
☐ C
☐ D
☐ E

39. 22. Which crops grow only in a tropical climate?

Mark only one oval.

- ☐ A. Oranges, lemons, and limes
☐ B. Barley, oats, and apples
☐ C. Cocoa beans, bananas, and papayas
☐ D. Potatoes, wheat, and corn

40. 23. Look at the map below, which shows three possible routes for a railroad line that will be built to connect Red City with Blue town. Which route would be the least expensive to construct? Give two reasons why the route you chose would be the least expensive.



Post Geography
Student
Questionnaire

In this section you will tell us about your geography experience. Please answer questions about when you learned geography and taking this assessment. The section has 8 questions.


APPENDIX C: Supplemental lessons

Urbanization Supplemental Lesson

Need:

Questions from McGraw Hill – Boehm

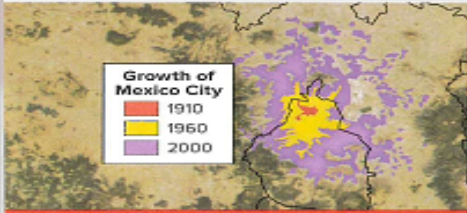
Historical and current photo of Lindon, Utah



Why Geography Matters: Mexico


challenges of urbanization


Rapid urban growth brings challenges to city governments around the world as they struggle to provide housing, services, infrastructure, and jobs, as well as curb pollution. Governments have limited funds to spend on basic upkeep and services. As a result, cities like **Mexico City** experience challenges such as environmental problems and poverty.



Growth of Mexico City

- 1910
- 1960
- 2000





Why has Mexico City grown so fast?

Today's Mexico City is the result of years of rural-to-urban migration by people looking for better economic opportunities. The first influx of these economic migrants coincided with rapid industrialization in the late nineteenth century. The pull forces of industrial jobs and the push forces of rural land policies drew people to Mexico City. The rural poor moved to the city as land was purchased around them by wealthy landowners. Similar factors continue to bring economic migrants to Mexico City seeking a better life for themselves and their families.

1. Human Systems What are the pull factors influencing migration to Mexico City? How are these different from the push factors that bring people to the city?

What is the social impact of rapid growth?

Economic migrants move to the city expecting to find jobs. Unfortunately, unemployment is common. Some migrants find temporary jobs or work in the informal sector—"underground economies" that are not taxed or regulated by the government. People often do not have access to health care and education. Lack of infrastructure—housing, electrical grids, sewer facilities, and roads—to support the growing population leads to the development of shantytowns. The influx of people to Mexico City puts enormous pressures on the natural environment. Underground water aquifers are being depleted, causing the city to sink. Inadequate sewer facilities lead to polluted land and water. Full of rubbish, landfills have been closed. Unregulated by the government, shantytowns are built in environmentally sensitive areas such as hill slopes.

2. Environment and Society What challenges has rural-to-urban migration created for the government of Mexico City?

What can be done?

Government agencies and other groups continue to establish initiatives and special projects to address these challenges. The government of Mexico and public-private partnerships are investing in sustainable and environmentally friendly housing development. Plan Verde (Green Plan) includes a range of programs to promote environmental sustainability by easing traffic congestion, reducing greenhouse gas emissions, and encouraging public transportation, cycling, and walking options. The Mexico City Climate Action Program provides funding for sustainable housing as well as renewable energy programs.

3. Human Systems Write a paragraph explaining how environmentally friendly policies could improve life in Mexico City.

174

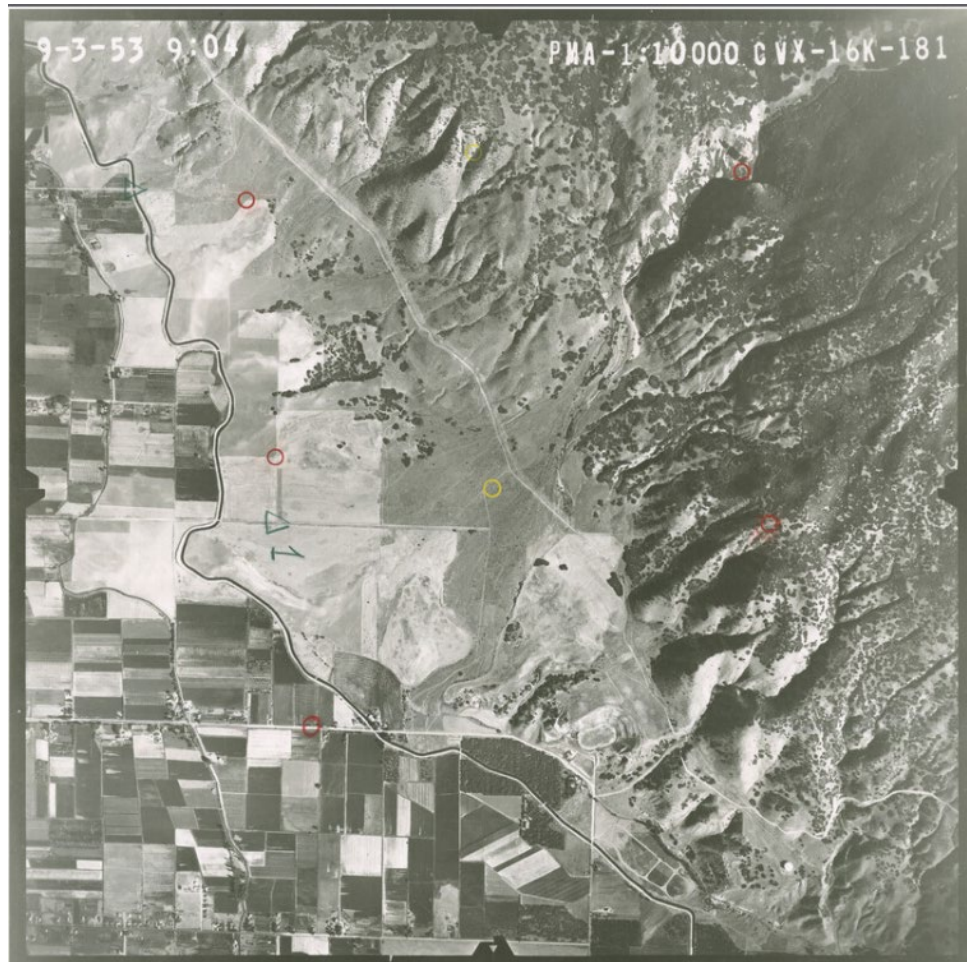
Sprawling Mexico City TODAY



THERE'S MORE **ONLINE** 

VIEW a map of the world's megacities • **WATCH** a video of Mexico's urban sprawl

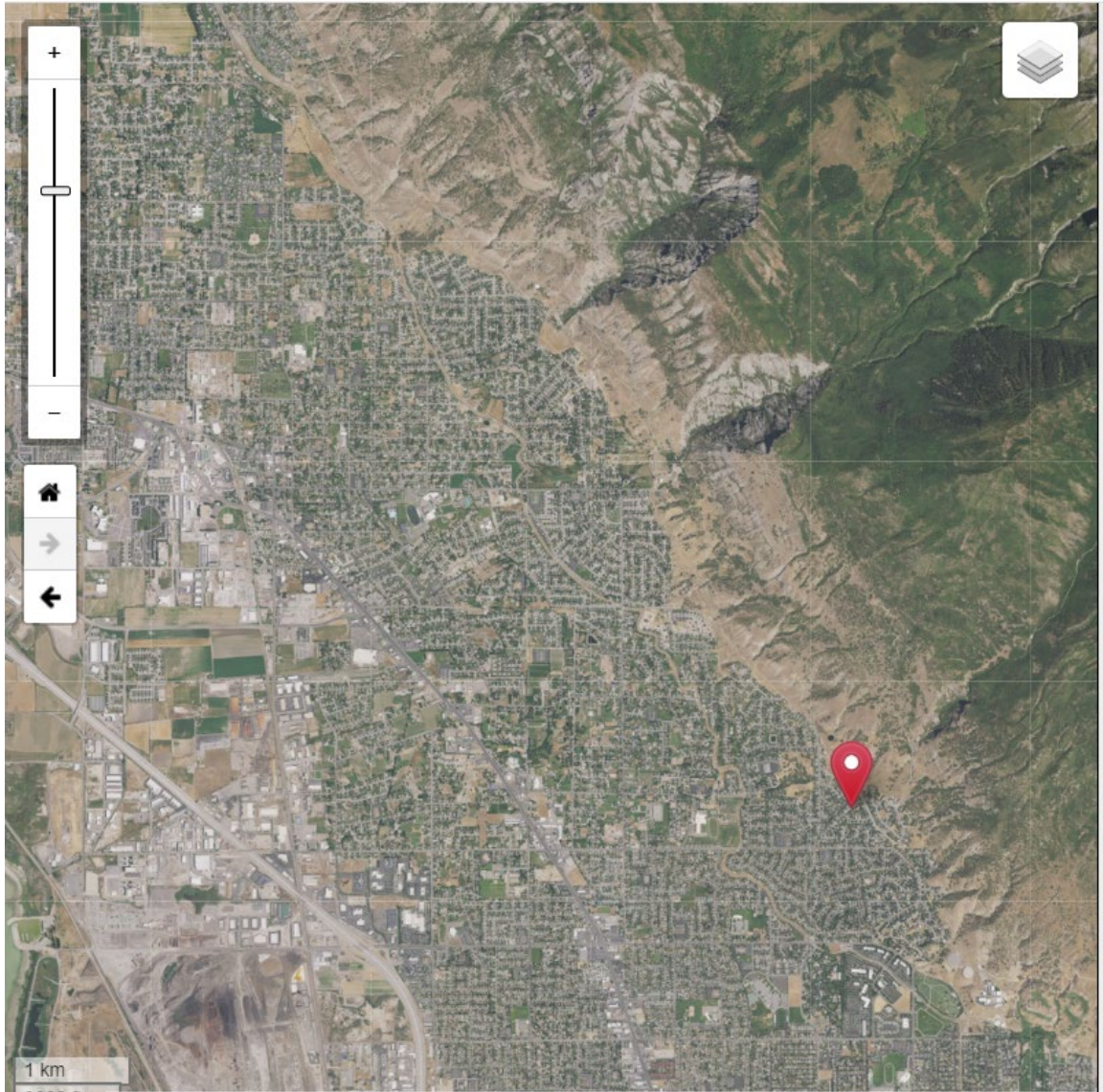
Why Geography Matters 175



1953 aerial photograph of Lindon, Utah

SOURCE:

<https://imagery.geology.utah.gov/pages/search.php?search=%21collection637>



2022 Aerial photograph of Lindon, Utah
SOURCE: Google Earth

Heat Islands Supplemental Lesson

Need:

Isoline/Heat Island PPT/Slides

Examples of isoline maps to show students.

Copies of a map for each student so they can draw isolines. OR project one of the heat maps on the whiteboard and have students draw isolines on the whiteboard.

Skyline view of Salt Lake City, Utah

Bird's-eye view of Salt Lake City, Utah

ISOLINE MAP & HEAT ISLANDS

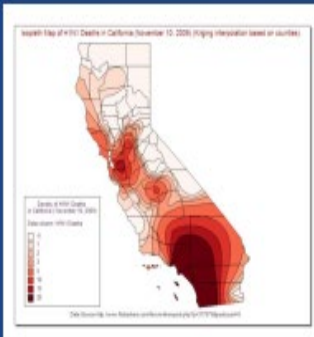
Isoline maps

- A Thematic map with lines that connect points of equal value
- A map that shows the depth of something by using curvy lines
- Each line represents a different depth or temperature
- Lines that are close together show more depth, lines further apart represent less depth
- What could be strengths of this type of map?
- What could be the weaknesses of this type of map?
- Examples: Elevation, temperature, disease, infection, earthquake

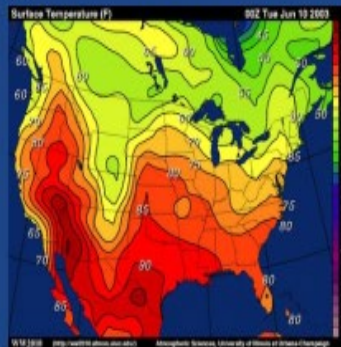
Isoline & Choropleth



Isoline & Choropleth



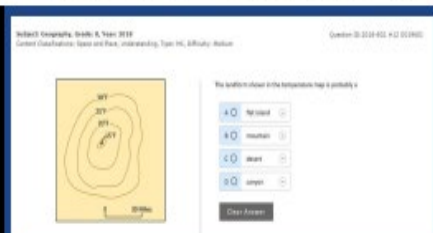
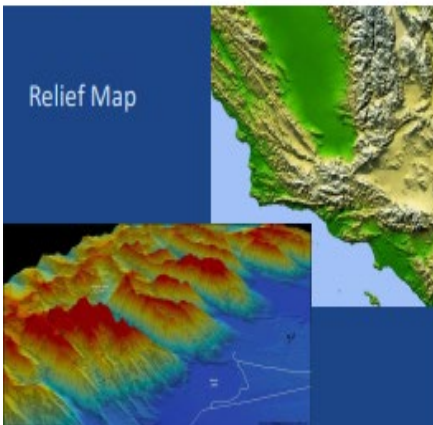
Isoline



Contour Map



Relief Map





Bird's-eye View of Salt Lake City, Utah



Skyline View of Salt Lake City, Utah

Test Taking Supplemental Lesson

Need:
Test Taking PPT/Slides

**How to: Short Answer,
Constructed Response,
Free Response, & Mini-
Essay Questions**
Task Verbs

Expected:

- Full Sentences
- Capitalization
- Punctuation
- **NO** idk or leaving it blank



HOW TO Answer the Prompt



1. Read the question carefully.
2. Reread the question.
3. Underline the action verb, i.e. compare/contrast, identify/illustrate, make/develop.
4. Ask yourself, "How many sentences will this require?" etc. "The teacher is silly or not?"
5. Ask yourself, "What are they really asking me to demonstrate my understanding of?" What are they not asking for?"
6. What essential terminology is in this question?
7. What specific examples apply and list them in the question. List...
8. There dump your brain and make a plan on paper (usually about 1 min) The better the plan, the better the answer.
9. Reread the question.
10. Don't answer the reader thinks the way you do. Write it like you would be your grandmother and communicate everything.
11. Use Rhetoric is required not including the question in the response.
12. Use Rhetoric is required not including the question in the response.
13. Read the question.
14. Reread the question. Are you answering what was asked?
15. Reread YOUR answer making sure the facts you made in your head are written on paper.
16. Fill in missing facts and any gaps of understanding.
17. When you think you are finished, return to 1.

IDENTIFY - 1 Sentence

- Proves you can identify/detect information.
- Simply say what the question is asking for in a full sentence.

DEFINE - 2 Sentences

- Proves you know definitions.
- Give the definition of what is asked for in a complete sentence.
- Giving an example if correct, appropriate, and relevant to the topic of the question can help with this.
- LIKE...

DESCRIBE- 3 Sentences

- Proves you know a concept.
- Describe is more specific as it requires details.
- "Paint a verbal picture"
- Fully illustrate how something works or worked.
- Several detailed sentences are necessary - a short paragraph
- Provide the relevant characteristics of a specified topic.
- Describe will be the easiest points.
- DESCRIBE is often paired with IDENTIFY.

EXPLAIN - 4 Sentences

- Explain questions ask students to provide information about how or why a relationship, process, pattern, position, or outcome occurs, using evidence and/or reasoning.
- More involved than describe.
- Must provide understanding of the concept and 1 more step.
 - Use the word **because**
 - Show **steps and steps**
- Explain means to write the answer to the prompt, followed by **demonstrating the results** of your initial answer. This means you would identify a term, concept, fact, situation, etc. followed by giving the results.
- Stretch your answer as far as you reasonably can.

COMPARE- 3 Sentences

- Find similarities between two concepts
- Find differences between two concepts



Ex. Agriculture: Subsistence v. Commercial farmer.

Same: both are farming, producing food,

Different: Subsistence- labor intensive, yield feeds own family, farms are small,
not for a profit, typically in LDC's, ex. rice paddy in Thailand

Commercial- advanced technology used, farms are large, yield grown to sell and make a profit, typically in MDC's, ex. corn in USA

DISCUSS - 4 Sentences

- Proves you know a concept from many perspectives.
- Describe is more specific as it requires details.
- "Paint a verbal picture"
- Fully illustrate how something works or worked.
- Several detailed sentences are necessary - a short paragraph
- Provide the relevant characteristics of a specified topic.

Prompt Verbs

Task/Verb	# of Sentences	What it means...
Identify	1	Simply say what the question is asking for in a full sentence. No explanation needed.
Define	1 or 2	What you need to define AND include an example.
Describe	2	Describe all perspectives.
Explain	3	Use specific details, discuss the logical connections or cause and effects of concepts, themes, or events.
Compare	3	Find the similarities and differences and talk about them.
Discuss	4	Explore the relationship between two , or more, different concepts and how they fit into a larger concept. Often requires Identification, definition, or examples as part of a good discussion. Taking both points of view, debate about something using details.

APPENDIX D: KGMPA screening data compared to the NAEP data.

Question	KGMPA % Correct	NAEP% Correct	Difference
1. Look at the diagram. The tilt of the Earth's axis has a direct effect on the	88	69	19
2. Heat from the Sun is important in the water cycle because it causes	98	93	5
3. What would a scientist probably study to predict where acid rain would fall?	45	36	9
4. When immigrant groups migrate from one place to another, they often bring along features of their traditional culture, such as food or sports. Name TWO other cultural features that immigrant groups bring with them during a migration.	50	22	28
5. What major beneficial effect does the summer monsoon have on the economy of India?	60	61	-1
6a. This map would be most useful to a	53	46	7
6b. Latitude on this map is represented by	55	48	7
7. What type of land use is shown in the photograph? Why is it important?	72	49	23
8. In the mid-nineteenth century, before railroads were constructed, people in the United States transported commercial materials, such as timber and coal, over long distances primarily by means of	42	56	-14
9. Based on the map, which of the following areas of Illinois has the densest population?	79	63	16
10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer.	5	2	3
11. The map best supports which two of the following conclusions?	23	45	-22
12. If it is 3:15 pm on August 2 in Anchorage, Alaska, what DATE is it in Miami Florida?	64	31	33
13. Which of the following statements best explains the characteristics of this landscape?	89	72	17
14. Select the quadrant in which the storm is likely to cause the most damage.	80	77	3

15. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	18	8	10
16. How is climate different from weather?	73	50	23
17. The dark-shaded areas on the map represent which of the following bioregions (biomes)?	63	40	23
18. Why is the temperature at A higher than in the surrounding areas?	5	1	4
19. This map shows a railroad network linking major cities in the Midwest. Select the most important rail hub city on the map.	41	44	-3
20. List TWO features that indicate that the village shown in the photograph is located in an area with a hot, dry climate. Explain how those features indicate that the climate is hot and dry.	19	9	10
21. Select the portion of the map that contains the Cajun region.	33	24	9
22. Which crops grow only in a tropical climate?	84	74	10
23. Look at the map below, which shows three possible routes for a railroad line that will be built to connect Red City with Blue town. Which route would be the least expensive to construct? Give two reasons why the route you chose would be the least expensive.	47	36	11

APPENDIX E: Comparison of KGMPA pre-intervention and post-intervention test scores.

Complete Question	KGMPA PRE % Correct	KGMPA POST % Correct	Difference
1. Look at the diagram. The tilt of the Earth's axis has a direct effect on the	88.5	88.5	0
2. Heat from the Sun is important in the water cycle because it causes	100	100	0
3. What would a scientist probably study to predict where acid rain would fall?	53.8	65.4	11.6
4. When immigrant groups migrate from one place to another, they often bring along features of their traditional culture, such as food or sports. Name TWO other cultural features that immigrant groups bring with them during a migration.	53.8	56	2.2
5. What major beneficial effect does the summer monsoon have on the economy of India?	65.4	64	-1.4
6a. This map would be most useful to a	57.7	48	-9.7
6b. Latitude on this map is represented by	50	48	-2
7. What type of land use is shown in the photograph? Why is it important?	76.9	60	-16.9
8. In the mid-nineteenth century, before railroads were constructed, people in the United States transported commercial materials, such as timber and coal, over long distances primarily by means of	38.5	44	5.5
9. Based on the map, which of the following areas of Illinois has the densest population?	65.4	72	6.6
10. What historical trends explain the language patterns shown in the map below? Be as specific as possible in your answer.	7.7	3	-4.7
11. The map best supports which two of the following conclusions?	42.3	29.2	-13.1
12. If it is 3:15 pm on August 2 in Anchorage, Alaska, what DATE is it in Miami Florida?	42.3	56	13.7
13. Which of the following statements best explains the characteristics of this landscape?	84.6	88	3.4

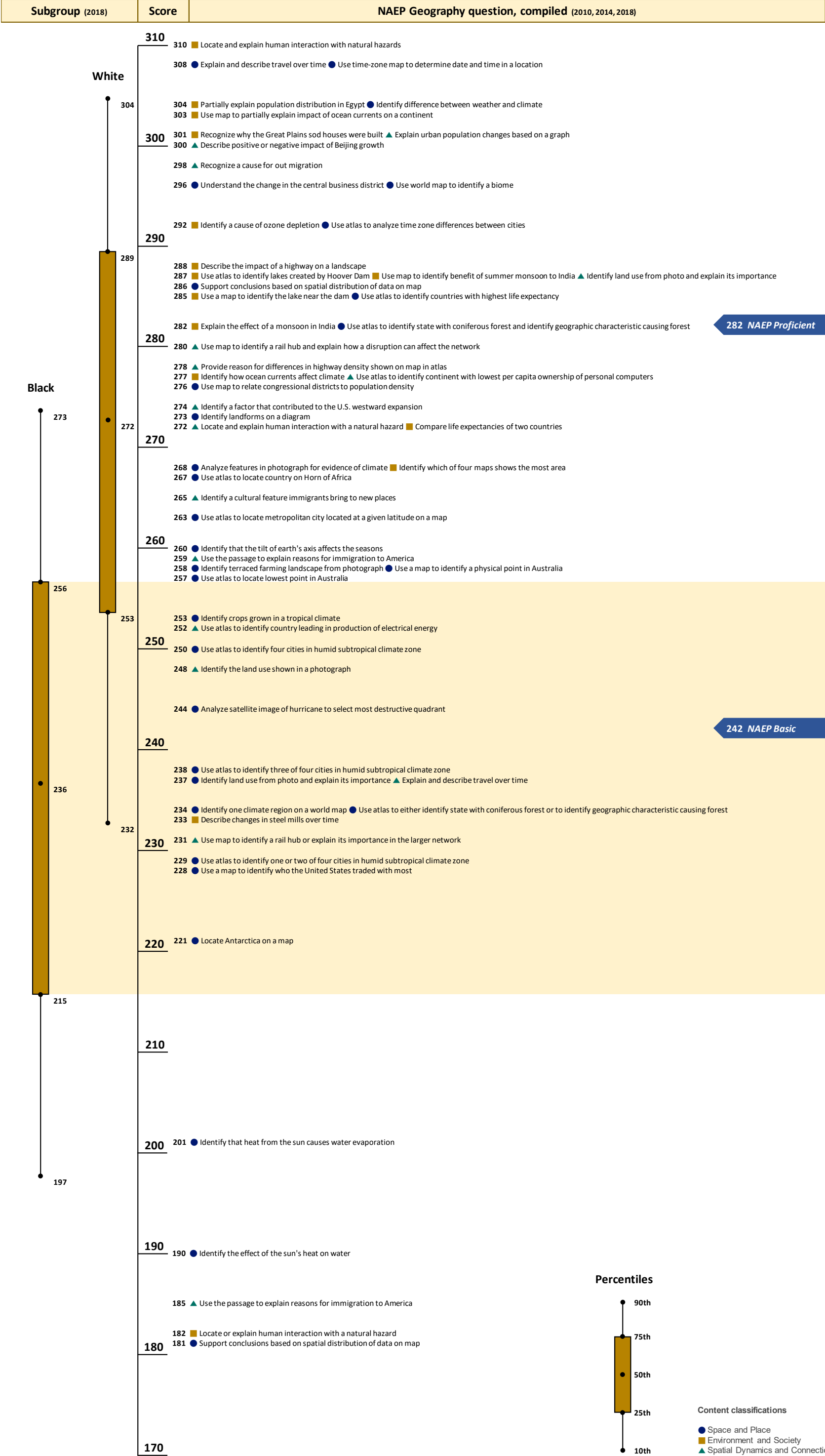
14. Select the quadrant in which the storm is likely to cause the most damage.	73.1	76	2.9
15. Give one POSITIVE and one NEGATIVE effect that this expansion could have on the quality of life of Beijing residents.	19.2	56	36.8
16. How is climate different from weather?	65.4	68	2.6
17. The dark-shaded areas on the map represent which of the following bioregions (biomes)?	57.7	80	22.3
18. Why is the temperature at A higher than in the surrounding areas?	0	4	4
19. This map shows a railroad network linking major cities in the Midwest. Select the most important rail hub city on the map.	30.8	68	37.2
20. List TWO features that indicate that the village shown in the photograph is located in an area with a hot, dry climate. Explain how those features indicate that the climate is hot and dry.	3.8	4	0.2
21. Select the portion of the map that contains the Cajun region.	23.1	32	8.9
22. Which crops grow only in a tropical climate?	88.5	88	-0.5
23. Look at the map below, which shows three possible routes for a railroad line that will be built to connect Red City with Blue town. Which route would be the least expensive to construct? Give two reasons why the route you chose would be the least expensive.	0	44	44

APPENDIX F: NAEP SWKABAT's - Grade 8

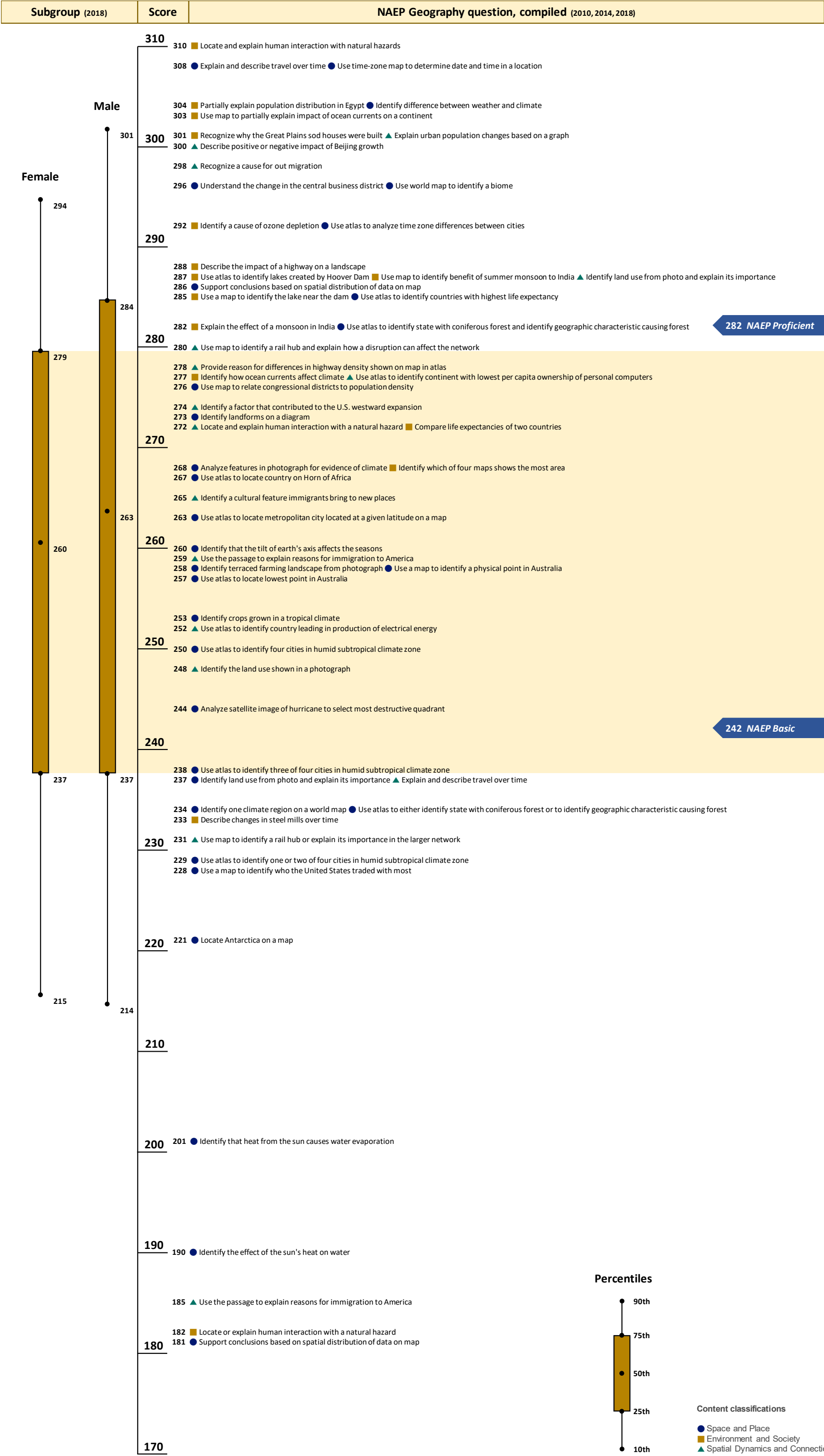
Basic (242)	Students should possess fundamental knowledge and vocabulary of concepts relating to patterns, relationships, distance, directions, scale, boundary, site, and situation; solve fundamental locational questions using latitude and longitude; interpret simple map scales; identify continents and their physical features, oceans, and various cities; respond accurately to descriptive questions using information obtained by use of visual and technological tools such as geographic models and/or translate that information into words; explain differences between maps and globes; and find a wide range of information using an atlas or almanac. Students should be able to recognize and illustrate the relationships that exist between humans and their environments, and provide evidence showing how physical habitat can influence human activity. They should be able to define a region and identify its distinguishing characteristics. Finally, they should be able to demonstrate how the interaction that takes place between and among regions is related to the movement of people, goods, services, and ideas.
Proficient (282)	Students should possess a fundamental geographic vocabulary; understand geography's analytical concepts; solve locational questions requiring integration of information from two or more sources, such as atlases or globes; compare information presented at different scales; and identify a wide variety of physical and cultural features and describe regional patterns. Students should be able to respond accurately to interpretive questions using geography's visual and technological tools and translate that information into patterns; identify differences in map projections and select proper projections for various purposes; and develop a case study working with geography's analytical concepts. In addition, students should be able to describe the physical and cultural characteristics of places; explain how places change due to human activity; and explain and illustrate how the concept of regions can be used as a strategy for organizing and understanding Earth's surface. Students should be able to analyze and interpret databases and case studies as well as use information from maps to describe the role that regions play in influencing trade and migration patterns and cultural and political interaction.
Advanced (315)	Students should have a command of extensive geographic knowledge, analytical concepts, and vocabulary; be able to analyze spatial phenomena using a variety of sources with information presented at a variety of scales and show relationships between them; and use case studies for special analysis and to develop maps and other graphics. Students should be able to identify patterns of climate, vegetation, and population across Earth's surface and interpret relationships between and among these patterns, and use one category of a map or aerial photograph to predict other features of a place such as vegetation based on climate or population density based on topographic features. Students should also be able to relate the concept of region to specific places and explain how regions change over time due to a variety of factors. They should be able to profile a region of their own design using geographic concepts, tools, and skills.

SOURCE: <https://nces.ed.gov/nationsreportcard/geography/achieveall.aspx#grade1>

APPENDIX G: Item Maps



Subgroup (2018)	Score	NAEP Geography question, compiled (2010, 2014, 2018)
White	310	Locate and explain human interaction with natural hazards
	308	Explain and describe travel over time
	304	Partially explain population distribution in Egypt
	303	Use map to partially explain impact of ocean currents on a continent
	300	Recognize why the Great Plains sod houses were built
	300	Describe positive or negative impact of Beijing growth
	298	Recognize a cause for out migration
	296	Understand the change in the central business district
	292	Identify a cause of ozone depletion
	289	Describe the impact of a highway on a landscape
Hispanic	284	Use atlas to identify lakes created by Hoover Dam
	282	Explain the effect of a monsoon in India
	280	Use map to identify a rail hub and explain how a disruption can affect the network
	278	Provide reason for differences in highway density shown on map in atlas
	277	Identify how ocean currents affect climate
	276	Use map to relate congressional districts to population density
	274	Identify a factor that contributed to the U.S. westward expansion
	273	Identify landforms on a diagram
	272	Locate and explain human interaction with a natural hazard
	268	Analyze features in photograph for evidence of climate
	267	Use atlas to locate country on Horn of Africa
	265	Identify a cultural feature immigrants bring to new places
	263	Use atlas to locate metropolitan city located at a given latitude on a map
	260	Identify that the tilt of earth's axis affects the seasons
	259	Use the passage to explain reasons for immigration to America
	258	Identify terraced farming landscape from photograph
	257	Use atlas to locate lowest point in Australia
	253	Identify crops grown in a tropical climate
	252	Use atlas to identify country leading in production of electrical energy
	250	Use atlas to identify four cities in humid subtropical climate zone
	249	Identify the land use shown in a photograph
	244	Analyze satellite image of hurricane to select most destructive quadrant
	240	Use atlas to identify three of four cities in humid subtropical climate zone
	237	Identify land use from photo and explain its importance
	234	Identify one climate region on a world map
	233	Describe changes in steel mills over time
	231	Use map to identify a rail hub or explain its importance in the larger network
	229	Use atlas to identify one or two of four cities in humid subtropical climate zone
	228	Use a map to identify who the United States traded with most
	227	Locate Antarctica on a map
	221	Locate Antarctica on a map
	210	
	207	
	200	Identify that heat from the sun causes water evaporation
	190	Identify the effect of the sun's heat on water
	185	Use the passage to explain reasons for immigration to America
	182	Locate or explain human interaction with a natural hazard
	181	Support conclusions based on spatial distribution of data on map
	180	
	170	



APPENDIX H: Passive assent parent/guardian permission letter



ASSENT CONSENT

Study Title: EVIDENCE FROM NAEP 8TH GRADE GEOGRAPHY DATA: IDENTIFYING AND FILLING THE ACHIEVEMENT GAP EQUITABLY FOR RACE AND GENDER

Principal Investigator: Allison M. Smith
Sponsor:

Co-Investigator/Faculty Advisor: Dr. Michael Solem

My name is Allison Smith, I am a graduate student at Texas State University and the world geography teacher at Karl G. Maeser Preparatory Academy. I am conducting a research study titled "EVIDENCE FROM NAEP 8TH GRADE GEOGRAPHY DATA: IDENTIFYING AND FILLING THE ACHIEVEMENT GAP EQUITABLY FOR RACE AND GENDER". I am doing this study because I want to identify what world geography content and procedural knowledge is needed to fill the achievement gap equitably. I am asking you to be a part of this study because you are a world geography student at Maeser Prep. This form will tell you a little bit about the study so you can decide if you want your scores to be included in the study or not.

You will take 20-minute pre-test, be taught a specialized world geography lesson, and take a 10-minute post-test. This will take place in our normal world geography classroom. Your scores are not included in your Maeser Prep grade. If you want to participate in this study, your scores will only be included in the data analysis. You can also stop being in this study at any time. The alternative to participating is taking a different online world geography assessment. You do not have to answer any questions you don't want to.

By participating you will be contributing to the betterment of geography education at Maeser Prep and possibly other 9th grade geography teachers.

Please talk about this study with your parents before you decide if you want to be in it. I will also ask your parents to give their permission. Even if your parents say you can be in the study, you can still say that you don't want to. It is okay to say "no" if you don't want to be in the study. No one will be mad at you. If you change your mind later and want to stop, you can.

You can ask me any questions about this study the next time you see me. You can also talk to my advisor Dr. Michael Solem or your mom or dad about this study. After all your questions have been answered, you can decide if you want to be in this study or not.

If you want to be IN this study do not sign. If you do NOT want to, please sign.

PRINT your name

Date

SIGN your name

Date

Signature of Person Obtaining Consent

Date

IRB approved application # 8601



Page 1 of 1

APPENDIX I: IRB approval letter



In future correspondence please refer to 8601

December 13, 2022

Allison Smith
Texas State University
601 University Dr.
San Marcos, TX 78666

Dear Allison:

Your application titled, 'EVIDENCE FROM NAEP 8th GRADE GEOGRAPHY DATA: IDENTIFYING AND FILLING THE ACHIEVEMENT GAP EQUITABLY FOR RACE AND GENDER' was reviewed by the Texas State University IRB and approved. It was determined there are: (1) research procedures consistent with a sound research design and they did not expose the subjects to unnecessary risk, (2) benefits to subjects are considered along with the importance of the topic and that outcomes are reasonable; (3) selection of subjects are equitable; and (4) the purposes of the research and the research setting are amenable to subjects' welfare and produced desired outcomes; indications of coercion or prejudice are absent, and participation is clearly voluntary.

In addition, the IRB found you will orient participants as follows: (1) passive parent informed consent and assent will be obtained, 2) Provision is made for collecting, using and storing data in a manner that protects the safety and privacy of the subjects and the confidentiality of the data; (3) Appropriate safeguards are included to protect the rights and welfare of the subjects; (4) Participants will not receive monetary compensation for participation in this project.

This project was approved at the Exempt Review Level

Check the IRB website frequently for guidance on how to protect participants. It is the expectation that all researchers follow current federal and state guidelines.

The institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use other instruments, please re-apply. Copies of your request for human subject's review, your application, and this approval are maintained in the Office of Research Integrity and Compliance.

Report any changes to this approved protocol to this office. Notify the IRB of any unanticipated events, serious adverse events, and breach of confidentiality within 3 days.

Sincerely,

A handwritten signature in cursive script that reads "Monica Gonzales".

Monica Gonzales
IRB Regulatory Manager
Research Integrity and
Compliance Texas State University

CC: Dr. Michael Solem

OFFICE OF RESEARCH AND SPONSORED PROGRAMS
601 University Drive | JCK #489 | San Marcos, Texas 78666-4616
Phone: 512.245.2314 | fax: 512.245.3847 | WWW.TXSTATE.EDU

This letter is an electronic communication from Texas State University-San Marcos, a member of The Texas State University System.