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Climate Change Education and Environmental Education: Perceptions and Knowledge Among Environmental Educators in the Southeastern United States

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CLIMATE CHANGE EDUCATION AND ENVIRONMENTAL EDUCATION:

PERCEPTIONS AND KNOWLEDGE AMONG ENVIRONMENTAL EDUCATORS

IN THE SOUTHEASTERN UNITED STATES

By
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DEDICATION

This dissertation is dedicated to Meredith Willson, who gave me 76 reasons to keep going.

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ABSTRACT

Climate change is a global environmental problem and issue. Mitigation and adaptation have been suggested for use in dealing with the impacts, both current and in the future. Climate change education as a mitigation and adaptation effort is one that could have great impact. This quantitative survey study examined the climate change and climate change education perception and knowledge of Southeastern Environmental Education Association members. This study segmented participants into one of six unique climate change groups: Alarmed, Concerned, Cautious, Doubtful, Dismissive, and Disengaged based on the Six Americas Survey developed by Maibach, Lesierowitz, Roser-Renouf, and Mertz. CC knowledge was collected with items based on an instrument developed by Leiserowitz, Smith, and Marlon. The results of this segmentation were also analyzed against the participants' demographics, and the climate change segment and knowledge proportions were compared to previous studies. An online survey was distributed to Southern Environmental Education Association members with a final sample of 93. Analysis of the data included discriminant analysis, multi-nominal logistic regression, chi-square, ANOVA, crosstabs, and descriptive statistics. The results of this study indicated that overall, Southeastern environmental education had high climate change perception levels, with most being segmented into the Concerned and Cautious groups. In addition, they reported higher climate change knowledge than the general public. The findings had limited implications for climate change mitigation and adaptation efforts for Southeastern environmental educators.

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CHAPTER I

INTRODUCTION

Climate change (CC) is a current and future problem that will impact the population and planet in a multitude of ways (Intergovernmental Panel on Climate Change (IPCC), 2013, 2014a, 2014b, 2014c, 2014d). Some of these impacts will include sea level rise, ocean acidification, increased temperatures, loss of flora and fauna, increase in poverty, and increased tension between countries (IPCC, 2013, 2014a, 2014b, 2014c, 2014d). In effort to both slow the impacts of CC and to deal with the future climate-related predictions, mitigation and adaptation techniques have been encouraged by several organizations and researchers (IPCC, 2013, 2014a, 2014b, 2014c, 2014d). Education for mitigation and adaptation was one method that has been presented for dealing with CC (IPCC, 2013, 2014a, 2014b, 2014c, 2014d). CC education was found underneath the umbrella of environmental education (EE) and sustainable development, as an effort to increase the literacy and decision-making skills of citizens (US Climate Change Science Program, 2009).

Environmental Education and its Forerunners

The use of education for environmental problems and issues is not a new trend (Lively & Preiss, 1957; Perkins, 1864; Stapp, 1974; Swann, 1975), but one that has roots in both EE and sustainability (Bangay & Blum, 2010; National Research Council, 2011; National Science Foundation, 2012). The forerunners of environmental related education can be found within the Conservation Movement (Lively & Preiss, 1957; Perkins, 1864; Stapp, 1974; Swann, 1975); Nature Study (Bailey, 1903; Minton, 1980; Nash, 1976;

Stapp, 1974; Swann, 1975), Conservation Education (Lively & Preiss, 1957), and Outdoor Education (Nash, 1976; Stapp, 1974; Swann, 1975). These education movements paved the path for the formalization and establishment of EE (Nash, 1976; Stapp, 1974; Swann, 1975).

In 1976, the Belgrade Charter, provided the first goals of EE that was to ensure the global population was educated and trained on environmental problems, issues, and solutions United Nations Educational, Scientific, and Cultural Organization –United Nations Environmental Programme (UNESCO-UNEP, 1976). EE, formally organized with goals, objectives, and guiding principles in 1977 in the Tbilisi Declaration, focused on environmental knowledge, awareness, attitudes, skills, and participation of citizens with environmental related problems and issues (UNESCO, 1977).

During this same time frame, sustainable development was formalized during the Brundtland Report as working towards current population needs without impacting the future population (World Commission of Environment and Development, 1987). To reach this definition of sustainable development, education for sustainable development was established in 1992 at the United Nations Conference on Environment and Development. Education for sustainable development promoted education as a method for achieving sustainable development. Even though EE and education for sustainable development both encourage similar types of education for the environment, the end goals and methods were different. However, the efforts of both EE and sustainable development included aspects of climate awareness, but the establishment of CC education provided a more focused approach for mitigation and adaptation efforts (Bangay & Blum, 2010).

Environmental Education Through Climate Change Education

CC education was a narrowly focused aspect of EE, which was the area of CC science (Dupigney-Giroux, 2010). In 2009, Congress encouraged the National Science Foundation to create CC programs, which lead to the development of the Climate Change Education Partnership (National Research Council, 2011; National Science Foundation, 2012). In addition, CC literacy guidelines were established by the National Oceanic Atmospheric Administration to define a climate literate person as one who was knowledgeable on the science as well as able to make decision regarding CC (U.S. Climate Change Science Program, 2009).

CC education research has demonstrated the inclusion of CC into the classroom was not common (Dupigney-Giroux, 2010; Hoffman, & Barstow, 2007; Jeffries, Stanisstreet, & Boyes, 2001; Wise, 2010). Within state standards, CC was found more often in high school standards and less frequently in elementary standards (Dupigney-Giroux, 2010; Wise, 2010). Two major movements in curriculum have increased the inclusion of CC standards in the classroom. These movements include the Framework for K-12 Science Education and the NGSS. Within the Southeast, every state, including Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee, had at least one CC related standard in the curriculum. However, only Kentucky has adopted the Next Generation Science Standards (NGSS Lead States, 2013) that has a more in-depth focus on CC, which were further discussed later in Chapter II.

Researchers have focused more on various other aspects of CC literacy, such as levels of knowledge K-12 students, K-12 teachers, preservice teachers, the general public, and non-formal educations hold in regard to CC. Research on K-12 students has

revealed that many students have misconceptions about CC (Bofferding & Kloser, 2015; Henriques, 2002; McNeill, & Vaughn, 2012; Shepardson, Niyogi, Choi, & Charusombat, 2009). However, the use of CC curriculum has been demonstrated as one method for reaching the goals of CC literacy (Bofferding & Kloser, 2015; Liarakou et al., 2013; McNeill, & Vaughn, 2012). Within the K-12 setting, the results were mixed; while there were some improvements in improving CC knowledge and clarifying misconceptions, there were still areas where more improvement was needed, such as increasing the inclusion of climate knowledge into the curriculum (Bofferding & Kloser, 2015; Liarakou et al., 2013; McNeill, & Vaughn, 2012).

In addition to K-12 students, researchers have found that K-12 teachers do demonstrate understanding of CC (McNeal, Walker, & Rutherford, 2014; Wise, 2010). However, K-12 teachers also still hold misconception regarding CC, such as greenhouse gases and political aspects of CC (McNeal et al., 2014; Wise, 2010) Overall, there was a general lack of awareness of CC demonstrated with K-12 teachers (Campbell, Erdogan, Medina-Jerez, & Zhang, 2010).

Students in higher education have been studied as well, and researchers have discovered that many higher education students were somewhat knowledgeable on CC (Leal Filho, 2010). However, more of the research has focused on the misconceptions that college students hold (Boon, 2012; Cordero, Todd, & Abellerra, 2008; Khalid, 2003; Ratinen, Viiri, & Lehesvuori, 2013; Ratinen, Viiri, Lehesvuori, & Kokkonen, 2015). These misconceptions have been reported to remain unchanged even with only the inclusion of knowledge-based intervention but were changed with the inclusion of intervention that includes a personal connection to the environment (Cordero et al.,

2008). However, the majority of the research on higher education focuses on reporting the levels of knowledge, rather than effective curriculum methods for improving CC knowledge.

The general public's knowledge of CC was well-researched. Several large-scale studies, including the 2005 National Environmental Education and Training Program as well as the 2009, 2013, 2014, and 2016 Yale Project on Climate Change Communication have provided analysis on several aspects of CC education and the general public. In 2005, it was reported that while a large portion of the general public agreed CC was occurring, it was not listed as a priority within environmental problems and issues (Coyle, 2005). The Yale Project on Climate Change (2009, 2013, 2014, 2016) has provided information again; while over half of the general public was informed on CC, they were not overly concerned with the risks.

A smaller field of research on CC education has focused on non-formal education. Some research has demonstrated non-formal education settings have a positive impact on CC education (Leiserowitz & Smith, 2011; Primack & Miller-Rushing, 2009; Sellmann & Bogner, 2013), while others have shown non-formal settings do not have positive impacts on CC education (Drissner, Haase, & Hille, 2010; Swin & Fraser, 2014).

There was some regional-specific research focuses on the Southeast United States. In a 2014 study, the use of dialogue in CC was reported as a positive technique of CC education (McNeal, Hammerman, Christiansen, & Carroll, 2014). Other regional specific Southeastern United States researchers have reported while educators in the Southeast were knowledgeable, they still held many misconceptions regarding CC (McNeal et al., 2014).

Statement of the Problem

The use of education as part of CC mitigation and adaptation can provide opportunities for reaching the goals of both EE and CC education. In addition, it can potentially create opportunities for citizens to reduce the future impacts of CC, both locally and globally. The majority of CC education research has focused the K-12 educational setting, higher education, and the general public. There was a growing number of research publications that focused on non-formal education and very little research that provided a regional specific spotlight on the Southeastern United States.

Researchers have demonstrated both the strengths and weaknesses of CC education. This purpose of this study examined what level of CC perceptions and knowledge reported by environmental educators located in the Southeastern United States. The significance of this study may also provide environmental educators located within the Southeastern United States with insight about the inclusion of CC education into their overall educational mission as well as contribute to the body of literature on CC education.

Research Questions

The reported level of CC perceptions and CC knowledge were investigated during this study. The research questions were:

Research question 1: How are Southeastern environmental educators classified into one of six categories based on their perceptions of climate change as measured by Six Americas Survey?

Research question 2: How do climate change perception levels compare depending on demographic factors?

Research question 3: How do climate change perceptions levels of Southeastern environmental educators differ compared to previous studies with the Six Americas Survey?

Research question 4: What is the knowledge level of Southeastern environmental educators regarding climate change indicated by the American's Knowledge of Climate Change instrument?

Research question 5: Does climate change knowledge significantly differ by the demographics?

Research question 6: Is the observed proportion of climate change knowledge of the current study equal to the observed climate change knowledge in the 2010 Leiserowitz et al. Study?

Theoretical and Conceptual Framework

The theoretical framework used in this study was based on the North American Association for Environmental Education's (NAAEE) framework for environmental literacy (Hollweg et al., 2011). The data analysis and interpretation were reported through the lens of the Environmental Literacy Framework (ELF) with a focus on CC perceptions and knowledge. This study concluded that CC education was useful for environmental educators, if environmental educators were working towards CC mitigation and adaptation. The conceptual framework will also be discussed as a visual representation of the overall study.

The NAAEE developed a framework that includes four components of environmental literacy. These components are competencies, knowledge, dispositions, and environmentally responsible behavior (Hollweg et al., 2011). Competencies are

skills needed by individuals to participate in activities related to environmental issues, which include "identify environmental issues; analyze those issues; evaluate environmental phenomena and interactions within socio-political systems; use evidence and knowledge to describe and support a position; and create and evaluate plans to resolve environmental issues" (Hollweg et al., 2011, p. 23).

Knowledge was defined with five types of knowledge, which were "knowledge of physical and ecological systems; knowledge of social, cultural, and political systems; knowledge of environmental issues; knowledge of multiple solutions to environmental issues; and knowledge of citizen participants and action strategies" (Hollweg et al., 2011, pp. 18-19). Dispositions were defined as aspects of behavior that impact an individual's level of motivation related to environmental issues (Hollweg et al., 2011). These dispositions include "sensitivity; attitudes, concern, and worldview; personal responsibility; locus of control/self-efficacy; motivation and intentions" (Hollweg et al., 2011, pp. 21-22). Environmentally responsible behavior was the combination of the previous components – competencies, knowledge, and disposition (Hollweg et al., 2011). Figure 1 illustrates the how the components of the ELF interact in a series of feedback loops (Hollweg et al., 2011). While the ELF may have several components, this research focused on the components of knowledge and the dispositions of perceptions related to CC.

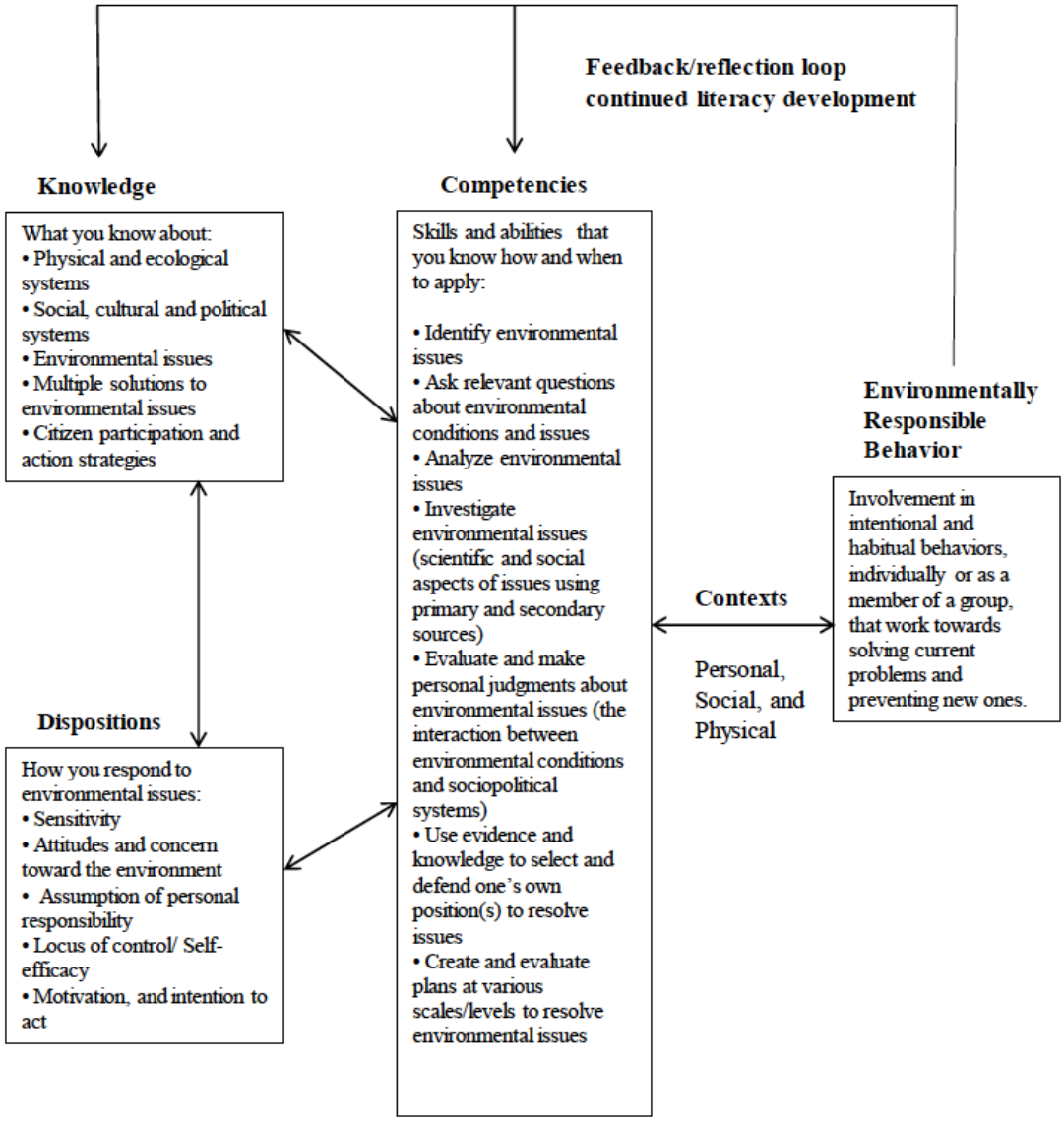

Figure 1. Environmental Literacy Framework (Hollweg et al., 2011, p. 17).

The ELF has found its use in the professional development of some environmental literacy instruments, both nationally and internationally. The Middle School Environmental Literacy Instrument (MSELI; McBeth, Hungerford, Marcinkowski, Volk, & Meyers, 2008), which collected baseline data and refined the instrument, later titled the Middle School Environmental Literacy Survey (MSELS; McBeth, Hungerford, Marcinkowski, Volk, & Cifanick, 2011), were both based on the

ELF. The MSELI and MSELS were based off four variables within the ELF: "knowledge, affect, cognitive skills, and behavior" (McBeth & Volk, 2010, p. 58). Programme for International Student Assessment (Hollweg et al., 2011) was developed as an international assessment for environmental literacy and was organized to ensure that a wide range environmental literacy concepts were incorporated and these variables were distributed across the ELF domains.

The Hollweg et al. (2011) ELF was also used in the investigation of how higher education courses impact environmental literacy in college students (King & Frauzen, 2017). The four components of knowledge, disposition, competencies, and behavior were all incorporated into the 31 statement instrument as well as reflection instrument for the instructors. King and Frauzen (2017) reported the framework focused on competencies; the instructors in this study did not focus on behavior but were "teaching about the environment and not for the environment" (para. 26). The students' perceptions of their environmental literacy increased from pretest to posttest. However, King and Frauzen (2017) reported these higher education courses encourage knowledge and competencies; they do not encourage behaviors or dispositions.

In Figure 2, the components of a CC education conceptual framework were illustrated through the Hollweg et al. ELF (2011). In Figure 2, the components of the original ELF that relate to this current dissertation were contained within the rectangles. The relationship to the dissertation were contained within the circles. The ELF variables of knowledge, dispositions, and competencies were collected through the use of the instrument in this study, while the only environmental responsible behavior was the action of being a member of an environmental education association.

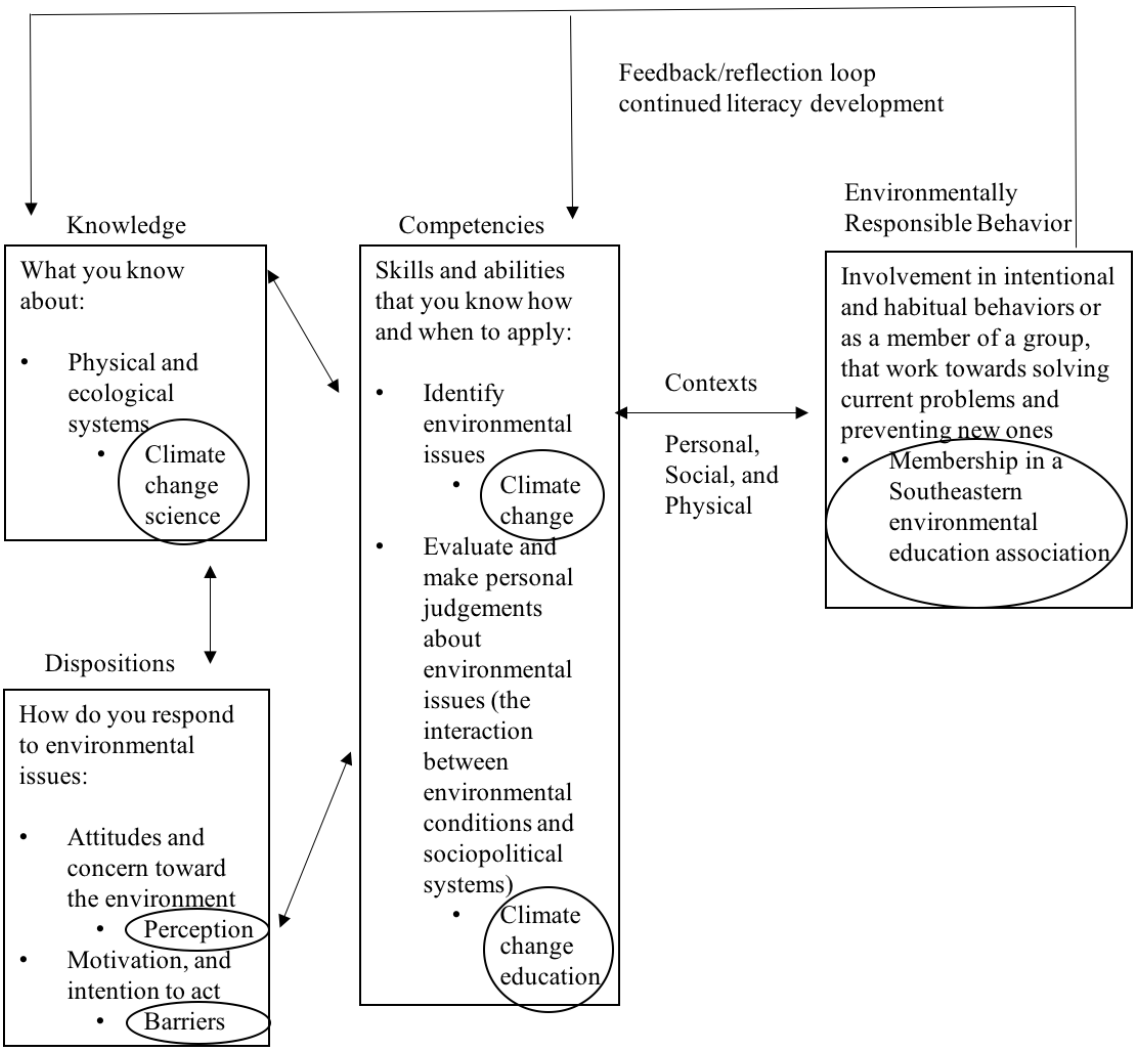

Figure 2. Comparison between the ELF and the CC education research variables (adapted from Hollweg et al., 2011).

The conceptual framework of this study is illustrated in Figure 3, which is a visual representation of the overall study, including the variables and the population. All members of Southeastern Environmental Education Associations (SEEA) were selected as the population for this study. The data for this study was gathered through an online survey, which included demographics, the Six Americas Survey (Maibach, Roser-Renouf, & Leiserowitz, 2009), and questions from the Americas Knowledge of Climate Change instrument (Leiserowitz, Smith, & Marlon, 2010). The Six Americas Survey

(2009) is a 15-item instrument that segments participants into one of six CC perception groups – Alarmed, Concerned, Cautious, Disengaged, Doubtful, and Dismissive. The Americas Knowledge of Climate Change instrument (2010) portion of the instrument included eight questions from the original study and was used to determine knowledge levels of the participants. CC perception data from the current study were first analyzed with demographics then compared to previous research with previous studies that used the Six Americas Survey. The results of the knowledge component of this study compared the results collected from the study participants to the CC knowledge of previous studies with the general public using the instrument American's Knowledge of Climate Change (2010). CC knowledge data were first analyzed with demographic data then compared to the original 2010 study. The size of the figure does not represent the actual population and sample sizes.

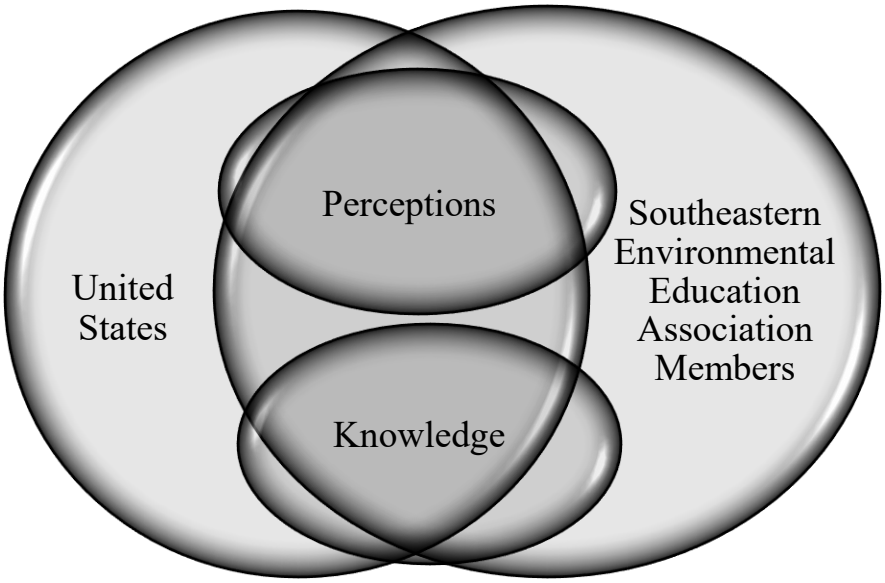

Figure 3. Overall conceptual framework and the relationship between the research questions, the sample, and the population.

Significance of the Study

The results from this study could contribute to the growing field of CC educational research. CC education was a supported tool for CC mitigation and adaptation according to the IPCC (2014a). This study can demonstrate if efforts towards CC education efforts were being produced. However, there are not many studies that focus on regional environmental education efforts; this research helped to identify what perceptions and knowledge are reported specifically within the Southeastern United States. Additionally, the research could assist SEEAs members in determining how they compare to others in regard to CC perceptions. The results from this study could be important for the EE community, as it could provide information on mitigation and adaptation efforts of CC. If CC is still one of the largest environmental problems and issues, then efforts from environmental educators should be reported to demonstrate the strengths and weaknesses of these contributions.

The results of this study are important to the researcher because it provided information as to what was being done locally for a global environmental problem. Specifically, within the Southeast, efforts are being put forth for CC education. As for the researcher, it is important because teaching within the field of EE is an uphill battle. Meaning, non-formal education does not get the same treatment as formal education while they both have a unique place in the world of education. This study provides value to the researcher personally to demonstrate what SEEA members are contributing towards CC education, especially within the Southeast where it is not a priority.

Procedures

The weaknesses and strengths of CC programs were illustrated in the literature review. The use of non-formal education in CC education was a growing area of research and one that had shown both positive and negatives for achieving climate literacy. The total population for this study was members of EE associations located in the Southeast United States. These states were all members of the SEEA and include Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. The current members of all individual EE associations were contacted through e-mail and included an online survey for this study. A non-random, purposive sampling method, which included the entire population of current members of SEEAs, was used to ensure an adequate sample size was reached.

The survey instrument used in this study collected responses relating to CC perceptions, knowledge, and demographics. The Six Americas Survey, developed by Maibach, Roser-Renouf, and Leiserowitz (2009), was used for assessing perceptions related to CC. The Six Americas Survey segmented participants into the following groups: Alarmed, Concerned, Cautions, Disengaged, Doubtful, and Dismissive. CC knowledge was collected using selected questions from the Leiserowitz et al. (2010) instrument. In addition, demographic information was also collected, which included age, gender, regional location, occupation, level of education, religious affiliation, and political affiliation.

Limitations/Delimitations

One delimitation of this study was the instrument; detailed descriptions of each instrument will be made in Chapter III. To make the online survey shorter and

manageable for participants, the 15-item Six Americas Survey was used instead of the 36-item Six Americas Survey. Another delimitation was the use of only eight knowledge CC items from the 2010 Leiserowitz et al. report.

A limitation of this study was the use of members of EE associations in the Southeast. Non-members of the larger EE community were not included in this study, even though these individuals may have provided additional data and insight into the research. The purpose of selecting only these members was to ensure a singular method of contacting participants and to have some consistency between the participants as members of a particular group.

Definition of Terms

Adaptation: The following was followed for adaptation:

> The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustments to expected climate and its effects. (IPCC, 2014b, p. 1758)

Anthropogenic emissions: Was defined as "emissions of greenhouse gases (GHGs), aerosols, and precursors of a GHG or aerosol caused by human activities. These activities include the burning of fossil fuels, deforestation, land use changes (LUC), livestock production, fertilization, waste management, and industrial processes" (IPCC, 2014a).

Climate Change: The IPCC (2013) definition for CC:

> …refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended

period, usually decades or longer. CC may be due to natural internal processes or external forgings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of o the atmosphere or in land use. (IPCC, 2013, p. 1450)

Climate Change Education: Was defined as "understanding the basic science of climate and CC; supporting informed decision making by individuals, organizations, and institutions behavior change; and stewardship where appropriate – all which are often summarized under the term 'climate literacy'" National Research Council, 2011, p. 6).

Climate Change Literacy: Was defined as "an understanding of your influence on climate and climate's influence of you and society" (US Climate Change Science Program, 2009, p. 3).

Environmental Education: The definition used for this research was the 1977 Tbilisi Conference, which defined the goals of EE as:

a) to foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;

b) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;

c) to create new patterns of behavior of individuals, groups and society as a whole towards the environment. (UNESCO, 1977, p. 24)

Environmental Issues: Was defined as "related to, but distinguished from, an environmental problem. An environmental issue reflects the presence of differing perspectives on possible solutions to an environmental problem" (NAAEE, 2004, p. 22).

Environmental Problem: Was defined as "related to, but distinguished from, an environmental issue. An environmental problem results from an interaction between human activity and the environment" (NAAEE, 2004, p. 22).

Formal Education: Was defined as "learning that takes place in education and training institutions, was recognized by relevant national authorities and leads to diplomas and qualifications. Formal learning was structured according to educational arrangements such as curricula, qualifications and teaching-learning requirements" (UNESCO, 2012).

Greenhouse Effect: Was defined as:

> …rapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. Some of the heat flowing back toward space from the Earth's surface was absorbed by water vapor, carbon dioxide, ozone, and several other gases in the atmosphere and the reradiated back toward the Earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase. (Environmental Protection Agency, 2016, para.7)

Global Warming: Was defined as the "gradual increase, observed or projected, in global surface temperature, as one of the consequences of radiative forcing caused by anthropogenic emissions" (IPCC, 2014a).

In-formal Education: Was defined through the use of NAAEE's informal EE definition which was an "education activity outside the formal system where people learn from exhibits, mass media, and everyday living experiences" (NAAEE, 2009). This tern

can be used interchangeably with non-formal education, but was defined separately for the purpose of this study.

Mitigation: Was defined as: "a human intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC, 2014, p. 1458).

Non-formal Education: Was defined through the use of NAAEE's non-formal EE definition which was education "that takes place at non-formal settings such as parks, zoos, nature centers, community centers, youth camps, etc. rather than in a classroom or school" (NAAEE, 2009). This term can be used interchangeably with informal education but was defined separately for the purpose of this study.

Summary

The use of education for mitigation and adaptation was a method that aligns with the overall goals of EE, which were to develop awareness, knowledge, attitudes, skills, and participation relating to environmental problems and solutions (UNESCO, 1977). EE efforts have been demonstrated through the growth of movements, such as sustainable development, and education for sustainable development, and CC education. CC educational research has demonstrated misconceptions, knowledge, and other variables related to the K-12 setting, higher education, and the general public.

Non-formal education was another area where researches have provided data on CC education research. There were a few CC education research studies that focus on the Southeast. Southeastern focused research may provide great knowledge to environmental educators. The results of these regional studies were informative specifically for environmental educators located in the Southeastern United States. These regional studies reported CC perceptions of Southeastern Extension Agents were similar to the

general public. Other CC perception studies focused on visitors of zoos and aquarium, who have higher perception levels when compared to the general public. However, other regions, outside of the Southeast, could find valuable use of the data as well as the overall field related to CC education.

CHAPTER II

LITERATURE REVIEW

The global climate has been changing. Since the 1950s, the climate has changed more than any other time in researched history (Intergovernmental Panel on Climate Change, 2014d). This change was due to the anthropogenic contributions, which have current impacts as well as future impacts on both natural and the human population (IPCC, 2014d). Since 1880, the ocean surface temperature has increased 0.85°C till 2012, global sea level increased an average of 0.19m from 1901 to 2012, and Arctic sea-ice decreased 4.1% each decade from 1979 to 2012 (IPCC, 2014d). Future risks include associated with climate change included the disruption of water systems due to melting ice, extreme precipitation, an increase in heat waves, ocean acidification, and more frequent storm surges (IPCC, 2014d). In addition to risks associated with the natural environment, water and food scarcity, increase in illnesses, such as heatstroke, waterborne sickness, alter agriculture systems, shifting, and/or reducing growing seasons, which can alter individual income; and increase conflict between countries (IPCC, 2014d).

CC adaptation and mitigation were two methods for planning for the projected risks of CC and reducing the long-term impacts of CC. One aspect of both adaptation and mitigation was the use of education to promote awareness, equitability, and participation in sustainability (IPCC, 2014d). Environmental education and sustainable development have both provided the main frameworks for CC education. This chapter will include the history of EE, sustainable development, CC science, and CC education.

In addition, environmental psychology was discussed as it relates to CC education. Furthermore, a literature review about the CC education in the context of K-12 education, higher education, non-formal education was provided, including a specific section about the Southeastern United States.

Historical Development of Environmental Education

The history of environmental conservation has been illustrated through two major movements: the Conservation Movement and the educational movement (Stapp, 1974; Swann, 1975). The educational movement has been defined through three distinct stages – Nature Study, Conservation Education, and Outdoor Education (Nash, 1976; Stapp, 1974; Swann, 1975). The historic analysis of the Conservation Movement, Nature Study, Conservation Education, and Outdoor Education were discussed in the following sections.

Forerunners of Environmental Education

The Conservation Movement. The beginning of the Conservation Movement has been linked with the 1864 publication of the book *Man and Nature* by George Perkins, published during the colonial days of the United States (Lively & Preiss, 1957; Stapp, 1974; Swann, 1975). Perkins provided scientific reasoning between the actions of man and the impact on nature, that "in the vocabulary of nature… she knows no trifles, and her laws are as inflexible" (Perkins, 1864, p. 548). The Conservation Movement focused more on the preservation of forests, soil conservation, and wildlife conservation (Lively & Preiss, 1957). However, it was not until F. D. Roosevelt's presidency did the Conservation Movement truly gained momentum with the establishment of national parks and other conservation efforts (Lively & Preiss, 1957; Stapp, 1974). Various forms of

conservation were created, including hunting regulations, the development of state and national parks, and the development of government organization (Lively & Preiss, 1957; Swann, 1975). These government organizations included the Fish and Wildlife Service, Forestry Service, and the Soil Conservation Service, who all had similar goals of environmental conservation (Lively & Preiss, 1957; Stapp, 1974).

Nature Study. The Nature Study movement gained recognition in 1891 with the publication of Wilber Jackman's *Nature Study in the Common Schools* (Bailey, 1903; Minton, 1980; Nash, 1976; Stapp, 1974; Swann, 1975). Jackman's book, *Nature Study for Common Schools*, provided teachers with curriculum for introducing nature science into the classroom (Jackman, 1981). In its beginnings, Nature Study focused on learning outside of the classroom, where students could gain a greater connection to nature (Bailey, 1903; Swann, 1975) as Nature Study was "concerned with the child's outlook on the world" (Bailey, 1903, p. 5). In 1908, the Nature Study Society was formed; its purpose included to provide education in the environment, to encourage conservation, and to encourage Nature Study in schools (Stapp, 1974; Swann, 1975).

Conservation Education. After the Civil War, when the United States was more of an agricultural society, the Morrill Act of 1862 created the first land-grant college system, which was pushed the Conservation Education movement forward (Lively & Preiss, 1957). Conservation Education initially focused on training for the technical and occupational purpose (Lively & Preiss, 1957). Conservation Education became more prevalent in the 1930 alongside with conservation efforts made at the state and national level (Nash, 1976; Swann, 1975) as the need for accountability from the public arose as a method for achieving conservation (Lively & Preiss, 1957).

Outdoor Education. Outdoor Education has roots in the 1920 through the work of L. B. Sharpe and Julian Smith (Nash, 1976; Stapp, 1974; Swann, 1975). The environment was the outdoor learning setting that provided direct interaction with the environment (Stapp, 1974; Swann, 1975). Outdoor Education was different than Conservation Education and Nature Study, as there was less focus on conservation and more on the setting of learning taking place in the outdoors (Nash, 1976; Swann, 1975). Moving the learning environment to the outdoors provided context to what the students were learning, as opposed to studying nature within the classroom walls (Nash, 1976). During this time, outdoor organization were formed, such as the American Association of Health, American Camping Association, and the National Outdoor Education Association (Stapp, 1974).

Through the progression of Nature Study, Conservation Education, and Outdoor Education, EE was developed. EE was designed to be a unique educational aspect through several international efforts, which was further discussed.

Environmental Education

EE, at its development, began to move towards a more interdisciplinary approach to education (Nash, 1976). The transition also included a focus on environmental quality, or living more sustainably within the environment (Stapp, 1974). Stapp (1970) defined EE as a pedagogy:

> …aimed at producing a citizenry that was knowledgeable concerning the bio-physical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution. (p. 15)

The shift from Conservation Education to EE moved the focus from the environmental experts (Tanner, 1974). EE provided research and citizen participation in the efforts to educate youth about the environment (Tanner, 1974). The differences in Outdoor Education and EE were that, even though EE may be taught outside, it was not always, and the goals of EE went beyond the goals of Outdoor Education, which had a focus on learning in the outdoor setting (Hungerford, 1975).

In 1976, the Belgrade Charter (UNESCO-UNEP, 1976) provided the first accepted goal of EE:

> The goal of environmental education was to develop a world population that was aware of, and concerned about the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions to current problems, and the prevention of new ones. (UNESCO-UNEP, 1976, p. 3)

To expand upon the Belgrade Charter, the Tbilisi Declaration, organized by UNESCO in 1977, created the first guideline for EE that was still used worldwide for reference when establishing EE standards. The EE goals established in Tbilisi included:

> a) to foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;
>
> b) to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;
>
> c) to create new patterns of behavior of individuals, groups and society as a whole towards the environment. (UNESCO, 1977, p. 24)

The objective of EE, as detailed in the 1977 Tbilisi Declaration, were:

- Awareness: to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.
- Knowledge: to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.
- Attitudes: to help social group and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
- Skills: to help social groups and individuals acquire the skills for identifying and solving environmental problems.
- Participation: to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems. (pp. 26-27)

The guiding principles of EE according to the Tbilisi document were:

- consider the environment in its totality - natural and built, technological and social (economic, political, technological, cultural-historical, moral, aesthetic);
- be a continuous lifelong process, beginning at the. pre-school level and continuing through all formal and non-formal stages;
- be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;
- examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;

- focus on current and potential environmental situations, while considering the historical perspective;
- promote the value and necessity of local, national and international co-operation in the prevention and solution of environmental problems;
- explicitly consider environmental aspects in plans for development and growth;
- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;
- relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;
- help learners discover the symptoms and real causes of environmental problems;
- emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills;
- utilize diverse learning environments and a broad array of educational approaches to teaching/ learning about and from the environment with due stress on practical activities and first-hand experience. (Tbilisi, 1977, p. 27)

One of the more recent large-scale research that has been undertaken, was to determine the current level of environmental literacy for sixth- and eighth-grade students in the United States. This research was the National Environmental Literacy Assessment Project (NELA) conducted by the researchers McBeth, Hungerford, Marcinkowski, Volk, and Meyers (2008). The research was divided into two phases; Phase I focused on developing a baseline for environmental literacy, and Phase II focused on the environmental literacy of schools that participate in EE programs within their schools.

The NELA Phase I of McBeth et al. (2008) research focused on the following environmental concepts: a) ecological knowledge; b) environmental affect: how one thinks about the environment, environmental sensitivity, and how you feel about the environment; c) cognitive skills: issue identification, issue analysis, and action planning; and d) behavior: what you do about the environment. The participants of NELA Phase I were selected using a stratified random sample with a final sample of 48 schools (McBeth et al., 2008). McBeth et al. (2008) found students scored the highest in ecological knowledge and environmental affect and found they scored the lowest in cognitive skills. The composite scores from all aspects, which had a range of 97 to 168 were 143.99 for the sixth-grade students, 140.19 for the eighth-grade students, and an overall score of 142.14 (McBeth et al., 2008). The researchers concluded the NELA Phase I results provided data on the current environmental literacy status with middle school students and would potentially be useful in program evaluation (McBeth et al., 2008).

The NELA Phase II of the study, focused on sixth-, seventh-, and eighth-grade students from 64 middle schools and were purposefully selected based on the inclusion of EE within the school (McBeth et al., 2011). What the NELA Phase II researchers found was the participants in Phase II outscored the participants in Phase I on environmental literacy (McBeth et al, 2011). The NELA Phase II students scored the highest in environmental knowledge, environmental affect, environmental behavior, and scored the lowest in cognitive skills (McBeth et al., 2011). This research showed the importance of EE programs in schools for developing environmental literacy in young learners. EE was the broad umbrella from which related environmental movements arose. These

movements include sustainable development, education for sustainable development, and CC education.

Sustainable Development

In 1972, the United Nations met in Stockholm to determine "common principles to inspire and guide" (United Nations, 1972, p. 8) all humans, which can be tasked with conservation and preservation of the human environment. The International Union for Conservation of Nature and Natural Resources (IUCN), provided further guidelines for sustainable development, to support the natural environment, such as soil conservation, plant and wildlife conservation, and population growth, but while also acknowledging development must still occur (IUCN, 1980).

Sustainable development in the 1987 World Commission of Environment and Development, also known as the Brundtland Report, provided more in-depth objectives for sustainable development. Sustainability was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 43). Instead of the previous visions of separating the environment and humans, the Brundtland Report included the notion the environment and humans were connected and must be treated as so.

The World Resources Institute (1992) divided sustainable development into four dimensions: economic, human dimensions, environmental, and technological. These dimensions were designed to view developing and developed countries differently with sustainable development; each country was in different levels of both development and sustainability (World Resources Institute, 1992). For example, a developing country would view sustainable development in the economic dimension through improving daily

living conditions and health care, while a developed country could provide pollution reduction and clean up, at a large expense in the environmental dimension (World Resources Institute, 1992).

Education for Sustainable Development

Education for Sustainable Development (ESD) was first brought to attention during the United Nations Conference on Environment and Development (Egelston, 2013; World Resources Institute, 1992). During the conference, chapter 36 titled, "Promoting Education, Public Awareness and Training", which relied on the Declaration and Recommendations of the Tbilisi Intergovernmental Conference on Environmental Education as the guidelines for Agenda 21 (World Resources Institute, 1992). ESD was described as how "human beings and societies can reach their fullest potential" (p. 320) and education was "critical for promoting sustainable development and improving the capacity of the people to address environment and development issues (p. 320). In similar fashion to the objectives of the Tbilisi Declaration, Agenda 21 stressed ESD should also include "environmental and ethical awareness, values and attitudes, skills and behavior consistent with sustainable development and for effective public participation in decision-making" (p. 320). The ESD described in Agenda 21 provided a guideline, not a curriculum, for a growing planet (Bangay & Blum, 2010; McKeown & Hopkins, 2003).

ESD as described in Agenda 21, not only focused on formal education, but also included the need for non-formal education (World Resources Institute, 1992). Within Agenda 21, non-formal education could be used in ESD to increase universal access to education, especially for females, provide training to teachers, encouraging more support for education relating to environment and development (World Resources Institute,

1992). Agenda 21 was an educational response for a political environment of CC (Bangay & Blum, 2010).

Environmental Education vs. Education for Sustainable Development

Both EE and education for sustainable development have a focus on the environment and there were similarities and difference between the two. McKeown and Hopkins (2003) illustrated while EE has more a focus on the natural environment, education for sustainable development included society, politics, economics, as well as the environment. Another difference was EE has emphasis on education about the environment (McKeown & Hopkins, 2003). Education for sustainable development included basic education, gender equality in education, and "reorienting education" (McKeown & Hopkins, 2003, p. 120), included education related to sustainability (McKeown & Hopkins, 2003; World Resources Institute, 1992). Both of these educational movements focus on providing training to professionals, public awareness, and interdisciplinary curriculum (McKeown & Hopkins, 2003).

Some controversy exists on whether EE was part of education for sustainable development or vice versa (Kopnina, 2012; McKeown & Hopkins, 2003; Payne, 2016). However, according to some researchers, sustainable development was very similar to the development of EE from Nature Study, Conservation Education, and Outdoor Education. While Nature Study, Conservation Education, and Outdoor Education influenced EE, it did not replace EE (Kopnina, 2012; McKeown & Hopkins, 2003). Similarly, EE may have paved the way for the development of education for sustainable development; it does not replace it (McKeown & Hopkins, 2003). The historical development, goals, and

mission provide enough distinction to prevent the complete blurring and blending of the two educational approaches (McKeown & Hopkins, 2003; Payne, 2016).

The continued growth of EE related areas through sustainability has also broadened the goals of EE. ESD provided some specification on gender difference, with the importance of providing education for females, while EE does stress gender differences within the Tbilisi document. Sustainable development also provides difference between developing and developed countries, while EE does not provide differences between countries, but unites them through similar goals and objectives.

Climate Change

Climate Change Science

By the end of the 21st century, the estimated sea level rise was projected to be within the range of 0.18 to 0.59m (IPCC, 2013). Historical data have recorded an increase in sea level rise during the span of 1961 to 2003 of an average rate of 1.8mm each year (IPCC, 2013). Historically, the last time a sea level rise of 4 to 6 meters was about 125,000 years ago, when Polar Regions were even warmer than the current temperatures (IPCC, 2013). The 12 past years, between 1995 and 2006, have been documented as the warmest years since 1850 and projected to increase by 1.5°C to 2°C by the end of the 21st century (IPCC, 2013). In addition, the IPCC stated anthropogenic causes were most likely the cause of over half of the global temperature rise from 1951 to 2010 (IPCC, 2013).

With future CC projections, people will experience an increase in hazards and risks. In coastal areas, as the sea level rises, there was an increase in storm surges, and there was a greater flood risk. As global temperature rises, it was estimated about 20 to

30% of plant and animal species will become extinct (IPCC, 2013). While CC was a global issue, the environmental problems were regional and will impact everyone in different ways.

CC will impact the entire world population in the future, and there was a need for immediate action. The IPCC provides several suggestions for CC mitigation, which included education (IPCC, 2013). Education was a vital part of CC mitigation because with proper education and awareness regarding the problem people was to change behaviors (IPCC, 2013).

Education was one of the many CC adaptation and mitigation strategies recommended by the IPCC (2014a, 2014c). CC education should be integrated into education at both at the formal and non-formal level (IPCC, 2014a, 2014c). Education described within the IPCC goes beyond CC knowledge but also included other social aspects, such as gender, health care, disaster awareness, socio-economics, and participation (IPCC, 2014a, 2014c). Education in the form of mitigation can assist policy makers with providing a better understanding of CC and provide empowerment to underutilized groups (IPCC, 2014a).

Climate Change and Social Science

Politics. During the 2016 presidential election, using the Leiserowitz et. al. (2012) Six Americas Survey, those individuals labeled as the most Alarmed group considered CC a top priority (Roser-Renouf, Maibach, Leiserowitz, & Rosenthal, 2016b). This Alarmed group consisted of only 17% of the U.S. population and a total of 19% of registered voters (Roser-Renouf et al., 2016b). The United Stated population can be

divided into three groups regarding their opinions on CC for the 2016 presidential election, highly concerned, somewhat concerned, and no concern.

The highly-concerned group consists of citizens who were both Alarmed and Concerned, was 45% of the population (Roser-Renouf et al., 2016b). The somewhat Concerned group were both Cautious and Disengaged for 34% of the population (2016b). The group with no concern, which included both Doubtful and Dismissive citizens, totaled 21% of the population. When it comes to voting for the next president, 84% of the Alarmed citizens stated protecting the environment influenced their voting, and 83% stated CC related issues influenced their voting (Roser-Renouf et al., 2016b). In the Dismissive CC group, only 4% stated the protecting the environmental, and 2% stated the CC influenced their voting.

There were also differences between preferences in the presidential candidate, 64% in the Alarmed group preferred Hillary Clinton and 5% preferred Donald Trump (Roser-Renouf et al., 2016b). In the Dismissive group, 3% preferred Hilary Clinton and 61% preferred Donald Trump. These survey results demonstrate a divide between the CC Alarmists and Dismissive individuals in the United States. The division of politics within CC circles was apparent in these studies. While individuals who favored Hillary Clinton, a Democrat, were more Alarmed about CC, and Republicans who supported Donald Trump were less inclined, or dismissive of CC. The great division, and lack of a middle ground, less people claiming to be somewhat concerned could potentially continue to grow further apart post-election.

The results of the 2016 election were the U.S. public elected President Trump to serve office from 2016 to 2020. Prior to election, President Trump has made several

public statements on the topic of CC. President Trump included CC into the campaign promises, which ranged from removing environmental regulations to having the United States end participation in international CC efforts (Bump, 2016). In 2012, President Trump posted on Twitter, "The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive" (Trump, 2012). The discussion of CC being manufactured was expressed by Trump in 2013 with the Tweet "Ice storm rolls from Texas to Tennessee - I'm in Los Angeles and its freezing. Global warming was a total, and very expensive, hoax!" (Trump, 2013).

In a November 2016 interview with the New York Times, the Presidential candidate Trump stated a different thought in regard to CC than previous public statements. In the interview, Presidential candidate Trump stated he has "an open mind to it (climate change) …It's one issue that's interesting because there were few things where there's more division than climate change" (The New York Times, 2016, para. 72). However, shortly after this interview, the chief of staff Reince Priebus provided additional comments on Presidential candidate Trump's position on CC. "Look, I'll have an open mind about it. But he has his default position, which was that most of it was a bunch of bunk. But he'll have an open mind and listen to people" (Priebus, 2016).

A Yale Climate Change Communication study, published in February 2017 reported about half of Trump voters believe global warming was occurring (*n*=1,226) (Leiserowitz, Maibach, Roser-Renouf, Rosenthal, & Cutler, 2017a). In addition, 47% stated that the United States should have international involvement to reduce global warming and 62% supported taxation as a way to mitigate CC (Leiserowitz et al., 2017a).

The differences of opinion and beliefs on the subject of CC has been one that continues to provide much disagreement from President Trump and the public.

After the election, one of President Trump's key campaign promises was to end the U.S. involvement with the Paris Agreement. The Paris Agreement was signed into agreement 2016 with the intention to have international efforts to fight CC (United Nations Framework Convention on Climate Change [UNFCCC], 2016). In May 2016, President Trump expressed he would "cancel the Paris Climate Agreement and stop all payments of the U.S. tax dollars to U.N. global warming programs" (CNN, 2016). This theme continued after election, when in April 2017, President Trump stated this "one-sided Paris climate accord, where the United States pays billions of dollars while China, Russia, and India have contributed and will contribute nothing" (Associated Press, 2017).

Voters thought the promise would perhaps be kept, since as of April 2017, President Trump's advisers met to determine if the United States would remain in the Paris Agreement or leave (Tatum, 2017; Worland, 2017). However, a national survey documented 70% of voters agree the United States should stay with the agreement (Leiserowitz et al., 2017a). Of these voters, 86% Democrats and 51% Republicans agreed the United States should continue participating in the Paris Climate Deal (Leiserowitz et al., 2017a).

On June 1, 2017, President Trump announced the United States would remove themselves from the Paris Agreement (Shear, 2017). One of the reasons from the removal was "It would once have been unthinkable that an international agreement could prevent the United States from conducting its own domestic affairs" (Shear, 2017, para. 10). The withdrawal from the Paris Agreement was met with both praise and criticism

from domestically and internationally. Miguel Arias Cañete, the European Union's Commissioner for Climate said "Today's announcement has galvanized us rather than weakened us, and this vacuum was filled by new broad committed leadership" (Cañete, 2017). Other tweets were expressed from I.B.M. (Shear, 2017), Mayor Peduto of Pittsburgh (Shear, 2017), and several cities, universities, mayors, business, and others signed a declaration "We Are Still In", which as of June 5, 2017 was up to 1,219 signatures (We Are Still In, 2017).

Religion. CC by many Americans can be defined through their individual and collective religious beliefs. Fifteen percent, or one out of every seven, Americans believe CC was controlled by God (Roser-Renouf et al., 2016a). The researchers were able to expand research on this population into the following group who believe "God controls the climate, therefore people can't be causing global warming" (Roser-Renouf et al., 2016a):

- Tea Party members (38%)
- Conservative Republicans (31%)
- Evangelical and Born-Again Christians (30%)
- Registered voters who support Donald Trump over Hillary Clinton (30%)
- Republicans (26%)
- People who believe Earth was created in six days, and described in the Bible (26%)
- People who watch the Fox News Cable Channel often (24%) or sometimes (21%)
- People who do not believe that humans evolved from earlier species (24%)
- African Americans (23%)

- High school graduates (22%)
- People whose household income was less than $30,000 annually (21%). (p. 2)

Those citizens who do not believe that God controls climate were grouped as:

- Agnostics and atheists (1%)
- People who do not believe that the Earth was created in six days, as described in the Bible (5%)
- People who listen to National Public Radio (NPR) often (3%) or sometimes (8%)
- People who have no religious affiliation (6%)
- Liberal Democrats (6%)
- Democrats (9%)
- People who believe humans evolved from earlier species (9%)
- Registered voters who support Hillary Clinton over Donald Trump (10%)
- People with a Bachelor's degree of higher (11%)
- People who never watch Fox News Cable Channel (11%). (Roser-Renouf et al., 2016a, p. 2)

One aspect of this research was that some participants believed "God controls the climate, therefore people can't be causing global warming" (Roser-Renouf et al., 2016a, p. 2). This statement indicated CC was only caused by either God or humans and did not allow for natural factors to be included. Even though God may control nature in some religions, the extent to this control may vary depending on where a person falls on the religious spectrum.

Additionally, the researchers Roser-Renouf et al. (2016a) reported:

- 14% of Americans believe that CC was the end of times

- 11% believe that since the end of times was coming, we do not need to worry about CC
- 9% believe that the apocalypse will occur during their lifetime

Religion was also used to categorize citizens in the United States using the Six Americas Survey, which classifies 12% as Alarmed, 29% as Concerned, 26% as Cautious, 7% as Disengaged, 15% as Doubtful, and 11% as Dismissive (Roser-Renouf, Maibach, Leiserowitz, Feinberg, & Rosenthal, 2016). Using a lens on how individuals view CC, 82% of the Alarmed group viewed CC as a moral issue and only 20% as a religious issue (Roser-Renouf et al., 2016). Only 6% of the Dismissive group view CC as a moral issue and only 9% as a religious issue.

Membership to certain religious groups provided additional information on an individual's level of CC belief. The most Alarmed group was Catholic at 26% with only 6% of Baptist identifying at Alarmed (Roser-Renouf et al., 2016). Those individuals described as Cautious were 28% Catholic, 19% Protestant, and 17% none of the above listed in the survey (Roser-Renouf et al., 2016). Individuals labeled as Dismissive were 19% Protestant, 17% Catholic, and 17% Baptist, and 17% other Christian (Roser-Renouf et al., 2016). These results were further illustrated in Figure 4 and there was a vast division between religious groups and the belief in anthropogenic CC. While Catholics had the greatest belief in CC, Baptist had the least percentage categorized as Alarmed. This research provided information that membership to a religious group, much like membership to a political group, did show variation between groups in their belief in CC.

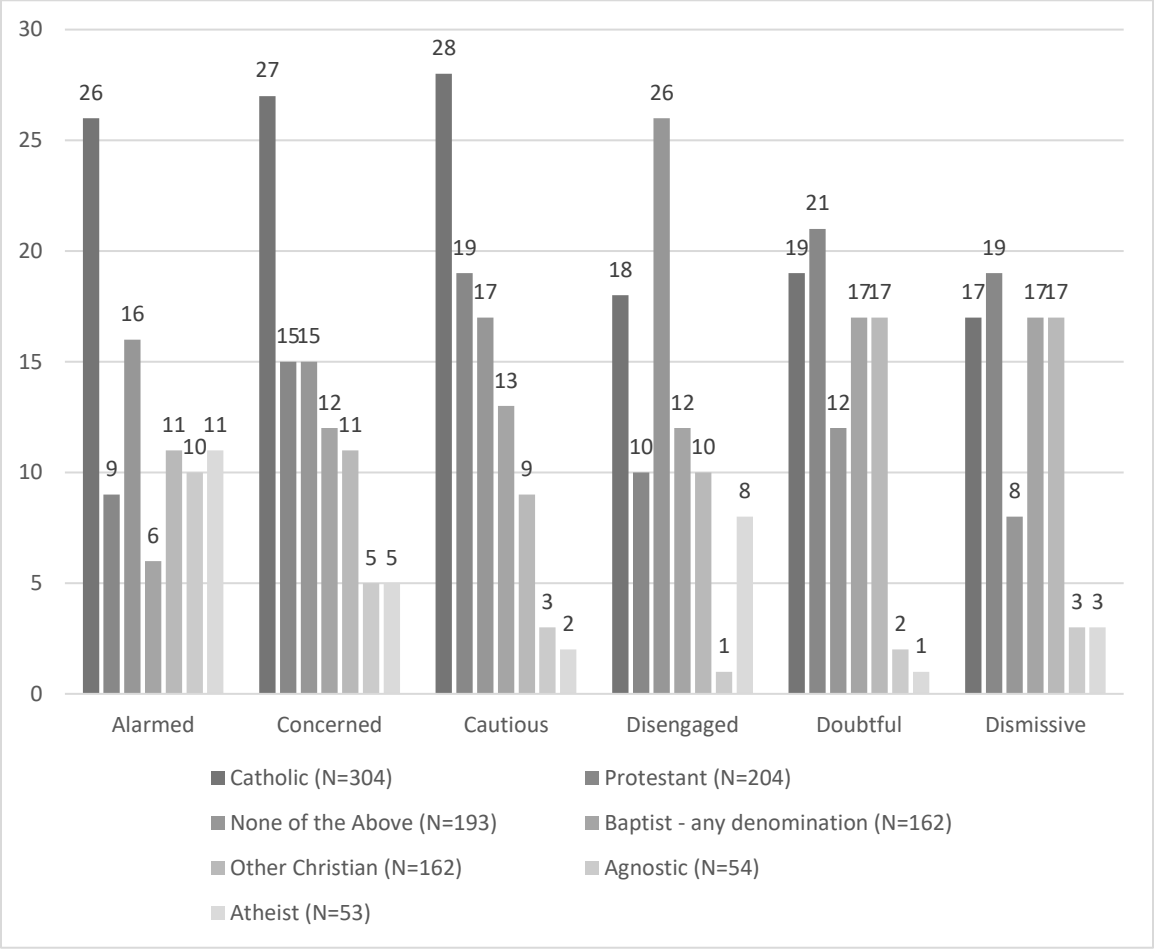

Figure 4. Religious Affiliation and the Six Americas Survey Categories as reported by Roser-Renouf et al. (2016).

Gender. The gender differences in environmental concern, has been called "ecofeminism" by the researchers Sakellari and Skanavis (2013, p. 77). Ecofeminism was defined as the gender differences exist may be the result of conceptualizations and not just priorities (Sakellari & Skanavis, 2013). In addition, the researchers reported while women tend to be more involved in EE and environmental justice, there was larger need to research the influence of gender (Sakellari & Skanavis, 2013).

In a 2012 Canadian study involving residents of Alberta, researchers reported of the sample of 1,200, while nearly 90% of both females and males agree climate has been

changing, slightly more females than males agree this change was anthropogenic (Davidson & Haan, 2012). In addition, males did not believe the impacts of CC were as severe as females reported (Davidson & Haan, 2012). This gender gap could be due to the notion females have been documented to be more concerned with environmental problems and issues than males (Delhomme, Cristea, & Paran, 2013; Gutierrez, 2016; MacDonald & Hara, 1994).

Research was not completely one-sided, a 2014 study focused on Indian college students in a technical course illustrated perhaps in an international setting, males can be more environmentally concerned than their female counterparts (Yadav & Pathak, 2014). These researchers used qualitative methods as a focus group to gather information on several CC topics, ranging from causes to environmental problems to their pro-environmental behaviors. In each of the five questions asked, the males generally demonstrated more environmental concern. However, the overall research did have several limitations, including the sample selection and the small sample size.

Overall the use of gender for predicting environmental concern was one needs further research (MacDonald & Hara, 1994). MacDonald and Hara (1994) argued "despite sagacious theories that led us to expect gender references to be strong, we found that gender accounts for little of the environmental concern" (p. 373). In 2013, research study focused on gender and environmental concern, the researchers initially stated gender did play a role in environmental concern, with females being more concerned than males (Mobley & Kilbourne, 2013). However, further analysis showed this gender difference existed when there was an interaction with technology and altruism. In other words, males had a lower environmental concern when they believed technology would

reduce CC while females had a higher environmental concern when they scored high in altruism (Mobley & Kilbourne, 2013). Furthermore, these results were not consistent across culture. Males in the United States, Canada, and Germany had consistent scores within their gender and the environment, while females in these counties did not have consistent scores (Mobley & Kilbourne, 2013).

The use of gender in environmental concern has mixed results according the researchers. This research ranged from studies that demonstrated a positive connection of females being more environmentally concerned (Delhomme et al., 2013; Gutierrez, 2016; MacDonald & Hara, 1994), to males being more concerned (Yadav & Pathak, 2014), and to having results indicate gender does not matter (Mobley & Kilbourne, 2013). Gender was a complicated aspect and does not seem to be easily isolated as a singular variable that relates to environmental concern, let alone CC beliefs.

Climate Change Education

CC education refers to education of a specific realm of knowledge, specifically CC science, and the attitudes and behaviors that are consistent with the mitigation of CC (Dupigney-Giroux, 2010). It provides a way for individuals to be prepared for and how to respond to changes brought on by CC (Mochizuki & Bryan, 2015). In addition, the use of education for CC has been supported as an affordable and cost-efficient method for dealing with CC (Mochizuki & Bryan, 2015).

CC education was one aspect of EE, which has been internationally recognized since the 1970s. The United Nations, in the Report of the United Nations Conference on the Human Environment, first supported the use of education, both formal and non-formal, as a method for dealing with environmental problems, including climate related

problems (United Nations, 1972). In 2011, United Nations Education, Scientific, and Cultural Organization (UNESCO) provided several recommendations for the use of CC education for mitigation and adaptation. Some of these recommendations included encourage lifelong learning with formal and non-formal settings, include global and local connections, use professional development to increase teacher knowledge and skills, increase the availability and quantity of curriculum, along with several others (UNESCO, 2011).

In 2009 and 2010, Congress asked the National Science Foundation to develop a CC education program (National Research Council, 2011). The Climate Change Education Partnership (CCEP) was developed and had a mission to develop high quality and effective resources relating to CC education (National Science Foundation, 2012). During the Phase I of CCEP, three workshops were held on CC interactions with engineered systems and how education can address them (National Research Council, 2014). The goals of Phase I were:

1) provide a listing of current CC education resources
2) determine the key stakeholders
3) conduct community workshops designed to develop CC education strategic plans
4) begin the process of developing standards, curriculum, professional development, and training (National Science Foundation, 2012).

The goal of Phase II was to fund strategic plans already in place that supported the goals of CC education (National Science Foundation, 2012).

During the first phase of the CCEP, the Climate Literacy and Energy Awareness Network (CLEAN) was created (Ledley, Gold, Hiepold, & McCaffrey, 2014). Those

involved with CLEAN participated in either the email list or weekly teleconferences (Ledley et al., 2014). In an emailed survey in 2013 to all CLEAN members, 51% reported they had referred others to the network, and 41% used CLEAN as a resource, either for personal or to share with students (Ledley et al., 2014). The majority of CLEAN members were involved for networking (47%), discussing science (45%), or sharing teaching ideas (38%) as reported by Ledley et al. (2014). CLEAN has provided a place for communicating CC with other like-minded individuals, even though many members were still not provided support (Ledley et al., 2014). Overall, CLEAN has provided a community of support for CC education. According to the CLEAN organization, to reach a greater impact in climate literacy, goals and a strategic plan would be beneficial to provided additional support to members (Ledley et al., 2014).

In 2009, the Climate Literacy Guide was developed by the National Oceanic and Atmospheric Administration, American Association for the Advancement of Science, and the National Science Foundation as an effort to encourage educators to include CC education in the classroom. Climate literacy was defined by the U.S. Climate Change Science Program (U.S. Climate Change Science Program, 2009) as a person who:

> Understands the essential principles of Earth's climate system; knows how to assess scientifically credible information about climate; communicates about climate and climate change in a meaningful way; and was able to make informed and responsible decision with regard to actions that many affect climate. (p. 3)

Encouraging climate literacy was a method to ensure everyone has the opportunity to understand how we interact with our environment and how we can

influence our environment. The following were the Climate Literacy Principles (U.S. Climate Change Science Program, 2009, pp. 9-14):

1. The sun was the primary source of energy for Earth's climate systems
2. Climate was regulated by complex interactions among components of the Earth system;
3. Life on Earth depends on, was shaped by, and affects climate;
4. Climate varies over space and time through both natural and man-made processes;
5. Our understanding of the climate system was improved through observations, theoretical studies, and modeling;
6. Human activities are impacting the climate system;
7. Climate change will have consequences for the Earth system and human lives.

While CC education became more defined through several efforts, including the Climate Literacy Principles, the Climate Change Education Partnership, and the CLEAN Network, CC within the classroom was also an area was noticed. However, to what extent CC was included into curriculum may vary from state to state, due to the design of each state's unique curriculum standards.

Climate Change Curriculum

CC pedagogy was not one that has not been commonly taught within the United States (Dupigney-Giroux, 2010; Hoffman & Barstow, 2007); Jeffries et al, 2001; Wise, 2010). In a study conducted by the TERC Center for Earth and Space Science Education, Hoffman and Barstow (2007) found 30 states directly and 12 indirectly include atmosphere, weather, and climate issues in the standards, while eight states do not. The

states within the southeastern region had standards directly relating to CC included Alabama, Georgia, Mississippi North Carolina, South Carolina, and Tennessee (Hoffman, & Barstow, 2007). However, only 11 states focus on CC science, and of these standards, only three include CC mitigation (Wise, 2010).

It was no surprise CC education might not even be present in elementary or secondary standards or the curriculum (Dupigney-Giroux, 2010). When elementary students were provided experiences focus on weather and climate, they have a better understanding of these concepts later in school (Dupigney-Giroux, 2010). The inclusion of CC curriculum into the classroom was not very prevalent in schools, both formal and informal (Dupigney-Giroux, 2010). One of the issues surrounding CC curriculum was the decision to make CC a singular subject or integrated within other subjects (Hamin & Marcucci, 2013). The Framework for K-12 Science Education was released in 2012 by the National Research Council provided guidelines or a framework for implementing science education in the classroom setting (National Research Council, 2012a).

This Framework for K-12 Science Education included three dimensions of practice, crosscutting concepts, and core ideas (National Research Council, 2012a). CC was addressed with in the standards through the dimension of practice, providing students the opportunity to contribute to current environmental problems and issues (National Academy Press, 2012a). The Framework for K-12 Science Education included a stand-alone standard, *Global Climate Change*, which focused more on anthropogenic causes as well as climate models and future predications (National Academy Press, 2012a). Students in both elementary, middle, and high school all had end goals underneath this specific CC standard. These goals included, by the end of the fifth grade, students should

understand as the temperature continues to rise, humans were affected; by the end of eighth grade, students should understand greenhouse gases, global temperature, and anthropogenic causes; and finally, by the end of 12th grade, students should understand climate models and future predictions (National Academy Press, 2012a).

CC was also included within the standard *Weather and Climate* as greenhouse gases, historical events, and natural events (National Academy Press, 2012a). To address the importance of interdisciplinary learning, the Framework for K-12 Science Education provided recommendations on CC related to social studies, math, and language arts (National Academy Press, 2012a, 2012b).

Based on the Framework for K-12 Science Education, the NGSS were developed to address the three dimensions of practice, crosscutting concepts, and core ideas (National Academy Press, 2012b; NGSS Lead States, 2013). The NGSS was designed to be standards, not curriculum, were aligned to the Common Core, which many states had previously adopted (NGSS Lead States, 2013). The purpose of the NGSS was to ensure students were prepared for careers in STEM (NGSS Lead States, 2013). Each grade was provided a "storyline", which provided the standards and expectations for each grade level, within several storylines, CC was addressed.

The initial grade level to include the term CC was found in the third-grade standards. However, the standard stresses assessment at this grade storyline does not include CC (NGSS Lead States, 2013). Further information in the NGSS for the exclusion for CC in the elementary level was the assessment focused on a singular environmental event, such as water, food, temperature, and precipitation, rather than a more complex event, such as CC (NGSS Lead States, 2013).

In middle school, the NGSS standards included providing evidence climate was changing as well as anthropogenic causes (NGSS Lead States, 2013). The singular middle school standard was listed as one of the main sub-categories underneath the disciplinary core ideas (NGSS Lead States, 2013). In high school, the NGSS standards built upon the middle school standards to include further information on systems and their interactions within weather and climate, anthropogenic causes, understanding models, and understanding solutions for environmental problems and issues (NGSS Lead States, 2013). CC was also housed underneath disciplinary core ideas (NGSS Lead States, 2013). Seven standards were provided in the high school story line; four of these were listed underneath the disciplinary core ideas, one was listed as a main understanding of students, and two were clarification statements of main standards (NGSS Lead States, 2013).

Since the development of the NGSS, only 18 states have adopted the standards (Academic Benchmarks, 2015). These states include Washington, Oregon, California, Nevada, Hawaii, Kansas, Arkansas, Iowa, Illinois, Kentucky, West Virginia, Maryland, Delaware, New Jersey, Connecticut, Rhode Island, Vermont, and Michigan (Academic Benchmark, 2015). Of these states, only Washington, Oregon, California, Nevada, Hawaii, Kansas, Arkansas, Illinois, Maryland, Delaware, New Jersey, Connecticut, and Vermont adopted the NGSS in their original format, while the other states adopted with changes (Academic Benchmark, 2015). The adoption process of the NGSS varies for each state, ranging from the board of education, to legislation, and in some states this passage relies simply on the superintendent (Pruitt, 2014). Another reason for the slow adoption of NGSS was the need for states to develop curriculum, materials, and

assessment (Pruitt, 2014). Of the states included within the SEEA, only Kentucky has adopted NGSS (Academic Benchmark, 2015).

The remaining states in the SEEA each have individual state science standards. Table 1 provides an analysis of remaining states within the SEEA and the inclusion of the term CC within the state science standards.

Table 1

Climate Change Related Standards in SEEA States

State Standards	Grades K-5	Grades 6-8	Grades 9-12
Alabama			2
Florida			4
Georgia			5
Kentucky		1	7
Mississippi			1
North Carolina			3
South Carolina			1
Tennessee			2

Alabama has two CC standards, and both were found in environmental science (Alabama State Board of Education, 2015). Florida has four CC related standards, two were within the earth systems and patterns standards, and the other two were interdependence related standards (Florida Department of Education, 2016). In Georgia, the standards relating to CC were for the high school standards of earth systems, ecology, meteorology, and oceanography, which were not required courses of study for high school (Georgia Department of Education, 2015). CC standards were not a part of the traditional curriculum in Georgia, and one could assume many high school students were not exposed to CC concepts. Kentucky adopted in 2013 the NGSS which has one middle school related standard in seventh grade (NGSS Lead States, 2013). Of all the states,

Kentucky has the most CC related standards, and the only state that includes a standard in middle school. Mississippi has one related CC standard, listed as a sub-standard within earth and space science (Mississippi Department of Education, 2012). The North Carolina standards included one main standard relating to CC within the earth/environmental essential standards and two sub-standards (North Carolina Department of Public Instruction, 2009). South Carolina has one sub-standard relating directly to CC (South Carolina Department of Education, 2016). Tennessee has two CC related standards, one in geology as a sub-standard and one in environmental science as a main standard (Tennessee Department of Education, 2011). The current standards demonstrate the inclusion of CC has increased within the Southeast since the 2007 TERC Center for Earth and Space Science Education study, which was evident through each state in the Southeastern United States including a minimum of one CC related standard.

CC curriculum has been presented through a variety of lens, but there was no guiding principle for developing the curriculum. Perhaps, this lack of guiding principle was why CC was not found very frequently within the state standards, specifically within the Southeast. However, even though state supported curriculum guidelines have not been supported, there has been efforts made by researchers. In 2010, McKeown-Ice and Hopkins published a set of components for CC education: 1) issue analysis, 2) community and personal decision-making, 3) political processes, 4) social justice, 5) inter-cultural sensitivity and inter-cultural competence, and 6) behavior change (p. 18). The purpose of these six components was to provide a dialogue within CC education goes beyond tradition classroom setting and providing life-learning education for all citizens (McKeown-Ice & Hopkins, 2010).

The use of education for CC mitigation and adaptation has grown, as evident of the increase in CC educational research. This research has included, but was not limited to, the formal setting of the K-12 classroom, focusing on K-12 teachers, the university level, and non-formal education. The following section will provide further information on how researchers were providing data on the effectiveness of CC education.

Climate Change Education Research

CC education research has been increasing in volume in recent years. A database search with the platform Galileo, produced 106 peer-review publications from the year 2016 to January 2017 using the search term *climate change education*. In the years 2010 to 2015, there were 849 peer-reviewed publication using the search term *climate change education'*. The areas of research interest for further investigation in this study included perceptions and knowledge for teaching CC.

Perceptions and Knowledge on Climate Change

The perception one holds on CC was a large aspect of the Six Americas Survey. Perception was divided into four categories: "global warming beliefs, issue involvement, climate-relevant behaviors, and preferred societal response" (Maibach et al., 2011, p. 3). These categories were described further in the following sections. CC beliefs was reviewed for several groups: K-12 students, K-12 teachers, higher education, the general public, non-formal educators, and the Southeastern United States. Research focusing on perceptions, knowledge, awareness, and beliefs for each group.

K-12 students. CC misconceptions usually formed at a younger age (Bofferding & Kloser, 2015; Henriques, 2002; Shepardson et al., 2009). A study by Henriques (2002) compiled a list of common science misconceptions students hold. This research was

especially important for teachers to identify misconceptions a priori and then provide instruction. Henriques identified some of the misconceptions including:

> …clouds (and rain) and made by God; flooding only occurs along rivers when the snow was melting in the spring; the atmosphere was made up solely of air; very cold winters can be predicted by seeing how hot it was last summer; and the greenhouse effect was caused when gases in the atmosphere behave as a blanket and trap radiation, which was then reradiated to the Earth. (Henriques, 2002, pp. 209-215)

In a literature review, Shepardson et al. (2011) found students did not think carbon dioxide was a greenhouse gas. Additionally, they found students believe CC cannot be stopped (Shepardson et al., 2011). All of these studies provided information on how misconceptions were clearly evident in youth and adults and the education system needs to be proactive in addressing these issues.

Curriculum that focuses on CC, however, was determined to be beneficial in not only addressing misconceptions, but also in providing further information on CC (Bofferding & Kloser, 2015). Bofferding and Kloser (2015) investigated the impact of mitigation and adaptation curriculum on students' understanding of CC through a pretest and posttest design research study among a sample of 387 students, 162 middle and 225 high school students. From the pretest to the posttest, there was a significant difference in scores relating to CC knowledge, causes, and mitigation efforts (Bofferding & Kloser, 2015). The data relating to adaptation demonstrated many of the students were unfamiliar with CC adaptation; 24% confused adaptation with mitigation, even after the CC curriculum (Bofferding & Kloser, 2015). The results of this study by Bofferding and

Kloser (2015) demonstrated CC curriculum can have a positive impact on understanding, and misconceptions can still remain and these need to be addressed with further instruction.

Some research indicated the use of conceptual change theory or critical evaluation can assist in altering misconceptions with CC (Lombardi, Sinatra, & Nussbaum, 2013). The conceptual change approach has been used since the 1980s and was conceptualized as the Cognitive Reconstruction of Knowledge Model (CRKM) by Dole and Sinatra in 1998. The new CRKM was defined as the strength of the student's commitment to an idea and the likelihood conceptual change may occur (Dole & Sinatra, 1998; Lombardi et al., 2013).

Lombardi et al. (2013) used the CRKM model to determine if students' perceptions of anthropogenic CC would be altered after participating in critical evaluation. The study by Lombardi et al. included 196 seventh-grade students participated in a "pre-instruction, quasi-experimental, and post-instruction phases" (Lombardi et al., 2013, p. 54) where half of the student participated in the critical evaluation activity (Lombardi et al., 2013). They found seventh grade students who participated in critical evaluation had greater changed in knowledge and also retested higher after 6 months (Lombardi et al., 2013).

The relationship between students' understanding, beliefs, and behavior was studied among high school students after participating in a CC curriculum (McNeill & Vaughn, 2012). The results indicated participation in CC curriculum had a positive impact on the students' understanding of CC and increasing their understanding of the anthropogenic CC causes (McNeill & Vaughn, 2012). The relationship to behaviors after

the CC curriculum showed students increased their understanding of different behaviors and their impact on CC, but also the variety of behaviors (McNeill & Vaughn, 2012). These behaviors increased from no one indicating transportation to over 40% indicating a reduction in transportation and include increase CFL bulb usage and conserving electricity (McNeill & Vaughn, 2012).

Internationally, research studies also contributed to the overall understanding of CC education. In a 2011 study, 626 Greek secondary students were surveyed on their CC knowledge, and Liarakou, Athanasiadis, and Gavrilakis found 57% of the eighth-grade students and 74% of the 11th-grade students provided correct responses on the survey instrument(. However, only 34% eighth-grade and 43% 11th grade student provided correct responses for the causes of CC, and 44% and 56% respectively provided solutions (Liarakou et al. 2011). As to the source of this knowledge, the leading response was the television, with 82% eighth grade and 87% 11th grade, while school accounted for 56% and 46% respectively (Liarakou et al., 2011).

K-12 teachers. Research in climate education has also gone beyond from what students know, but to include teachers' knowledge, perceptions, attitudes, and other aspects related to CC education. McNeal et al. (2014) reported while educators from their study were overall knowledgeable on CC, there were still misconceptions. Some of the misconceptions included whether hydrogen was a greenhouse gas, how the contribution of CFCs to increased temperatures, and how CC may contribute to future homeland security (McNeal et al., 2014). The 2014 study included a sample of 420 Grades 6 to 20 Southeastern U.S. educators. Fortner (2001) demonstrated many teachers

hold similar misconceptions as their students, even if the teachers place greater emphasis on CC education.

Some research indicated K-12 teachers have a lack of awareness on environmental issues, including CC (Campbell et al., 2010). This lack of awareness was reported from teachers in Turkey, Bolivia, and the United States; of the 171 teachers, 61% of the U.S. teachers were able to identify environmental problems discussed at an international conference, the Bali-Indonesia United Nations Climate Change Conference, while only 37% of Bolivian and 30% of the Turkish teachers did (Campbell et al., 2010). The researchers theorized American teachers were more aware of the environmental problems, such as CC, when there are more CC media in the United States, such as the documentary *An Inconvenient Truth* (2010).

Higher education. CC in higher education has been another area where research has explored CC related areas. Providing CC education at the university level has been cited as a priority by some (Fahey, 2012; Leal Filho, 2010; Sanni, Adejuwon, Ologeh, & Siyanbola, 2010). Higher education was one area of importance for incorporating CC education and for preparing future citizens going into their respective career paths (Fahey, 2012).

In a 2010 study, 1,250 university students from 166 universities in 43 countries were surveyed on CC (Leal Filho, 2010). The results demonstrated the majority of the students had an accurate description of CC; 62% described it as a changing climate and 57% understand melting ice caps (Leal Filho, 2010). As to where the students learned this information, 82% in North America cited the internet, and 68% cited university course while in Asia 35% citing the internet and 22% citing from university courses (Leal

Filho, 2010). Further analysis included the majority of students learned about CC in natural science (73%) or social sciences (68%) courses (Leal Filho, 2010).

Misconceptions on CC were found within several studies with pre-service teachers (Boon, 2010; Cordero et al., 2008; Khalid, 2003; Ratinen et al., 2013; Ratinen et al., 2015). Cordero et al. (2008) found many of these misconceptions continue even after a 15-week long university course on weather and climate based on their survey of 400 students. However, they also found students who took an ecological footprint quiz, which focused on how personal actions contribute to CC, scored higher on the questionnaire than students who did not take the ecological footprint.

Misconceptions especially relating to greenhouse gases were found to be a common area where university students held confusion (Keinonen et al., 2016; Khalid, 2003; Ratinen et al., 2015). Pre-service teachers also held misconceptions about the science behind greenhouse gases, such as stating the ozone depletion was the result of greenhouse gases, solar radiation has no impact on greenhouse, and the relationship between weather, climate and greenhouse effect (Keinonen et al., 2016; Khalid, 2003; Ratinen et al., 2013).

CC knowledge held by teachers, especially at the early childhood level, was described as highly important for science literacy of students (Lloyd et al., 2007). Boon (2010) researched 107 Australian pre-service teachers, ranging from early childhood to secondary education, and reported not only the preservice teachers had low knowledge, but also misconceptions relating to CC. The misconceptions included confusion about the role of greenhouse gases, causes of the greenhouse effect, and the ozone layer (Boon, 2010). Overall CC knowledge of preservice teachers has been reported to be at lower

levels, and there were not enough opportunities to provide pre-service teachers with knowledge to teach CC (Boon, 2010; Lloyd et al., 2007).

Within higher education, CC curriculum has been reported in the form of graduate seminars (Hamin & Marcucci, 2013). However, at many universities the inclusion of any form of EE was considered supplemental material and many preservice teachers learn content in one course and pedagogy in another course (Dominguez & McDonald, 2010). Kirk et al. (2014) reported CC was taught in a variety of courses; however, these courses were mostly related to geosciences.

General public. In a 2005 study funded by the National Environmental Education and Training Foundation (NEETF) and a collaboration with Roper Reports surveyed 1,500 participants, reported the varying levels of environmental knowledge and awareness of the general public. CC, along with pollution, energy, and habitat loss, was indicated by up to 70% of the participants as an environmental issue they had heard of (Coyle, 2005). However, only 45% of North Americans correctly identified automobile, homes, and industrial emission as the main causes of global warming, and even though 77% agree CC was a serious problem it was given the lowest score for seriousness of environmental problems (Coyle, 2005).

A recent study through Yale Program on Climate Change Communication found of 1,266 surveyed adults 70% think global warming was happening, and only 13% do not believe it was happening (Leiserowitz, Maibach, Roser-Renouf, Rosenthal, & Cutler, 2017b). The researchers also found 55% of North Americans believe CC was anthropogenic (Leiserowitz et al., 2017b). While North Americans report high beliefs about CC, 71% of them believes it was a problem of the future and 65% of them believed

it was a problem for the world's poorest populations (Leiserowitz et al., 2017b). A recent poll from the Yale Program demonstrated the majority of North Americans were supportive of the knowledge of CC.

National studies, sponsored by the Yale Project on Climate Change Communication took place during 2009, 2010, 2013, and 2014, were most commonly referred to as the Six Americas. The Six Americas Survey was used to measure the public's "climate change beliefs, attitudes, risk perceptions, motivations, values, policy preferences, behaviors, and underlying barriers to action" (Maibach et al., 2009, p. 1). After further analysis of the data, the researchers were able to place North Americans into six groups on how they differ on CC: alarmed, concerned, cautions, disengaged, doubtful, and dismissive. The groups were described by Maibach et al. (2009) as:

- The Alarmed group are the most supportive of CC. They are "convinced it was happening, human-caused, and a serious and urgent threat. The Alarmed are already making changes in their own lives and support and aggressive national response" (p. 3).
- The Concerned group are "convinced that global warming was a serious problem, but while they support a vigorous national response, they are distinctly less involved in the issue" (p. 3).
- The Cautious "also believe that global warming was a problem, although they are less certain that it was happening that the Alarmed or Concerned; they don't view it as a personal threat, and don't feel a sense of urgency to deal with it" (p. 4).

- The Disengaged "haven't thought much about the issue at all, don't know much about it, and are the most likely to say that they could easily change their minds about global warming" (p. 4).
- The Doubtful are "evenly split among those who think global warming was happening, those who think it isn't, and those who don't know. Many within this group believe that if global warming was happening, it was caused by natural changes in the environment, believe global warming won't harm people for many decades into the future, if at all, and say that America was already doing enough to respond to the threat" (p. 4).
- The Dismissive, "like that Alarmed, are actively engaged in the issue, but on the opposite ends of the spectrum; the majority believe that warming was not happening, was not a threat to either people of non-human nature, and strongly believe it was not a problem that warrants a national response" (p. 4).

In 2009, Maibach et al. identified six different groups of U.S. citizens who can be categorized into based on "measures of the public's CC beliefs, attitudes, risk perceptions, motivations, values, policy preferences, behaviors, and underlying barriers to action" (p. 1). These categories were 33% Concerned, 19% Cautious, 18% Alarmed, 12% Disengaged, 11% Doubtful, and 7% Dismissive. Even though more than half of the responders agree CC was a concern, none reported they were completely hopeful that impacts of CC can be successfully reduced (Maibach et al., 2009).

Another national study by the Yale Project on Climate Change Communication (2010) found:

- 57% know that the greenhouse effect refers to gases in the atmosphere that trap heat;
- 50% of North Americans understand that global warming was caused by human activities;
- 45% understand that carbon dioxide traps het from the Earth's surface;
- 25% have ever heard of coral bleaching or ocean acidification (Leiserowitz et al., 2010, p. 3).

In December 2013, additional data were collected for the Yale Project and included that nearly 63% of Americans believe CC was happening, and this number has remained constant since the spring of 2013 (Leiserowitz et al., 2014). However, in that same timeline, North Americans who do not believe in CC increased from 16% to 23% (Leiserowitz et al., 2014). Other highlights from this 2014 Yale Report included:

- 37% of Americans agree that CC was the result of natural causes
- 42% agree that scientists know CC has occurred
- 65% of Americans thought that CC was problematic to future generation (Leiserowitz et al., 2014).

Leiserowitz et al. (2014) divided North Americans into six different categories for CC; there were 27% Concerned, 23% Cautious, 16% Alarmed, 15% Dismissive, 12% Doubtful, and 5% Disengaged as collected in November of 2013. These numbers changed from the 2009 study that had 33% Concerned, 18% Alarmed, and 11% Doubtful (Maibach et al., 2014). When looking at CC responses for each category, North Americans labeled as alarmed had 81% in agreement that scientists think CC was

occurring, which 65% Disengaged did not know, and 55% of the Dismissive group thought there was disagreement on CC with scientists (Leiserowitz et al., 2014).

The most recent Yale Project using the Six Americas Survey was conducted in October 2014. These results indicated 13% were Alarmed, 31% were Concerned, 23% were Cautious, 7% were Disengaged, 13% were Doubtful, and 13% were Dismissive (Roser-Renouf, Maibach, Leiserowitz, Feinberg, Rosenthal, & Kreslake, 2014). The changes in the Six Americas Survey was illustrated in Figure 5. The largest groups continued to be the Concerned group with 31%. This group was described as individuals who were sure CC was occurring, even by anthropogenic causes, but this threat was for future generations to worry about and not for the current generation (Roser-Renouf et al., 2014). The Dismissive group has increased from September 2012 to October 2014 from 8% to 13%. Dismissive were individuals who believe CC was not happening (Roser-Renouf et al., 2014).

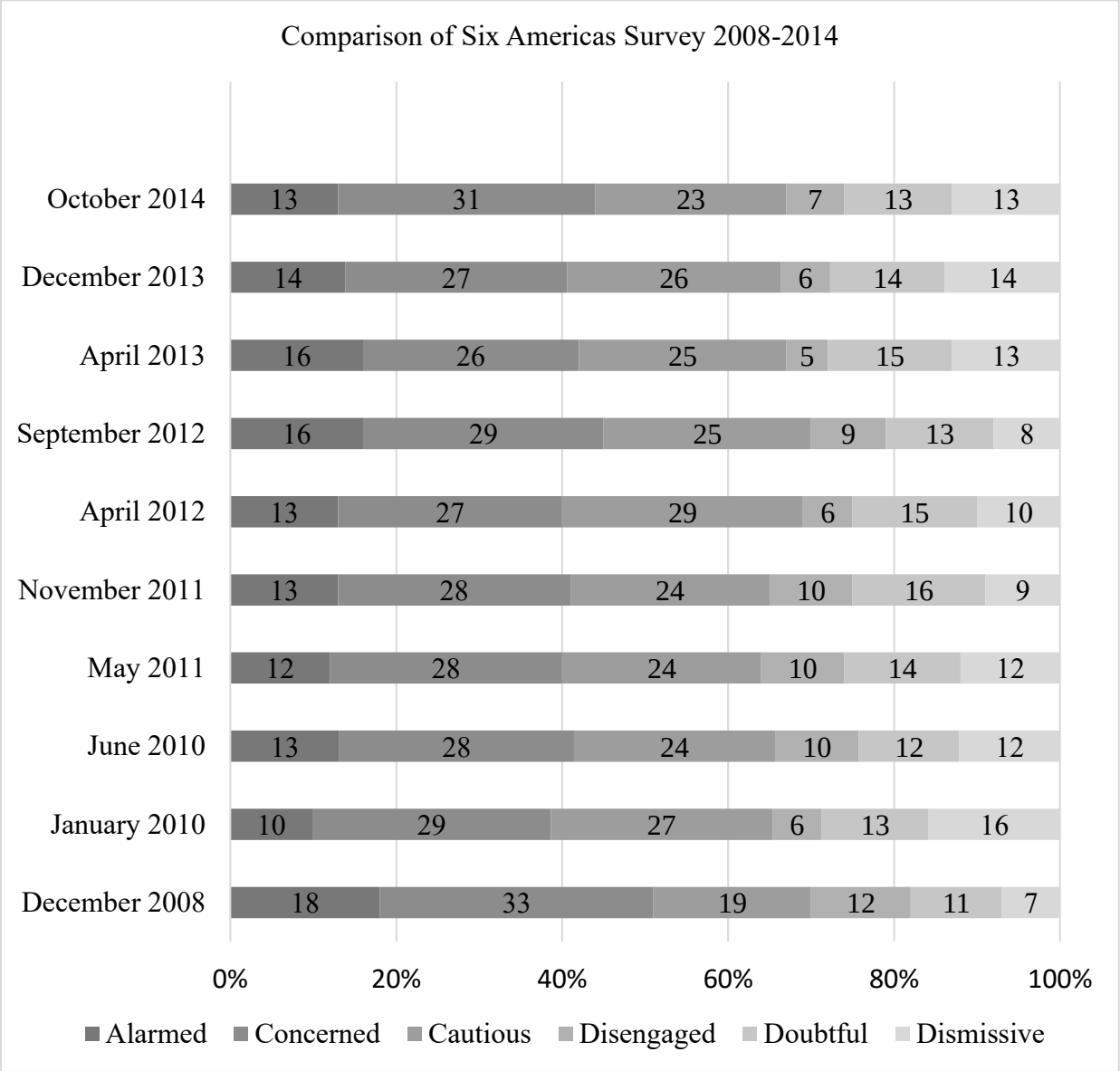

Figure 5. Comparison of the Six Americas Survey conducted by Yale Communication from 2008-2014.

Additional research from Yale Communication included a survey conducted in March 2016 with 1,204 adults (Leiserowitz, Maibach, Roser-Renouf, Feinburg, & Rosenthal, 2016). The level of North Americans in 2016 who believe CC was happening was 70%, and 43% were extremely sure it was happening (Leiserowitz et al., 2016). However, only half reported anthropogenic causes were responsible for the changes, only

38% believed CC was currently impacting people, and 71% believed CC was a worry for future generations.

Dickinson, Crain, Yalowitz, and Cherry (2013) used citizen science with the general public as a method for providing CC education. By using an online survey, the researchers received 3,456 completed surveys, where 94% were from the United States (Dickinson et al., 2013). The researchers found when CC was framed by discussing harm to wildlife, specifically birds, there was more of an interest in CC when it was framed with the impacts on humans (Dickinson et al., 2013). This research showed positive framing was not the only method for discussion CC, but negative framing was useful when it took the humans out (Dickinson et al., 2013).

Non-formal education. It was ultimately up to education to address misconceptions and teach CC education. Research outside of the traditional classroom non-formal education centers, such as museums, has indicated non-formal education centers were effective in promoting a better understanding of CC. Overall, non-formal education has indicated that participants are more aware of environmental problems (Leiserowitz & Smith, 2011; Primack & Miller-Rushing, 2009; Sellmann & Bogner, 2013) and change environmental attitudes (Drissner et al., 2010).

A 2011 study by the Yale Project on Climate Change Communication found that:

- 90% of frequent visitors say that global warming was happening, compared to 67% of occasional visitors and 60% of non-visitors;
- 65% of frequent visitors correctly understand that the greenhouse gas effect refers to gases in the atmosphere that trap heat, compared to 78% of occasional visitors, and 60% of non-visitors;

- 11% of frequent visitors know how much carbon dioxide there was in the atmosphere today, compared to 12 % of occasional visitors and 5% of non-visitors. (Leiserowitz & Smith, 2011, p. 2)

Even though museums appear to be an effective source of scientific information, it does have limits. In addition, the researchers Leiserowitz and Smith (2011) did not provide any further information as to the differences in results between visitors and non-visitors of non-formal centers. For the most part, the information at non-formal centers was very limited, and these organizations have acknowledged they were slow at addressing controversial topics (Cooper, 2011). In addition, the people who visit museums choose to do so, which may be a reason why they report higher numbers than individuals who do not visit.

Botanical gardens serve as informal education sites that mainly focus on providing information on plants and ecosystems and can provide CC education through these aspects (Primack & Miller-Rushing, 2009; Sellmann & Bogner, 2013). However, botanical gardens have the potential and expertise to relay CC related information to students as well as the general public (Primack & Miller-Rushing, 2009; Sellmann & Bogner, 2013). Botanical gardens were useful in providing long-term research with impacts of CC on local flora (Primack & Miller-Rushing, 2009). In a 2013 study, Sellmann and Bogner studied 108 students, ages 15 to 19 in Bavaria, where half of the sample participated in a 1-day trip to a botanical garden with a specific CC curriculum. With the use of a test-retest method the researchers found students who participated in the CC curriculum had significantly higher scores than the control group and had higher retention scores when retested 4 to 6 week later.

Drissner et al. (2010) investigated students' environmental attitudes after visiting an EE center. The researchers found students' attitude towards the utilization of nature was increased but their attitudes in preserving nature decreased after visiting the EE center (Drissner et al., 2010). It would appear short-term EE might not be a powerful tool in encouraging students to participate in preservation behaviors according to the research by Drissner et al. (2010). However, what the researchers did report was the students had an increase in attitudes in learning about small animals after visiting the EE center.

A 2014 study, sponsored by the National Science Foundation (NSF), indicated that members of the Association of Zoos and Aquariums found educators at zoos and aquariums were not reaching potential with CC education (Swim & Fraser, 2014). The researchers also found that first the confidence of these non-formal educators must be developed on how provide CC information to the public and how to interact with the public while providing this information (Swim & Fraser, 2014). However, the qualitative data showed if the CC education was geared towards the unique exhibits, then it would be easier to communicate to the public (Swim & Fraser, 2014).

Kelly et al. (2014) surveyed 3,594 visitors of zoos and aquariums using the 2012 Leiserowitz et al. "Global Warming Six Americas Survey" to determine what CC characteristics were held by these visitors. The findings were that 40% were concerned, 24% were alarmed, 18% were cautious, 7% were doubtful, 6% were dismissive, and 4% were disengaged (Kelly et al., 2014). These results differed from the national sample from the 2014 Leiserowitz et al. study where 27% concerned, 23% cautious, 16% alarmed, 15% dismissive, 12% doubtful, and 5% disengaged. A comparison of previous

research using the Six Americas Survey were illustrated in Figure 6. What this research demonstrated was visitors of zoos and aquarium have higher than average levels of concern for CC, and the researchers Swim and Fraser (2014) report indicated the educators were not communicating CC to this audience. The division between engagement and communication was an area that should be further researched in an effort to promote CC education at zoos and aquariums.

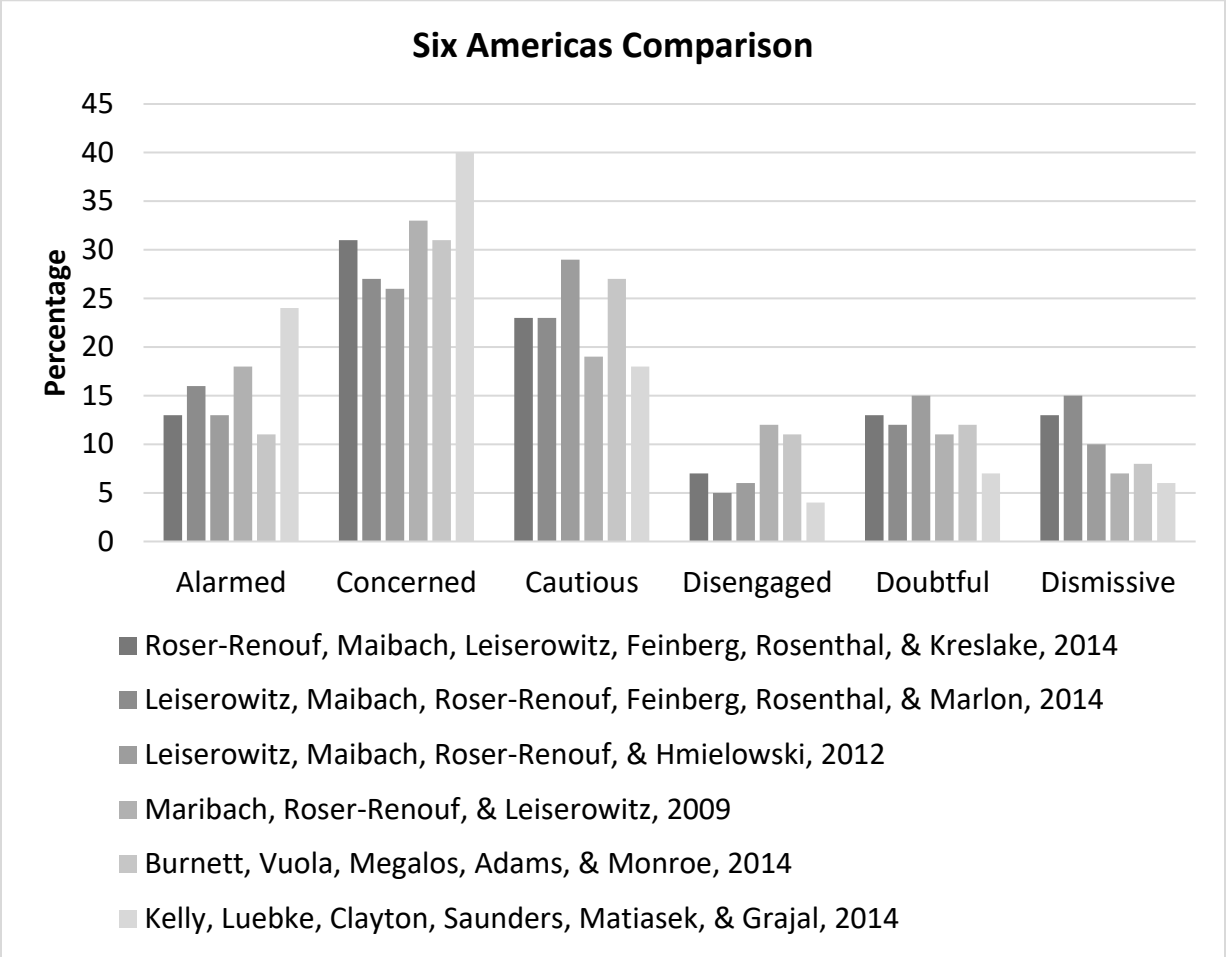

Figure 6. Comparison between Yale Communication Six Americas Data and Visitors of Zoos and Aquarium. Note. Shown in percentages.

The Alliance for Climate Education (ACE) was formed in 2009, and the organizations mission was to "educate young people on the science of CC and empower them to take action" (Alliance for Climate Education, 2016, para 1). Through the use of in-school programs, the program combines pop culture, entertainment, and CC education to provide education to over two million students since 2009 (Alliance for Climate Education). In a 2014 study, the ACE program was evaluated with the use of the 2009 Maibach et al. Six Americas Survey (Flora et al., 2014). The survey was provided to 1,241 high school students in a pre-post format, and all the participants attended the ACE

assembly on CC at their respective schools. The results from the study indicated after participation in the ACE assemble, students changed their category in the Six Americas Survey (Flora et al., 2014). Flora et al (2014) demonstrated a 49% increase in dismissive pre-assembly groups to a more engaged category, a decrease of 32% of students from the alarmed category to a less engaged one, with the largest change in categories coming from students in the disengaged (72%) and doubtful (68%). The students who moved from the alarmed category only moved one category down to the concerned category. In addition, the students had a 27% increase in CC knowledge. However, the results of this one-time exposure to the ACE assembly was discussed as a short-term impact with the participants (Flora et al., 2014).

In order to have environmental educators who were capable of providing CC education, training was essential. A case study involving 15 graduate students enrolled in a CC education course demonstrated CC knowledge increased at the end of the course as well as perceptions (Lambert & Bleicher, 2014). The change in CC perceptions included a move in the direction to be more aligned with climate scientists, which included anthropogenic causes of current CC (Lambert & Bleicher, 2014). Gaining knowledge and perceptions on CC was one area, but what these graduate students also gained was the ability to communicate CC science more effectively to a variety of audiences.

Southeastern United States. A limited number of published research studies has focused on CC education within the Southeastern region of the United States. In 2013, a NSF grant, the Climate Literacy Partnership in the Southeast (CLiPSE) was awarded to Mississippi University, with a partnership between Alabama-Huntsville University and the principal investigator, Dr. McNeal (NSF, 2010). The CLiPSE project was designed

to develop educational programs related to CC, specifically in the Southeast (McNeal, Hammerman, et al., 2014; McNeal, Walter, et al., 2014; NSF, 2010). The overall goals of the CLiPSE were to:

1) form a robust regional network reaching several key audiences in the SEUS,
2) create a strategic plan and pilot activities to engage these audiences, and
3) inventory and provide recourses to support climate education with these audiences. (McNeal, Hammerman, et al., 2014, p. 632)

Part of the CLiPSE project included volunteer attendees (*n*=168) to a dialogue-based event in Savannah, Georgia and two campuses Mississippi State University, one for students and the other for the general public (McNeal, Hammerman, et al., 2014). During these events, the participants were divided into groups of similar interest or background and partnered with a CLiPSE partner and a moderator. The overview of the event included initial discussion within the groups, questions presented from the moderator, and the event finished with evaluation. After these initial discussions, all the participants were provided with an open-ended survey, which provided both quantitative and qualitative data for the CLiPSE project (McNeal, Hammerman, et al., 2014).

The results of the 2014 McNeal, Hammerman, et al. (2014) study included the participants felt the use of dialogue has a positive impact on their CC knowledge, policies, and religious perspectives. The qualitative results provided the more valuable data, and many of the participants felt the open discussions with a diverse audience was the most beneficial since everyone felt their opinion was heard and mattered. However, some participants felt the discussion did not lead to any solutions. The CLiPSE project

brought was a newer method in discussion CC within the Southeastern conservative region (McNeal, Hammerman, et al., 2014).

Another research conducted with the Southeastern region, focused on educators teaching grades 6 to 20. This study was also conducted as part of the CLiPSE grant (McNeal, Walter, et al., 2014). During this study, the researchers used the Climate Stewardship Survey as an online survey to teachers in the Southeast region. The 2014 McNeal, Walter, et al. study included 279 completed surveys; 49.1% were from South Carolina, 16.8% from Tennessee, 14% from Georgia, and 6.8% from Arkansas; only represented 9.3% African-American, and the sample was 68.9% female (McNeal, Walter, et al., 2014). In addition, 61.3% were Protestant, while 30.8% were Democrat, 22.2% were Republican, and 26.9% were Independent (McNeal, Walter, et al., 2014).

The results from the 2014 McNeal, Walter, et al. study demonstrated many of the participants were knowledgeable about CC and had few misconceptions. The misconceptions they had included CFCs and the ozone layer did not contribute to CC (McNeal, Walter, et al., 2014). Unlike other studies where participants reported sources of knowledge as the media (Coyle, 2005; Dickinson et al., 2013; Leal Filho, 2010; Leiserowitz et al., 2010; Liarakou et al., 2011), the participants of this study reported government organizations, such as NOAA, NSP, and NASA, as primary sources of knowledge and IPCC and scientists and secondary sources.

The Six Americans Survey (Maibach et al., 2009) was used to study Extension Agents in southern Extension Agents in an effort to determine perceptions and behavior related to CC (Burnett, Vuola, Megalos, Adams, & Monroe, 2014; Monroe, Plate, Adams, & Wojcik, 2015). Extension was a program provided by land-grant colleges and

universities as “non-formal education and learning activities to people throughout the country…It emphasizes taking knowledge gained through research and education and bringing it directly to the people to create positive changes” (U.S. Department of Agriculture, 2016, para. 1). In 2014, data were collected from 400 North Carolina Extension Agents, and the results indicated 11% were Alarmed, 31% were Concerned, 27% were Cautious, 11% were Disengaged, 12% were Doubtful, and 8% were Dismissive (Burnett et al., 2014). Nearly 70% of the sample were categorized among individuals who believe in CC and those Extension Agents who worked in natural resources were found to be the most alarmed by CC.

A larger study on Extension Agents focused on 2,758 Extension Agents in the southeastern states, Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, Texas, and Virginia (Monroe et al., 2015; Wojcik, Monroe, Adams, & Plate, 2014). The researchers found the southern Extension Agents did not differ much from the results of the 2012 Leiserowitz, Maibach, Roser-Renouf, and Hmielowski study. The perceptions the individuals held differed from program area; individuals in agriculture were least Concerned or Alarmed; individuals in natural resources were more likely to be Concerned or Alarmed (Monroe et al., 2015). The researchers also reported that even with professional development, “the cultural shift” (p. 232) may hinder the inclusion of CC programs for Extension Agents (Monroe et al., 2015). This cultural shift described by the researchers was if creating these professional development opportunities that are voluntary to attend, most likely only Extension Agents with high levels of CC concern would attend, and making the gap between Extension Agents concerned and not concerned with CC larger (Monroe et al., 2015). The comparison between the Extension

Agents and the previous Yale Communication Six Americas studies was illustrated in Figure 7. Overall, there was a similar trend between the Extension Agents and the general public on the belief of CC.

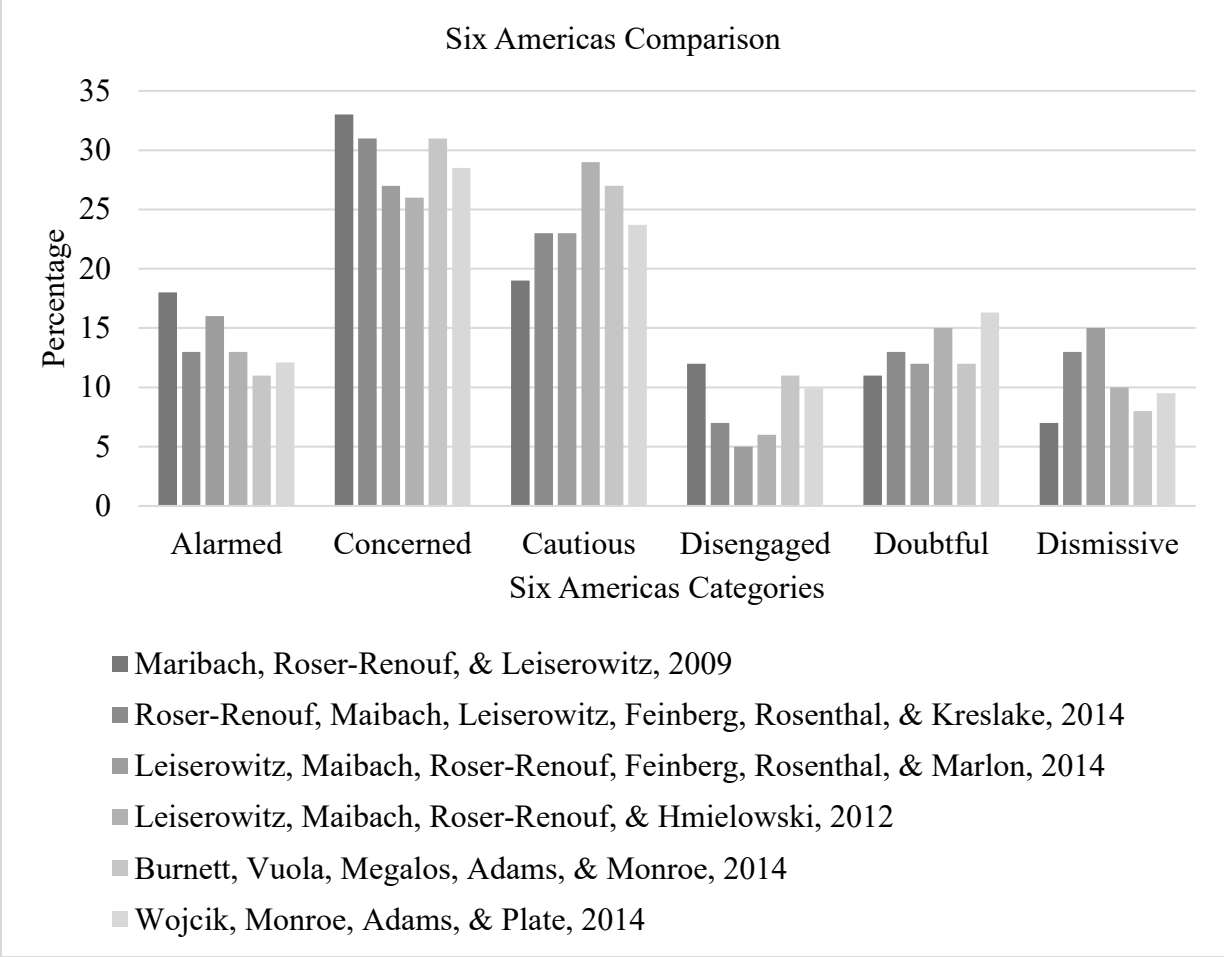

Figure 7. Comparison between Yale Communication Six Americas data and Extension Agents in the Southeastern United States.

A 1996 dissertation by Fason compared 12th-grade students in Valdosta, Georgia and 12th-grade students in Lansing, Michigan. Fason found, within the sample of 784 students, students from Georgia had a more positive attitude towards the environment, the Georgia students were more knowledgeable about global warming, and both groups reported personal responsibility for the environment (Fason, 1996).

Summary

Education for CC mitigation and adaptation was encouraged by the IPCC (2013, 2014a, 2014b, 2014c, 2014d). The inclusion of CC education, while has shown to be beneficial, has slowly been incorporated more into traditional education. As more state standards and national standards, such as the NGSS include CC related standards, CC education may become more common within the classroom. However, researchers have shown misconceptions still exist with K-12 students, K-12 teachers, higher education students, the general public, and non-formal educators. Even though misconceptions exist, there was also research that demonstrated these same groups were knowledgeable about CC, and there was an increase in individuals who agreed CC was happening.

Providing education for CC has begun to go beyond the classroom and can be taught by non-formal educations, including environmental educators. Researchers have found both positive and negative aspects for CC education within non-formal education. In addition, regional research within the Southeastern United States has focused on CC. Some of this research has indicated, within the Southeast, there was not much difference of CC attitudes when comparing environmental related specialists to the rest of the U.S. population (Monroe et al., 2015). However, other researchers have indicated positive results on CC knowledge in teachers within the Southeast (McNeal et al., 2014).

More research was needed to demonstrate the current status of the inclusion of CC education. In addition, this research could provide a narrower focus on the Southeastern United States region and a focus on what environmental educators were contributing to the field of CC education. Finally, this research can also provide a

comparison to a regional subset of the Southeastern United States on attitudes, knowledge, and perceptions when compared to national data.

CHAPTER III

METHODOLOGY

The purpose of this study was to examine CC perceptions and knowledge that were self-reported by SEEA members. This chapter includes information on the research this study's methodology, detail the sample selection, describe the instrument along with the reason for the instrument selection, describe the data collection procedures, and provide information on the statistical procedures that were used.

Research Design

A quantitative research design method, with a survey methodology, was used for this study, which was conducted with an online survey. The benefits of using a survey methodology provided the opportunity to collect information about knowledge, attitudes, values, and behavior of a participant (Fink, 2013). A limitation with a survey is there is no manipulation of any variable and analysis is limited to predictions (Bordens & Abbott, 2005). However, in this study, the use of a survey was useful in answering the research questions, which did not require experimental manipulation. Experimental manipulation was not required because participants were not randomly assigned to a treatment or control group. In addition, no independent variables were manipulated during this study. Quantitative analyses included descriptive statistics, chi-square analysis, discriminant analysis (DA), multinomial logistic regression (MLR) analysis, and *z*-tests. An online survey, via Qualtrics, was administered to members of SEEAs in the states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

In this study, the dependent variables were CC perceptions and knowledge, and the sets of independent variables were demographic factors. The researcher used established instruments for data collection, which included the Six Americas Survey (Maibach et al., 2009) and knowledge questions from the 2010 study by Leiserowitz et al., American's Knowledge of Climate Change. The following research questions were investigated:

Research question 1: How are the Southeastern environmental educators classified into one of six categories based on their perceptions of climate change as measured by Six Americas Survey?

Research question 2: How do climate change perception levels compare depending on demographic factors?

Research question 3: How do climate change perception levels of Southeastern environmental educators differ compared to previous studies with the Six Americas Survey?

Research question 4: What is the knowledge level of Southeastern environmental educators regarding climate change indicated by the American's Knowledge of Climate Change instrument?

Research question 5: Does climate change knowledge significantly differ by the demographics?

Research question 6: Is the observed proportion of climate change knowledge of the current study equal to the observed climate change knowledge in the 2010 Leiserowitz et al. Study?

Population and Sample

The target population of this study included SEEA members and was used to answer the research questions. The accessible population included SEEA members in the states of Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. EEs were from a variety of backgrounds, such as formal educators, non-formal educators, informal educators, administrators, directors, undergraduate students, graduate students, or in professions not directly related to education. To gain further insight into this broad population, demographic questions were used to better describe the population after the survey was completed.

A purposive sampling technique was used for this study, and the entire population of current members of SEEAs was surveyed. Specifically, the type of purposive sampling method used was total population sampling (Etikan, Musa, & Alkassim, 2016). Total population sampling was utilized in situations when it was better to use the entire population, in case removing some parts of the population could reduce the wealth of data collected (Etikan et al., 2016). The assumption for this type of sampling was the sample was to be representative of the entire population (Ary, Jacobs, & Sorensen, 2010; Etikan et al., 2016). This population was identified because of membership in SEEAs. Purposive, total population sampling technique was beneficial for this research to provide a depth of information from the participants (Teddlie & Tashakkori, 2009). Another benefit to a purposive, total population sampling was to reduce the chance of missing information, or non-responses on the survey, and to meet the requirements for the minimum sample size needed to conduct statistical analysis for this study.

Disadvantages to total population sampling included the risk that was one SEEA organization could opt out of the research study entirely, therefore not providing a complete picture of SEEA members in this study. Some of the SEEA organizations could have more members than others, causing one state to have more representation. Another limitation was there was no control over who was a current member, as was an active and paid member of the association. It was unknown if each association kept an up to date email list for current, paid members or a list of members that may no longer be active in the association. Not knowing if memberships were current was potentially a problem in having people participate in the survey who were not representative of the SEEA. For example, some members may have moved to other regions in the United States or could have had a career change but still received emails and/or newsletters from their SEEA. Having a sample with non-responsive population could possibly skew the results, and the non-responsive members might have different characteristics than the responsive population does (Laerd, 2013).

Determining the sample size for this study was made without knowing the total population of environmental educator members in the Southeast. The total population was unknown and there were no published reports on the demographics of any of the EE association. The sample size was determined by the statistical analysis, MLR.

MLR was suggested to have a minimum of 10 samples for each independent variable, with no more than 14 independent variables (Hosmer & Lemeshow, 2000). Using 10 as the minimum for each independent variable and nine as the total independent variables, a sample size of 90 was needed for MLR analysis. In the event, there are less than 10 samples for the independent variables, only the categories with more than 10

were able to use for analysis. Therefore, the minimum sample size needed for this study was 90, based on the MLR analysis. The final sample size used in this study was 93 and is further discussed in Chapter IV.

The assumption for an appropriate sample size for DA was for the sample size to be as small as 20 observations for the smallest group, according to Poulson and French (2008). When there were only four or five independent variables, however, it was suggested to have four or five times more observations (Poulson & French, 2008). In this study, there were 12 independent variables. Using the guidelines from Poulson and French (2008), the smallest sample size for a category could be 20. To determine the minimum number needed for DA, the Kelly 2013 study that utilized the Six Americas Survey instrument on visitors of zoos and aquariums was used to calculate the minimum sample size for DA.

To determine the DA sample size, the most recent Six Americas Survey from 2014 was used. In the 2014 study, the smallest CC group was the Disengaged group with 7% or 89 from the sample of 1,272. If the smallest group in the current study were to also be the Disengaged group with 20 participants, then the sample would be 286. Because this study had six dependent variables that relied on DA analysis, the minimum sample for DA was 286. The DA was used with the Six Americas Survey, which was an existing model and the researchers provided a script for analysis, this minimum sample of 286 was not required.

In order to get the best response rate for the survey and meet the minimum sample size, all EE members in these eight states were contacted through their respective e-mail listserv of these organizations. Therefore, the sample in this study was the entire

population of current members of SEEA. The benefit for the total inclusion of the population into the sample was for convenience and to increase the likelihood of returned, completed surveys.

Instrumentation

The survey in this study was used to determine the perceptions and knowledge related to CC. In addition, demographic information was collected. The instrument used in this study consisted of three parts: demographics, the Six Americas Survey, and CC knowledge questions. The average time to complete the survey was 10 to 15 minutes. The following section provides further information on each section of the survey. The complete survey questions, which were distributed with Qualtrics, can be found in Appendix C.

Demographic Factors

The demographic questions used with this instrument included objective questions. The type of objective demographic questions included age, religion, rural or urban setting, state of EE organization membership, grade levels taught, EE organization membership, political affiliation, and religious affiliation. For example, age was presented in seven categories (i.e., 18-24, 25-34, 35-44, 45-54, 55, 64, 65-74, and 75 and older). Religion questions provided a selection of 14 religions affiliations for participants to choose from. Based on these demographic factors, an MLR and chi-square test were conducted in terms of CC perceptions levels to see if there were any differences among the groups. ANOVA was conducted to see if any of these demographic factors differ among CC knowledge levels.

Six Americas Survey

Data were collected with the use of the Six Americas Survey (Maibach et al., 2009) to determine CC perceptions. Permission to use this instrument was granted via email on January 25, 2017 (see Appendix H). This instrument included 15 questions that segmented participants into six CC categories – Alarmed, Concerned, Cautious, Doubtful, Disengaged, and Dismissive - based on their beliefs, social preference, and behavior (Maibach et al., 2009). The use of the term global warming was used within the survey, as designed by the researchers, instead of the term CC, and the term has been used interchangeably (Maibach et al., 2009). In addition, the term global warming may be less confusing to the general public, and it was used more often by the public (Burnett et al., 2014). The Six Americas Survey included 15 closed-ended questions that collected data on beliefs, issue involvement, behavior, and preferred societal responses (Burnett et al., 2014).

The Six Americas Survey was tested for both validity and reliability through the Yale Project on Climate Change and previous studies that used the instrument (Holthuis, Lotan, Saltzman, Mastrandrea, & Wild, 2010; Howe, Mildenberger, Marlon, & Leiserowitz, 2015; Maibach et al., 2011; Maibach et al., 2009). The validation of the Six Americas Survey included external validation and internal cross-validation (Howe et al., 2015). The external validation results were the "mean absolute difference between model estimates and validation results" of 2.9, *SD* = 1.5 (Howe et al., 2015, p. 7). Cross-validation was also used on the sub-sets of data, where data from the large-population state were compared to a small-population state (Howe et al., 2015). The cross-validation indicated that less-populated areas were less accurate than higher-populated areas. The

survey was still able to estimate the average opinion even among these sub-groups (2015).

Climate Change Knowledge

The data for CC knowledge research questions were gathered with selected questions from 2010 study by Leiserowitz et al., American's Knowledge of Climate Change. The original instrument included 81 questions that included topics on CC beliefs and worry, understanding of the *greenhouse effect*, weather vs. climate, the flow of heat across the planet, CC: past and present, temperature estimates, conceptual models of CC, fossil fuels, carbon dioxide, causes of global warming, climate skeptic arguments, impacts, solutions, and information sources (Leiserowitz et al., 2010). For the purpose of this research, eight questions were used from the American's Knowledge of Climate Change survey. The questions included were one question for greenhouse effect, three items for fossil fuels, and four items for carbon dioxide. Including only eight survey items also helped keep the instrument shorter in an effort to have higher participation.

Ethical Considerations

Due to the design of this study, there were no foreseen risks, psychological or physical, while participating in this study. To protect the identity of each participant, all steps necessary to remove any identification to ensure confidentiality and anonymity during the research process were implemented. Confidentiality was achieved by not collecting names and emails in the survey. In order to participate in this study, all members of the SEEA organizations received an email about the study that also included the consent form. In the email, participants were provided with a brief explanation of the

study, an online consent form, and access to the survey for completion. All survey data were stored on a password secured website.

Data Collection

Before any data collection took place, approval from the Institutional Review Boards (IRB) and dissertation committee was received. After the approval of the IRB and dissertation committee, permission was requested from each SEEA president to conduct research with the use of an online survey emailed to members. The SEEA presidents were provided with information about the purpose of the study, benefits of participation, informed consent, the instrument, data collection methods, and asked if they would email a link to their members. The survey link directed email recipients to the Qualtrics survey. Qualtrics had the option to make all responses anonymous, which was expected in this research. The initial time frame for surveys to be emailed was during a 1-month span to allow time for the SEEA presidents to send emails to members and time for participants to respond. However, the emails were asked to be sent during the month of November and December, which did not have enough participation to meet the minimum sample size. To meet the minimum sample size, a total of 90 participants were needed. The duration of data collection was 3 months, which yielded a final participation of 104 participants.

Response Rate

Having a minimum sample of 90 participants for data analysis, 90 usable surveys would need to be collected. The EE Association of Georgia has over 1,000 members, so it was optimistic that the minimum number of surveys would be met because eight SEEA organizations were included in this study. The information about Georgia's membership

size was determined through both active and inactive members of the organization, and both members were emailed during this research.

If sample size was not met, the Six Americas Survey for research question one could still occur using the guidelines set out by Maibach et al. (2009). In a 2014 dissertation, Doherty used the Six Americas Survey with a sample of 52 participants for the DA. Another doctoral study by Greenberg (2013) used a sample of 33 for data analysis with the Six Americas Survey. A master's level study included analysis using the Six Americas Survey with 24 participants (Timm, 2014). Limitations from each study did not address small samples as any problem with the Six Americas Survey (Doherty, 2014; Greenberg, 2013; Timm, 2014).

Data Analysis Overview

The quantitative data were first analyzed through descriptive statistics to provide a general overview and summary. The descriptive statistics included mean scores, frequency, percentages, and distribution. Data analysis for the Six Americas Survey included DA, MLR, and Chi-square analysis conducted with SPSS. The script provided by the instrument's originators (Maibach et al., 2011) was followed for the DA analysis. This script provided a step-by-step process for data analysis collected with the Six Americas Survey using SPSS. The selected questions from the American's Knowledge of Climate Change (Leiserowitz et al., 2010) were analyzed through descriptive statistics, ANOVA, chi-square analysis, and a z-test analysis all conducted with SPSS. The details of each data analysis are further described later in this chapter.

Demographic Profile

Initial analysis was conducted on the demographic data. The demographic data included descriptive statistics of the sample reporting the frequency, distribution, measures of central tendency, and percentages. This data were presented in tables and a narrative description was used for additional information on the demographic profile.

Item Analysis Summary

Table 2 identifies the research design that answered each research question. The research questions answered in this study were:

Research question 1: How were the Southeastern environmental educators classified into one of six categories based on their perceptions of climate change as measured by Six Americas Survey?

Research question 2: How do climate change perception levels compare depending on demographic factors?

Research question 3: How did climate change perceptions levels of Southeastern environmental educators differ compared to previous studies with the Six Americas Survey?

Research question 4: What was the knowledge level of Southeastern environmental educators regarding climate change indicated by the American's Knowledge of Climate Change instrument?

Research question 5: Does climate change knowledge significantly differ by the demographics?

Research question 6: Is the observed proportion of climate change knowledge of the current study equal to the observed climate change knowledge in the 2010 Leiserowitz et al. Study?

Table 2

Analysis for each Research Question

Research Question	Instrumentation	Analysis	How will the analysis answer the research question?
1	Six Americas Survey instrument	Descriptive statistics and DA	Participants were segmented into one of the six categories based on their perception levels using the Six Americas Survey.
2	Six Americas Survey instrument and demographics	Descriptive statistics, MLR, and Chi-square	Descriptive statistics of the demographics and the Six Americas will be displayed graphically. MLR analysis was used to determine the relationship between the demographic variables and perception levels. Chi-squared analysis was used to examine the relationship between the demographics and the Six Americas Survey results.
3	Six Americas Survey Instrument	Descriptive statistics and Chi-square	The CC segments of the general public were compared CC segments of the current study using charts. Chi-square analysis was used to examine the relationship between the current study and the previous Six Americas Survey.
4	American's Knowledge of Climate Change instrument	Descriptive statistics and Chi-square	Participants were provided a score on CC knowledge. Chi-square analysis will be used to determine if a relationship exists between the current study and previous studies with the Six Americas categories.

Research Question	Instrumentation	Analysis	How will the analysis answer the research question?
5	American's Knowledge of Climate Change instrument and demographics	Descriptive statistics and ANOVA	Descriptive statistics provided insight into the demographic differences on CC knowledge. ANOVA was used to determine if differences exist among the groups based on demographic factors, and identify any interactions among independent variables and identify the predictive power of demographic variables on knowledge levels.
6	American's Knowledge of Climate Change instrument	Descriptive statistics and *z*-test	The observed proportion of CC knowledge in the current study was compared to observed proportion of CC knowledge of the 2010 Leiserowitz et al.. Analysis was conducted with a *z*-test.

Research Question One

Research question 1 focused on the Six Americas Survey. Participants were placed into one of six unique CC perception groups based on their responses (Maibach et al., 2009). In a guidebook, developed by the researchers Maibach et al. (2009), the method of DA was described for identifying the similar characteristics and classifying the participants into one of the six CC categories. A DA was used initially to make the subgroups of the six CC categories depending on the responses of the participants (Bordens & Abbott, 2005). DA was appropriate when data were used to predict the membership into one group (Bordens & Abbott, 2005). In this study, DA was conducted to segment participants into one of six categories of CC perceptions.

The Six Americas Survey DA was further explained in 2011 by Maibach et al. In the original, 36-item instrument, the instrument was developed the following constructs:

"global warming beliefs", "global warming issue involvement", "global warming and energy efficiency and conservation behaviors", and "preferred societal response to global warming" (Maibach et al., 2011, p. e17572). The researchers developed a shorter, 15-item survey, and, when the researchers applied the data set from the 36-item instrument, the shorter instrument correctly classified 83.8% of the sample (Maibach et al., 2011). During DA, the analysis does not permit missing data, so the researchers provided steps in the guidebook for handling missing data (Maibach et al., 2011); the guidebook is further addressed later in this section.

Following the screening instruments from Maibach et al. (2011) the data set was created with the 15-items, labels, and response codes listed in the guidebook. According to the guidebook (2011), dummy variables were created from nominal variables. The dummy variables were needed when multiple predictor categories were represented as only zeros and ones while using categorical data as predictors (Field, 2005). In the Maibach et al. (2011) guidebook, a specific syntax was provided for the dummy variables. The guidebook also provided a way to respond to some survey answers, such as "don't know" that participants selected. For example, survey item 2 asked participants "Assuming global warming is happening, do you think it is…. 1) Caused mostly by human activities; 2) Caused mostly be natural changes in the environment; 3) Other; 4) None of the above because global warming isn't happening". Recoding of missing data were done based on their responses to the previous question, "Do you think global warming is happening?"; if they responded global warming is not happening, they were recoded as 4, if they said global warming is occurring, they were recoded as 1, while the rest were recoded as 3 (Maibach et al., 2011). After missing data was addressed for this

item, the items were recoded into three dummy variables, and the "other" response was the removed category. The dummy codes provided by the researchers were (Maibach et al., 2011, p. 21):

IF (Belief2=1) Belief2_dummy1=0.

IF (Belief2=2) Belief2_dummy1=0.

IF (Belief2=3) Belief2_dummy1=0.

IF (Belief2=4) Belief2_dummy1=1.

IF (Belief2=1) Belief2_dummy2=0.

IF (Belief2=2) Belief2_dummy2=1.

IF (Belief2=3) Belief2_dummy2=0.

IF (Belief2=4) Belief2_dummy2=0.

IF (Belief2=1) Belief2_dummy3=1.

IF (Belief2=2) Belief2_dummy3=0.

IF (Belief2=3) Belief2_dummy3=0.

IF (Belief2=4) Belief2_dummy3=0.

DA cannot be run with missing data, and researchers provided steps on how missing data should be excluded (Maibach et al., 2011). If questions have 80% or more missing data, these items should not be included in the sample, with the exception of responses that were "do not know", which was not considered missing data (Maibach et al., 2011). Missing data from the individual participant's survey responses can be replaced with the mean value for the variables in the instrument (Maibach et al., 2011). The responses that were "don't know" should be dummy-coded for DA and this syntax

was listed in the guidebook (Maibach et al., 2011). Additional information from the codebook can be found in Appendix C the SPSS script in Appendix F.

Research Question Two

In research question 1, the participants were categorized into one of the six CC groups (i.e., alarmed, concerned, cautious, disengaged, doubtful, and dismissive) based on their responses to the Six Americas Survey. DA determined what combinations of demographic variables predict the CC group memberships. The Six Americas Survey data were used along with demographic data to determine if there were differences between CC perception level and selected demographics. The data were analyzed with descriptive statistics, MLR, and chi-square.

Research Question Three

Research question 3 focused on data collected from the Six Americas Survey and was compared to previous studies (Burnett et al., 2014; Kelly et al., 2014; Leiserowitz et al., 2014; Leiserowitz et al., 2016; Leiserowitz et al., 2010; Maibach et al., 2009; Monroe et al., 2015; Wojcik, Monroe, Adams, & Plate, 2014; Roser-Renouf et al., 2014) The mean scores of this study was compared to the mean scores of the previous studies with a chi-square analysis.

Research Question Four

Research question 4 focused on CC knowledge using questions from the Leiserowitz et al. (2010) Americans' Knowledge of Climate Change instrument. Staying consistent with the original instrument, the items were coded as either a correct response or an incorrect response (Leiserowitz et al., 2010). According to the researchers, there was a clear answer for most of the items, and the others can be supported by scientific

research (Leiserowitz et al., 2010). The answers key from the researchers was used to score these questions. The researchers did not provide any additional explanation on which questions were more difficult than others, other than it was best to assume most U.S. citizens have not taken formal courses on CC and therefore not surprising their knowledge was low (Leiserowitz et al., 2010). Also, the questions on the instrument were not what the typical American would encounter on a normal day and beyond the information they may have learned from the media and other possible sources (Leiserowitz et al., 2010). The data were presented in descriptive statistics and a chi-square analysis was used.

Research Question Five

Research question 5 focused on comparing the results of research question 4 against the demographics. Analysis included descriptive statistics and ANOVA. The ANOVA analysis used the dependent variables of the CC knowledge scores and the demographic independent variables to determine if differences exist. The following hypotheses was tested for research question 5: the null hypothesis stated there is no statistically significant difference between the group means, and the alternative hypothesis stated there is a statistically significant difference between the group means. In other words, the null hypothesis stated there are no statistically significant differences in the demographics and knowledge scores, and the alternative hypothesis stated there are statistically significant differences in demographics and the knowledge scores.

Research Question Six

Research question 6 focused on comparing the proportions from the current study and previous studies that used the America's Knowledge of Climate Change instrument.

The original report from Leiserowitz et al. (2010) included the number of correct responses for each instrument item, and these individual test items were compared to the scores from this study. The analysis for research question 6 included descriptive statistics of the participants knowledge item scores for each instrument item that and was further illustrated in a table. Analysis for proportions was conducted with a *z*-test.

Data Analysis

In this section, the types of data analysis used in this study are discussed. Data analysis included DA, MLR, Chi-square of independence, and ANOVA. Assumption testing for the analysis will be included in this section as well.

Assumptions

Assumptions for the various data analysis are illustrated in Table 3. These assumptions must be met for each of the data analysis used in this study. Failing to meet the assumptions can result in several errors. If the observations were not independent and the data does not have equal variances, there was a chance of committing a Type I or Type II error (Lomax & Hahs-Vaughn, 2012).

Table 3

Assumptions for Data Analysis

	DA	MLR	Chi-square	ANOVA	*z*-test
Sample size		X	X	X	X
Normal distribution			X	X	X
Homogeneity of variances			X	X	X
Quantitative or categorical variables	X	X	X	X	
Independence of observations	X	X	X	X	X
Two or more categorical groups			X		

Sample size, as previously discussed, was met with a minimum sample size of 90 participants. Normal distribution for data were tested with kurtosis and skewness (Fields, 2005; Lomax & Hahs-Vaughn, 2012). Testing for homogeneity of variance included the Levene Statistic test (Fields, 2005). If the Levene's test was significant ($p<.05$), then homogeneity of variances has been violated; if the test was not significant ($p>.05$), then homogeneity has not been violated (Fields, 2005).

The observations in this sample were independent, in that each participant responded to the survey individually at their own time and place (Gravetter & Wallnau, 2009; Lomax & Hahs-Vaughn, 2012). There was no interaction among the participants. Outliers were tested in SPSS, and these were eliminated from the data analysis (Gravetter & Wallnau, 2009; Lomax & Hahs-Vaughn, 2012; Poulson, & French, 2008). The non-multicollinearity assumption was when one of the predictor variables was too perfectly correlated, and this assumption was determined through the use of a scatterplot.

The dependent variables were recoded, following the guidelines from Lomax and Hahs-Vaughn (2012) for categorical variables in regression analysis to meet the assumption that the data must either be quantitative or categorical. For example, gender was recoded as 0 for female and 1 for male. The remainder of the categorical dependent variables were recoded for analysis. The linearity of the data were tested in SPSS through a scatterplot (Fields, 2005). Chi-square analysis included categorical data collected through the online survey. Assumptions for chi-square included sample size, homogeneity of variance, categorical data, and independent observations,

Discriminant Analysis

DA was appropriate for answering researching question 1 because the goal was to classify participants into one of the six CC categories based upon their unique demographics (National Research Council, 1988). Specifically, linear discriminant analysis was used to model the research from the Six Americas Survey (Maibach et al., 2011). This type of analysis was also appropriate when there were categorical dependent variables and categorical independent variables (National Research Council, 1988). DA data analysis was used to predict the membership into one group (Bordens & Abbott, 2005), which in this study was into one of six categories of CC perceptions.

Multinomial Logistic Regression

MLR was used to answer research question 2. This type of analysis was appropriate to predict a nominal group membership from one or more independent variables (Tabachnick & Fidell, 2013). Demographic factors were used to predict CC perception group membership. MLR was also appropriate because there were more than two categories. The MLR predicted if a demographic was not within a particular CC perception category (Tabachnick & Fidell, 2013). The results of the SPSS analysis included model fitting information, which was reported with a chi-square statistic, significance level, and effect size (Laerd, 2013). An alpha level of less than .05 was chosen as a cut-off for statistical significance (Laerd, 2013). The next analysis included the Likelihood Ratio Tests, which provided data about which independent variables were statistically significant in predicting CC group membership (Laerd, 2013).

Chi-square Test of Independence

Chi-square test of independence was used to answer research questions 2, 3, and 4. The purpose of a chi-square test of independence was to determine the relationship between a variable within the population (Gravetter & Wallnau, 2009). It is also used when the data is categorical (Gravetter & Wallnau, 2009). For research question 2, a chi-square test was used to determine the relationship between two categorical variables, the CC segments and the demographics, with a *p*-value of.05. Research question 3 also used a chi-square test of independence, which compared the distribution of a group within another group, which was used to determine if there was statistical significance difference in the proportions of the current study and previous studies Six Americas Survey studies (Gravetter & Wallnau, 2009).

ANOVA

ANOVA was used to answer research question 5. This type of analysis is used when testing the difference between a continuous, dependent variable and a categorical, independent variable (Gravetter & Wallnau, 2009). The multiple variables in this study were the demographics and the scores from the America's Knowledge of Climate Change. ANOVA was used for testing the following hypotheses: the null hypothesis stated there is no statistically significant difference between the group means, and the alternative hypothesis stated there is a difference between the group means. In other words, the null hypothesis stated there are no statistically significant differences in the demographics and knowledge scores, and the alternative hypothesis stated there are statistically significant differences in demographics and the knowledge scores.

z-test

A *z*-test was used to answer research question 6. This type of analysis was used to test the proportions of two different groups (Stat Trek, 2019). A *z*-test was used for testing the following hypotheses: the null hypothesis stated there is no statistically significant difference between the proportions, and the alternative hypothesis stated there is a statistically significant difference between the proportions. In other words, the null hypothesis stated there are no statistically significant differences in the proportion of the knowledge scores between the current study and the Leiserowitz et al. (2010) study, and the alternative hypothesis stated there are statistically significant differences in knowledge score proportions.

Reporting the Data

The analyzed data are presented in Chapter IV and included tables, charts, and text. The use of multiple style presentations (i.e., graphs, tables, charts, and text) provided different ways for the data to be understood by the reader. Each research question was further analyzed and discussed in Chapter IV.

Validity and Reliability

Validity was a very important consideration when developing and utilizing instruments. It is the measure of how well an instrument measures what it is supposed to measure (Ary et al., 2010). The survey in this study comprised of several instruments, and the validity of these instruments were discussed earlier in this document. The external validity for this study related to how the results can be generalized to the general population (Ary et al., 2010). One threat to external validity was the sampling procedure might not represent environmental educators in the Southeast. Since only SEEA

members were recruited for this study, a portion of non-SEEA environmental educators were not included in this study. In addition, the final sample was composed of volunteers who participated in the study. Volunteers may be different than non-volunteers and generalization was limited to the final sample size (Ary et al., 2010).

Reliability was the consistency to which an instrument measures a particular phenomenon (Ary et al., 2010). Random errors of reliability in this study were external factors, such as fatigue, internet outage, or motivation level of the participant. Motivation was addressed by letting the participants know this research would be presented at conferences to demonstrate how Southeastern environmental educators were working towards CC mitigation and adaptation. Incidences of internet disconnections were out of the control of the researcher.

Item Analysis Chart

The following table illustrates how the literature review correlated to the instrument used in this study. Table 4 provided details for how each item on the survey, demographics, Six Americas Survey, and CC knowledge have specific research connections from the literature review.

Table 4

Item Analysis Chart: Survey

Item	Research	Research Question
What organization are you a member of?	Howe et al. (2015)	2 and 5
How would you describe where you currently live?	Howe et al. (2015)	2 and 5
What was your age?		2 and 5

Item	Research	Research Question
What was your highest level of education or degree completed?		2 and 5
How would you classify your organization?		2 and 5
What type of environmental education program does your organization provide?		2 and 5
What grade levels do you teach?		2 and 5
What was your religious affiliation?	Roser-Renouf et al. (2016a)	2 and 5
What was your political affiliation?	Roser-Renouf et al. (2016b)	2 and 5
What do you think? Do you think that global warming was happening?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
Assuming global warming was happening, do you think it was…	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
How much do you think global warming will harm you personally	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009)	1, 2, 3

Item	Research	Research Question
	Monroe et al. (2015) Wojcik et al. (2014)	
When do you think global warming will start to harm people in the United States?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
How much do you think global warming will harm future generations of people?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al.(2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
How much had you thought about global warming before today?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
How important was the issue of global warming to you personally?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3

Item	Research	Research Question
How many of your friends share your views on global warming?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
Which of the following statements comes closest to your view?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
Do you think citizens themselves should be doing more of less to address global warming?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al .(2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
Do you think global warming should be a low, medium, high, or very high priority for the President and Congress?	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3

People disagree whether the United States should reduce gas emission on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view? The United States should reduce its greenhouse gas emissions...	Leiserowitz et al. (2016) Leiserowitz et al. (2014) Leiserowitz et al. (2012) Maibach et al. (2011) Maibach et al. (2009) Monroe et al. (2015) Wojcik et al. (2014)	1, 2, 3
The "greenhouse effect" refers to…	Flora et al. (2014) Kelly et al. (2014) Leiserowitz, & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Which of the following gases in the atmosphere are good at trapping heat from the Earth's surface?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Which of the following are "fossil fuels"?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Which gas was produced by the burning of fossil fuels?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6

To the best of your knowledge, roughly how much carbon dioxide was in the atmosphere in the year 1850?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Roughly how much carbon dioxide was in the atmosphere today?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Which of the following countries emits the largest total amount of carbon dioxide?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6
Which of the following countries emits the most carbon dioxide per person?	Flora et al. (2014) Kelly et al. (2014) Leiserowitz & Smith (2011) Leiserowitz et al. (2010) Roser-Renouf et al. (2014) Swim & Fraser (2014)	4, 5, 6

Researcher's Statement

CC in general was the reason for my interest in this research project. The researcher has been involved with non-formal education since 2004, environmental education since 2008, and began to study CC in 2010 during my specialist's degree program at Florida Institute of Technology. Since then, the researcher has been more aware about the lack of CC education inclusion. The researcher would like to see CC education become more of a focus in EE, especially in the Southeast.

In addition, the researcher has participated in conferences that include CC and attended workshops for CC education, but the researcher was never able to incorporate

much of this knowledge and skill into the programs being leading, due to various barriers and lack of interest from individuals not involved with EE. The researcher began to wonder, what were we as a collective group of environmental educators doing with CC education? Were we reaching the goals of a climate literate society? Or, was living in a world of CC deniers making the efforts appear small and insignificant, when we could potentially be doing more than we realize?

In order to answer these questions, the researcher decided to make CC the focus of this dissertation. While uninformed about what we were doing and if we were doing anything about CC education in the Southeast, the researcher was interested in allowing fellow environmental educators in the Southeast an opportunity to demonstrate what they were contributing to CC education. Providing hope and filling in the gaps within the CC education efforts in the Southeast was beneficial for increasing efforts and demonstrating that collectively environmental educators were working toward mitigation and adaptation techniques for CC.

Summary

The overall goal of this research was to discover what CC perceptions and knowledge SEEA members report. For this study, a quantitative research study was designed to answer the research questions with an online survey. The survey questions were adopted from a national study of the Six Americas Survey (Leiserowitz et al., 2012), knowledge questions from a 2010 study by Leiserowitz et al., and the demographic questions. Using a survey instrument that was used at national level, studies allowed direct comparisons between the previous studies and the current study, which then allowed the researcher to put current study's results in a better context.

Overall, the selected methodologies and analyses provide deeper insight into understanding CC knowledge and perceptions of SEEA members, which contributes to the CC education research literature.

CHAPTER IV

RESULTS

This chapter presents the quantitative data collected as well as the data analysis that examined the CC perceptions and knowledge SEEA members self-report. The beginning of this chapter includes the descriptive statistics of the participants. Next, results for each of the research questions were examined including analysis and interpretation of the quantitative analysis.

Research Design

This quantitative research study utilized an online survey to collect data on participants' CC knowledge and perceptions. The survey also collected demographic data, which allowed comparisons among various demographic groups. The participants of the research study were SEEA members, which included the states of states of Alabama, Florida, Georgia, Tennessee, South Carolina, and North Carolina. Kentucky and Mississippi did not participate in the study.

Organization of Data Analysis

The data analysis will first be presented with an overview of the respondents. The collected demographic data will be presented with a table to give a better overall description of the participants. Each research question will be answered with data analysis, which will include tables, charts, and an interpretation.

Demographic Descriptive Analysis

The initial data analysis included descriptive statistics of the participants' demographic information as seen in Table 5. There were 93 participants were included in

this study. The participants SEEA memberships were from Georgia (30.1%), Tennessee (17.2%), Florida (17.2%), South Carolina (12.9%), Alabama (10.8%), and North Carolina (9.7%). The participants identified as female (69.9%) and 25.8% as males. The age range of respondents was 24 to 34 years old (33.3%), 35 to 44 years old (21.5%), 45 to 54 years old (15.1%) and 55 to 64 years old (14%). The majority of the participants lived in urban cluster area (53.8%) then followed by urban areas (25%) and rural areas (18.3%). Most participants had a bachelor's degree (49.5%) or a master's degree (45.2%).

The participants selected the best response to describe the organization where they worked; the most frequent was non-profit organization (26.9%) then followed by K-12 school (18.3%), museum/zoo/aquarium (14%), and nature center (12.9%). The type of programming the organization provided were elementary programs (82.8%), middle school programs (74.2%), and high school programs (67.7%). Grade levels taught by the participants were K through 5th grade (79.6%), middle school (72%), high school (67.7%), adults (54.8%), college (45.2%), PreK (41.9%), and none (6.5%).

The final two demographic items focused on religious and political affiliations of the participants. Most participants selected Christian (33.3%) as their religious affiliation, and 15.1% of participants indicated "nothing in particular" and "don't know/refuse". For political affiliation, both the Democrat and Independent category had 34.4% each, 12.9% would rather not say, 9.7% have no political affiliation, and 8.6% are Republican.

Table 5

Demographic Breakdown of (Participants N = 93)

	N	%
SEEA Membership		
Alabama	10	10.8
Florida	16	17.2
Georgia	28	30.1
Kentucky		
Mississippi		
North Carolina	9	9.7
South Carolina	12	12.9
Tennessee	16	17.2
No Response	2	2.2
Residency (Where Currently Live)		
Rural	17	18.3
Urban Clusters	50	56.8
Urban	26	28
Age Range		
18-24	11	11.8
25-34	31	33.3
35-44	20	21.5
45-54	14	15.1
55-64	12	14.0
65-74	2	2.2
74+	2	2.2
Gender Identification		
Female	65	69.9
Male	24	25.8
Choose not to respond	3	3.3
Education		
Some college credit, no degree	1	1.1
Trade/technical/vocational training		
Associate degree	1	1.1
Bachelor's degree	46	49.5
Master's degree	42	45.2
Professional degree	0	0
Doctorate	3	3.2
Type of Organization		
Nature Center	12	12.9
Museum/Zoo/Aquarium	13	14.0
For-Profit Business	6	6.5
Non-profit Organization	25	26.9

	N	%
K-12 school (public or private)	17	18.3
College or University	6	6.5
State Government Organization	5	5.4
Federal Organization	1	1.1
Other	8	8.6
Type of Environmental Education Provided by Organization		
Preschool	41	44.1
Elementary School	77	82.8
Middle School	69	74.2
High School	63	67.7
Summer Camps	58	62.4
Homeschool Programs	52	55.9
After School Programs	35	37.6
Pre-service Teachers	30	32.3
In-service Teachers	41	44.1
Residential Programs	20	21.5
Other	19	20.4
Grade Levels Taught		
PreK	39	41.9
K-5	74	79.6
6-8	67	72
9-12	63	67.7
College	42	45.2
Adult Learners	51	54.8
None	6	6.5
Religious Affiliation		
Christian	31	33.3
Catholic	6	6.5
Orthodox Christian		
Mormon		
Jehovah's Witness	1	1.1
Other Christian	3	3.2
Jewish	1	1.1
Muslim		
Buddhist	6	6.5
Hindu		
Atheist	7	7.5
Agnostic	10	10.8
Nothing in particular	14	15.1
Don't know/refuse	14	15.1
Political Affiliation		
Democrat	32	34.4

	N	%
Republican	8	8.6
Independent	32	34.4
Other		
None	9	9.4
Rather not say	12	12.9

Data Analysis

This section presents the data analysis for each of the six research questions. If needed, missing data were addressed. The data set had 93 participants from SEEA members. As discussed in Chapter III, the survey consisted of nine demographic items, 15 items for the Six Americas Survey, and eight CC knowledge questions. The data analysis included assumption testing for the appropriate analysis. Following each analysis was an interpretation of the data. Discussion, conclusions, and implication will be discussed in Chapter V.

Missing Data

Missing data for research question 1 were handled according to the researchers' Six Americas Survey guidebook Maibach et al. (2011). Missing data were first conducted by removing any participants that had 80% or more missing variables (Maibach et al., 2011). In this study 104 surveys were submitted; 11 total participants were removed as they had 80% or more data missing. In addition, missing items for each survey item had specific instructions provided by the researcher (Maibach et al., 2011); the complete list of instructions for missing data can be found in Appendix F. The participants with 80% or more data missing were removed from the sample, the final sample of 93 was used for the entirety of analysis.

While not a missing item, one of the instrument items was corrected by using the mean responses. The corrected item was number 21 where a typo was discovered post

distribution of the survey. The error was the first response for the item was typed "Global warming is happening" when the correct response was "Global warming isn't happening". This error did not provide participants with an option to select the one response that was against global warming. The mean responses of other items that monitored participant's beliefs about global warming were used to replace the responses for this item, and the analysis mislabeled participants who do believe in CC with participants who do not believe in CC.

Research Question One

Six Americas Survey results. Research question 1 used the Leiserowitz et al. (2012) Six Americas 15-Item Survey. The guidebook developed by Maibach et al. (2009) was followed for conducting a DA of the data, which used the survey items to categorize each participant into one of the six CC segments. The researchers stated that missing data should be replaced with the mean score, and was also done for responses that had "don't know" or "not applicable" as the participants' response. (Maibach et al., 2009). Each of the 15 survey items had specific instructions for calculating the mean data, if required. The data, following the guidelines set forth by the researchers (i.e., Maibach et al., 2009), had to be recoded with dummy variables. The researchers provided a specific syntax for SPSS to recode the 15-item survey (Maibach et al., 2009) as detailed in Appendix E.

DA was conducted on the collected data, and the CC segments were first represented in numerical form in SPSS, with 1 representing the Alarmed category, 2 for the Concerned category, 3 for the Cautious category, 4 for the Disengaged category, 5 for the Doubtful category, and 6 for the Dismissive category. The results, as illustrated in

Figure 8, show that of the 4.3% of the participants were categorized as Alarmed (*n*=4), 40.9% as Concerned (*n*=38), 51.6% as Cautious (*n*=48), 1.1% as Disengaged (*n*=1), 2.2% as Doubtful (*n*=2), and 0% as Dismissive *(n*=0).

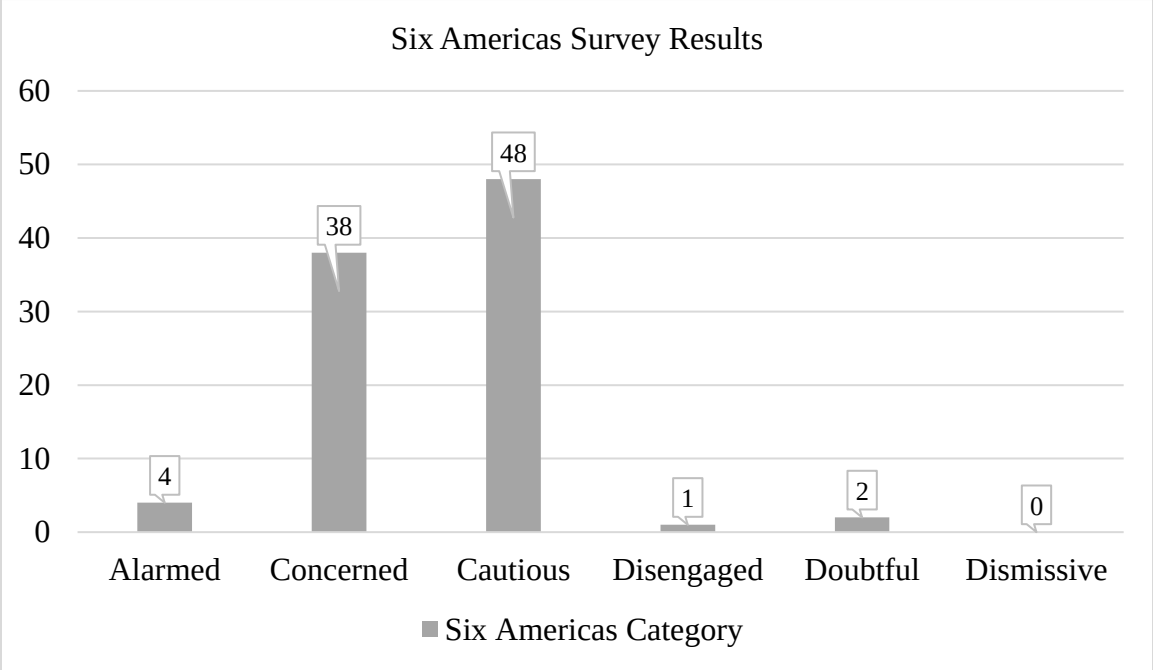

Figure 8. Number of participants by each categories of Six Americas Survey (*N*=93).

Further analysis of the Six Americas Survey included descriptions of each CC group based on their answers to the Six Americas Survey. The following section includes the mean response code for each question in the 15-item Six Americas Survey. Each item for the Six Americas Survey has a unique set of codes, including the total amount of responses participants could select from. To see all the survey items along with the corresponding survey answers, see Appendix B. Table 6 provides all the mean response codes for the 15 CC perception items. There were a lot of commonalities between the CC groups; most CC groups responded similarly, even though participants were segmented into different CC groups.

Table 6

Six Americas Survey Items and Climate Change Average Discriminant Response Codes

Instrument Question	Average Discriminant Response Codes				
	Alarmed *n*=4	Concerned *n*=38	Cautious *n*=48	Disengaged *n*=1	Doubtful *n*=2
Question 1: Do you think global warming is happening?	1.00	1.11	1.77	1.00	1.00
Question 2: Assuming global warming is happening, do you think it is…	1.00	1.03	1.12	3.00	1.50
Question 3: How worries are you about global warming?	1.25	1.39	1.65	2.00	1.00
Question 4: How much do you think global warming will harm you personally?	4.00	3.26	2.96	0.00	3.00
Question 5: When do you think global warming will start to harm people in the United States?	1.25	1.11	1.57	1.00	1.00
Question 6: How much do you think global warming will harm future generations of people?	4.00	4.00	3.48	0.00	4.00
Question 7: How much had you thought about global warming before today?	1.00	1.15	1.92	1.00	1.00
Question 8: How important is the issue of global warming to you personally?	4.00	3.92	3.60	4.00	2.50
Question 9: How much do you agree or disagree with the following statement: “I could easily change my mind about global warming.”	4.00	3.89	3.22	4.00	4.00
Question 10: How many of your friends share your personal views on global warming?	4.25	3.66	2.84	3.00	4.00
Question 11: Which of the following statements comes closest to your view?	3.73	3.78	3.37	4.00	2.50
Question 12: do you think citizens themselves should be doing more of less to address global warming?	5.00	4.82	4.26	5.00	4.50

Question 13: Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?	4.75	2.29	1.72	1.00	4.00
Question 14: Do you think global warming should be a low, medium, high, or very high priority for the President and Congress?	4.00	3.75	4.00	2.96	4.00
Question 15: People disagree whether the United States should reduce gas emissions on its own or make reduction only if other countries do too. Which of the following statements comes closest to you own point of view? The United States should reduce its greenhouse gases…	1.00	0.97	1.13	1.00	1.00

Note. The Six Americas Survey categories and participants responses to the belief of global warming; group size for each was: Alarmed (*n*=4), Concerned (*n*=38), Cautious (*n*=48), Disengaged (*n*=1), Doubtful (*n*=2), and Dismissive (*n*=0). Average discriminant response codes for each climate change segment are based on the 2009 Maibach et al. guidebook.

As seen in Table 6, it was of interest to note how similar the participants were in some responses, even though they were segmented into different categories. For example, the Doubtful segment had many items in common with the Alarmed, Concerned, and Cautious groups. The DA provided in the guidebook was designed to calculate scores that placed the participants into one of the six CC categories.

In Appendix E, after dummy coding, there were six sections within the analysis that calculate a score for each of the six CC segments, as provided by the researchers Maibach et al. (2009). These six sections calculated a score for each of the CC segments, "Seg1" calculated the Alarmed score, "Seg2" calculated the Concerned score, "Seg3" calculated the Cautious score, "Seg4" calculated the Disengaged score, "Seg5" calculated the Doubtful score", and "Seg6" calculated the Dismissive score. The highest score for each of the segments was relabeled as "TopSeg", and this score used to classify the participants into one of the six CC segments.

A sample of 10 participants' score in each of the six CC segments, as well as the highest, or "TopSeg", have been provided in Table 7. In the 19 examples provided in Table 7, many of the participants were very close to being segmented into another category. For example, Participant 1's "TopSeg" was 98.05, which resulted in being segmented into the Cautious group, and their second highest score was 96.32, which would have been the Concerned group. Participant 6 was segmented into the Doubtful group with a "TopSeg" score of 101.31 but had a second highest score of 100.68, a difference of 0.63, which would have resulted in being segmented into the Cautious group. Regardless of the similarities between each participant and their individual item

scores, segmentation into a category was based on an overall formula based on all the scores combined.

Table 7

Sample of Individual Scores from Study Participants Discriminant Analysis

	Segment Scores							
Participant	Alarmed	Concerned	Cautions	Disengaged	Doubtful	Dismissive	"TopSeg"	Segment
1	90.28	96.32	98.05	94.11	93.77	79.65	98.05	Cautious
2	106.13	113.11	111.80	108.88	106.79	93.37	113.11	Concerned
3	121.33	126.47	125.80	122.77	122.24	107.34	126.47	Concerned
4	126.43	128.04	125.01	119.27	115.79	98.75	128.04	Concerned
5	80.33	91.57	94.96	89.20	93.96	83.01	94.96	Cautions
6	91.84	98.96	100.68	93.38	101.31	91.50	101.31	Doubtful
7	98.21	104.45	104.46	102.21	99.91	86.20	104.46	Cautions
8	88.39	94.92	95.28	91.57	94.32	82.68	95.28	Cautions
9	117.94	118.93	117.43	112.42	111.99	98.61	118.93	Concerned
10	104.81	114.41	113.75	109.70	104.57	86.05	114.41	Concerned

Note. The above table provides a sample of 10 participants from the current study. A comprehensive list of participant scores can be found in Appendix F.

Interpretation. The audience surveyed in this study provided a baseline for CC perceptions of SEEA members. Results of the Six Americas Survey indicate that the majority, or 96.7%, of the participants believed in global warming. The CC groups of Alarmed, Concerned, and Cautious made up of 96.7% (*n*=90) of the participants. Only 3.3% (*n*=3) of the participants were categorized as Disengaged or Doubtful.

Further analysis of each question highlighted similarities between some of the CC perception groups and their responses. For example, regardless of the CC segment, all participants responded they believe global warming is happening. There were similarities between the Alarmed and Doubtful segment responses were the participants both selected the highest number of times they boycotted companies who were not taking steps to reduce global warming. While participants responded similarly on several items, they ultimately were segmented into different CC categories. The segmentation into different groups was due to the scores the participants received during the DA analysis. The DA analysis scored the participants in each of the six CC categories, and the category with the highest score was the participants' CC segment. Therefore, even though a participant in the Alarmed group had similar responses to participants in the Doubtful or any other segment, the segmentation into one of the CC groups was based on the individual's high score.

Research Question Two

Assumption testing. Before completing the analysis for research question 2, the data were examined to ensure the assumptions were met. Sample size, categorical variables, and independence of observations were tested. The data were first tested to ensure it met assumptions required for MLR, which was suggested to have a minimum of

10 samples for each independent variable, with no more than 14 independent variables (Hosmer & Lemeshow, 2000). In this study, each independent variable had a minimum of 10, and the sample size was met. The dependent variable, the CC segments, was measured at a nominal level, and the independent variables were also measured at a nominal level. The data also had independence of observations, and participants could only be categorized into one category. Therefore, the assumptions were met for MLR analysis.

Multinomial logistic regression analysis. An MLR was performed to model the relationship between the dependent variable and the independent variables, which was further confirmed by a chi-square analysis. The dependent variable was the six CC categories first analyzed for research question 1. The independent variables were the demographic variables of what organization participants were members of, where they lived, gender, level of education, type of organization they worked at, political affiliation, and religious affiliation. A *p*-value of .05 was used to test for statistical significance. As shown in Table 8, there were no statistically significant independent variables.

Table 8

Predictor's Contributions in the Multinomial Logistic Regression (N=93)

Predictor	Model Fitting	χ^2	*df*	*p*
What organization are you a member of?	92.84	13.04	20	.876
How would you describe where you currently live?	86.68	6.88	8	.550
What gender do you identify with?	106.64	26.84	8	.082
What is your highest level of education or degree completed?	89.02	9.13	16	.904
How would you classify your organization?	75.24	13.28	32	.442

Predictor	Model Fitting	χ^2	*df*	*p*
What is your religious affiliation?	83.36	21.58	36	.855
What is your political affiliation?	70.46	8.38	16	.407

No statistically significant differences were produced with an MLR analysis. A backward selection analysis was conducted to reduce the effects of potential multicollinearity. The backward selection analysis first began with keeping all the independent variables within the MLR model and removing one variable at a time, starting with the variable that was least statistically significant (Lomax & Hahs-Vaughn, 2012). The backward analysis continued until there were no independent variables that were not statistically significant. The backward analysis led to a similar result with the complete factor MLR that there were no significant differences between the independent variable and dependent variable for research question 2. The use of a whole group MLR and a backwards selection MLR, indicated that demographics were not able to be used to predict the CC perception groups.

Chi-square and crosstabs analysis. An alternative description of the demographics and the CC segments was conducted with a chi-square test with a crosstab analysis. The chi-square and crosstabs analysis was conducted to further understand the MLR analysis between CC segments and the demographics of participants. A chi-square analysis was also conducted for each independent variable, and no statistically significant differences were found between the dependent variable and individual independent variables. However, while the demographic variables were not statistically different, they did differ in their state organization, education, religion, and political affiliation as seen in

Table 9. The following section will provide a narrative on the crosstab analysis of each CC segment and the demographics.

The Alarmed segment (*n*=4) was comprised of more Floridians (*n*=2) than any other group with also one member from North Carolina and Tennessee and was split evenly between males and females. This group also had two participants from a rural setting and one each from an urban cluster and urban setting. They also all had degrees, with one bachelor's, one master's, and one doctorate, and each participant worked at a different type of organization. They were split between religion, with half as Christian and the other as nothing in particular; they were also Democrat (*n*=1), Independent (*n*=2), and would rather not say (*n*=1).

The Concerned segment (*n*=38) had more diversity in their demographics, with having members of this segment representing each state with Georgia as the highest (*n*=11) and having more participants from an urban cluster (*n*=18) and urban setting (*n*=13). Overall, this group was mostly female (*n*=26) and highly educated with members having bachelor's (*n*=19), master's (*n*=18), and a doctorate (*n*=1). They were nearly split between Christians (*n*=7) and nothing in particular (*n*=8), but the group had more Catholics (*n*=4), other Christian (*n*=2) Jewish (*n*=1), and participants who refused to answer (*n*=8) than any other segment. The Concerned segment also was comprised of primarily Democrats (*n*=11) and Independents (*n*=14), but it also included two Republicans and 11 participants who would rather not say or none.

The largest group, the Cautious segment (*n*=48), also had presentation from every state, with Georgia (*n*=16) as the highest, the majority living in an urban cluster (*n*=30), and mostly female (*n*=34). The Cautious segment had members report they either had

some college/no degree (*n*=1) or an associated degree (*n*=1). The Cautious group comprised of mostly Christians (*n*=20), and, while mostly Democrats (*n*=19) and Independents (*n*=15), they had the largest number of Republicans (*n*=6) compared to the other segments.

The Disengaged group, which was only one participant from Tennessee, lived in an urban cluster, female, had a master's degree, was a Christian, and was an Independent. The Doubtful group members (*n*=2) were from Florida and Georgia, lived in an urban setting, both female, had master's degrees, were a Christian and Buddhist, and were a Democrat or had no political preference.

Table 9

Climate Change Segments and Cross-tab Analysis of Demographics

	Alarmed (*n*=4)		Concerned (*n*=38)		Cautious (*n*=48)		Disengaged (*n*=1)		Doubtful (*n*=2)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
SEEA Membership										
Alabama			4	11.1	6	12.5				
Florida	2	50	6	16.4	11	14.6			1	50
Georgia			11	30.6	16	33.3			1	50
Kentucky										
Mississippi										
North Carolina	1	25	2	5.6	6	12.5				
South Carolina	1	25	5	13.9	6	12.5				
Tennessee			8	22.2	7	14.6	1	100		
No Response										
Residency (Where You Currently Live)										
Rural	2	50	7	18.4	8	16.7				
Urban Clusters	1	25	18	47.4	30	62.5	1	100		
Urban	1	25	13	34.2	10	20.8			2	100
Gender Identification										
Female	2	50	26	70.3	34	70.8	1	100	2	100
Male	2	50	8	21.6	14	29.2				
Choose not to respond				8.1						
Education										
Some college credit, no degree					1	2.1				

	Alarmed (*n*=4)		Concerned (*n*=38)		Cautious (*n*=48)		Disengaged (*n*=1)		Doubtful (*n*=2)	
Trade/technical/vocational training										
Associate degree					1	2.1				
Bachelor's degree	1	25	19	50	26	54.2				
Master's degree	2	50	18	47.4	19	39.6	1	100	2	100
Professional degree										
Doctorate	1	25	1	2.6	1	2.1				
Type of organization participants work for										
Nature Center	1	25	2	5.3	9	18.8				
Museum/Zoo/Aquarium	1	25	6	15.8	5	10.4			1	50
For-Profit Business			2	5.3	4	8.3				
Non-profit Organization	1	25	11	28.9	13	27.1				
K-12 school			7	18.4	8	16.7	1	100	1	50
College or University			2	5.3	4	8.3				
State Government Organization			2	5.3	3	6.3				
Federal Organization					1	2.1				
Other	1	25	6	15.8	1	2.1				
Religious Affiliation										
Christian	2	50	7	18.4	20	41.7	1	100	1	50
Catholic			4	10.5	2	4.2				
Orthodox Christian										
Mormon										
Jehovah's Witness										
Other Christian			2	5.3	1	2.1				
Jewish			1	2.6		0				
Muslim				0		0				
Buddhist			1	2.6	4	8.3			1	50

	Alarmed (*n*=4)		Concerned (*n*=38)		Cautious (*n*=48)		Disengaged (*n*=1)		Doubtful (*n*=2)	
Hindu				0		0				
Atheist			3	7.9	4	8.3				
Agnostic			4	10.5	6	12.5				
Nothing in particular	2	50	8	21.1	4	8.3				
Don't know/refuse			8	21.1	6	12.5				
Political Affiliation										
Democrat	1	25	11	28.9	19	39.6			1	50
Republican	0	0	2	5.3	6	12.5				
Independent	2	50	14	36.8	15	31.3	1	100		
Other										
None			6	15.8	2	4.2			1	50
Rather not say	1	25	5	13.2	6	12.5				

Interpretation. The demographic variables of the SEEA membership, residence, level of education, place of work, political affiliation, and religious affiliation were analyzed with an MLR, and there were no demographic predictors that had any statistical significance. Overall, the independent variables explained none of the variance between the dependent variable of the CC perception groups. Even though two variables, where participants live and religious affiliation, were close to a *p*-value of .05, these results were still too high and risk a Type I error if interpreted as significant. The demographics were further analyzed with a chi-square and no statistically significant differences were discovered. However, a descriptive of each CC category provided a narrative of the differences found within each segment.

Research Question Three

Assumption testing. Before completing the analysis for research question 3, the data were examined to ensure the assumptions were met. Sample size, normal distribution, categorical variables, and independence of observations were the same as for research question 2. Therefore, the assumptions were met for chi-square analysis as well.

Descriptive statistics. Research question 3 used the data collected from research question 1 and compared to previous studies using the Six Americas Survey. The previous studies include national studies, a study focused on visitors of zoos and aquariums, and a study comparing Extension Agents in the southeast, which were illustrated in Figure 9. Respondents from the current survey did not mirror the ones conducted with the general public.

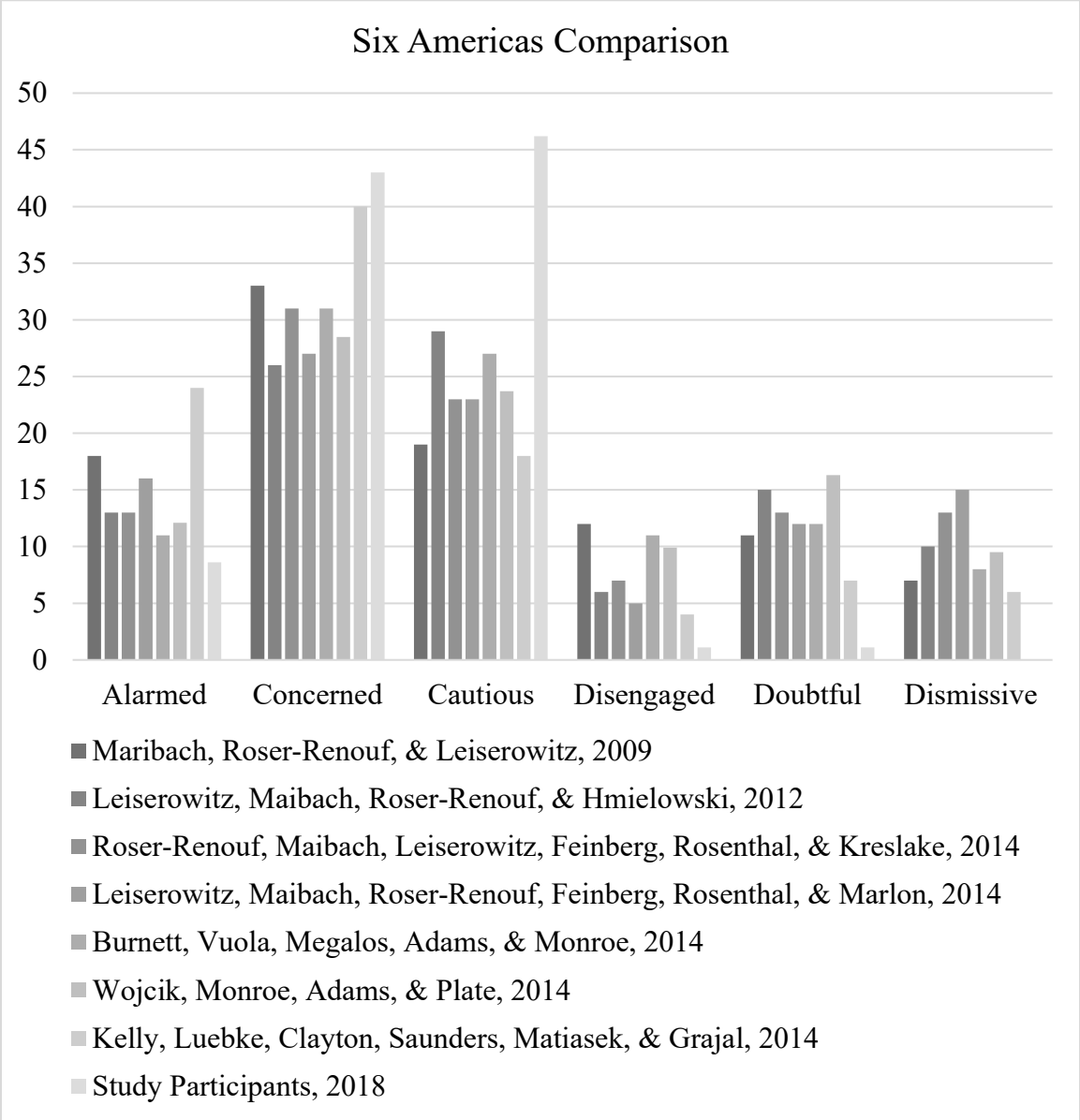

Figure 9. Comparison between Current Study and Previous Six Americas Survey Data.

Note. Numbers are shown as a percentage.

Chi-square analysis. The Crosstab function was also used in SPSS to analyze any differences between the different results of the Six Americas Survey as described in Table 10. The crosstab analysis included a chi-square test of independence to examine the relationship between the current study and the previous Six Americas studies. The relationship between these variables was statistically significant χ^2 (35, N =9,286) =

613.2, $p < .05$. The crosstabs were further analyzed with the column perspectives. An overview of the statistically significant difference can be found in Table 11.

Table 10

Overview of the Significant Differences Found Between the Current and Previous Six Americas Survey

	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6	Study 7
Alarmed	X	X	X	X	X	X	X
Concerned		X	X	X			X
Cautious	X	X	X	X	X	X	X
Disengaged	X	X	X	X	X		X
Doubtful	X	X	X	X	X		X
Dismissive	X	X	X	X	X	X	X
Chi-square	χ^2 (5) = 79.99, $p < .001$	χ^2 (5) = 48.76, $p < .001$	χ^2 (5) = 761.30, $p < .001$	χ^2 (5) = 48.90, $p < .001$	χ^2 (5) = 42.96, $p < .001$)	χ^2 (5) = 79.31, $p < .001$	χ^2 (5) = 84.80 $p < .001$
Cramer's *V*	.19	.21	.21	.21	.30	.15	.20

Note. An "X" indicated where the significant differences were found, when compared to the current study. Study 1 is the Maibach et al. (2009); Study 2 is the Leiserowitz et al. (2012); Study 3 is Roser-Renouf et al (2014); Study 4 is Leiserowitz et al. (2014); Study 5 is Burnett et al. (2014) ; Study 6 is Kelly et al (2014); Study 7 is Wojcik et al. (2014).

A crosstabulation table was created which assigns a subscript letter to the columns; letters that are different signify a statistically significant difference. The crosstabulation analysis as performed with a z-test in SPSS. An illustration of this analysis is in Table 11. For each individual study, a post-hoc analysis was performed using the Cramer's *V* to determine the effect size. A Cramer's *V* was appropriate to use as there were more than two categories for each study and the variables were all nominal (Lomax & Hahs-Vaughn, 2012). Cramer's *V* suggests that a small effect size as .10, a medium effect size as .30, and a large effect size as .50 (Lomax & Hahs-Vaughn, 2012). Effect size was used to determine how much of a difference there was between the current study and each previous study.

Table 11

Crosstabulation for Climate Change Studies and Six Americas Survey Climate Segments

Climate Change Segments		Study							
		Burnett et al. (2014)	Current Study 2018	Kelly et al. (2014)	Leiserowitz et al. (2012)	Leiserowitz et al. (2014)	Maibach et al. (2009)	Roser-Renouf et al. (2014)	Wojcik et al. (2014)
Alarmed	Count	44_{a}	4_{b}	863_{c}	129_{a}	130_{a}	383_{d}	166_{a}	334_{d}
	% within Study	11.0%	4.3%	24.3%	13.1%	13.1%	18.0%	13.0%	19.7%
Concerned	Count	$124_{a, b, c, d, e, f}$	$38_{f, g}$	1437_{g}	$258_{d, e}$	$260_{c, e}$	$703_{b, f}$	395_{b}	$469_{a, c, d, e}$
	% within Study	31.0%	40.9%	40.4%	26.3%	26.3%	33.0%	31.0%	27.6%
Cautious	Count	$108_{a, b}$	48_{c}	646_{d}	288_{b}	290_{b}	405_{d}	$293_{a, e}$	368_{e}
	% within Study	27.0%	51.6%	18.2%	29.3%	29.3%	19.0%	23.0%	21.7%
Disengaged	Count	44_{a}	1_{b}	143_{b}	59_{c}	60_{c}	256_{a}	89_{c}	125_{c}
	% within Study	11.0%	1.1%	4.0%	6.0%	6.1%	12.0%	7.0%	7.4%
Doubtful	Count	$48_{a, b, c, d}$	2_{e}	252_{e}	$149_{c, d, f}$	$150_{b, d, f}$	234_{a}	$165_{a, b, c, d}$	275_{f}
	% within Study	12.0%	2.2%	7.1%	15.2%	15.2%	11.0%	13.0%	16.2%
Disengaged	Count	$32_{a, b, c}$	0_{d}	215_{c}	99_{b}	100_{b}	$149_{a, c}$	165_{e}	$126_{a, c}$
	% within Study	8.0%	0.0%	6.0%	10.1%	10.1%	7.0%	13.0%	7.4%
Total	Count	400	93	3556	982	990	2130	1273	1697
	% within Study	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

When comparing the current study to the Maibach et al. (2009) study, all the CC categories were statistically different, except for the Concerned group. The 2009 study had 2,219 participants from the general public. A downward trend can be seen in the Alarmed, Concerned, Disengaged, Doubtful, and Dismissive CC segments from the 2009 to the current study. There was also an upward trend in percentages of participants in the Cautious groups in the current study compared to the 2009 study. There was a significant difference between the current study and the 2009 study ($\chi^2(5) = 79.99$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2009 was .19, suggesting a small effect size, which has a low practical significance.

The current study was statistically significantly from the Leiserowitz et al. (2012) study in the all of the segments. The 2012 study had 982 participants of the general public. A downward trend from the 2012 study to the current study was found in the Alarmed, Disengaged, Doubtful, and Dismissive CC segments while there was an upward trend with the Concerned and Cautious segments. There was a statistically significant difference between the current study and the 2012 study ($\chi^2(5) = 48.76$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2012 study was .21, suggesting a small effect size, which has a low practical significance.

The current study was statistically significantly from the Roser-Renouf et al. (2014) study and the segments that were statistically different in all the CC segments. A downward trend from the 2014 study to the current study was found in the Alarmed, Disengaged, Doubtful, and Dismissive CC segments while there was an upward trend with the Concerned and Cautious segments. The 2014 study included 1,275 participants from the general public. There was a statistically significant difference between the

current study and the 2014 study ($\chi^2(5) = 761.296$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2014 was .21, suggesting a small effect size, which has a low practical significance.

The current study was statistically significantly from the Leiserowitz et al. (2014) study and the segments that were statistically different in the CC segments. There was an upward trend in percentages in the Concerned and Cautious groups only. The 2014 study was conducted with 830 adults from the general population. There was a statistically significant difference between the current study and the 2014 study ($\chi^2(5) = 48.895$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2014 study was .21, suggesting a small effect size, which has a low practical significance.

The current study was statistically significantly from the Burnett et al. (2014) study only the Alarmed, Disengaged, Doubtful, and Dismissive segments were significantly different. There were downward trends in all these segments. There was a statistically significant difference between the current study and the 2014 study ($\chi^2(5) = 42.96$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2014 study was .30, suggesting a medium effect size, which has a medium level practical significance.

The current study was statistically significantly from the Kelly et al. (2014) study at the Alarmed, Concerned, Cautious, and Dismissive segments. There was a downward trend in percentages in the Alarmed and Dismissive groups while there was an upward trend in the Concerned and Cautious groups. The 2014 study surveyed 3,594 visitors of zoo and aquariums. There was a statistically significant difference between the current

study and the 2014 study ($\chi^2(5) = 79.309$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the Kelly et. al (2014) study was .15, suggesting a small effect size, which has a low practical significance.

The current study differed significantly from the Wojcik et al. (2014) study in all the CC segments. The Alarmed, Disengaged, Doubtful, and Dismissive groups had higher percentages in the 2014, while the Concerned and Cautious groups had a higher percentage. The 2014 study based on 2,758 Extension Agents in the Southeast. There was a statistically significant difference between the current study and the 2014 study ($\chi^2(5) = 84.799$, $p < .001$). The Cramer's *V* value for the relationship strength between the current study and the 2014 study was .20, suggesting a small effect size, which has a low practical significance.

Interpretation. Using a chi-square test of independence, there was a statistically significance difference between each of the previous studies and the current study's Six Americas Survey results. The current study had the lowest group percentage for the Alarmed, Disengaged, Doubtful, and Dismissive groups and the highest membership for the Concerned and Cautious groups. Even though, these results were statistically significant, the data analysis also included a Cramer's *V* effect size, which provided additional interpretation of the results.

All but one of the previous studies had a small Cramer's *V* effect size, with a range of .15 to .30. Even though each previous study was statistically significant when analyzed with the current study, there was a low practical significance according to the small Cramer's *V* effect size. While these studies were statistically different, the small effect size indicates these results should be interpreted with caution. There could be

several reasons for the discrepancy between the *p*-value and the effect size, which may include a small sample size (Lomax & Hahs-Vaughn, 2012). The Burnett et al. (2014) study had a medium effect size with a Cramer's *V* value of .30, which can be interpreted as there most likely some practical significance to the results.

Research Question Four

Research question 4 used the Leiserowitz et al. (2012) instrument, American's Knowledge of Climate Change. The original instrument contained 42 items, and eight items from the original document were used in this study. The selection process of the eight CC instrument items was discussed in Chapter II. No recoding of the data was necessary for the eight items selected for this study. All survey items had a correct response as determined by Leiserowitz et al. (2010).

Descriptive statistics. Similar to Leiserowitz et al. (2012), the participants were provided an overall score. The scores were calculated by tallying the total number of correct answers from the instrument items. Within eight questions, 12 responses were correct, and some items had more than one correct response. Participants were not deducted points if they answered an item incorrectly. For example, if a participant answered 10 out of 12 correct responses, they would have received an 83.33% score. An overall mean score was calculated for each participant. The overall mean score for the participants was 73% and the score of the participants is illustrated in Figure 10.

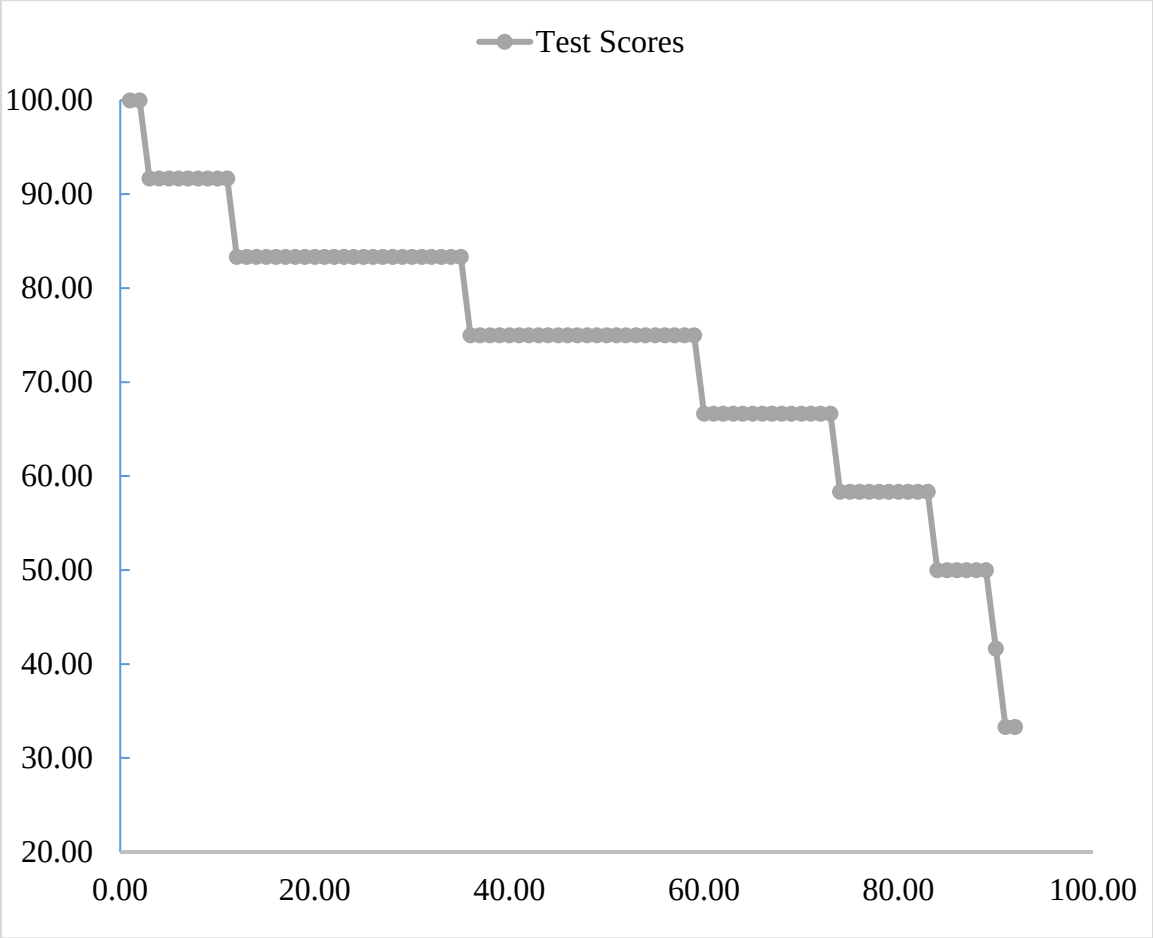

Figure 10. Climate change knowledge scores, shown as a percentage (*N*=93).

Descriptive statistics were conducted for each individual CC knowledge item. As seen in Table 12, the frequency and percentage for each CC knowledge item is provided. The correct response for each item is indicated by an "X". An over-whelming majority of the participants (98.9%) understood that the term *greenhouse effect* refers to the atmospheric gases that trap heat. One participant selected "the Earth's protective ozone layer" as the only other response for this item. For the survey item on what atmospheric gases are good at trapping heat, 95.6% selected carbon dioxide, 74,2% selected methane, and 35.5% selected water vapor, which are all three correct responses. Hydrogen

(21.5%) and oxygen (10.8%) were also selected by survey participants, which are incorrect, and only 1.1% selected the "don't know" response.

There were two survey items relating to fossil fuels. The first item focused on what are fossil fuels and 97.8% selected coal, 93.5% selected oil, and 75.3% selected natural gas, which are all correct responses. Also selected by some participants were wood (7.5%) and hydrogen (3.2), while no participants selected solar energy. The second fossil fuel related question was to select the gas produced by fossil fuels, which 98.9% selected the correct response of carbon dioxide and 1.1% selected don't know.

Two questions focused on CC atmospheric levels over time. The first asked how much carbon dioxide was in the atmosphere in the year 1850. The correct response (30.5%) was 290 parts per million (ppm), while 33.7% selected 150 ppm, 12% selected 350 ppm, and 23.9% selected "did not know". The second survey item focused on the same question but for the current year of 2018, and 42.9% selected the correct response of 410 ppm. Other responses were 290 ppm (19.8%), 450 ppm (13.2%), and "don't know" (19.8%).

The last two knowledge questions focused on countries and carbon dioxide emission rates. The first question was which country emits the largest amount of carbon dioxide, with China (68.8%) being the correct response, and other responses included United States (15.1%), India (9.7%) and "don't know" (5.4%). The second item was on which country emits the most carbon dioxide per person, with United States (81.7%) as the correct response, and other responses included China (11.8%), India (2.2%) and "don't know" (3.2%).

Table 12

Descriptive Statistics for Responses on Climate Change Knowledge Items

Instrument Question and Answer	*N*	%
Question 1: The "greenhouse" refers to:		
Gases in the atmosphere that trap heat (X)	92	98.9
The Earth's protective ozone layer	1	1.1
Pollution that causes acid rain		
How plants grow		
Don't know		
Question 2: Which of the following gases in the atmosphere are good at trapping heat from the Earth's surface?		
Carbon dioxide (X)	88	95.6
Methane (X)	69	74.2
Water vapor (X)	33.3	35.5
Hydrogen	20	21.5
Oxygen	10	10.8
Don't know	1	1.1
Question 3: Which of the following are "fossil fuels"?		
Coal (X)	91	97.8
Oil (X)	87	93.5
Natural gas (X)	70	75.3
Wood	7	7.5
Hydrogen	3	3.2
Solar		
Question 4: What gas is produced by the burning of fossil fuels?		
Carbon dioxide (X)	90	98.9
Hydrogen		
Helium		
Oxygen		
Don't know	1	1.1
Question 5: To the best of your knowledge, roughly how much carbon dioxide was in the atmosphere in the year 1850?		
150 parts per million	31	33.7
290 parts per million (X)	28	30.4
350 parts per million	11	12.0
410 parts per million		
450 parts per million		
Don't know	22	23.9
Question 6: Roughly how much carbon dioxide is in the atmosphere today?		

Instrument Question and Answer	*N*	%
150 parts per million		
290 parts per million	4	4.4
350 parts per million	18	19.8
410 parts per million (X)	39	42.9
450 parts per million	12	13.2
Don't know	18	19.8
Question 7: Which of the following countries emits the largest total amount of carbon dioxide?		
United States	14	15.2
China (X)	64	69.6
India	9	9.8
Germany		
Japan		
Don't know	5	5.4
Question 8: Which of the following countries emits the most carbon per person?		
United States (X)	76	81.7
China	11	11.8
India	2	2.2
Germany		
Japan		
Don't know	3	3.3

Note. The correct answer is indicated by the "X".

Interpretation. Overall, the participants were relatively knowledgeable on the CC items. The mean score for the entire sample was 73% out of a score of 100. There were still some items responses that had misconceptions, such as what types of gases are good at trapping atmospheric heat; only 35.5% correctly identified that water vapor was included as a correct response. In addition, only 42% correctly identified the current carbon dioxide atmospheric levels.

Research Question Five

Research question 5 investigated if CC knowledge significantly differs by the demographics. The quantitative dependent variable was the actual score each participant received in research question 4. The categorical independent variables were what organization participants were members of, where they lived, age, gender, level of

education, type of organization they worked at, political affiliation, and religious affiliation. Analysis was originally to be conducted with ANOVA, but after failing to meet assumptions, it was tested with a non-parametric test Kruskal-Wallis.

Assumption testing. Assumption testing included independence, normality, and homogeneity of variance. The assumption of independence was met through having two groups that were independent of each other. Homogeneity of variance was also tested with the Levene Statistic. The assumption for homogeneity was only for the data and was only met for the variables: education levels, organizations, and political affiliation (Table 13). Those variables with a *p*-value less than .05 met violated the assumption of homogeneity of variance.

Table 13

Levene Statistic Assumption Test for Homogeneity of Variance

Demographic	Levene Statistic	df_1	df_2	*p*
What organization are you a member of?	5.33	7	81	.00
How would you describe where you currently live?	0.78	7	83	.00
What gender do you identify with?	3.72	7	82	.00
What is your highest level of education or degree completed?	1.32	7	83	.25
How would you classify your organization?	0.28	7	83	.96
What is your religious affiliation?	2.23	7	83	.04
What is your political affiliation?	0.56	7	83	.79

Assumption for normality was tested with the Shapiro-Wilk, and this test is better suited for smaller samples (Laerd, 2013). The following table shows the Shapiro-Wilk *p*-values for each independent variable. *P*-values greater than .05 met the assumption of

normality; *p*-values less than .05 violate the assumption of normality. As indicated in Table 14, there were several variables that did not meet the assumption of normality.

Table 14

Shapiro-Wilk Assumption Test for Normality

Test Score	Demographic	Shapiro-Wilk		
		Statistic	*df*	*p*
What environmental education association are you a member of?				
	Environmental Education Association of Alabama	.86	10	.03
	League of Environmental Educators in Florida	.82	16	.01
	Environmental Education Alliance of Georgia	.92	28	.05
	Environmental Educators of North Carolina	.89.	9	.21
	Environmental Education Association of South Carolina	.83	12	.02
	Tennessee Environmental Education Association	.85	15	.02
How would do describe where you currently live?				
	Rural	.93	16	.22
	Urban clusters	.91	50	.00
	Urban	.94	26	.13
What gender do you identify with?				
	Female	.94	64	.00
	Male	.91	24	.03
	Choose not to respond	.75	3	.00
What is your highest level of education or degree completed?				
	Bachelor's degree	.94	45	.03
	Master's degree	.92	42	.07
	Doctorate degree	.75	3	.00
How would you classify your organization?				
	Nature Center	.93	12	.33
	Museum/Zoo/Aquarium	.84	13	.02
	For-Profit Business	.85	6	.17
	Non-profit organization	.92	24	.07
	K-12 school	.95	17	.38
	College or University	.77	6	.03
	State Government Organization	.89	5	.38
	Other	.83	8	.05
What is your religious affiliation?				
	Christian	.95	31	.12

Test Score	Demographic	Shapiro-Wilk		
	Catholic	.84	6	.12
	Other Christian	.96	3	.64
	Buddhist	.96	6	.80
	Atheist	.83	6	.11
	Agnostic	.89	10	.16
	Nothing in particular	.79	14	.00
	Don't know/refuse	.95	14	.59
What is your political affiliation?				
	Democrat	.93	31	.04
	Republican	.94	8	.62
	Independent	.95	32	.16
	None	.76	9	.01
	Rather Not Say	.91	12	.21

Analysis. The hypotheses of interest for the ANOVA test included the null hypotheses, which stated there is no statistically significant difference in means, and the alternative hypotheses stated there is a statistically significant difference in means. The data analysis had variables that failed both the assumption test of homogeneity and normality, a non-parametric test, Kruskal-Wallis test was used for analysis. A Kruskal-Wallis test is based on ranked data (Field, 2005). This test was appropriate when data failed both normality and homogeneity of variance (2005). A Kruskal-Wallis test compares the mean ranks, the null hypotheses are there are no statistically significant differences in mean ranks, and the alternative hypotheses there is at least one mean rank that is not equal. The Kruskal-Wallis test revealed there were no significant differences between knowledge levels and the demographics. Thus, the researcher failed to reject the null hypothesis (Table 15).

Table 15

Kruskal-Wallis Analysis (N=93)

	Mean Rank	Kruskal-Wallis	*df*	*p*
What environmental education association are you a member of?		2.87	5	.72
Environmental Education Association of Alabama	41.65			
League of Environmental Educators in Florida	45.19			
Environmental Education Alliance of Georgia	45.04			
Environmental Educators of North Carolina	57.06			
Environmental Education Association of South Carolina	48.25			
Tennessee Environmental Education Association	40.13			
How would do describe where you currently live?		1.07	2	.59
Rural	40.97			
Urban clusters	46.69			
Urban	49.54			
What gender do you identify with?		1.12	2	.57
Female	45.59			
Male	45.17			
Choose not to respond	61.50			
What is your highest level of education or degree completed?		2.63	4	.62
Some college credit, no degree	14.5			
Associate degree	69.50			
Bachelor's degree	45.9			
Master's degree	46.74			
Doctorate degree	55.17			
How would you classify your organization?		4.61	8	.80
Nature Center	40.42			
Museum/Zoo/Aquarium	53.38			
For-Profit Business	47.17			
Non-profit organization	43.23			
K-12 school	43.26			
College or University	44.00			
State Government Organization	60.00			
Federal Organization	69.50			
Other	51.19			

	Mean Rank	Kruskal-Wallis	*df*	*p*
What is your religious affiliation?		8.62	9	.47
Christian	40.66			
Catholic	41.75			
Other Christian	36.83			
Jewish	69.5			
Buddhist	34.67			
Atheist	63.67			
Agnostic	51.05			
Nothing in particular	49.43			
Don't know/refuse	51.68			
What is your political affiliation?		3.25	4	.52
Democrat	46.69			
Republican	31			
Independent	48.83			
None	50.06			
Rather Not Say	47.46			

Interpretation. The data were unable to be analyzed with ANOVA, due to failed assumption testing. An alternative, non-parametric test, Kruskal-Wallis was conducted instead. No significant differences in mean ranks were determined to exist in test scores among the demographics explored. Further discussion will be included in Chapter V.

Research Question Six

Research question 6 focused on comparing CC knowledge of this study's participants and CC knowledge of previous studies using the same instrument. The original study by Leiserowitz et al. (2010) surveyed 2030 individuals and included 81 CC knowledge items. In the 2010 publication, the researchers provided the percentage of responses for each test item by the participants. For the purpose of this study, the eight questions included in the current study were isolated and rescored based on the percentages of correct and incorrect answers provided, which was consistent on how the current study's participants were scored. The new calculated average mean score was

52% correct responses in the 2010 study. The mean percentage score was 73% of correct responses in the current study.

Descriptive statistics. Descriptive statistics were conducted for each CC knowledge test question. The percentages of participants who selected each response item are illustrated in Table 16. Responses are shown for both the current study and the Leiserowitz et al. (2010) study. The authors of the 2010 study provided the total number of responses for each item from all participants. The number of correct responses was converted into a percentage by the current researcher for comparison to the current study.

Proportions analysis. The knowledge proportions for each population were analyzed using a *z*-test for proportions, which is appropriate when comparing scores from two different populations (Laerd, 2013). The assumption for a *z*-test are to have a sample larger than 30 and have independent random samples, which were both met for this analysis (Laerd, 2013). For the proportions analysis, the null and alternative hypothesis were used, where p_1 is the 2010 study and p_2 is the current study. :

$$H_o: p_1 = p_2$$

$$H_a: p_1 \neq p_2$$

The null hypotheses states there is no statistically significant difference between the proportions of the current study and the 2010 study, and the alternative hypotheses states there is a statistically significant difference. A two-tailed test was conducted with a significance level of .05. A positive *z*-score indicates the score is greater than the mean, while a negative *z*-score is less than the mean (Laerd, 2013). Post-hoc analysis was also conducted for effect size. A Cohen's *d* effect size was used to test for differences between proportions of different sample sizes (Cohen, 1988).

The proportions analysis was first conducted with the mean score for each population, as seen in Table 16. The calculated *p*-value for the proportions was .00006. The *p*-value was less than .05, the proportions were not equal and considered statistically significant. A Cohen's *d* was used for determining effect size. The effect size was calculated using a Cohen's *d* with a value of .49, which is a medium effect size. The participants in the current study had statistically significant higher test scores that participants in the 2010 study. The Cohen's d effect size was .41, which is almost a medium effect size, and has practical significance.

Table 16

z-test Two-Tailed Proportions Analysis of Knowledge Mean Scores from the Current Study and the 2010 Leiserowitz et al. Study

	Leiserowitz et al. (*N*=2030)	Current Study (*N*=93)	*z*-score	*p*	Cohen's *d*
Test proportion	.52	.73	-3.99	.00006	.41

Further proportions analysis was conducted with each individual knowledge question's corresponding responses, using the same null and alternative hypothesis as the initial analysis. As seen in Table 17, there were several statistically significant proportions, the null hypothesis was rejected, and the alternative hypothesis was accepted. The responses that were not statistically significant failed to reject the null hypothesis. Each corresponding response was had a Cohen's effect size calculated. In the eight knowledge questions utilized in this study, there were 46 total responses. Of these responses, 29 responses were analyzed to be statistically different.

Table 17

z-test Two-Tailed Proportions Analysis of Knowledge Responses from the Current Study and the 2010 Leiserowitz et al. Study

Instrument Question and Answer	Leiserowitz et al. (*N*=2030)	Current Study (*N*=93)	*z*-score	*p*	Cohen's *d*
Question 1: The "greenhouse" refers to:					
Don't know	203		3.21	.0013	0.33
How plants grow	61		1.7	.09	0.18
Pollution that causes acid rain	406		.97	.33	0.10
The Earth's protective ozone layer	426	2	4.68	<.00001	0.49
Gases in the atmosphere that trap heat (X)	1340	91	-6.4	<.00001	0.68
Question 2: Which of the following gases in the atmosphere are good at trapping hear from the Earth's surface?					
Don't know	853	1	7.87	<.00001	0.82
Oxygen	142	10	-1.39	.16	0.14
Hydrogen	142	20	-5.15	<.00001	0.54
Water vapor (X)	244	33	-6.58	<.00001	0.68
Methane (X)	507	69	-10.43	<.00001	1.08
Carbon dioxide (X)	904	90	-9.87	<.00001	1.05
Question 3: Which of the following are "fossil fuels"?					
Solar	142		2.64	.0083	0.28
Hydrogen	223	3	2.38	.017	0.26
Wood	568	7	4.34	<.00001	0.46
Natural gas (X)	1218	70	-2.95	.003	0.31
Oil (X)	1542	87	-3.93	.00008	0.42
Coal (X)	1015	92	-9.24	<.00001	0.98
Question 4: What gas is produced by the burning of fossil fuels?					
Don't know	528	1	5.44	<.00001	0.58

Oxygen	41		1.39	.17	0.15
Helium	20		.96	.34	0.10
Hydrogen	81		1.96	.05	0.21
Carbon dioxide (X)	1360	92	-6.48	<.00001	0.69
Question 5: To the best of your knowledge, roughly how much carbon dioxide was in the atmosphere in the year 1850?					
Don't know	1583	2	16.43	<.00001	1.74
450 parts per million	20		.21	.83	0.02
410 parts per million	41		.3	.76	0.03
350 parts per million	81	32	-12.78	<.00001	1.36
290 parts per million (X)	122	27	-8.5	<.00001	0.91
150 parts per million	203	32	-7.34	<.00001	0.78
Question 6: Roughly how much carbon dioxide is in the atmosphere today?					
Don't know	1543	18	12.11	<.00001	1.29
450 parts per million	121	11	-2.29	.02	0.24
410 parts per million (X)	142	42	-12.79	<.00001	1.36
350 parts per million	122	18	-5.07	<.00001	0.54
290 parts per million	61	4	-.07	.48	0.01
150 parts per million	41		1.39	.17	0.15
Question 7: Which of the following countries emits the largest total amount of carbon dioxide?					
Don't know	487	5	4.16	.00064	0.44
Japan	81		1.96	.05	0.21
Germany	20		.96	.34	0.10
India	41	9	-4.76	<.00001	0.51
China (X)	731	65	-6.6	<.00001	0.70
United States	690	14	3.79	.00016	0.40
Question 8: Which of the following countries emits the most carbon per person?					

Don’t know	629	3	5.73	<.00001	0.61
Japan	102		2.22	.03	0.23
Germany	20		.96	.34	0.10
India	81	2	.9	.37	0.10
China (X)	365	11	1.52	.13	0.16
United States	853	77	-7.75	<.00001	0.82

Note. Comparing climate change knowledge responses for each question, shown as the actual number of participant responses.

Interpretation. Overall, the participants from this study provided more correct responses to the CC knowledge questions when compared to the previous Leiserowitz et al. (2010) study. There was a statistically significant difference between the proportions of the current study and the Leiserowitz et al. (2010) study, p=.00006 and d=.41. The effect size of .41 indicated that 27.4% of the mean of the current study was at the 66th percentile of the 2019 study. In addition, when viewing each question individually, overall, the current study provided more correct responses for each of the instrument items when compared to the 2010 study. The responses that had a Cohen's d effect size of more than 1.00 indicated that the difference between the means of the current study and the 2010 Leiserowitz et al. study was larger than one standard deviation.

In knowledge question 1, the correct response was "gases in the atmosphere that trap heat", and the proportions were statistically significant at p<.00001, There was also an effect size of -.68, which is considered half way between a medium and large effect size (Cohen, 1988). In knowledge question 2, the correct responses of water vapor (d=-68), methane (d=1.08), and carbon dioxide (d=1.05) were each statistically significant (p<.00001). In addition, water vapor had an effect size of 68, which is medium effect size. Methane was d=1.08, and carbon dioxide was d=1.05; each had very large effect sizes that indicated very high practical significance.

For knowledge question 3, the correct responses were: natural gas (p=.3), oil (p=.00008), and coal (p<.00001); all of which were statistically significant. Natural gas and oil both had small effect sizes (d=-.31, d=-.42 respectively) while coal had a large effect size (d=-.98). For knowledge question 4, there was a statistically significant

difference for the correct answer of carbon dioxide, $p<.00001$ and a medium to large effect size of .69.

Knowledge questions 5 and 6 focused on the carbon dioxide levels in the 1850 and 2018 calendar years. In the year 1850, carbon dioxide levels were at 290 parts per million, and this response was statistically significant ($p<.00001$). A large effect size of -.91 was also calculated for knowledge question 5. In the year 2018, carbon dioxide levels were 410 parts per million, and this response was also statistically significant ($p<.00001$) and had a very large effect size of -1.36. The last two knowledge questions focused on what countries had the most emissions. The proportions for responses on the country that emits the largest amount of carbon dioxide was statistically significant ($p<.00001$) and had a medium effect size of -.51. The final knowledge question current response was that China and was not statistically significant ($p=.13$) and had a low effect size ($d=.16$).

Summary

An online survey was used to determine CC perception and knowledge in reported by SEEA members. This study included a sample of SEEA members located in the states: Alabama, Georgia, Florida, South Carolina, North Carolina, and Tennessee.

The participants (N=93) in this study were members of Georgia ($n=28$), Florida ($n=16$), Tennessee ($n=15$), South Carolina ($n=12$), Alabama ($n=10$), and North Carolina ($n=9$). Half of the participants were from urban clusters ($n=50$, 53.8%), 25 to 34 years old ($n=31$, 33.3%), female ($n=65$, 69.9%), and had a bachelor's degree ($n=46$, 49.5%). The majority of participants worked at a non-profit ($n=25$, 26.9%) and multiple grade levels were taught by participants, but the most common was elementary programs

(*n*=77, 82.8%). The most common religious affiliation was Christianity (*n*=31, 33.3%) and most common political affiliation was Independent (*n*=32, 34.4%).

The participants were first analyzed with the Six Americas Survey and were placed into one of six CC segments. The participants of this study were segmented into the following groups Cautious (*n*=48), Concerned, (*n*=38), Alarmed (*n*=4), Doubtful (*n*=2), and Disengaged (*n*=1). MLR and a chi-square analysis found no significant differences between the CC segments and the demographic variables of the participants. The CC segments from this current study were analyzed with a chi-square between seven previous studies that all included the Six Americas Survey. A significant difference was found between all the previous study CC segment proportions. The level of CC knowledge was determined to be a mean score of 73, out of a score of 100. Analysis was conducted with an ANOVA, and no statistical difference were found between knowledge scores and demographics. The overall CC knowledge score was compared against the score of the general public, and the participants in this study had higher knowledge than the general public. Further analysis of the current group and the previous 2010 Leiserowitz et al. resulted in several significant differences in the survey items, where the current study was not the same as the 2010 population in regard to the responses provided for each CC knowledge item.

CHAPTER V

DISCUSSION

This chapter is organized with first an overview of the problem followed by a summary of the research analysis from Chapter IV. A discussion of the research will include both CC perceptions and CC knowledge. This chapter will also include discussion on the relationship to research, the conceptual framework, implications, conclusions, and recommendations.

Overview of the Problem

Climate will always change, but what has been unique to our current era has been the contribution of anthropogenic causes (IPCC, 2014d). These anthropogenic contributions have been the highest in recorded history and their impacts, while already impacting the planet through sea level rise, increased temperature, and melting Polar Regions; these impacts will continue to be felt by future generations (IPCC. 2014d). Some CC impacts could potentially be reduced through adaptation and mitigation efforts made by individuals, corporations, and governments (IPCC, 2014b). One effort that supports mitigation and adaptation is education, such as EE, education for sustainable development, and CC education.

EE has been defined since 1976 in the Belgrade Charter with the goal that citizens should have environmental concern, knowledge, skills, attitudes, motivation, and a commitment towards environmental solution (UNESCO-UNEP, 1976). In 1992, Education for Sustainable Development, a narrower EE field, focused on encouraging attitudes, skills, and behavior that supported sustainable development (World Resources

Institute, 1992). CC education has been supported in several variation, including the United Nations that education should be used for environmental problems, such as CC (UNESCO, 1972) and in 2010 by Congress as they developed a CC education program to develop CC education resources (National Research Council, 2011). While there is no universally accepted definition or goals of CC education, National Oceanic and Atmospheric Administration, American Association for the Advancement of Science, and the NSF developed the Climate Literacy Guide, which defined a climate literate person as someone who has knowledge, communication, and behavior that support CC efforts (U.S. Climate Change Science Program, 2009).

This CC education research was divided into two focus areas for this dissertation: perceptions and knowledge. A large portion of CC perception research has been made by the Yale Project on Climate Change Communication that used the instrument Six Americas Survey to segment participants into one of six categories of CC – Alarmed, Concerned, Cautious, Disengaged, Doubtful, and Dismissive (Maibach et al., 2009). The Six Americas Survey has been administered several years from 2009 to 2016 with the general public, and the range for participants who believe in CC have been from 63-70% of the participants (Leiserowitz et al., 2016; Leiserowitz & et al., 2014; Maibach et al., 2009; Roser-Renouf et al., 2014). Additional studies conducted with the Six Americas Survey include the 2014 Kelley et al. where the researchers found 82% of visitors of zoos and aquariums believe in CC. Finally, a 2014 study found that Southeastern Extension Agents had 70% of the audience classified as individuals who believe in CC (Burnett et al., 2014).

CC research focusing on knowledge has also been a growing. Researchers have found the students can hold several misconceptions on CC, such as flooding is limited to the specific season, God makes the rain, a cold winter can predict a warm summer, and carbon dioxide is not a greenhouse gas (Henriques, 2002; Shepardson et al., 2011). Other researchers have reported teachers also hold misconceptions, such as the types of greenhouse gases and the future impacts of CC (McNeal et al, 2014). Within the general public, researchers have reported misconceptions on the causes of global warming and CC (Coyle, 2005). The knowledge portion of the current study also revealed some misconceptions that the SEEA participants have. Misconceptions included some participants selected hydrogen as a heat trapping gas and did not consider water vapor as a heat trapping gas.

Summary of the Research Analysis

For this research, the researcher examined CC perceptions and knowledge of SEEA members. This analysis was conducted through a quantitative study research design that included an online survey. Participants were members in SEEA organization within eight states: Alabama, Florida, Georgia, North Carolina, South Carolina, and Tennessee. Participants were recruited using an email sent from each individual SEEA organization through their newsletter. Two states, Kentucky and Mississippi, did not participate in the research.

Participants responded to statements and questions relating to CC perceptions and knowledge. An unknown number of potential participants were emailed the survey, but 104 were returned, with a final sample of 93 surveys, after removing surveys with less than 70% completion. The survey also gathered demographics, and, overall, the

participants were from the state of Georgia (30.1%); female (69.9%); lived in urban clusters (56.8%); had both bachelor's degrees (49.5%) and master's degrees (45.2%); worked at a non-profit (26.9%); taught elementary programs (77%); were Christian (33.3%); and identified as a Democrat (34.4%) and as an Independent (34.4%).

The Six Americas Survey, and corresponding DA, has been used on the general U.S. public (Leiserowitz et al., 2014; Leiserowitz et al., 2016; Maibach et al., 2009; Roser-Renouf et al., 2014), Southeastern Extension Agents (Burnett et al., 2014; Monroe et al., 2015), and visitors of zoos and aquariums (Kelly et al., 2014). However, the Six Americas Survey has not been applied to the audience used in this study, which was SEEA members. The results of the Six Americas Survey segmentation classified most of the participants as Concerned (n=38) and Cautious (n=48), with an overwhelming portion of the participants believing in CC (96.7%). The demographics were analyzed with a MLR and chi-square analysis, and no statistically significant variables were found for the CC segments. A chi-square analysis was used to analyze the CC segments of the current study with previous studies. Statistically significant differences were found with each previous study (see Table 10). In the current study, SEEA members were better represented in the Concerned and Cautious segments than all previous studies.

The CC knowledge portion of the instrument resulted in participants who were somewhat knowledgeable about CC. Overall, they answered 73% of the instrument items correctly. There were no statistical differences between any of the demographics and the knowledge scores. A Kruskal-Wallis analysis was conducted for the demographics and resulted in no statistically significant differences between knowledge levels and the demographics. Finally, a two-tailed z-test was conducted to determine if the proportion

of the current study was different than a previous study regarding the CC knowledge responses on the survey instrument. The proportions of correct responses for every knowledge survey item were statistically significant.

Discussion of Research Findings

In this research study, the researcher examined what CC perceptions and knowledge SEEA members report. While this study illustrated how environmental educators are contributing to CC education, the results are confined to SEEA members. The study results suggest these SEEA members are willing to contribute to CC mitigation and adaptation efforts. The following section will provide an analysis of the current study in relation to the CC perceptions and knowledge levels of SEEA members.

Climate Change Perceptions

Research questions 1 through 3 focused on the Six Americas Survey, which was developed to segment audiences into CC groups. Based on the results of the Six Americas Survey analysis of SEEA members, it is clear this sample was overall aware that CC is happening. A large majority (96.8%) of the study participants fell within the Alarmed, Concerned, and Cautious CC segments based on the Six Americas Survey (Maibach et al., 2009).

A more detailed analysis of the segmentation through the Six Americas Survey highlighted where the differences existed between each of the six categories – Alarmed, Concerned, Cautious, Disengaged, Doubtful, and Dismissive – through the participants' answers for each survey item. While there were some similarities, such as all participants and all groups believe in global warming, the differences were found in the behavioral

aspects, such as not purchasing from a company that was not working towards lowering carbon emissions.

The Alarmed segment was not the only group with the belief that global warming is happening. Both the Disengaged and Doubtful groups had a consensus; they are extremely sure global warming is happening. The Alarmed group also had a consensus global warming was caused by anthropogenic activities, and overall most of the participants in the Alarmed segment were very worried about global warming. This group also believed global warming will harm them personally, harm U.S. citizens, and impact future generations. The Alarmed segment had thought about global warming a lot prior to the taking the online survey and were more likely to have friends to share their global warming beliefs. This group also believed that while global warming was happening, it was unclear if people would do what is needed to reduce CC impacts. In addition, the Alarmed group believed citizens, Congress, and the President should be doing more to address CC. The Alarmed segment stood out the most with the actions of punishing companies who were not taking steps to reduce global warming. Lastly, the Alarmed group had a consensus that the United States should reduce emissions regardless of what other countries do.

The Concerned group, overall, were extremely sure global warming was happening and in agreement that humans cause global warming but were less worried about global warming when compared to the Alarmed group. There was also a lower level of concern that global warming would harm them personally or future generation but slightly more concerned about U.S. citizens when compared to the Alarmed group. While they had thought about global warming a lot prior to the survey, the issue was

slightly less important to them personally when compared to the Alarmed group. Compared to the Alarmed group, they were less likely to change their minds about global warming. When compared to the Alarmed group, the Concerned group had reported less times they punished companies for not reducing global warming.

The Cautious group, overall, was very sure that global warming was happening. The Cautious group again was similar to both the Alarmed and Concerned group in that the group believed global warming was the result of anthropogenic causes. However, they were less worried compared to both the Alarmed and Concerned group about global warming, how much global warming would harm them personally, would harm U.S. citizens, and would harm future generation. Compared to all the other groups, they thought about global warming the least prior to the survey and the issue of global warming was the less important than both the Alarmed and Concerned groups. This group also was most likely to have their beliefs changed about global warming compared to other groups. This group also was most like to have only boycotted a company once for not reducing global warming in the past year. Finally, this group rated the priority of the President and Congress the lowest at high, rather than very high.

The Disengaged group, while only had one survey participant classified within this segment, did have differences in survey responses. Like the other groups, this person was extremely sure that global warming was happening but, unlike the other groups, selected the cause of global warming to something other than anthropogenic or natural causes. This group was also the least worried about global warming. The Disengaged group was the only group who selected they did not know how much global warming would harm them personally or future generations. Similar to the other groups, they had

thought about global warming a lot prior to the survey and found the issue of global warming very important, similar to the Alarmed group. The Disengaged group was similar to all the other groups, in that it was unclear on if society will do anything for reducing global warming and the United States should reduce greenhouse emissions regardless of what the remainder of the world does. Another difference with the Disengaged group was the only group who selected they had never punished companies that were not taking actions to reduce global warming.

The Doubtful group, while having two participants categorize in this segment, was extremely sure global warming was happening. The participants selected that humans and natural causes cause global warming. While this group was very worried about global warming, they only thought global warming would harm them a moderate amount. They rated the importance of global warming the lowest of the group and were not willing to change their minds on global warming. Another difference in the Doubtful group was the only group who selected humans cannot reduce global warming and, even if humans could reduce global warming, they are not going to change their behaviors. Even though labeled as Doubtful, this group had punished companies in the past the second most frequent with compared to all the other groups.

These data were also analyzed with a multinomial logistic regression and a chi-square to determine if there were differences within the Six Americas Survey segments based on the demographics; no significant differences were found. Therefore, there were no demographic variables that could be used to predict group membership. One reason for the lack of a statistically significant difference was the number of variables used in the analysis. For example, there were eight survey options for level of education and 14

survey options for religious affiliation. Because there were so many survey options and having only the minimum sample size, additional research should be conducted with either a larger sample and/or less demographic items on the survey.

The analysis with the demographics was different from other research in the 2009 Maibach et al. study, the researchers reported the CC groups differed with political and religious beliefs. The groups that have higher beliefs in CC were more likely to be liberal politically and were less likely to identify as an evangelical Christian. In a 2015 study, researchers Monroe et al. reported the Southeastern Extension Agents had similar demographics as the general public. Monroe et al. (2015) discussed these results were surprising as most Extension Agents have higher levels of education and are in positions to communicate science to the general public. In this current study, most participants had a bachelor's degree (49.5%) or master's degree (45.2%), and, according to Maibach et al. (2009), most U.S. citizens classified as Alarmed have at least a bachelor's degree or higher.

The data of the current study were also analyzed to determine if there was a significant difference in the segmentation audience of this study compared to previous studies; seven studies were used for this analysis. Four of these studies had the general public as the participants, one study had participants who were visitors of zoos and aquariums, and two studies focused on Southeastern Extension Agents. In almost all the general population studies, there were statistically significant differences found in the proportions of every CC segment. For the studies that focused on Southeastern Extension Agents, there were also statistically significant differences (Burnett et al., 2014; Wojcik et al., 2014). The last analysis with visitors of zoos and aquariums also had significant

differences were found in all the categories (Kelly et al. 2014). These results will be discussed in the following section.

Starting with the general public studies (Leiserowitz et al., 2014; Leiserowitz et al., 2012; Maibach et al., 2009; Roser-Renouf et al., 2014), there were considerable differences between the general public and the current study. These statistically significant differences included less participants in the Alarmed, Doubtful, and Dismissive groups and more participants in the Concerned and Cautious groups. However, the effect size for these studies was a small Cramer's *V* effect size. Even though the results were statistically significant, the effect size indicated the results were not practical, and the discrepancy may be due to the small sample size of the current study.

Compared to visitors of zoos and aquariums, research conducted by Kelly et al. (2014), there were more similarities between these two groups than any of the other groups. However, there was a greater proportion of zoos and visitors who were Alarmed compared to the current study. The level of CC awareness with the Kelly et al. (2014) study could indicate the audience in which SEEA members interact with are more receptive to CC programming than perceptions of SEEA members. However, this analysis also had a low effect size of .15, which is an interesting result. This low effect size could be due to the small sample size from the current study.

The Burnett et al. (2014) and Wojcik et al. (2014) study both focused on Southeast Extension Agents. The only segment that did not have a statistically significance difference was the Concerned segment. Every other segment was statistically different. Both Extension Agents and SEEA members are groups who

potentially provide scientific information to the general public. While the Extension Agents were similar to the general public, the SEEA members had more individuals who believed in CC. Perhaps one difference is that environmental educators work more with education while Extension Agents work in fields, such as agriculture; 4-H; community development; food, nutrition, or health; natural resources; and forestry.

One noticeable difference between the current study and the previous studies was that overall, the previous studies had a higher percentage of participants within the Alarmed group. One explanation is that while most all U.S. citizens believe in CC, about only half believe in anthropogenic causes, including teachers (Plutzer et al, 2016). To teach "both sides" of CC, some teachers report reducing the impact that humans have on CC and focus more on natural causes (Branch, Rosenau, & Berbeco, 2016; Bryce & Day, 2014; Plutzer et al., 2016; Roman & Busch, 2016). In addition, teachers face pressure from outside forces, such as the community, administration, and parents, to not focus on CC within the classroom (Branch et al., 2016; Plutzer et al., 2016). Science teachers are encouraged to provide more than one perspective and this pedagogy could also be applicable for SEEA members. SEEA members who teach CC may not fully agree there is a consensus about CC Therefore, are not as Alarmed as they could be because they are allowing for some skepticism to be included within their curriculum.

Beyond simply using teaching methods to be more "open-minded" the textbooks, formal teachers use in the classroom to teach CC also include some skepticism. Roman and Busch (2016) found a greater percentage of science textbooks presents climate mostly as a consensus among scientists, but there is still skepticism presented. This skepticism included the anthropogenic causes of CC, which is a consensus among the

climate science community, but not presented as such in textbooks (Roman & Busch, 2016). Branch et al. (2016) reported that some teachers actively visit CC denial websites to ensure they have information on both sides, which perhaps increases their skepticism. Because the materials teachers use in the classroom encourage skepticism, these materials could have impacted why there were less Alarmed participants in the current study than the previous studies.

Climate Change Knowledge

The results of this study demonstrated that SEEA members have a medium level of CC knowledge. This medium level of CC is based on the score of 73% correct on the CC knowledge instrument. However, when compared to the general public, this level is higher, with the general public receiving a mean score of 52% on the same CC knowledge items and illustrated that SEEA members possess a good understanding of some CC areas, but there are still some gaps that exists. Where the participants were most knowledgeable was on the items that dealt with greenhouse gases, fossil fuels, and country of origin for carbon dioxide. The survey items that dealt with the amount of carbon dioxide in the atmosphere, both current and historical, had less participants select the correct response. When the knowledge level was analyzed with a Kruskal-Wallis test, there were no significant differences found with the demographic variables. The results of the Kruskal-Wallis analysis could have been because the small sample size and there were too many demographic variables for analysis.

The knowledge levels of the participants were also compared to the knowledge level of a previous study of the general population. Before the analysis took place, the general public knowledge scores we scored with the similar questions and similar style as

the current research. The eight questions were taken from the Leiserowitz et al. (2010) study, which originally had 81 CC knowledge questions and 2,030 participants. After the eight questions along with the percentage of the participants who selected the correct response were scored, the Leiserowitz et al. (2010) participants were given a score of 52%. When a proportions test was conducted, there was a significant difference between the two studies, $p<0.0001$.

However, as discussed earlier in Chapter IV, the participants in the current study scored high on the CC knowledge instrument than previous studies with the Leiserowitz et al. (2010) study. Even with higher knowledge levels, there were less SEEA members segmented into the Alarmed category. One reason there might be a disconnect between perceptions and knowledge is that is some uncertainty about the level of CC impacts in the future (Saylan & Blumstein, 2011). Because of this uncertainty, some individuals may put off behavioral changes that would have individuals considered an Alarmed person. This uncertainty is almost the same as a person knowing that eating a well-balanced diet is healthy, but actively choosing to eat fast food on a daily basis, or a person smoking cigarettes even though they are aware of the long-term effects.

Another reason there might disconnect between knowledge and perceptions is the time the survey was administered, with President Donald Trump in the White House. While most of the participants selected they were either Democrat (34%) or Independent (34%), all the SEEA states in the current study were Republican wins in the 2016 election. Researchers have reported that individuals with a more conservative political identification are less willing to believe in CC and anthropogenic causes (Ziegler, 2017). Because these states have more Republicans than Democrats, perhaps SEEA members

are less likely to be a CC alarmist or to go against culture. EE may be seen by some individuals as more left-leaning (Henderson, Long, Berger, Russell, & Drewes, 2017; Kahan, 2012) and might be a reason SEEA members are not as alarmed, so they are more accepted within a right-leaning culture in the Southeast.

Relationship to Research

In Chapter II, this research identified previous research, which related to this current study. The research areas of interests were CC perceptions and knowledge. In the next section, the researcher will connect the current study to previous research.

Climate Change Perceptions Related Studies

Several studies have investigated CC perception segments using the Six Americas Survey. Starting with the general public studies (Leiserowitz et al., 2014; Leiserowitz et al., 2012; Maibach et al., 2009; Roser-Renouf et al., 2014), there were considerable differences between the general public and the current study. The results of this study do not support the previous results from national data. The participants in this study did not have similar results as the general public for both CC segments and knowledge in previous studies. The proportions of the current study had less in the Alarmed segment and more in both the Concerned and Cautious segments. However, what was similar between the current study and previous studies was that overall most of the participants believe in CC. Previous studies with the Six Americas Survey had a range of 63 to 70% segmented into the Alarmed, Concerned, and Cautious groups, or those individuals who believe in global warming.

Compared to visitors of zoos and aquariums, research conducted by Kelly et al. (2014), there were more similarities between these two groups than any of the other

groups. There was a greater proportion of zoos and aquarium visitors segments as Alarmed than the current study. However, these two studies had the highest percentage of participants categorized into Alarmed, Concerned, and Cautious segments than the other previous studies. These two studies demonstrate that populations who are more involved with environmental knowledge are more likely to believe in CC.

Climate Change Knowledge Related Studies

A repeating theme within CC knowledge research was misconceptions (Bofferding & Kloser, 2015; Boon, 2010; Campbell et al., 2010; Cordero et al., 2008; Henriques, 2002; Khalid, 2003; Ratinen et al., 2013; Ratinen et al., 2015; Shepardson et al., 2009). Overall, the participants in this study had a medium level of CC, based on 73% correct responses on the knowledge portion of the survey. Misconceptions they held, which were consistent with the literature, were the types of greenhouse gases. While most every participant selected correctly carbon dioxide (95.6%) and methane (74.2%), only 35.5% selected water vapor was also a greenhouse gas. Another misconception was the historical aspects of CC, In the year 1850, there was 290 parts per million carbon dioxide in the atmosphere (30.4%), while a slightly larger group selected 150 parts per million (33.7%) or "don't know" (23.9%).

Theoretical and Conceptual Framework

The theoretical framework for this study provided was based on the ELF created by Hollweg et al. (2011). The ELF was designed with components of environmental literacy: competencies, knowledge, dispositions, and environmentally responsible behavior. While the framework emphasized all four components, the results of this study

indicated that knowledge, competencies, and dispositions were more present in the results.

Competencies mainly focused on identifying environmental issues and lacked in other areas, such as analyzing environmental issues, using evidence to defend positions on environmental issues, and evaluating environmental plans (Hollweg et al., 2011). Knowledge in this study was limited to the climate system and did not provide opportunities for participants to demonstrate knowledge about social, political, or cultural issues; knowledge about environmental solutions; or knowledge about the different ways citizens can participate in climate action (Hollweg et al., 2011). Dispositions were limited to perceptions and did not include ways for participants to demonstrate motivation, self-efficacy, and personal responsibility (Hollweg et al., 2011). Finally, environmentally responsible behavior was limited to SEEA membership but did not explore other behaviors relating to CC mitigation and adaptation.

The conceptual framework for this study illustrated the relationship between the variables, perceptions and knowledge, the study population, and previous studies. Data from this study demonstrated that overall SEEA members believe in climate change, with the majority of participants segmented as either Cautious or Concerned. The participants in the current study, differed significantly from previous studies of the Six Americas Survey, with less participants in the current study being segmented as Alarmed and more segmented within the Cautious segment. Additionally, participants in this study were more knowledgeable about CC than the general public. Demographics were also included in data analysis for CC perceptions and knowledge. This study did not display any type of statistically significant difference between the CC perceptions, knowledge, and

demographics. The ELF served as a way to assess environmental literacy, which in this current study was CC perceptions and knowledge.

While the results of this study demonstrated SEEA members believed in CC and were knowledgeable about CC, additional research should address the relationship between perceptions and knowledge. Additionally, research should explore why participants in this study were less alarmed about CC than previous studies. It would also be potentially useful to continue exploring demographics.

Implications

Results from this study have implications for the role of SEEA members and CC education. The findings of this study demonstrated that SEEA members are mostly very concerned about CC and have higher knowledge levels than the general public. This survey did not ask participants about the various ways they already are providing CC education.

Limitations

The limitations of this study include the small sample size. This small sample size of 93 participants limited the analysis with demographics, and there was no significant difference reported in this research in regards to the demographics. Having insight on how the individual SEEAs support CC education would have been useful for both members and the associations. The members would have found additional resources and support for CC education and the associations would have been able to understand gaps in what they offer members.

As common with surveys, the data collected relied upon self-reported behaviors and not actual observed behaviors. It would be interesting to determine if there are actual

behaviors associated with CC education and the SEEA population. These actual behaviors could relate to the efforts SEEA members are participating in CC education.

Another limitation could have been the timing of this research. The research data collection took place in spring of 2018, which was during the Trump Administration of the United States. As discussed earlier in this study, several CC items were either removed from policy or were included in denial discussion with the public. It is possible that this turmoil, in regard to CC within the government, affected SEEA members' responses on the survey. This turmoil could be one reason there were less Alarmed participants than previous studies that used the Six Americas Survey.

Conclusion and Recommendations

The purpose of this study was to determine what the CC perceptions and knowledge SEEA members report. What the research found was that overall SEEA members have a high CC perception level are overall knowledgeable about CC. These findings and review of literature have brought to light a new population and their CC mitigation and adaptation efforts. With this knowledge, SEEA members could be more willing to participate in additional CC efforts.

CC and CC education are areas that should have ongoing research. Perception of CC may impact the level of CC efforts, future research should continue to focus on the different ways environmental educators are contributing to CC mitigation and adaptation. In addition, demographics should be further investigated, with perhaps a narrower focus to determine if there are some demographics that can predict an environmental educator's CC perception.

What this research did not include was the opportunity for participants to provide richer information about CC education efforts. These survey results demonstrated that SEEA members overwhelmingly believe in CC, are relatively knowledgeable, and are willing to participate in CC education related activities. However, the gap lies within the details of how they are incorporating CC education either into their current jobs or other aspects as an environmental educator. This research did not allow SEEA members to provide examples of where they are contributing to CC education. Future studies should consider exploration of the various types of CC programming that SEEA members are involved with.

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APPENDICES

APPENDIX A

PARTICIPANT CONSENT LETTER

Dear Participant,

My name was Lauren Johnson and I am a doctoral student at Columbus State University. I am inviting you to participate in my doctoral research: "Climate Change Education and Environmental Education: Perceptions and Knowledge among Environmental Educators in the Southeastern United States". The purpose was to demonstrate what we, as environmental educators perceive and know about climate change. This online survey with Qualtrics has been designed to gather such information.

Your participation in this research was completely voluntary. You may decline, or leave questions blank that you do not wish to answer. There was no compensation for responding nor was there any known risk. In order to ensure that all information will remain confidential, there was no information gathered from the survey that identifies the person by name or by place of business

Participation in my dissertation research will only require the completion on an online survey that will collect demographic information. The survey should take no more than 30 minutes.

At the end of the survey, you are provided the option to opt-into a $100 Amazon gift card drawing. To do this, you will need to include your name and email address. This information will only be used for the drawing. After the drawing was complete, all information was deleted.

The results of this research were presented in a dissertation for the completion of the doctoral program at Columbus State University. While individual responses are obtained, and recorded anonymously and kept in the strictest confidence, aggregate data were presented representing averages or generalizations about the responses as a whole. No identifiable information was collected from the participant and no identifiable responses was presented in the final form of this study. All data were stores in a secure location accessible only to the researcher. The researcher retains the right to use and publish non-identifiable data.

Participation is entirely voluntary; individuals are free to choose not to participate.

If you have any questions or concerns about this project, feel free to contact myself at Johnson_lauren1@columbusstate.edu at Oxbow Meadows Environmental Learning Center in Columbus, GA. Information about the rights of human subjects in research can be located on the Columbus State University's website at: https://aa.columbusstate.edu/research/irb/index.php

Thank you for your assistance,

Lauren C. Johnson
Oxbow Meadows Environmental Learning Center
Education Program Manager
Columbus State University
Doctoral Student

APPENDIX B

ONLINE SURVEY QUESTIONS

Q1 What organization are you a member of?

- Environmental Education Association of Alabama (1)
- League of Environmental Educators in Florida (2)
- Environmental Education Alliance of Georgia (3)
- Kentucky Association for Environmental Education (4)
- Mississippi Environmental Education Alliance (5)
- Environmental Educators of North Carolina (6)
- Environmental Education Association of South Carolina (7)
- Tennessee Environmental Education Association (8)

Q2 How would you describe where you currently live?

- Rural (less dense, small population, not very developed) (1)
- Urban Clusters (2,500 to 50,000 people) (2)
- Urban (50,000 people or more) (3)

Q3 What is your age?

- ○ 18-24 years old (1)
- ○ 25-34 years old (2)
- ○ 35-44 years old (3)
- ○ 45-54 years old (4)
- ○ 55-64 years old (5)
- ○ 65-74 years old (6)
- ○ 75+ years (7)

Q4 What gender do you most identify with?

- ○ Female (1)
- ○ Male (2)
- ○ Choose not to respond (3)
- ○ Other (please specify) (4) _____

Q5 What is your highest level of education or degree completed?

- ○ High school graduate, diploma or the equivalent (for example: GED) (1)
- ○ Some college credit, no degree (2)
- ○ Trade/technical/vocational training (3)
- ○ Associate degree (4)
- ○ Bachelor's degree (5)
- ○ Master's degree (6)
- ○ Professional degree (7)
- ○ Doctorate degree (8)

6 How would you classify your organization? (Select the best response that applies)

- ○ Nature Center (1)
- ○ Museum/Zoo/Aquarium (2)
- ○ For-Profit Business (3)
- ○ Non-profit Organization (4)
- ○ K-12 school (public or private) (5)
- ○ College or University (6)
- ○ State Government Organization (7)
- ○ Federal Organization (8)
- ○ Other (please specify) (9)

_____

Q7 What type of environmental education program does your organization provide? (Select all the apply)

- [ ] Preschool programs (1)
- [ ] Elementary programs (2)
- [ ] Middle school programs (3)
- [ ] High school programs (4)
- [ ] Summer Camps (5)
- [ ] Homeschool programs (6)
- [ ] After school programs (7)
- [ ] Pre-service teacher training (8)
- [ ] In-service teacher training (9)
- [ ] Residential programs (10)
- [ ] Other (please specify) (11)

_____

Q8 What grade levels do you teach? (Select all that apply)

- ☐ PreK (1)
- ☐ K-5 (2)
- ☐ 6-8 (3)
- ☐ 9-12 (4)
- ☐ College (5)
- ☐ Adult learners (6)
- ☐ None (7)

Q9 What is your religious affiliation?

- Christian (1)
- Catholic (2)
- Orthodox Christian (3)
- Mormon (4)
- Jehovah's Witness (5)
- Other Christian (6)
- Jewish (7)
- Muslim (8)
- Buddhist (9)
- Hindu (10)
- Atheist (11)
- Agnostic (12)
- Nothing in particular (13)
- Don't know/refuse (14)

Q10 What is your political affiliation?

- Democrat (1)
- Republican (2)
- Independent (3)
- Other (4)
- None (5)
- Rather Not Say (6)

Q11 What do you think? Do you think that global warming is happening?

- Yes...and I'm extremely sure (1)
- Yes...and I'm very sure (2)
- Yes...and I'm somewhat sure (3)
- Yes...but I'm not at all sure (4)
- No...and I'm extremely sure (5)
- No...and I'm very sure (6)
- No...and I'm somewhat sure (7)
- No...but I'm not at all sure (8)
- Or...I don't know (9)

Q12 Assuming global warming is happening, do you think it is...

- Caused mostly by human activities (1)
- Caused mostly by natural changes in the environment (2)
- Other (3)
- None of the above because global warming isn't happening (4)

Q13 How worried are you about global warming?

- Very worried (1)
- Somewhat worried (2)
- Not very worried (3)
- Not at all worried (4)

Q14 How much do you think global warming will harm you personally?

- Not at all (1)
- Only a little (2)
- A moderate amount (3)
- A great deal (4)
- Don't know (5)

Q15 When do you think global warming will start to harm people in the United States?

- ○ They are being harmed now (1)
- ○ In 10 years (2)
- ○ In 25 years (3)
- ○ In 50 years (4)
- ○ In 100 years (5)
- ○ Never (6)

Q16 How much do you think global warming will harm future generations of people?

- ○ Not at all (1)
- ○ Only a little (2)
- ○ A moderate amount (3)
- ○ A great deal (4)
- ○ Don't know (5)

Q17 How much had you thought about global warming before today?

- ○ A lot (1)
- ○ Some (2)
- ○ A little (3)
- ○ Not at all (4)

Q18 How important is the issue of global warming to you personally?

- ○ Not at all important (1)
- ○ Not too important (2)
- ○ Somewhat important (3)
- ○ Very important (4)
- ○ Extremely important (5)

19 How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."

- ○ Strongly agree (1)
- ○ Somewhat agree (2)
- ○ Somewhat disagree (3)
- ○ Strongly disagree (4)

Q20 How many of your friends share your views on global warming?

- ○ None (1)
- ○ A few (2)
- ○ Some (3)
- ○ Most (4)
- ○ All (5)

Q21 Which of the following statements comes closest to your view?

- Global warming is happening. (1)
- Humans can't reduce global warming, even if it is happening. (2)
- Humans could reduce global warming, but people aren't willing to change their behavior so we're not going to. (3)
- Humans could reduce global warming, but it's unclear at this point whether we will do what's needed. (4)
- Humans can reduce global warming, and we are going to do so successfully. (5)

Q22 Do you think citizens themselves should be doing more or less to address global warming?

- Much less (1)
- Less (2)
- Currently doing the right amount (3)
- More (4)
- Much more (5)

Q23 Over the past 12 months, how many times have you punished companies that are opposing steps to reduce global warming by NOT buying their products?

- Never (1)
- Once (2)
- A few times (2-3) (3)
- Several times (4-5) (4)
- Many times (6+) (5)
- Don't know (6)

Q24 Do you think global warming should be a low, medium, high, or very high priority for the President and Congress?

- Low (1)
- Medium (2)
- High (3)
- Very High (4)

Q25 People disagree whether the United States should reduce gas emission on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view?

The United States should reduce its greenhouse gas emissions...

- ○ Regardless of what other countries do (1)
- ○ Only if other industrialized countries (such as England, Germany and Japan) reduce their emissions (2)
- ○ Only if other industrialized countries and developing countries (such as China, India and Brazil) reduce their emissions (3)
- ○ The US should not reduce its emissions (4)
- ○ Don't know (5)

Q26 The "greenhouse effect" refers to

- ○ Gases in the atmosphere that trap heat (1)
- ○ The Earth's protective ozone layer (2)
- ○ Pollution that causes acid rain (3)
- ○ How plants grow (4)
- ○ Don't know (5)

Q27 Which of the following gases in the atmosphere are good at trapping heat from the Earth's surface?

- [ ] Carbon dioxide (1)
- [ ] Methane (2)
- [ ] Water Vapor (3)
- [ ] Hydrogen (4)
- [ ] Oxygen (5)
- [ ] Don't know (6)

Q28 Which of the following are "fossil fuels"?

- [ ] Coal (1)
- [ ] Oil (2)
- [ ] Natural gas (3)
- [ ] Wood (4)
- [ ] Hydrogen (5)
- [ ] Solar (6)
- [ ] Energy (7)

Q29 Which gas is produced by the burning of fossil fuels?

- Oxygen (1)
- Hydrogen (2)
- Helium (3)
- Carbon dioxide (4)
- Don't know (5)

Q30 To the best of your knowledge, roughly how much carbon dioxide was in the atmosphere in the year 1850?

- 150 parts per million (1)
- 290 parts per million (2)
- 350 parts per million (3)
- 410 parts per million (4)
- 450 parts per million (5)
- Don't know (6)

Q31 Roughly how much carbon dioxide is in the atmosphere today?

- ○ 150 parts per million (1)
- ○ 290 parts per million (2)
- ○ 350 parts per million (3)
- ○ 410 parts per million (4)
- ○ 450 parts per million (5)
- ○ Don't know (6)

Q32 Which of the following countries emits the largest total amount of carbon dioxide?

- ○ United States (1)
- ○ China (2)
- ○ India (3)
- ○ Germany (4)
- ○ Japan (5)
- ○ Don't know (6)

Q33 Which of the following countries emits the most carbon dioxide per person?

- United States (1)
- China (2)
- India (3)
- Germany (4)
- Japan (5)
- Don't know (6)

APPENDIX C

SIX AMERICAS SURVEY: CODEBOOK, 15-ITEMS

Label	Question Stem	Responses & Coding	Recoding & Missing Data Treatment
Belief Items			
Belief1	Recently you may have noticed that global warming has been getting some attention in the news. Global warming refers to the idea that the world's average temperature has been increasing over the past 150 years, may be increasing more in the future, and that the world's climate may change as a result. What do you think? Do you think global warming is happening?	1. Extremely sure global warming is not happening 2. Very sure global warming is not happening 3. Somewhat sure global warming is not happening 4. Not at all sure global warming is not happening 5. Don't know 6. Not at all sure global warming is happening 7. Somewhat sure global warming is happening 8. Very sure global warming is happening 9. Extremely sure global warming is happening	Calculate mean & substitute for missing data.
Belief2	Assuming global warming is happening, do you think it is…	1. Caused mostly by human activities 2. Caused mostly by natural changes in the environment 3. Other 4. None of the above because global warming isn't happening	This variable is recoded into three dummy variables. "Other" is the omitted response category. Recoding of missing data on this item: if respondent said gw is not occurring on Belief1, respondent is coded as 4; if respondent said gw is occurring on Belief1, s/he is coded as 1.[1] The remainder are recoded as 3.

[1] This recoding is similar to mean substitution, given that 70% of the respondents who believe global warming is occurring also believe that humans are causing it. Please note that this recoding applies to very few respondents: in two independent data sets gathered in 2010 (Ns = 1,001 & 1,024) only one respondent was recoded in this manner.

Belief4	How much do you think global warming will harm you personally?	0. Don't know 1. Not at all 2. Only a little 3. A moderate amount 4. A great deal	Calculate item mean excluding "don't know" responses & substitute for missing data. This variable is recoded into dummy variables for discriminant analysis within the SPSS and SAS syntax. "Only a little" is the omitted response category.
Belief5	How much do you think global warming will harm future generations?	0. Don't know 1. Not at all 2. Only a little 3. A moderate amount 4. A great deal	Calculate item mean excluding "don't know" responses & substitute for missing data. This variable is recoded into dummy variables for discriminant analysis. "Only a little" is the omitted response category.
Belief7	When do you think global warming will start to harm people in the United States?	1. Never 2. 100 years 3. 50 years 4. 25 years 5. 10 years 6. They are being harmed now	Calculate item mean & substitute for missing data.
Belief8	Which of the following statements comes closest to your view?	1. Global warming isn't happening 2. Humans can't reduce global warming, even if it is happening 3. Humans could reduce global warming, but people aren't willing to change their behavior, so we're not going to 4. Humans could reduce global warming, but it's unclear at this point whether we will do what's needed 5. Humans can reduce global warming, and we are going to do so successfully	Calculate item mean & substitute for missing data.

Issue Involvement (INV) Items			
Inv15	How worried are you about global warming?	4. Very worried 3. Somewhat worried 2. Not very worried 1. Not at all worried	Calculate item mean & substitute for missing data.
Inv16	How much had you thought about global warming before today?	1. Not at all 2. A little 3. Some 4. A lot	Calculate item mean & substitute for missing data.
Inv18	How important is the issue of global warming to you personally?	1. Not at all important 2. Not too important 3. Somewhat important 4. Very important 5. Extremely important	Calculate item mean & substitute for missing data.
Inv19	How much do you agree or disagree with the following statement: "I could easily change my mind about global warming."	4. Strongly disagree 3. Somewhat disagree 2. Somewhat agree 1. Strongly agree	Calculate item mean & substitute for missing data.
Inv22	How many of your friends share your views on global warming?	1. None 2. A few 3. Some 4. Most 5. All	Calculate item mean & substitute for missing data.
Behavior Items			
Behavior25	Over the past 12 months, how often have you punished companies that are opposing steps to reduce global warming by NOT buying their products?	0. Don't know 1. Never 2. Once 3. A few times (2-3) 4. Several times (4-5) 5. Many times (6+)	Calculate item mean excluding "don't know" responses & substitute for missing data. This variable is recoded into dummy variables for discriminant analysis. "Once" is the omitted response option.

Preferred Societal Response (PSR) Items			
PSR32	Do you think global warming should be a low, medium, high, or very high priority for the next president and Congress?	1. Low 2. Medium 3. High 4. Very high	Calculate item mean & substitute for missing data.
PSR34	Do you think citizens themselves should be doing more or less to address global warming?	1. Much less 2. Less 3. Currently doing the right amount 4. More 5. Much more	Calculate item mean & substitute for missing data.
PSR36	The United States should reduce its greenhouse gas emissions…	4. Regardless of what other countries do 3. Only if other industrialized countries (such as England, Germany and Japan) reduce their emissions 2. Only if other industrialized countries and developing countries (such as China, India and Brazil) reduce their emissions 1. The US should not reduce its emissions 0. Don't know	Calculate item mean excluding "don't know" responses & substitute for missing data. This variable is recoded into dummy variables for discriminant analysis within the SPSS and SAS syntax. "Only if other industrialized countries reduce" is the omitted response option.

(Maibach et al., 2011, pp. 12-15)

APPENDIX D

SIX AMERICAS INSTRUMENT: SPSS SCRIPT, 15-ITEMS

```
/*SPSS syntax to run audience segmentation for Global Warming's Six
Americas*/
/*15 item version*/
/*10.3.10*/

/*creating dummy variables for discrim analyses */

*BELIEF ITEM RECODES.
IF (Belief2=1) Belief2_dummy1=0.
IF (Belief2=2) Belief2_dummy1=0.
IF (Belief2=3) Belief2_dummy1=0.
IF (Belief2=4) Belief2_dummy1=1.

IF (Belief2=1) Belief2_dummy2=0.
IF (Belief2=2) Belief2_dummy2=1.
IF (Belief2=3) Belief2_dummy2=0.
IF (Belief2=4) Belief2_dummy2=0.

IF (Belief2=1) Belief2_dummy3=1.
IF (Belief2=2) Belief2_dummy3=0.
IF (Belief2=3) Belief2_dummy3=0.
IF (Belief2=4) Belief2_dummy3=0.

IF (Belief4= 0) Belief4_dk=1.
IF (Belief4=1) Belief4_dk=0.
IF (Belief4=2) Belief4_dk=0.
IF (Belief4=3) Belief4_dk=0.
IF (Belief4=4) Belief4_dk=0.

IF (Belief4= 0) Belief4_dummy1=0.
IF (Belief4=1) Belief4_dummy1=1.
IF (Belief4=2) Belief4_dummy1=0.
IF (Belief4=3) Belief4_dummy1=0.
IF (Belief4=4) Belief4_dummy1=0.
```

```
IF (Belief4= 0) Belief4_dummy2=0.
IF (Belief4=1) Belief4_dummy2=0.
IF (Belief4=2) Belief4_dummy2=0.
IF (Belief4=3) Belief4_dummy2=1.
IF (Belief4=4) Belief4_dummy2=0.

IF (Belief4= 0) Belief4_dummy3=0.
IF (Belief4=1) Belief4_dummy3=0.
IF (Belief4=2) Belief4_dummy3=0.
IF (Belief4=3) Belief4_dummy3=0.
IF (Belief4=4) Belief4_dummy3=1.

IF (Belief5= 0) Belief5_dk=1.
IF (Belief5=1) Belief5_dk=0.
IF (Belief5=2) Belief5_dk=0.
IF (Belief5=3) Belief5_dk=0.
IF (Belief5=4) Belief5_dk=0.

IF (Belief5= 0) Belief5_dummy1=0.
IF (Belief5=1) Belief5_dummy1=1.
IF (Belief5=2) Belief5_dummy1=0.
IF (Belief5=3) Belief5_dummy1=0.
IF (Belief5=4) Belief5_dummy1=0.

IF (Belief5= 0) Belief5_dummy2=0.
IF (Belief5=1) Belief5_dummy2=0.
IF (Belief5=2) Belief5_dummy2=0.
IF (Belief5=3) Belief5_dummy2=1.
IF (Belief5=4) Belief5_dummy2=0.

IF (Belief5= 0) Belief5_dummy3=0.
IF (Belief5=1) Belief5_dummy3=0.
IF (Belief5=2) Belief5_dummy3=0.
IF (Belief5=3) Belief5_dummy3=0.
IF (Belief5=4) Belief5_dummy3=1.

*BEHAVIOR RECODES.
```

```
IF (Behavior25=0) Behavior25_dk=1.
IF (Behavior25=1) Behavior25_dk=0.
IF (Behavior25=2) Behavior25_dk=0.
IF (Behavior25=3) Behavior25_dk=0.
IF (Behavior25=4) Behavior25_dk=0.
IF (Behavior25=5) Behavior25_dk=0.

IF (Behavior25=0) Behavior25_dummy1=0.
IF (Behavior25=1) Behavior25_dummy1=1.
IF (Behavior25=2) Behavior25_dummy1=0.
IF (Behavior25=3) Behavior25_dummy1=0.
IF (Behavior25=4) Behavior25_dummy1=0.
IF (Behavior25=5) Behavior25_dummy1=0.

IF (Behavior25=0) Behavior25_dummy2=0.
IF (Behavior25=1) Behavior25_dummy2=0.
IF (Behavior25=2) Behavior25_dummy2=0.
IF (Behavior25=3) Behavior25_dummy2=1.
IF (Behavior25=4) Behavior25_dummy2=0.
IF (Behavior25=5) Behavior25_dummy2=0.

IF (Behavior25=0) Behavior25_dummy3=0.
IF (Behavior25=1) Behavior25_dummy3=0.
IF (Behavior25=2) Behavior25_dummy3=0.
IF (Behavior25=3) Behavior25_dummy3=0.
IF (Behavior25=4) Behavior25_dummy3=1.
IF (Behavior25=5) Behavior25_dummy3=0.

IF (Behavior25=0) Behavior25_dummy4=0.
IF (Behavior25=1) Behavior25_dummy4=0.
IF (Behavior25=2) Behavior25_dummy4=0.
IF (Behavior25=3) Behavior25_dummy4=0.
IF (Behavior25=4) Behavior25_dummy4=0.
IF (Behavior25=5) Behavior25_dummy4=1.

*PREFERRED SOCIETAL RESPONSE RECODES.
IF (PSR36=0) PSR36_dk=1.
```

```
IF (PSR36=1) PSR36_dk=0.
IF (PSR36=2) PSR36_dk=0.
IF (PSR36=3) PSR36_dk=0.
IF (PSR36=4) PSR36_dk=0.

IF (PSR36=0) PSR36_dummy1=0.
IF (PSR36=1) PSR36_dummy1=1.
IF (PSR36=2) PSR36_dummy1=0.
IF (PSR36=3) PSR36_dummy1=0.
IF (PSR36=4) PSR36_dummy1=0.

IF (PSR36=0) PSR36_dummy2=0.
IF (PSR36=1) PSR36_dummy2=0.
IF (PSR36=2) PSR36_dummy2=1.
IF (PSR36=3) PSR36_dummy2=0.
IF (PSR36=4) PSR36_dummy2=0.

IF (PSR36=0) PSR36_dummy3=0.
IF (PSR36=1) PSR36_dummy3=0.
IF (PSR36=2) PSR36_dummy3=0.
IF (PSR36=3) PSR36_dummy3=0.
IF (PSR36=4) PSR36_dummy3=1.

/*calculate scores on each segment */

COMPUTE
Seg1=(3.2284798852*Belief1)+(11.5079786006*Belief2_dummy3)+(13.6904840356*Bel
ief2_dummy2)+(18.5731386352*Belief2_dummy1)
+(12.0797542474*Inv15)+(5.8427850018*Belief4_dummy3)+(2.3930680504*Belief4_du
mmy2)+(-
0.7691695976*Belief4_dummy1)+(0.2012890276*Belief4_dk)+(2.7046419357*Belief7)
+(23.2246663429*Belief5_dummy3)+
(14.0902389364*Belief5_dummy2)+(14.7898550235*Belief5_dummy1)+(22.3128623659*
Belief5_dk)+(5.1463518237*Inv16)+(3.8390709517*Inv18)+(8.3807770779*Inv19)+(2
.0290111850*Inv22)+(8.4995302131*Belief8)+ (8.0786612406*PSR34)+
```

```
(36.5459151519*Behavior25_dummy1)+
(35.4576975514*Behavior25_dummy2)+(40.7629296767*Behavior25_dummy3)+(40.61973
61652*Behavior25_dummy4)+(33.0336182280*Behavior25_dk)+(8.0785866977*PSR32)+
(48.5967144345*PSR36_dummy3)+(51.2838895142*PSR36_dummy2)+(46.3068510844*PSR3
6_dummy1)+(48.9322792165*PSR36_dk)-194.5358884009.
EXECUTE.

COMPUTE
Seg2=(2.9987729884*Belief1)+(11.8779992956*Belief2_dummy3)+(14.4861958473*Bel
ief2_dummy2)+(18.8534743577*Belief2_dummy1)
+(10.7668045757*Inv15)+(2.7392827372*Belief4_dummy3)+(2.2996117048*Belief4_du
mmy2)+(-
0.4549351653*Belief4_dummy1)+(1.1680995240*Belief4_DK)+(2.4522651997*Belief7)
+(21.5856836133*Belief5_dummy3)+
(15.0998480823*Belief5_dummy2)+(14.3792197221*Belief5_dummy1)+(20.6108950371*
Belief5_dk)+(4.1677674194*Inv16)+(2.4204975264*Inv18)+(6.6137214249*Inv19)+(1
.2257623650*Inv22)+(7.9540337990*Belief8)+ (7.2327243697*PSR34)+
(35.7508174068*Behavior25_dummy1)+
(33.8007118547*Behavior25_dummy2)+(35.6593871544*Behavior25_dummy3)+(34.44139
45641*Behavior25_dummy4)+(32.6814925834*Behavior25_dk)+(6.3738342237*PSR32)+
(46.6806809221*PSR36_dummy3)+(49.7756891746*PSR36_dummy2)+(45.5440893473*PSR3
6_dummy1)+(47.1568535149*PSR36_dk)-152.1547655233.
EXECUTE.

COMPUTE
Seg3=(2.6053209984*Belief1)+(12.2146467510*Belief2_dummy3)+(16.6238719038*Bel
ief2_dummy2)+(20.4871488764*Belief2_dummy1)
+(8.6300659093*Inv15)+(0.7971699451*Belief4_dummy3)+(0.6120600561*Belief4_dum
my2)+(1.8460125797*Belief4_dummy1)+(-
1.5051598605*Belief4_dk)+(1.7866243160*Belief7)+(14.7975189596*Belief5_dummy3
)+
(13.1187908094*Belief5_dummy2)+(11.8557424532*Belief5_dummy1)+(15.9490510674*
Belief5_dk)+(3.8678869619*Inv16)+(1.3447539013*Inv18)+(5.2599506157*Inv19)+(0
.7590469936*Inv22)+(7.3153798749*Belief8)+ (6.9137687892*PSR34)+
(35.5316408395*Behavior25_dummy1)+
(32.0799087611*Behavior25_dummy2)+(33.6275785235*Behavior25_dummy3)+(32.76439
48929*Behavior25_dummy4)+(31.5978434907*Behavior25_dk)+(5.3109631541*PSR32)+
```

```
(41.9104837812*PSR36_dummy3)+(47.0012185484*PSR36_dummy2)+(43.0172720768*PSR3
6_dummy1)+(44.4482920817*PSR36_dk)-117.6878462187.
EXECUTE.

COMPUTE
Seg4=(2.2348930223*Belief1)+(12.4569891301*Belief2_dummy3)+(17.0620359445*Bel
ief2_dummy2)+(20.1005379347*Belief2_dummy1)
+(8.1474420935*Inv15)+(2.9082109518*Belief4_dummy3)+(1.9267988235*Belief4_dum
my2)+(0.3248284895*Belief4_dummy1)+(5.3668578075*Belief4_dk)+(2.1418527450*Be
lief7)+(17.6783708846*Belief5_dummy3)+
(12.2727710786*Belief5_dummy2)+(15.8789830288*Belief5_dummy1)+(28.3748119410*
Belief5_dk)+(3.2842417086*Inv16)+(2.0416658924*Inv18)+(4.7263734917*Inv19)+(0
.8187360185*Inv22)+(7.3982724288*Belief8)+ (6.5305042252*PSR34)+
(37.5193119594*Behavior25_dummy1)+
(34.7180134396*Behavior25_dummy2)+(34.4974831738*Behavior25_dummy3)+(34.17306
50308*Behavior25_dummy4)+(34.7230287539*Behavior25_dk)+(5.3865473425*PSR32)+
(42.2460971229*PSR36_dummy3)+(47.9147832556*PSR36_dummy2)+(43.8646498235*PSR3
6_dummy1)+(46.3976098975*PSR36_dk)-128.1099282283.
EXECUTE.

COMPUTE
Seg5=(2.1306226685*Belief1)+(11.9811709330*Belief2_dummy3)+(18.8753890747*Bel
ief2_dummy2)+(20.9131782993*Belief2_dummy1)
+(5.5472055353*Inv15)+(2.5358705635*Belief4_dummy3)+(2.0203760495*Belief4_dum
my2)+(4.1731160821*Belief4_dummy1)+(0.4775679431*Belief4_dk)+(1.0938454085*Be
lief7)+(9.8681696214*Belief5_dummy3)+
(7.5378104627*Belief5_dummy2)+(18.6813205653*Belief5_dummy1)+(16.0039738665*B
elief5_dk)+(3.8443649492*Inv16)+(0.5807554851*Inv18)+(6.4666607518*Inv19)+(1.
8111948545*Inv22)+(5.4053958195*Belief8)+ (5.3399656490*PSR34)+
(37.6146821041*Behavior25_dummy1)+
(33.2858721048*Behavior25_dummy2)+(35.3756370262*Behavior25_dummy3)+(34.14731
93401*Behavior25_dummy4)+(33.8626290652*Behavior25_dk)+(3.8934788930*PSR32)+
(42.2556145430*PSR36_dummy3)+(47.7249377761*PSR36_dummy2)+(44.4860607659*PSR3
6_dummy1)+(45.6033590279*PSR36_dk)-102.3905392904.
EXECUTE.
```

```
COMPUTE
Seg6=(1.5943550833*Belief1)+(12.5175769012*Belief2_dummy3)+(19.0491087262*Bel
ief2_dummy2)+(23.9988562505*Belief2_dummy1)
+(3.2985655119*Inv15)+(3.4061605398*Belief4_dummy3)+(2.6139517679*Belief4_dum
my2)+(3.2637582409*Belief4_dummy1)+(0.9277354280*Belief4_dk)+(0.6390613901*Be
lief7)+(10.3578154521*Belief5_dummy3)+
(8.0134843756*Belief5_dummy2)+(45.3740329220*Belief5_dummy1)+(15.4200673744*B
elief5_dk)+(4.8184818287*INV16)+(-
0.3735500348*Inv18)+(8.1671282627*Inv19)+(2.7100831022*Inv22)+(4.8842883677*B
elief8)+ (3.4956968702*PSR34)+
(37.2718511398*Behavior25_dummy1)+
(30.5647292437*Behavior25_dummy2)+(34.0235050701*Behavior25_dummy3)+(31.66063
05951*Behavior25_dummy4)+(32.4181472957*Behavior25_dk)+(3.4331079508*PSR32)+
(41.9484654096*PSR36_dummy3)+(47.5826604488*PSR36_dummy2)+(56.5421091023*PSR3
6_dummy1)+(45.0400541451*PSR36_dk)-118.6431285116.
EXECUTE.

 /*Determine segment by highest score*/

COMPUTE TopSeg=MAX (Seg1, Seg2, Seg3, Seg4, Seg5, Seg6).
EXECUTE.

IF (TopSeg = Seg1) Segment=1.
IF (TopSeg = Seg2) Segment=2.
IF (TopSeg = Seg3) Segment=3.
IF (TopSeg = Seg4) Segment=4.
IF (TopSeg = Seg5) Segment=5.
IF (TopSeg = Seg6) Segment=6.

VALUE LABELS Segment
  1 'Alarmed'
  2 'Concerned'
  3 'Cautious'
  4 'Disengaged'
  5 'Doubtful'
  6 'Dismissive'.
```

(Maibach et al., 2011, pp. 19-27)

APPENDIX E

SIX AMERICAS INSTRUMENT "TOPSEG" RESULTS

Participant	Alarmed Segment Score	Concerned Segment Score	Cautions Segment Score	Disengaged Segment Score	Doubtful Segment Score	Dismissive Segment Score	"TopSeg" Score	Climate Change Segment
1	64.65	78.5	84.04	82.5	79.75	64.49	84.04	3
2	103.17	116.53	124.12	112.47	117.63	102.81	124.12	3
3	125.58	132.34	130.38	124.85	121.39	105.96	132.34	2
4	111.45	112.32	112.06	108.19	106.11	90.79	112.32	2
5	103.94	109.43	110.36	105.57	101.97	84.57	110.36	3
6	112.79	121.13	119.29	115.25	113.43	98.79	121.13	2
7	120.9	124.41	123.96	119.55	119.89	109.38	124.41	2
8	112.24	117.17	116.16	113.47	112.29	99.71	117.17	2
9	111.21	117.85	116.45	112.48	111.2	97.07	117.85	2
10	108.44	112.48	111.09	105.73	107.95	97.03	112.48	2
11	108.79	116.73	115.97	112.49	111.77	98.92	116.73	2
12	90.28	96.32	98.05	94.11	93.77	79.65	98.05	3
13	106.13	113.11	111.8	108.88	106.79	93.37	113.11	2
14	121.33	126.47	125.8	122.77	122.24	107.34	126.47	2
15	126.43	128.04	125.01	119.27	115.79	98.75	128.04	2
16	80.33	91.57	94.96	89.2	93.96	83.01	94.96	3
17	91.84	98.96	100.68	93.38	101.31	91.5	101.31	5
18	98.21	104.45	104.46	102.21	99.91	86.2	104.46	3
19	88.39	94.92	95.28	91.57	94.32	82.68	95.28	3
20	117.94	118.93	117.43	112.42	111.99	98.61	118.93	2
21	104.81	114.41	113.75	109.7	104.57	86.05	114.41	2
22	98.29	104.71	106.84	100.9	108.85	99.05	108.85	5
23	105.83	114.91	112.86	112.53	109.17	95.55	114.91	2
24	68.88	79.45	80.91	73.79	74.34	61.95	80.91	3

Participant	Alarmed Segment Score	Concerned Segment Score	Cautions Segment Score	Disengaged Segment Score	Doubtful Segment Score	Dismissive Segment Score	"TopSeg" Score	Climate Change Segment
25	119.97	120.15	118.19	113.24	113.8	101.32	120.15	2
26	124.56	122.61	119.87	115.88	115.48	102.30	124.56	1
27	100.71	110.36	110.66	107.10	107.88	95.49	110.66	3
28	116.38	118.49	117.14	111.94	112.06	98.16	118.49	2
29	121.86	120.16	118.08	113.74	114.39	101.66	121.86	1
30	128.77	130.29	126.03	122.43	119.07	103.87	130.29	2
31	111.21	117.85	116.45	112.48	111.2	97.07	117.85	2
32	104.23	112.29	110.66	121.5	108.12	90.37	121.5	4
33	114.28	122.97	122.46	117.23	115.37	100.93	122.97	2
34	85.51	98.53	102.83	95.56	99.29	87.57	102.83	3
35	117.80	117.71	116.56	112.10	110.76	96.24	117.80	1
36	60.84	69.86	72.79	66.05	67.00	55.18	72.79	3
37	100.69	110.74	108.99	109.24	105.32	90.73	110.74	2
38	95.66	101.51	103.22	97.77	99.61	85.48	103.22	3
39	102.77	109.18	109.22	104.29	104.02	89.56	109.22	3
40	117.29	126.29	124.81	121.31	113.66	82.34	126.29	2
41	102.74	110.73	109.82	106.78	108.24	98.13	110.73	2
42	98.23	111.06	114.1	111.84	106.93	91.41	114.10	3
43	92.63	103.13	103.75	100.57	102.54	91.99	103.75	3
44	98.89	111.75	113.19	107.99	104.53	87.91	113.19	3
45	73.01	89.95	100.75	90.97	93.49	75.16	100.75	3
46	109.12	119.56	121.2	114.17	112.06	96.34	121.20	3
47	119.16	131.96	137.41	125.54	123.95	103.02	137.41	3
48	111.11	120.77	124.91	116.42	117.03	99.82	124.91	3
49	103.92	109.59	107.99	105.83	104.67	92.21	109.59	2
50	108.63	116.83	114.61	116.75	112.04	99.94	116.83	2
51	126.00	131.07	126.87	122.77	117.84	101.00	131.07	2
52	107.17	110.96	109.95	104.12	107.34	95.15	110.96	2

Participant	Alarmed Segment Score	Concerned Segment Score	Cautions Segment Score	Disengaged Segment Score	Doubtful Segment Score	Dismissive Segment Score	"TopSeg" Score	Climate Change Segment
53	98.56	110.06	112.05	104.44	105.61	90.53	112.05	3
54	101.26	107.09	107.07	103.69	102.14	87.07	107.09	2
55	125.58	132.34	130.38	124.85	121.39	105.96	132.34	2
56	100.71	110.36	110.66	107.10	107.88	95.49	110.66	3
57	117.39	120.50	118.69	115.20	113.75	100.41	120.50	2
58	88.35	96.54	98.04	93.96	97.75	86.89	98.04	3
59	80.33	91.57	94.96	89.20	93.96	83.01	94.96	3
60	106.59	111.06	109.72	106.93	106.37	94.36	111.06	2
61	102.42	112.44	112.70	108.72	108.65	95.05	112.70	3
62	120.39	123.67	120.77	117.70	112.60	95.70	123.67	2
63	114.28	122.97	122.46	117.23	115.37	100.93	122.97	2
64	70.36	87.28	95.79	85.59	93.91	83.36	95.79	3
65	110.75	112.72	112.63	106.27	109.85	98.91	112.72	2
66	58.00	69.24	71.36	63.17	69.34	48.76	71.36	3
67	83.59	95.97	101.77	94.49	94.40	78.48	101.77	3
68	73.90	91.12	98.59	89.26	93.65	79.28	98.59	3
69	53.83	63.45	66.78	59.85	65.24	57.96	66.78	3
70	102.54	104.17	103.22	98.57	102.52	92.45	104.17	2
71	55.99	70.67	80.17	71.99	76.17	58.91	80.17	3
72	102.82	114.32	117.26	111.74	111.80	96.87	117.26	3
73	85.28	99.70	105.45	96.79	97.73	82.51	105.45	3
74	122.70	122.17	118.77	113.25	113.4	99.24	122.70	1
75	53.06	66.59	73.03	64.03	62.10	34.69	73.03	3
76	68.09	85.99	94.99	84.46	91.21	80.85	94.99	3
77	90.65	104.06	110.26	101.18	102.69	76.29	110.26	3
78	103.29	108.32	107.83	104.51	103.96	89.78	108.32	2
79	110.62	111.40	110.14	105.11	107.86	95.94	111.40	2
80	108.50	118.45	120.93	111.83	114.25	100.23	120.93	3

Participant	Alarmed Segment Score	Concerned Segment Score	Cautions Segment Score	Disengaged Segment Score	Doubtful Segment Score	Dismissive Segment Score	"TopSeg" Score	Climate Change Segment
81	108.18	114.72	114.64	111.83	108.67	94.29	114.72	2
82	115.36	120.12	119.26	115.93	114.32	101.82	120.12	2
83	104.51	116.30	119.91	111.18	110.43	96.05	119.91	3
84	78.88	89.42	92.84	89.03	90.25	77.65	92.84	3
85	80.30	86.21	86.91	80.39	78.65	66.69	86.91	3
86	52.19	66.37	76.63	65.69	68.01	41.39	76.63	3
87	91.01	105.50	112.24	104.09	106.32	92.31	112.24	3
88	88.66	101.83	108.45	98.51	104.75	94.76	108.45	3
89	55.52	67.37	76.17	67.65	66.24	34.38	76.17	3
90	109.65	115.75	117.65	111.76	114.12	104.27	117.65	3
91	87.57	101.67	105.92	98.61	97.88	81.68	105.92	3
92	85.68	99.83	106.28	97.13	99.45	85.25	106.28	3
93	93.83	105.14	111.71	102.61	105.27	90.85	111.71	3

APPENDIX F

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Institutional Review Board

Columbus State University

Date: 12/14/17

Protocol Number: 18-048

Protocol Title: Climate Change Education and Environmental Education: Perceptions, Barriers, and Efforts Among Environmental Educators in the Southeastern United State

Principal Investigator: Lauren Johnson

Co-Principal Investigator: Deniz Peker

Dear Lauren Johnson:

The Columbus State University Institutional Review Board or representative(s) has reviewed your research proposal identified above. It has been determined that the project is classified as exempt under 45 CFR 46.101(b) of the federal regulations and has been approved. You may begin your research project immediately.

Please note any changes to the protocol must be submitted in writing to the IRB before implementing the change(s). Any adverse events, unexpected problems, and/or incidents that involve risks to participants and/or others must be reported to the Institutional Review Board at irb@columbusstate.edu or (706) 507-8634.

If you have further questions, please feel free to contact the IRB.

Sincerely,

Amber Dees, IRB Coordinator

Institutional Review Board
Columbus State University

APPENDIX G

PARTICIPANT INFORMED CONSENT FORM

Informed Consent Form

You are being asked to participate in a research project conducted by Lauren Johnson, a Doctoral student in the Education at Columbus State University. The supervising faculty for this dissertation is Dr. Deniz Peker, peker_deniz@columbusstate.edu

I. Purpose:
The purpose of this project is to demonstrate what we, as environmental educators perceive and know about climate change as and also to investigate our barriers and efforts of climate change education. This online survey with Qualtrics has been designed to gather such information.

I. Procedures:
Participation in this dissertation research will only require the completion on an online survey that will collect demographic information, climate change perception and knowledge information, and also climate change education barriers and efforts. There is a total of 33 items and the survey should take no more than 30 minutes, but most should be able to complete in 15-20 minutes. There is a possibility that the data will be used for future research projects.

III. Possible Risks or Discomforts:
Your participation in this research is completely voluntary. You may decline, or leave questions blank that you do not wish to answer. There is no compensation for responding nor is there any known risk.

IV. Potential Benefits:
The benefits of this research will demonstrate what Southeastern environmental educators know and perceive about climate change and also the barriers and efforts towards climate change education.

V. Costs and Compensation:
There are no costs or compensation for participation in this survey.

VI. Confidentiality:
While individual responses are obtained, and recorded confidentially and kept in the strictest confidence, aggregated data will be presented representing averages or generalizations about the responses as a whole. No identifiable information will be collected from the participant and no identifiable responses will be presented in the final form of this study, to ensure that data is anonymous. In the survey instrument, names, email addresses, places of employment, and other identification information will not be collected to ensure anonymity. All data collected with Qualtrics will be stored both in Qualtrics and on the researcher's computer. Both are password protected and only the

researcher has access to. The researcher retains the right to use and publish nonidentifiable data.

VII. Withdrawal:
Your participation in this research study is voluntary. You may withdraw from the study at any time, and your withdrawal will not involve penalty or loss of benefits.

For additional information about this research project, you may contact the Principal Investigator, Lauren Charel Johnson at [redacted] or johnson_lauren1@columbusstate.edu. If you have questions about your rights as a research participant, you may contact Columbus State University Institutional Review Board at irb@columbusstate.edu.

I have read this informed consent form. If I had any questions, they have been answered. By selecting the I agree radial and Submit, I agree to participate in this research project.

APPENDIX H

PERSONAL COMMUNICATION

Lauren Johnson Wed, Jan 25, 2017 at 11:38 AM
To: Leiserowitz
Hello Dr. Leiserowitz,
I am emailing to seek permission to use the Six Americas Survey Instrument for my dissertation. The focus of my dissertation is to determine perceptions, barriers, and efforts related to climate change education held by environmental educators in the Southeast US. The Six Americas Instrument is something that I believe would be beneficial to assisting with my research questions. Also, I like the idea of contributing to ongoing climate change research, in place of developing my own unique instrument.
If it is possible to use the instrument that would be an amazing addition to my dissertation efforts.
Thank you!
Lauren C. Johnson
Education Program Manager
Oxbow Meadows Environmental Learning Center
Columbus State University

Leiserowitz, Anthony Wed, Jan 25, 2017 at 5:06 PM
To: Lauren Johnson
Hi Lauren,

Yes, it's available for researchers to use. We've created a manual that should explain how to do so (attached).

Hope this helps!

Cheers,
Tony

Anthony Leiserowitz, Ph.D.
Director, Yale Program on Climate Change Communication
School of Forestry & Environmental Studies
Yale University