GAUGING THE PERCEPTIONS OF HIGH SCHOOL STUDENTS IN DIFFERENT DEMOGRAPHICS ON ENVIRONMENTAL EDUCATION TOPICS

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ABSTRACT

Environmental education is a topic that has been promoted by advocates and researchers for more than three decades; however, a majority of public schools still fail to cover the fundamental basics of environmental education in their curriculum. This project seeks to understand how high school aged students (10^{th} grade) understand three environmental concepts including: 1) recycling; 2) food production; and 3) concept of the natural environment, amongst the demographics of: 1) rural; 2) urban cluster; and 3) large metropolitan/inner city.

Questionnaires were designed using the Likert Scale questions in order to quantify differing perceptions between rural, urban cluster, and large metropolitan/inner city school students. Initial focus groups were conducted to enhance the survey instrument. The survey was conducted in Minnesota with 204 tenth grade high school students; 90 from rural schools, 55 from urban cluster, and 59 from large metropolitan/inner city areas. Results indicate that students in different demographics understand recycling differently; as pupils in large metropolitan/inner city and urban cluster areas find recycling to be a priority while students in rural areas often do not view recycling as important. Students do perceive the topics of food production and nature similarly across demographics. Students have a general understanding of where their food comes from and food production. Additionally, the study found students today are spending less time watching television, but have greater access to multiple electronic devices that account for a large portion of how they spend their time. Finally, as a result of challenges throughout the research project, this study examined the issues and process of working with children in a public school setting. This research can be used by both formal and non-formal educators to understand the perceptions of the students they work with in order to better educate them.

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DEDICATION

This dissertation is dedicated to Dr. Peter Hovde. You were never just my professor; you were my mentor, and most importantly, my friend. Your passion for education, policy, and the environment is the very reason I pursued this degree. I trust you are aware of the extent your guidance and friendship have contributed to the person I have become. *Soli Deo Gloria*

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CHAPTER 1. INTRODUCTION

Environmental education in the United States dates back decades; in fact, some may argue that environmental education began to form in the early 1900s appearing under the blanket of conservation ideals and practices. Jumping forward to the mid-1900s the country faced numerous environmental catastrophes such as Love Canal and the use of DDT that led to the passing and implementation of the National Environmental Policy Act, the Clean Water Act, the Clean Air Act, and the Endangered Species act, just to name a few. In addition to these new laws, the United States also saw an increase in environmental organizations and conservation policies that aimed at helping to conserve and protect our nation's environment. The result of these campaigns not only pushed through the new legislation, but worked to ensure that environmental disasters would exist only in our nation's history. It was out of this era that the topic of 'environmental education' began to take shape. Following the environmental disasters of the mid 1900s, the need and demand for education regarding our nation's natural resources skyrocketed. Focus settled on how to prevent environmental catastrophes from occurring again and how the problems were going to be solved. The challenge became that while people understood the solutions to overcome catastrophe, they didn't necessarily understand the root of the problem itself (Gigliotti, 1990).

Numerous scientists, activists, and academics have spent years, even decades attempting to define environmental education; the truth is that the topic of environmental education is so broad that many fail to realize that a one size fits all approach will only prove detrimental to the field itself (Hungerford, 2010). If the ultimate goal of education is to create informed citizens that will make choices and adapt their behavior based on their personal knowledge, then maybe the more current term of environmental literacy is a better way to describe this goal. There

appears to be a profound infatuation with the culture and the popularity of environmental issues and concerns as opposed to the actual knowledge that lies behind it. Perhaps Larry M. Gigliotti said it best, "we seem to have produced a citizenry that is emotionally charged but woefully lacking in basic ecological knowledge" (Gigliotti, 1990).

While environmental education, as a field, focuses on teaching to the masses and creating a larger knowledge base, studies have shown that adolescents may be the most promising age group to target in terms of environmental education due to their ability to understand and comprehend complex issues surrounding the environment (Bryant & Hungerford, 1977; Bissonnette & Contento, 2001; DiEnno & Hilton, 2005). Many environmental education programs seek to create environmentally literate citizens such as Project Wet and Project Learning Tree, though we still have little understanding of what these students know and understand about the environment and how that changes based on the area, demographics, in which you live.

The purpose of this project is to identify the common perceptions of tenth grade high school students in rural, urban cluster, and large metropolitan/inner city areas on the topics of recycling, food production, and the natural environment, as they relate to environmental education. During the research process the study also brought to light the challenges that exist working with youth in a public school setting. An additional chapter was added to the dissertation to address this issue. It is our hope that the information found in this dissertation will help guide environmental educators in the process of creating environmentally literate citizens. Specific objectives of the project include:

1) Gauge the perceptions of high school students across demographics on the topic of recycling to see if correlations exist between how they perceive recycling and their behavior towards it.

2) Understand students' knowledge of food, where their food comes from, and how this influences their purchasing and consumption preferences. In addition, to determining if this information is similar or different across demographics.

3) Comprehend how students across demographics perceive nature and what they constitute as nature. Additionally this project sought to quantify the amount of time students' spend in nature doing different activities, and to understand the activities that may be keeping students from the outdoors such as time spent on electronics.

4) Identify the challenges and obstacles that exist in research involving adolescents in a public school setting.

1.1. References

Bissonnette, M. M., & Contento, I. R. (2001). Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: application of a psychosocial model. *Journal of Nutrition Education, 33*(2).

Bryant, C. K., & Hungerford, H. R. (1977). An analysis of strategies for teaching environmental concepts and values clarification in kindergarten. *The Journal of Environmental Education*, *9*(1).

DiEnno, C.M. and S. Hilton. **(**2005). High School Students' Knowledge, Attitudes, and Levels of Enjoyment of an Environmental Education Unit on Nonnative Plants. *The Journal of Environmental Education*. 37(1).

Gigliotti, L. M. (1990). Environmental education: What went wrong? What can be done?. *The Journal of Environmental Education, 22*(1).

Hungerford, H. **(**2010). Environmental Education (EE) for the 21st Century: Where Have We Been? Where Are We Now? Where Are We Headed? *The Journal of Environmental Education.* 41(1).

CHAPTER 2. LITERATURE REVIEW

Environmental education, albeit a broad topic, was perhaps best defined by Hungerford as "an interdisciplinary effort aimed at helping learners gain the knowledge and skills that would allow them to understand the complex environmental issues facing society as well as the ability to deal effectively and responsibly with them" (Hungerford, 2010). The objective of environmental education is to evaluate environmental problems and concerns and work towards a solution that involves the development of a pro-environmental behavior (Magnus et al., 1997).

2.1. Evolution of Environmental Education.

Environmental education has evolved significantly over the last 50 years. It was used as a means to educate the general public after the environmental crisis' of the late 1960s early 1970s. Concerns that circulated around environmental education and its development were initially addressed at the United Nations Environmental, Scientific, and Cultural Organization-United Nations Environment Programme (UNESCO-UNEP) Tbilisi Intergovernmental Conference on Environmental Education (1977). The conference established goals, principles, and objectives for environmental education along with 39 additional sets of recommendations (Marcinkowski, 2009). The conference also founded guidelines that stressed the importance of environmental awareness, knowledge, attitudes, skills, and participation (UNESCO, 1977).

During the 1990s there was a shift in how the field of environmental education was both seen and structured in the United States. Development issues impacting the environment were becoming more of a problem which meant that environmental education was seen in a new light and as an approach that could not only impact the present but could be seen as a sustainable option for the future (Tilbury, 1995). To further this position, during the 1992 United Nations

Conference on Environment and Development, it was concluded that education and sustainable development would work simultaneously together in the future (United Nations, 1992).

2.2. Development of Environmental Behavior

Development of one's self and behaviors have been explored through the works of many scientists, educators, and sociologists for years (Ballantyne & Parker, 1996; Bryant and Hungerford, 1977; Hungerford & Volk, 1990). For the purpose of this study, development of self and one's behavior will be linked referencing the principles behind identity theory. Identity theory is a theory that seeks to clarify an individual's behaviors and actions with the different roles they play in their lives (Hogg et al., 1995). This theory explains social behavior in terms of shared relationships amongst one's self and the society in which they live. In order to fully understand the reasoning behind a person's behavioral development, it is imperative to recognize and define how they view themselves and the concept of self which they developed based on the society that surrounds them. The structure of 'identity' and how one may arrive at the concept of self is seen through developmental stages and external relationships.

The development of self and one's behavior acts as a large contributor to understanding environmental education. The overall goal of any education is ultimately to shape one's behavior (Hungerford & Volk, 1990); environmental education seeks to not only develop one's behavior, but produce a citizenry that is action based in order to change behavior through interaction with the environment and the development of knowledge. Ultimately, a citizenry that is action based is formed following a change in attitude and awareness; and this can only be achieved through an increase in knowledge (Hungerford & Volk, 1990). Greater knowledge and understanding of the environment will lead to pro-environmental actions and behaviors (Ramsey & Rickson, 1976). To further the idea of knowledge serving as the foundation for development,

Hines et al. (1987) released an environmental meta-analysis that tied factors such as responsibility, attitude, and personality traits, along with knowledge to the development of action based responsible environmental behavior. The analysis concluded that an individual must be aware and knowledgeable of an environmental issue before they are able to form an action in regards to it (Hines et al., 1987). The conclusion that environmental knowledge is a precursor to environmental attitude or action is a common finding amongst researchers and authors alike (Hungerford & Volk, 1990; Hillcoat & Forge, 1995; Rickinson, 2001; Kollmuss & Agyeman, 2002).

2.3. Adolescent Development and Environmental Education

In order to seek out an age group that is appropriate to teach environmental education, it is imperative to understand the stages of cognitive development and how individuals are able to form decisions and gain knowledge. Awareness and reaction to environmental issues arise only if a person can cognitively understand them (Hungerford & Volk, 1990). Having more access to information does not necessarily equate to a pro-environmental behavior, in fact, Gigliotti (1990) refers to some ideas of environmental education as a myth people see themselves as something completely detached from anything living around them. He goes on to argue that environmental education must be seen as the core of education beginning with children and adolescents in elementary school (Gigliotti, 1990).

To further this position, Richard Louv, author of the book *Last Child in the Woods: saving our children from nature-deficit disorder*, utilizes Howard Gardner's theory of multiple intelligences to argue that nature plays a vital role in not only nurturing children, but that it is imperative to their cognitive development and how they are able to perceive new concepts (Louv, 2005). It was concluded that the main goal of naturalist intelligence was to be able to

identify items in our natural surroundings; however, that idea also focuses on what is 'man-made' (Louv, 2005).

The disconnection between children and nature can be narrowed down to industrialization in all forms; children today are spending around half of the time outdoors that they did two decades ago (Kuo & Sullivan, 2001). Beyond that, there is a compelling argument that suggests the more interaction adolescents have with environmental education and the environment itself, there is a positive correlation to the students developing a pro-environmental attitude and behavior (Jaus, 1982; Jaus, 1984; Armstrong & Impara, 1991).

2.4. Environmental Education and the Natural Environment

Evaluation of a student's concept and perception regarding the natural environment is a topic that has been explored on many levels, but only in regards to the extent of specific adolescent groups tied with a specific environment. Bixler et al., (1994) conducted a research study seeking to explain discomforts and fears of urban students when faced with a trip to a wildland area. The study concluded that for individuals never exposed directly to natural environments, their interpretations of these complex and dynamic areas must be based on whatever they have learned from indirect sources such as horror movies, amusement parks, television shows, zoos, museums, and classrooms. The research went on to explain that students from urban schools tend to have higher fears of what lies outdoors in a wildland area and that there is a need for urban students to have frequent experiences with these environments (Bixler et al., 1994). While Bixler et al. (1994) focused primarily on school age children in an urban environment, they did conclude that the environment in which a child is raised shows a direct correlation to their comforts, or lack thereof, in a natural environment. Louv (2005) contends that our institutions, built development, and attitudes and perceptions have allowed people to

correlate the outdoors with danger or fear, ridding the association of positive feelings or understanding. Louv (2005) is ultimately arguing that the youth in today's society have little to no concept of what lies outside in the natural environment and that there is no longer the freedom to roam, explore, or spark imagination because the fear to do so is great.

2.5. Environmental Education and Food Production

Over the years there has been some, albeit little, research focusing on student knowledge and perception of food systems amongst high school age students; with most research focusing on eating and consumption patterns tied to student health. Research has concluded there is a significant disconnection between adolescents and the role of the food system thus presenting the challenge that students are removed from or lack the knowledge and process of consuming the food they eat (Harmon & Maretzki, 2006). Studies completed by Frick et al. (1995) found that students had a lack of information or were not being taught about agriculture at the secondary school level. While the study focused on student knowledge surrounding agricultural impacts on natural resources, policy, plants and animals, it brought light to the problem that children today have little to no understanding of where their food comes from and the disconnection between the food and its source (Frick et al., 1995). The idea behind a lack of knowledge or a disconnection has been linked to the shift our country has made from residing in rural agriculturally driven communities to suburban/urban neighborhoods. The knowledge that once linked society, including youth, to agriculture and livestock continues to diminish, although some communities and urban school programs (few) are attempting to establish food and agriculture education through school and urban gardening (Vallianatos, et al. 2004). With the modern prepared food industry how and when we eat has changed; the culture surrounding food in this country now circulates around convenience (Popkin et al., 2005; Harmon & Maretzki,

2006). Beyond fast food chains and convenience stores, agriculture goods one can purchase often do not reflect what can be grown locally or in the region. This is true especially in areas where agriculture is ruled by climate and food products can travel upwards of 1500 miles before it reaches the consumer (Pirog et al., 2003), thus creating an even larger divide between adolescents and their understanding of where food comes from.

2.6. Environmental Education and Recycling

The concept of recycling can be directly related to a learned environmental behavior. Hungerford & Volk (1990) refer to recycling as a 'personal investment' concluding that recycling may not be motivated by monetary gain, but rather motivated by an understanding of need (Hungerford & Volk, 1990). Currently, the majority of studies regarding recycling amongst adolescents seem to bring to light the lack of knowledge surrounding the specifics of recycling rather than the concept itself (Bonnett & Williams, 1998; Prestin & Pearce, 2010). Studies focusing on recycling are also more abundant when researching the topic amongst college aged students. Colleges and universities across the country are developing environmental programs, clubs, and organizations to give rise to the need for pro-environmental behaviors. The literature surrounding higher education institutions and recycling is mainly focused on correlating knowledge of the topic with behavior and personal attitude (Williams, 1991; Pike et al., 2003). The literature in general lacks a connection between adolescents and the understanding of recycling.

2.7. Demographics

The United States Census Bureau (USCB) defines urban as any area consisting of more than 50,000 people (USCB, 2015). This research looked at schools categorized as large metropolitan/inner city meaning that there is a large centralized population that both

economically and socially increase when integrated with the surrounding areas (US Census Bureau, 1994). In addition, this location also provided access to students living in the inner city; a place often plagued by high rates of poverty, larger education gaps, and lack of proper housing. (Taylor et al., 1998). The USCB also defines a second category as urban cluster, which is an area consisting of populations greater than 2,500 and fewer than 50,000 (USCB, 2015). While there is no specific definition of rural, the USCB defines rural as a place that is not constituted as urban in any capacity. Thus, it can be assumed, and for the sake of this research that rural is an area populated by less than 2,500 residents. Numerous studies have been conducted surrounding environmental education and specific demographics (Bixler et.al, 1994; Harmon & Maretzki, 2006; Taylor et al., 2008) and others have specifically sought to compare two demographics to each other (Frick et al., 1995; Bixler & Flyod, 1997). No study to date has bridged the three specific demographics or large metropolitan/inner city, urban cluster, and rural to gauge the role of location of students to how they understand and perceive the environment around them.

2.8. References

Armstrong, J. B., & Impara, J. C. (1991). The impact of an environmental education program on knowledge and attitude. *The Journal of Environmental Education*, *22*(4).

Ballantyne, R.R. and J.M. Parker. (1996). Teaching and Learning in Environmental Education: Developing Environmental Conceptions. *The Journal of Environmental Education*. 27(2).

Bissonnette, M. M., & Contento, I. R. (2001). Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: application of a psychosocial model. *Journal of Nutrition Education*, *33*(2).

Bixler, R. D., Carlisle, C. L., Hammltt, W. E., & Floyd, M. F. (1994). Observed fears and discomforts among urban students on field trips to wildland areas. *The Journal of Environmental Education*, *26*(1).

Bixler, R. D., & Floyd, M. F. (1997). Nature is scary, disgusting, and uncomfortable. *Environment and Behavior*, *29*(4).

Bonnett, M., & Williams, J. (1998). Environmental education and primary children's attitudes towards nature and the environment. *Cambridge Journal of Education*, *28*(2).

Bryant, C. K., & Hungerford, H. R. (1977). An analysis of strategies for teaching environmental concepts and values clarification in kindergarten. *The Journal of Environmental Education*, *9*(1).

DiEnno, C.M. and S. Hilton. **(**2005). High School Students' Knowledge, Attitudes, and Levels of Enjoyment of an Environmental Education Unit on Nonnative Plants. *The Journal of Environmental Education*. 37(1).

Frick, M. J., Birkenholz, R. J., Gardner, H., & Machtmes, K. (1995). Rural and urban inner-city high school student knowledge and perception of agriculture. *Journal of Agricultural Education*, *36*.

Gigliotti, L. M. (1990). Environmental education: What went wrong? What can be done?. *The Journal of Environmental Education*, *22*(1).

Harmon, A. H., & Maretzki, A. N. (2006). Assessing food system attitudes among youth: development and evaluation of attitude measures. *Journal of Nutrition Education and Behavior*, *38*(2).

Hillcoat, J., Forge, K., Fien, J., & Baker, E. (1995). 'I Think It's Really Great that Someone Is Listening to Us...': young people and the environment. *Environmental Education Research*, *1*(2).

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, *18*(2).

Hogg, M. A., Terry, D. J., & White, K. M. (1995). A tale of two theories: A critical comparison of identity theory with social identity theory. *Social Psychology Quarterly*.

Hungerford, H. and T. Volk. (1990). Changing Learner Behavior through Environmental Education. *The Journal of Environmental Education*. 21(3).

Hungerford, H. **(**2010). Environmental Education (EE) for the 21st Century: Where Have We Been? Where Are We Now? Where Are We Headed? *The Journal of Environmental Education.* 41(1).

Jaus, H. H. (1982). The effect of environmental education instruction on children's attitudes toward the environment. *Science Education*, *66*(5).

Jaus, H. H. (1984). The development and retention of environmental attitudes in elementary school children. *The Journal of Environmental Education*, *15*(3).

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental Education Research*, *8*(3).

Kuo F E and Sullivan W C. (2001). Environment and crime in the inner city: does vegetation reduce crime? *Environment and Behaviour.* 33.

Louv, R. (2005). Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder. New York, NY: Workman Publishing Company, Inc.: 2.

Magnus, V. J., Martinez, P.& Pedauye, R. (1997). Analysis of environmental concepts and attitudes among biology degree students. *Journal of Environmental Education, 29*(1).

Marcinkowski, T. (2009). Contemporary Challenges and Opportunities in Environmental Education: Where Are We Headed and What Deserves Our Attention? *The Journal of Environmental Education*. 41(1).

Pike, L., Shannon, T., Lawrimore, K., McGee, A., Taylor, M., & Lamoreaux, G. (2003). Science education and sustainability initiatives: A campus recycling case study shows the importance of opportunity. *International Journal of Sustainability in Higher Education, 4*(3).

Pirog, R. S., & Benjamin, A. (2003). Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions.

Popkin, B. M., Duffey, K., & Gordon-Larsen, P. (2005). Environmental influences on food choice, physical activity and energy balance. *Physiology & Behavior, 86*(5).

Prestin, A., & Pearce, K. E. (2010). We care a lot: Formative research for a social marketing campaign to promote school-based recycling. *Resources, Conservation and Recycling, 54*(11).

Ramsey, C. E., & Rickson, R. E. (1976). Environmental knowledge and attitudes. *The Journal of Environmental Education, 8*(1).

Rickinson, M. (2001). Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research, 7*(3), 207-320.

Taylor, A. F., Wiley, A., Kuo, F. E., & Sullivan, W. C. (1998). Growing up in the inner city green spaces as places to grow. *Environment and Behavior, 30*(1).

Tilbury, D. (1995). Environmental education for sustainability: Defining the new focus of environmental education in the 1990s. *Environmental Education Research, 1*(2).

United Nations Conference on Environment and Development (UNCED). (1992). Earth Summit. Rio de Janeiro, Brazil.

United Nations Educational, Scientific, and Cultural Organization-United Nations Environment Programme (UNESCO/UNEP). (1977) Intergovernmental Conference on Environmental Education, Tbilisi (USSR).

United States Census Bureau. (1994). Chapter 13: Metropolitan Areas. Geographic Reference Manual.

United States Census Bureau. (2015). 2010 Census Urban and Rural Classification. Geographic Reference Manual.

Vallianatos, M., Gottlieb, R., & Haase, M. A. (2004). Farm-to-school strategies for urban health, combating sprawl, and establishing a community food systems approach. *Journal of Planning Education and Research, 23*(4), 414-423.

Williams, E. (1991). College students and recycling: Their attitudes and behaviors. *Journal of College Student Development*. 32(1).

CHAPTER 3. HOW STUDENTS IN DIFFERENT DEMOGRAPHICS PERCEIVE RECYCLING

3.1. Abstract

Recycling is one of the easiest steps that can be done to enact environmental change, and yet people in many areas do not engage in recycling. This study gauges the perceptions of high school students (10^{th} grade) towards recycling. To determine the recycling knowledge of students and their behavior and attitude towards it, researchers developed a 19-question survey and distributed to high school students across three demographics throughout the state of Minnesota. Large metropolitan/inner city, urban cluster, and rural areas were designated as demographic categories to explore whether or not students' knowledge, perception, and behavioral patterns differed dependent upon where they lived. Results indicate that recycling, as an environmental education topic, is perceived differently in different demographics. Additionally, as recycling programs become more complex, less and less students, regardless of demographics, understand what exact products are recyclable. Implications of this research can benefit recycling professionals, and formal and non-formal educators to develop new lesson plans or curriculum surrounding recycling, its environmental importance, and to develop new recycling programs and initiatives throughout their communities.

3.2. Introduction

The United States Environmental Protection Agency (EPA) estimates that Americans throw away over 250 million tons of trash every year. Of the 254 million tons of waste produced in 2013, only 87 million tons of waste were recycled or composted, roughly accounting for just over 30% (EPA, 2016). The EPA has documented the steady growth rates of recycled/composted waste since 1960 and shows that, while recycling rates continue to increase,

so does the production of waste (EPA, 2016). American's may be recycling at higher rates than they were five decades ago, but they are also consuming and producing significantly more trash. Interestingly enough, it is estimated that the school systems in the United States produce or contribute up to 35% of the waste accumulated (EPA, 2007). Therefore, adolescents seem to be an ideal or at least appropriate age group to target in terms of increasing environmental knowledge of recycling.

Studies have shown that adolescents are perhaps the most suitable age to target when influencing behavior because their environmental knowledge will contribute to their future actions regarding the environment (Lyons & Breakwell, 1994). Numerous studies have indicated that younger generations are less likely to recycle than their elders (Vining & Ebreo, 1990; Derksen & Gartrell, 1993; Meneses & Palacio, 2005), but these adolescents have significantly more concern towards environmental issues (Nord et al., 1998). To address this gap, studies have linked lack of attitude or behavior (towards recycling) with a lack of specific environmental knowledge (Bonnett & Williams, 1998; Prestin & Pearce, 2010). A study by Prestin and Pearce (2010) found that high school students possess environmental knowledge regarding recycling and conservation, but lack the specific knowledge of what is recyclable. This same finding was also documented by Bonnett and Williams (1998) in their research on how children understand recycling and what can or cannot be recycled.

Adolescents are an ideal age group to target in terms of environmental knowledge as related to recycling, because not only are students concerned about the environment (Nord et al., 1998), but high school students are able to understand the complexities that surround many environmental issues (DiEnno & Hilton, 2005). Currently, research regarding recycling and adolescents is sparse and the studies that do exist linking behavior, knowledge, or attitudes of

students to recycling mainly involving projects at colleges and universities (Williams, 1991; Pike et al., 2003; Hansen et al., 2008).

Beyond studying adolescents, the current study assessed differences in demographics with an initial hypothesis that students in rural areas would have less understanding of recycling and would be less likely to participate. Numerous studies have found that when recycling infrastructure or availability is not readily available or convenient, participation in recycling decreases and rural areas tend to recycle less than their urban counterparts (Derksen & Gartrell, 1993; Berger, 1997; Ewing, 2001). The Minnesota Pollution Control Agency, the lead solid waste agency in the state where the study took place, estimates that garbage collection is double if not three times more expensive in rural communities than in urban areas (MNPCA, 2016). Additionally, even though burn barrels and burning garbage is considered illegal in the state of Minnesota due to detrimental impacts on air quality and human health, the agency still offers a guide on how to stop the use of burn barrels, demonstrating there is still a presence of this type of waste removal in the state (MNPCA 2016).

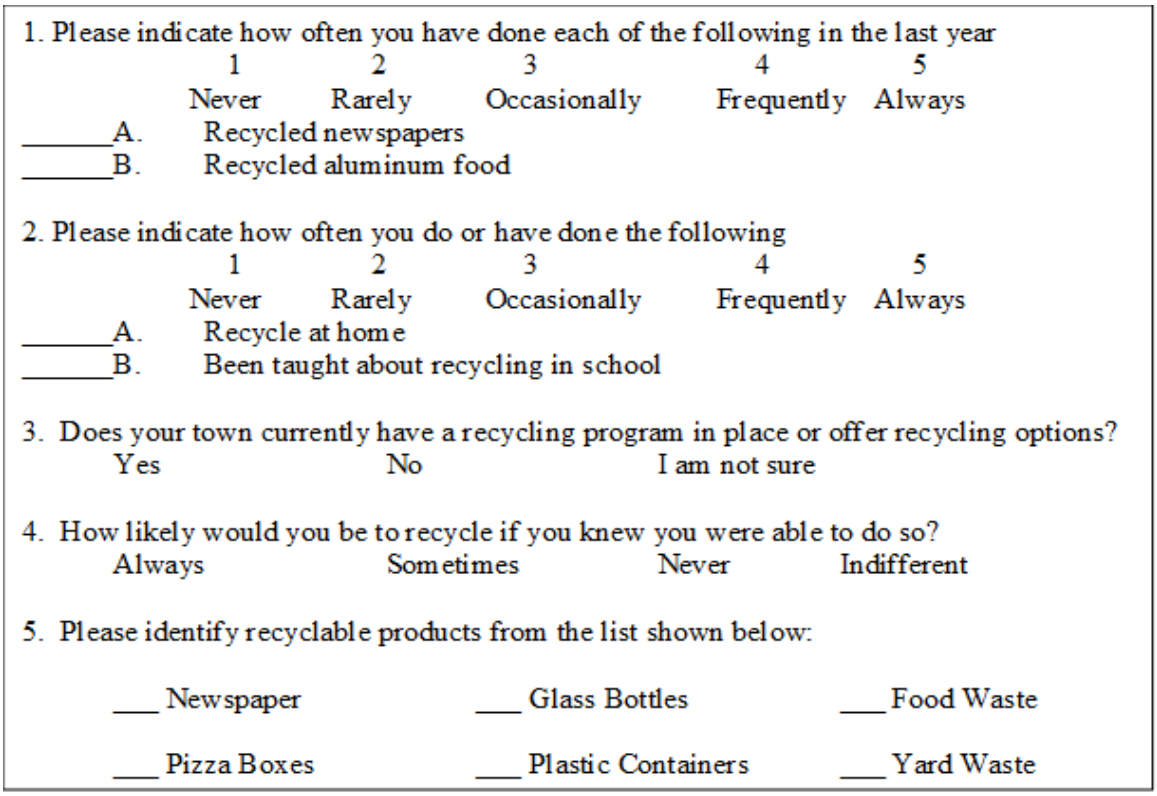
The current project seeks to evaluate what high school students in rural, urban cluster, and large metropolitan/inner-city areas understand in regards to recycling. Beyond gauging their knowledge of specific environmental concerns regarding recycling, the project also assesses the availability of recycling infrastructure and resources both in schools and at home amongst the three demographics. Finally, the study seeks to gauge student behavior and attitudes towards recycling across demographics and seeks to understand how students perceive the importance of recycling.

3.3. Materials and Methods

A survey instrument was used to gauge students' knowledge on the topics of recycling. The survey instrument was developed over the course of a year. Focus groups were used to refine the questions and ensure that the topic of recycling was appropriately covered for the purpose of the project. The initial focus groups consisted of a dozen education, environmental, and extension professionals. These groups were utilized to refine the survey to appropriately gauge students understanding of recycling and desire to recycle. The survey presented to the professional focus group consisted of 19 questions. A student focus group was also utilized to make sure the questions were easily understandable and could be answered without confusion. The student focus group consisted of 22 tenth graders from an urban school not used in the final data collection. The initial survey presented to the student focus group also had 19 questions surrounding the topic of recycling. Survey questions were designed based on existing literature on recycling, demographic populations, and questions from field professionals. While no specific questions were taken from any one document, some survey questions were adapted from Bonnett & Williams (1998). The survey design used Likert scale questions focusing on behavioral patterns and opinions of recycling, yes and no questions to gauge how students viewed specific topics, and check all that apply questions to gauge student knowledge of recycling. Some examples of these questions are included in Figure 3.1. The final survey instrument presented to students contained 19 total questions and can be found in Appendix A.

The sample population for the study consisted of 204 tenth grade high school students from different demographics across the state of Minnesota. Schools were selected in large metropolitan/inner city, urban cluster, and rural areas. The US Census Bureau defines urban as an area or areas consisting of more than 50,000 people (USCB, 2015). For the purposes of this

study, researchers utilized large urban areas and categorized them as large metropolitan/inner city. Centralized areas that consist of the communities that surround them to form a large population are considered a large metropolitan area (USCB, 1994); further, inner city is defined as a disadvantaged area that is often plagued by 'social disturbances' and 'physical deterioration' (Peng et al., 1992). The school used in the large metropolitan/inner city category fit these definitions. The US Census Bureau additionally defines urban cluster as any area consisting of fewer than 50,000 people but greater than 2,500 (USCB, 2015), this was the definition used to fulfill the urban cluster demographic. Finally, although not defined specially by the US Census Bureau, rural is described as an area that is not urban. Therefore, we looked at rural populations as areas consisting of fewer than 2,500 residents. Based on these definitions there were 90 tenth grade students from rural schools, 59 from large metropolitan/inner city schools, and 55 students from urban cluster that took part in the study.



1. Please indicate how often you have done each of the following in the last year

	1	2	3	4	5
	Never	Rarely	Occasionally	Frequently	Always
_____A.	Recycled newspapers				
_____B.	Recycled aluminum food				

2. Please indicate how often you do or have done the following

	1	2	3	4	5
	Never	Rarely	Occasionally	Frequently	Always
_____A.	Recycle at home				
_____B.	Been taught about recycling in school				

3. Does your town currently have a recycling program in place or offer recycling options?

Yes No I am not sure

4. How likely would you be to recycle if you knew you were able to do so?

Always Sometimes Never Indifferent

5. Please identify recyclable products from the list shown below:

___ Newspaper ___ Glass Bottles ___ Food Waste

___ Pizza Boxes ___ Plastic Containers ___ Yard Waste

Figure 3.1. Sample questions from recycling questionnaire.

Participants for the study were acquired after the following criteria had been met: 1) all proper documents and surveys were approved by the project university's Institutional Review Board (in this case North Dakota State University); and 2) permission was granted from the high school principal, or in the case of larger areas, permission had to be granted by the superintendent or research and evaluation department. The next step was to gain permission from each tenth grade classroom teacher. Upon teacher approval, parental permission slips along with a student waiver had to be signed prior to the survey being administered. The survey was given and the classroom was supervised in person by one of the project co-investigators to ensure that only students having completed all consent levels participated.

The recycling survey took approximately ten minutes to complete. Of a possible 548 students in the classrooms asked to participate, 204 students were able to complete the survey having all of their consent levels completed. Identifiable information was not gathered from this survey; meaning that no age, gender, race, income, household, or parental information was obtained, as it was not deemed needed for research purposes and would have decreased sample size given research and review restrictions.

Upon completion of data collection, all surveys were coded and digitized first into Microsoft Excel and then into IBM Statistical Package for the Social Sciences (SPSS) (George and Mallery, 2012). Correlation statistics were run using cross tabulation. Cramer V was used to judge the strength of the correlation and association (Elliot, 2008) and had to have a $P = <0.05$ to interpret significant differences among the demographics. Finally, cells were determined to be significantly different using a Z-test with a Bonferroni correction (Bamberg and Moser, 2007).

3.4. Results and Discussion

Personal perceptions, attitudes, and behaviors towards recycling among students surveyed tended to vary across the three demographics. When asked how often students recycled particular products, such as newspapers, magazines, aluminum food cans, pop and soda cans, plastic products, and glass containers, throughout the course of a year; results showed that pupils from rural populations were less likely to recycle compared with those from urban cluster and large metropolitan/inner city areas (Table 3.1). Plastic products, newspapers, glass containers, and aluminum cans all showed that those in urban cluster and large metropolitan areas recycled more frequently than rural students. The recycling of pop cans showed that an increasing amount of rural students frequently to always recycle these items as opposed to never or rarely which was the typical rural response on the majority of other recycling products. Studies have shown that earning monetary incentives is a reason as to why people recycle (Oskamp et al., 1991; Gamba & Oskamp, 1994). Other factors that may indicate why recycling of pop cans may have been more popular is due to states with "bottle bills" will pay cash for returned aluminum and glass bottles (Earth911, 2012). This may be one reason that we see an increase in this particular product being recycled in rural areas.

In terms of behavioral patterns, students were asked how often they chose to purchase products specifically sold in recyclable or biodegradable containers. These questions showed that there was significant difference in the students purchasing products in recyclable containers in that urban cluster and large metropolitan/inner city students were more likely to frequently purchase these products compared to the rural students. However, overall there was still only a small percentage of all the students surveyed that said they "always" select products based on it being recyclable (5%) or biodegradable packaging (2%). Therefore, it can be concluded that

purchasing these types of products must be a purposeful behavior amongst the small group of students that do it. This behavioral pattern may be related to the fact that the typical adolescent or average consumer does not want to pay a premium on their product based solely on its packing (Yue et al., 2010).

Behaviorally, results indicate that rural students recycle less at home when compared to the other demographics; in relation to this, it was also more common for urban cluster and large metropolitan students to have recycling opportunities in their homes when compared to rural students. In fact, over 56% of rural students indicated that the frequency they recycled was between never and occasionally, while only 14% of urban cluster students reported that same frequency category and 12% of large metropolitan/inner city students. These differences may reflect the fact that rural areas have challenges supporting recycling programs due to the high costs associated with such programs and the amount of waste that must be attained to support them (Jakus et al., 1997). To further expand on the topic, students were asked how likely they would be to recycle at home and in school if it were easily accessible and the responses yielded significant differences amongst demographics (Table 3.2). The number of rural students who said they would recycle if it was easily available increased compared to those that currently recycle. Answers reflect that students tend to recycle rather than not, but students in urban settings are more likely to always recycle when compared to rural students. In the home, more students voiced that they would be willing to recycle if it was easily accessible; however, 36% of students in rural areas still selected that they would never, rarely, or occasionally recycle if it was easily accessible. This conclusion is similar to the findings of Derksen and Gartrell (1993) in that those in rural areas are less likely to recycle when compared with people from larger urban communities (Derksen & Gartrell, 1993).

Table 3.1. Response of students to recycled materials in the last year.

	Rural	Urban Cluster	Large Metro/ Inner City	Total Student Response
		Newpapers		
Never	27 % a	9% b	8% b	17%
Rarely	34% a	15% b	8% b	22%
Occasionally	18% a	27% a	20% a	21%
Frequently	14% a	20% a	17% a	17%
Always	7% a	29% b	46% a	24%
		Magazines		
Never	34% a	13% b	14% b	23%
Rarely	42% a	25% a, b	12% b	29%
Occasionally	13% a	25% a	20% a	19%
Frequently	7% a	18% a	19% a	13%
Always	3% a	18% b	36% b	17%
		Pop or Soda Cans		
Never	10 % a	0% b	3% a, b	5%
Rarely	17% a	4% a, b	2% b	9%
Occasionally	19% a	9% a	8% a	13%
Frequently	17% a	25% a	27% a	22%
Always	38% a	62% b	59% b	50%
		Aluminum Cans		
Never	21% a	5% b	7% a, b	13%
Rarely	17% a	7% a	7% a	11%
Occasionally	20% a	15% a	17% a	18%
Frequently	16% a	24% a	17% a	18%
Always	27% a	49% b	53% b	40%
		Plastic Products		
Never	17% a	2% b	3% b	9%
Rarely	24% a	5% b	5% b	14%
Occasionally	13% a	16% a	17% a	15%
Frequently	20% a	48% b	34% a, b	31%
Always	26% a	29% a	41% a	31%
		Glass Containers		
Never	26% a	5% b	10% a, b	16%
Rarely	22% a	13% a	12% a	17%
Occasionally	21% a	20% a	12% a	18%
Frequently	12% a	27% a	22% a	19%
Always	19% a	35% a, b	44% b	30%

Values within rows with different letters are significantly different P= <0.05

Questions were also asked to assess whether students felt a personal investment in recycling. When asked if they felt it was important that they recycle, more rural students were

neutral to the topic while urban cluster and large metropolitan/inner city students strongly agreed with the statement.

Table 3.2. Response of students to likelihood of recycling if easily accessible.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Recycle at school		
Never	4% a	0% a	3% a	3%
Rarely	14% a	4% a, b	2% b	8%
Occasionally	20% a	22% a	10% a	18%
Frequently	37% a	42% a	32% a	37%
Always	24% a	33% a, b	53% b	35%
		Recycle at home		
Never	11% a	0% b	2% a, b	5%
Rarely	12% a	5% a	2% a	7%
Occasionally	12% a	5% a	5% a	8%
Frequently	29% a	24% a	20% a	25%
Always	36% a	65% b	71% b	54%

Values within rows with different letters are significantly different P= <0.05

This could relate to the amount of recycling curriculum students are exposed to as studies indicate that students who are exposed to environmental education early on in their schooling tend to have more positive attitudes towards the environment (Jaus, 1982; Jaus, 1984). Students throughout all demographics indicated that they had been exposed to some recycling curriculum in school, but greater numbers of students in large metropolitan/inner city schools indicated that they had been exposed to such curriculum when compared to their peers in urban cluster and rural areas. Most students, regardless of demographic, agree that recycling is important to helping the planet. Significant differences were found in the response category of strongly agree as urban cluster students were more likely to strongly agree recycling is important to helping the planet than rural students.

As part of the study, students were asked to identify products that were or were not recyclable (Table 3.3). For the most part, results indicate that there were no significant differences across the demographics with the exception of e-waste. E-waste is a term used to

refer to electronic waste (Kahhat et al., 2008). Students in urban cluster areas were more likely to select cell phones, electronics, and computers as items they could recycle when compared to the rural and large metropolitan/inner city students. It is important to note that the following section only records student responses of what is or is not recyclable; the survey did not aim to determine if their answers were correct or incorrect. The majority of students (98%) across all demographics agreed that newspapers were recyclable. Seventy-three percent of students said that pizza boxes were able to be recycled. When asked about plastic bottle lids, 77% of students believe that they could be recycled. While there was no significant difference between demographics, students seemed torn as to whether or not old paint cans were able to be recycled; 49% said they could while 51% felt that they were not recyclable. Fifty-two percent of all students surveyed felt that cell phones could be recycled; which includes 78% of urban cluster students saying that cell phones could be recycled. Both large metropolitan/inner city and rural students had more respondents saying that cell phones could not be recycled.

Another general category of "electronics" was offered to the students; 50.4% of students felt that electronics were recyclable (Table 3.3). However, a greater number of rural and large metropolitan/inner city students felt that they were not recyclable and 69% of urban cluster students felt that they were. Students were in agreement when asked if glass bottles could be recycled as 93% said yes. In terms of plastic containers, 97% of students across demographics felt that they were recyclable and 96% of students across demographics agreed that aluminum cans were recyclable. Used notebook or computer paper was slightly different, 86% of students agreed it could be recycled, but when comparing across demographics, more rural students did not believe it could be recycled. Students weren't sure about aluminum foil; 49% of students felt that it could be recycled while 51% felt it could not.

Table 3.3. Response of students to what products are/are not recyclable.

	Rural	Urban Cluster	Large Metro/Inner City	Total Student Response
Newspaper Recycled	98% a	98% a	98% a	98%
Newspaper Not Recycled	2% a	2% a	2% a	2%
Pizza Boxes Recycled	74% a	73% a	71% a	73%
Pizza Boxes Not Recycled	26% a	27% a	29% a	27%
Plastic Bottle Lids Recycled	79% a	76% a	75% a	77%
Plastic Bottle Lids Not Recycled	21% a	24% a	25% a	23%
Old Paint Cans Recycled	51% a	56% a	37% a	49%
Old Paint Cans Not Recycled	49% a	44% a	63% a	51%
Cell Phones Recycled	39% a	78% b	49% a	52%
Cell Phones Not Recycled	61% a	22% b	51% a	48%
Electronics Recycled	44% a	69% b	42% a	50%
Electronics Not Recycled	56% a	31% b	58% a	50%
Glass Bottles Recycled	91% a	96% a	93% a	93%
Glass Bottles Not Recycled	9% a	4% a	7% a	7%
Plastic Containers Recycled	97% a	96% a	97% a	97%
Plastic Containers Not Recycled	3% a	4% a	3% a	3%
Aluminum Cans Recycled	97% a, b	100% b	90% a	96%
Aluminum Cans Not Recycled	3% a, b	0% b	10% a	4%
Used Notebook/Computer Paper Recycled	79% a	91% a	93% a	86%
Used Notebook/Computer Paper Not Recycled	21% a	9% a	7% a	14%
Aluminum Foil Recycled	51% a	53% a	42% a	49%
Aluminum Foil Not Recycled	49% a	47% a	58% a	51%
Computers Recycled	37% a	60% b	37% a	43%
Computers Not Recycled	63% a	40% b	63% a	57%

Values within rows with different letters are significantly different P = <0.05

Technically aluminum foil can be recycled if a recycling program allows it; however, like any other item contaminated by food or grease, if it has been contaminated then it cannot recyclable (Earth911, 2016). Across demographics 43% of students felt that computers were able to be recycled; however, the majority came from urban cluster students. Both rural and large metropolitan/inner city respondents had a larger proportion of no responses. These results reiterate what previous research has concluded, that students have a limited understanding of

specifically what products are recyclable (Bonnett & Williams, 1998; Prestin & Pearce, 2010). Further, some research has argued that recycling products a person can easily associate with recycling can increase the behavior to do so, while products that they are less likely to associate with recycling or are confused by often are regarded as trash (Mackert & Lazard, 2015).

When asked what they were able to recycle at school, the majority of students indicated that beverage cans, paper, and bottles could all be recycled. There seemed to be little understanding or little interaction with biodegradable utensils as most students indicated they could not be recycled at school. Finally, students were split as to whether or not cardboard was able to be recycled at school with only 51% reporting that cardboard was recyclable at school. Surprisingly, results showed that while there was no significant difference amongst demographics, only 54% of students were confident that their school had a recycling program in place, while 43% were unsure as to whether or not one existed. All schools used in this study were verified to have some sort of recycling program in place. As a follow up to this portion of the survey, students were also asked if their town had a recycling program in place, and while there was no significant difference amongst demographics, over a third of all students in each demographic category were unsure as to whether or not their towns had recycling programs. More telling perhaps is that 58% of rural respondents indicated that their town had a recycling program; yet, earlier results indicated that this group still has a strong detachment from recycling and do not perceive it as necessary. Again, as with school recycling programs, it was verified that each community surveyed also had a recycling program in place.

Research indicates that if students lack knowledge of the recycling process, then they cannot necessarily understand its importance (Tsurusaki and Anderson, 2010). In terms of developing an individual identity, one cannot develop a social behavior or take action towards an

issue if they do not understand it (Hines et al., 1987). To gauge how important the adolescents felt recycling was to them, we asked students how likely they would be to recycle if they knew they were able to do so. There were significant differences between rural and large metropolitan/inner city students, in that the majority of large metropolitan/inner city students indicated that they would always be likely to recycle, while the majority of rural students indicated that they would sometimes recycle.

3.5. Conclusion

The main purpose of this research was to assess students understanding about the topic of recycling and how their knowledge/lack of knowledge, influenced their perceptions, behaviors, or attitudes towards recycling. Additionally, the study successfully assessed students across a gradient of demographics from rural to urban cluster to large metropolitan/inner city area to determine if demographics played a role in their understanding.

Overall, the study was able to conclude that urban cluster and large metropolitan/inner city students appear to perceive recycling as an everyday necessity, while their peers in rural communities find recycling to be less important and were less inclined to participate in the process. Interestingly, it was assumed prior to the research being conducted that recycling rates may be lower in rural areas due to lack of recycling programs or harder access to such facilities. However, all students surveyed in this study lived in areas that had recycling programs both at school and in the community, though students were more aware of their community programs than their school programs. Despite students saying that they had access to recycling programs, rural students still felt indifferent or neutral to the topic when compared with students from large metropolitan/inner city and urban cluster areas.

Students across demographics had a hard time understanding what products could be recycled and which products could not. While common recyclable materials were easier to identify than less common items, results did show a need to further educate students on what items are recyclable. Students reported that they felt learning about environmental issues and concerns was important to them, but that they did not feel they were taught about these topics frequently in school.

Teachers, and education and recycling professionals can use the information from this study to further develop new or existing recycling programs and curriculum in the school system. Future research is needed to further investigate why students in rural areas feel more detachment to the concept of recycling and how those behaviors or attitudes could change. Additionally, expanding this survey to more schools in different regions could provide insight into recycling and its level of importance in different areas of the country.

3.6. References

Berger, I. (1997). The demographics of recycling and the structure of environmental behavior. *Environment and Behavior*, *29*(4).

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1).

Bonnett, M., & Williams, J. (1998). Environmental education and primary children's attitudes towards nature and the environment. *Cambridge Journal of Education*, *28*(2).

Derksen, L., & Gartrell, J. (1993). The social context of recycling. *American Sociological Review*. 58.

DiEnno, C. M., & Hilton, S. C. (2005). High school students' knowledge, attitudes, and levels of enjoyment of an environmental education unit on nonnative plants. *The Journal of Environmental Education*, *37*(1).

Earth911. (2012). Get money for recycling. Published April 5, 2012. Accessed August 30, 2016, http://earth911.com/home-garden/get-money-for-recycling/.

Earth911. (2016). What not to put in the bin. Published April 22, 2016. Accessed August 30, 2016, http://earth911.com/home-garden/what-not-to-put-in-the-bin/.

Elliott, C. (2008). Assessing ‘fun foods’: nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, *9*(4).

Ewing, G. (2001). Altruistic, egoistic, and normative effects on curbside recycling. *Environment and Behavior*, *33*(6).

Gamba, R. J., & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling programs. *Environment and behavior*, *26*(5).

George, D., & Mallery, P. (2012). IBM SPSS Statistics 19 Step by Step: A Simple Guide and Reference. Pearson Publishing.

Hansen, L. T., Olson, L., Kerr, J., McMellen, C., Kaplowitz, M., & Thorp, L. (2008). Recycling attitudes and behaviors on a college campus: use of qualitative methodology in a mixed-methods study. *Journal of Ethnographic & Qualitative Research*, *2*(3).

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, *18*(2).

Jakus, P. M., Tiller, K. H., & Park, W. M. (1997). Explaining rural household participation in recycling. *Journal of Agricultural and Applied Economics*, *29*(01).

Jaus, H. H. (1982). The effect of environmental education instruction on children's attitudes toward the environment. *Science Education*, *66*(5).

Jaus, H. H. (1984). The development and retention of environmental attitudes in elementary school children. *The Journal of Environmental Education*, *15*(3).

Kahhat, R., Kim, J., Xu, M., Allenby, B., Williams, E., & Zhang, P. (2008). Exploring e-waste management systems in the United States. *Resources, Conservation and Recycling*, *52*(7).

Lyons, E., & Breakwell, G. (1994). Factors predicting environmental concern and indifference in 13-to 16-year-olds. *Environment and Behavior*, *26*(2).

Mackert, M., & Lazard, A. Can I Recycle This?. 6th Annual Sustainability Symposium; The University of Texas at Austin; September 18, 2015.

Meneses, G., & Palacio, A. (2005). Recycling behavior a multidimensional approach. *Environment and Behavior*, *37*(6).

Minnesota Pollution Control Agency. (2016). Rural garbage collection strategies. Accessed August 30, 2016. https://www.pca.state.mn.us/waste/rural-garbage-collection-strategies.

Nord, M., Luloff, A. E., & Bridger, J. C. (1998). The association of forest recreation with environmentalism. *Environment and behavior*, *30*(2).

Oskamp, S., Harrington, M., Edwards, T., Sherwood, D., Okuda, S., & Swanson, D. (1991). Factors influencing household recycling behavior. *Environment and Behavior*, *23*(4).

Peng, S., Wang, M., & Walberg, H. (1992). Demographic Disparities of Inner-City Eighth Graders. *Urban Education*, *26*(4).

Prestin, A., & Pearce, K. (2010). We care a lot: Formative research for a social marketing campaign to promote school-based recycling. *Resources, Conservation and Recycling*, *54*(11).

Pike, L., Shannon, T., Lawrimore, K., McGee, A., Taylor, M., & Lamoreaux, G. (2003). Science education and sustainability initiatives: A campus recycling case study shows the importance of opportunity. *International Journal of Sustainability in Higher Education*, *4*(3).

Tsurusaki, B. K., & Anderson, C. W. (2010). Students' understanding of connections between human engineered and natural environmental systems. *International Journal of Environmental and Science Education*, *5*(4).

United States Census Bureau. (1994). Chapter 13: Metropolitan Areas. Geographic Reference Manual.

United States Census Bureau. (2015). 2010 Census Urban and Rural Classification. Geographic Reference Manual.

United States Environmental Protection Agency. (2007). Tools to reduce waste in schools. Washington, D.C.

United States Environmental Protection Agency. (2016). Municipal Solid Waste. Washington, D.C.

Vining, J., & Ebreo, A. (1990). What makes a recycler? A comparison of recyclers and nonrecyclers. *Environment and Behavior*, *22*(1).

Williams, E. (1991). College students and recycling: Their attitudes and behaviors. *Journal of College Student Development*. 32(1).

Yue, C., Hall, C. R., Behe, B. K., Campbell, B. L., Dennis, J. H., & Lopez, R. G. (2010). Are consumers willing to pay more for biodegradable containers than for plastic ones? Evidence from hypothetical conjoint analysis and nonhypothetical experimental auctions. *Journal of Agricultural & Applied Economics*, *42*(4).

CHAPTER 4. HOW DO STUDENTS PERSPECTIVES AND KNOWLEDGE OF FOOD PRODUCTION CHANGE ACROSS DEMOGRAPHICS

4.1. Abstract

The purpose of this research study was to understand how students in different demographics in the state of Minnesota understood and perceived concepts relating to food production. Researchers not only gauged what students knew about different topics related to food, but also their attitudes and consumption patterns surrounding food choices. Schools within the demographic categories of large metropolitan/inner city, urban cluster, and rural areas were chosen to see if perceptions and knowledge rates of adolescents were dependent upon the demographic in which they lived. A total of 204 students were surveyed using a variety of types of questions to answer research objectives. Results indicate that students have a general understanding of food production and where their food comes from, but as food sources become more complex or items are less common, students become confused. Results also showed that students have a strong willingness to learn more about food production and other environmental topics in school, but agree that they are not often receiving this interaction in the classroom. Implications from this study can help researchers and educators understand the current knowledge and perceptions students have about the food system. Information can also help in developing future curriculum and strategies to increase knowledge of the food system.

4.2. Introduction

The Centers for Disease Control and Prevention (CDC) define the food production chain using the stages of food production, processing, distribution, and preparation (CDC, 2015). This food system is one that over the years has grown increasingly complex (Bissonnette & Contento, 2001), and as the population in the United States continues to grow, so does the demand for food.

The need to feed not only our country's, but also the world's, growing population means that our food system has become so extensive that products are processed to increase shelf life and quality and travel great distances before reaching your table (Bissonnette & Contento, 2001). A study conducted in 1969 showed that, from farm to table, the average distance food traveled was 1,346 miles (Hendrickson, 1996). More recently, a study by Pirog et al. (2003) estimated that food travels over 1,500 miles before it reaches your dining room table; while locally produced food traveled an average of 44.6 miles (Pirog et al., 2003). These numbers can also be regionally different as found in a study by Hora and Tick (2001) which found that fruits and vegetables conventionally transported to Maryland had traveled 1,686 miles.

Due to food system complexity, many scientists and researchers believe that influencing adolescent's perceptions and behaviors regarding the food system will lead to positive environmental behavior and healthier food choices (Bissonnette & Contento, 2001; Harmon & Maretzki, 2006; Lytle et al., 2006). Adolescents, developmentally, are at a cognitive stage in life where they are beginning to develop their own personal identities and form their own set of beliefs and behaviors (Cobb, 1992). This stage in life also allows them more influence on what and how they eat, both in school and at home. Numerous studies have concluded that choice, buying power, and influence are all factors that contribute to the impact adolescents are having on the food system (Story & Resnick, 1986; Bissonnette & Contento, 2001; Contento et al., 2006; Harmon & Maretzki, 2006; Lytle et al., 2006; Stobbelaar et al., 2007).

To date, the majority of research surrounding adolescents and food or the food system focuses on nutritional intake, dietary habits, obesity, general health and nutritional education (Fitzgerald et al., 2010; Neumark- Sztainer, 1999; Pirouznia, 2001; Robinson-O'Brien et al., 2009; Turconi et al., 2003). Studies of adolescent's attitudes and behaviors about the food

system found opinions vary and students were ambiguous in their food selection choices based on the environment (Bissonnette & Contento, 2001; Harmon & Maretzki, 2006). Minimal research has been done to date on agricultural literacy. Frick et al. (1995) surveyed rural and inner city students in regards to agriculture literacy, specifically, looking at agriculture in regards to significance, policy, processing, and marketing. They found that rural students had higher overall knowledge scores, but both subgroups had little interaction with actual agriculture knowledge (Frick et al. 1995). While this study explored agricultural literacy in general, the current study narrows the scope to understand what exactly students know about food production and the food system.

While some research has been done to assess the knowledge of adolescents and food production, there is a lack of research assessing the extent of students understanding of the food system, their knowledge surrounding specific food products, their perception of different topics related to food production, and their consumption patterns. The Frick et al. (1995) study showed a difference between rural and inner city students' knowledge of agriculture; yet people generally assume that students living in rural and inner city areas would have a different knowledge base on the topic. However, research has yet to establish the similarities and differences of how students across the gradient from rural, to urban cluster, to large metropolitan/inner city areas view and understand food production. It is important to understand these student's current knowledge base and pre-conceived ideas in order to properly educate them (DeLaughter et al., 1998; Dykstra, 1997).

The current study aims to understand tenth grade high school students across different demographics perceptions of food production; specifically, what they know about food production and how the food ends up on their table. This study explores if students understand

where their food comes from and if they are able to identify different food products with their original source. Additionally, adolescent populations across the demographics of rural, urban cluster, and large metropolitan/inner city were surveyed to assess how demographic setting influences understanding of food production and food choice.

4.3. Materials and Methods

A survey instrument was utilized to assess students understanding of food production. The survey instrument designed for this project was created as part of a yearlong process that included multiple focus groups and revisions. Two separate focus groups were utilized to hone in on questions that would ensure appropriate clarity and answers on the topic of food production. Initially, professionals from academia, the North Dakota State University (NDSU) Extension Service, and other environmental disciplines were brought in to help refine survey questions and gauge whether or not the project would be able to accurately assess student understanding of food production. The initial survey was given to a focus group of nine professionals and contained approximately 38 questions focused on food production. The second focus group that was leveraged consisted of tenth grade high school students, the same age category as our project sample, to ensure that questions were not only easy to understand, but could be answered with clarity. Twenty-two students from an urban school located outside the study area of the main project were utilized. These respondents were not used in the final data collection process. The survey distributed to the student focus group also consisted of 38 questions based on and adapted from other literature related to the topic (Bissonnette & Contento, 2001; Harmon & Maretzki, 2006) and from professional focus group input. The survey was designed using a mixed method approach which was reflected in the different styles of questions. Some questions utilized Likert scale design and focused on understanding student

behaviors, attitudes, and perceptions of food production; while other survey questions, like matching and "yes" and "no" questions were utilized to gauge student knowledge. Examples of questions can be found in Figure 4.1. The final survey instrument was comprised of 37questions and can be found in Appendix B.

The study area for the project was the state of Minnesota. One state was chosen for the project as to ensure that educational standards remained consistent across all schools selected. The sample population for the project consisted of 204 tenth grade high school students across different demographics in the state of Minnesota. Of the 204 students, 90 were tenth grade students from rural school districts meaning that they lived in communities of less than 2,500 people. There were 59 students from large metropolitan/inner city schools. The US Census Bureau defines an urban area as a population greater than 50,000 (USCB, 2015). A large metropolitan area is defined not only by it being in an urban location, but as a core community often including the surrounding areas to make up a larger population (USCB, 1994). Additionally, for this demographic category, we sought areas that were not only large metropolitan but also considered inner city, or a disadvantaged community suffering from 'physical deterioration' and 'social disturbances' (Peng et al., 1992). Finally, 55 students were from cities with over 2,500 residents but less than 50,000 residents, or what the US Census Bureau defines as an "urban cluster" (USCB, 2015).

1. Please indicate how often you have done each of the following in the last year

	1	2	3	4	5
	Never	Rarely	Occasionally	Frequently	Always
_____A.	Purposely purchased organic food				
_____B.	Looked at a food label to see where your food comes from				

2. Please indicate how likely you would be to do the following if it were easily accessible

	1	2	3	4	5
	Never	Rarely	Occasionally	Frequently	Always
_____A.	Eat more fruits and vegetables				
_____B.	Grow your own food if you were taught				

3. Do you have easy access to fresh fruits and vegetables at home?

Yes No

4. Match the following products with its source that is typically grown in the area

A. ___Flour i. Beets

B. ___Sugar ii. Wheat

Figure 4.1. Sample questions from food production questionnaire.

Initially, the project needed the Institutional Review Board (IRB) approval at the project university, in this case North Dakota State University (NDSU), since adolescents are considered a protected population. Upon IRB approval, participants were only allowed to participate in the survey after the following measures had been completed; permission was obtained by the school principal, or as was needed with the large metropolitan/inner city schools, permission was granted only after the superintendent and research and evaluation department reviewed the project. Permission was then sought from each individual classroom teacher. This project focused mainly on tenth grade biology classrooms, but in the case of smaller rural schools, tenth grade general education classes were selected because student class size was so small. After teacher approval, documents seeking written parental permission were obtained, along with a youth written permission assent form. The survey was administered in individual classrooms under the supervision of one of the project's co-investigators in order to make sure all forms of consent were received before students were allowed to participate.

The food production survey took approximately 20 minutes to complete. Out of a possible 548 students asked to participate, 204 students successfully completed all appropriate levels of consent required and were allowed to complete the survey. For research purposes, no identifiable information was obtained from the students. This included: age, gender, religion, ethnicity, income, household, or parental information because doing so was not deemed appropriate or needed for the purpose of this research and could have potentially limited the overall sample size of the project due to research restrictions.

Following collection of all survey instruments, each survey was coded and digitized into Microsoft Excel before being input into IBM Statistical Package for the Social Sciences (SPSS) (George and Mallery, 2012). Cross tabulations and likelihood ratios were determined by running correlation statistics for each question. Cramer V was utilized to determine the association and correlation strength (Elliot, 2008), demographic differences were determined significant based on $P = <0.05$. Lastly, significant differences amongst cells were determined using a standard Z-test with a Bonferroni connection (Bamberg and Moser, 2007).

4.4. Results and Discussion

Knowledge, understanding, perception, and behavior in regards to food production and the food system appear to vary depending on demographics. To gain insight into purchasing patterns of the respondents, students were asked how often they personally purchased food from a grocery store, gas station, and farmers market over the last year (Table 4.1). There was no significant difference across demographics in purchasing habits at a grocery store. However, we saw that students in rural areas differ significantly in terms of purchasing food at a gas station. Results showed that 54% students in rural areas reported obtaining food at gas stations frequently or always, while around 41% of students in large metropolitan/inner city and 33% of those in

urban cluster areas report that they rarely purchase food from a gas station. Liese et al. (2007) conducted a research study showing that convenience stores tend to be the most common food store type found in rural communities, which could be the reason for student response rate in the current study. The current study also found that purchasing food from a farmer's market or farm stand is not a common practice in any demographic setting.

Table 4.1. Response of students to locations purchased food in the last year.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Grocery Store		
Never	0% a	0% a	0% a	0%
Rarely	3% a	4% a	0% a	2%
Occasionally	7% a	13% a	12% a	10%
Frequently	33% a	40% a	37% a	36%
Always	57% a	44% a	55% a	51%
		Gas Station		
Never	3% a	4% a	3% a	3%
Rarely	14% a	33% b	41% b	27%
Occasionally	28% a	35% a	29% a	30%
Frequently	28% a	13% a	15% a	20%
Always	27% a	16% a	12% a	20%
		Farmers Market/ Farm Stand		
Never	16% a	7% a	7% a	11%
Rarely	36% a	40% a	24% a	33%
Occasionally	24% a	31% a, b	49% b	33%
Frequently	14% a	18% a	15% a	16%
Always	10% a	4% a	5% a	7%

Values within rows with different letters are significantly different P= <0.05

Students were then asked how often their households (not necessarily the student but a parent or other food purchaser) purchased food from different sources (Table 4.2); over 90% of all respondents said their household purchased food from a grocery store and rarely at a co-op or natural foods store. In terms of gas stations, the most common answer across demographics was rarely; however, there was a small portion, 14%, of rural students selecting frequent purchases of food from gas stations, which was again significantly different from urban cluster and large metropolitan/inner city areas. Factories, meaning buying direct from the source i.e. bakery,

yielded similar results in that there were no significant differences across demographics and were rarely utilized. Farmer's markets while not commonly utilized seemed to be more convenient or used by rural and urban cluster students.

Student responses across demographics remained consistent in terms of the household getting their food from their garden as a food source, showing no significant differences in any of the response categories (Table 4.2). To explore the topic of gardening further we asked students how often they gardened over the course of a year and the results yielded no significant differences across demographics with occasionally being the most common answer. To follow up, students were asked how likely they would be to garden or grow their own food if it was easily accessible to them, occasionally was again the most common response with rarely as the least common answer. It appears that there is little difference in the desire to garden or eat fresh produce from one's own garden across demographics. This is especially interesting as research indicates that gardening can not only yield better food choice in adolescents, but it can also change their perceptions and understanding of different produce (Lineberger & Zajicek, 2000; Morris et al., 2001; Posten et al., 2005).

When asked how often students used hunting as a source for food, the most common answer amongst urban cluster and large metropolitan/inner city schools was never (Table 4.2). Rural students more commonly responded occasionally, frequently, and always; which is not surprising seeing as how hunting is considered one of the most popular and largest activities outdoors in the state of Minnesota (MNDNR, 2012). The Department of Natural Resources (DNR) for the state boasts around 200,000 license sales per year (MNDNR, 2012).

Table 4.2. Response of students to locations purchased food in the last year.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Grocery Store		
Never	0% a	0% a	0% a	0%
Rarely	0% a	2% a	5% a	2%
Occasionally	8% a	4% a	0% a	4%
Frequently	39% a	35% a	53% a	42%
Always	53% a	60% a	42% a	52%
		Co-Op/ Health Food/ Natural Food Store		
Never	27% a	22% a	20% a	24%
Rarely	43% a	40% a	41% a	42%
Occasionally	20% a	31% a	22% a	24%
Frequently	9% a	7% a	14% a	10%
Always	1% a	0% a	3% a	1%
		Gas Station		
Never	16% a	20% a	31% a	21%
Rarely	38% a	56% a	39% a	43%
Occasionally	29% a	20% a	27% a	26%
Frequently	14% a	4% a, b	2% b	8%
Always	3% a	0% a	2% a	2%
		Factory		
Never	29% a	27% a	20% a	26%
Rarely	32% a	36% a	42% a	36%
Occasionally	29% a	31% a	32% a	30%
Frequently	7% a	4% a	3% a	5%
Always	3% a	2% a	2% a	2%
		Farmers Market		
Never	22% a	5% a	5% a	13%
Rarely	31% a	44% a	27% a	33%
Occasionally	36% a	33% a	49% a	39%
Frequently	9% a	13% a	17% a	12%
Always	2% a	5% a	2% a	3%
		Garden		
Never	12% a	25% a	17% a	17%
Rarely	23% a	27% a	29% a	26%
Occasionally	18% a	24% a	29% a	23%
Frequently	31% a	13% b	17% a, b	22%
Always	16% a	11% a	8% a	12%
		Hunting		
Never	21% a	42% b	66% c	40%
Rarely	11% a	22% a	12% a	14%
Occasionally	26% a	20% a, b	7% b	19%
Frequently	26% a	15% a	10% a	18%
Always	17% a	2% b	5% a, b	9%
		Retail/Warehouse		
Never	3% a	0% a	2% a	2%
Rarely	12% a	2% a	3% a	7%
Occasionally	33% a	27% a	8% b	25%
Frequently	32% a	25% a	54% b	37%
Always	19% a	45% b	32% a, b	30%

Values within rows with different letters are significantly different P= <0.05

Finally, the study was able to gather that urban cluster students are more likely than their peers in the other demographics to purchase food at retail/warehouse stores. The urban cluster students shopping at retail/warehouse stores were significantly different than their rural and large metropolitan/inner city counterparts in the occasionally, frequently, and always categories (Table 4.2). This is not surprising as big box stores tend to be built outside of urban core areas where land is less expensive and more expansive (Jones & Doucet, 2000), and they aren't often built in residential areas due to the lack of population to support the store.

Students were also asked about their consumption habits. Since adolescents in today's world have greater influence and purchase power on the food choices in their home than in the past (Kümpel et al., 2007), we wanted to understand what different types of products students were consuming. We asked students how often they purposely purchased and consumed organic food, significant differences appeared amongst the demographics on both questions (Table 4.3).

Table 4.3. Response of student's purposeful behavior towards organic food in the last year.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Purchased Organic Food		
Never	33% a	20% a, b	14% b	24%
Rarely	36% a	22% a	29% a	30%
Occasionally	18% a	35% a	20% a	23%
Frequently	10% a	15% a, b	29% b	17%
Always	3% a	9% a	8% a	6%
		Consumed Organic Food		
Never	33% a	18% a, b	12% b	23%
Rarely	31% a	20% a	24% a	26%
Occasionally	23% a	35% a	24% a	26%
Frequently	10% a	16% a, b	29% b	17%
Always	2% a	11% a, b	12% b	7%

Values within rows with different letters are significantly different P= <0.05

Students in the urban cluster and large metropolitan/inner city areas answered frequently as to their purchasing habits of organic food, while over half of the students from the rural areas answered never or rarely. Consumption patterns also emerged showing that 41% of large

metropolitan/inner city students purposely consumed organic food frequently or always when compared to their rural peers in which 64% responded that they never or rarely consume organic food purposefully (Table 4.3).

Students consumption patterns and knowledge surrounding produce were assessed and results indicate that even though students had to travel different distances depending on their demographic (Figure 4.2), they still clearly felt (94%) that they had easy access to fruits and vegetables in the home. Significant differences were seen in transportation patterns to purchase these items amongst the different demographics; rural respondents drove either less than one mile to purchase produce or more than five miles.

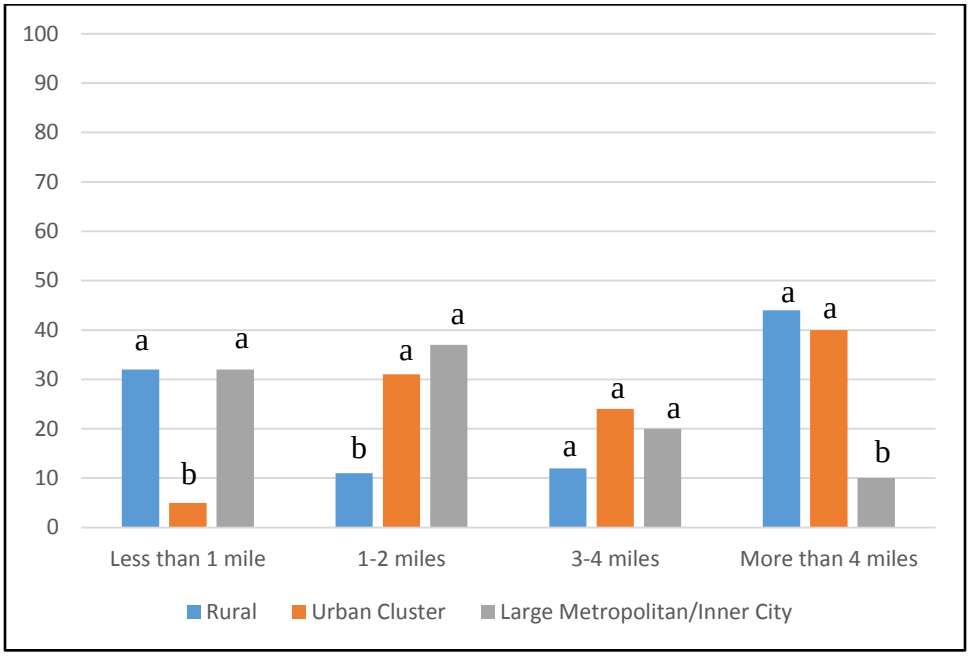


Figure 4.2. Percentage of students reported distance traveled to obtain produce.
Values within demographics with different letters are significantly different P= <0.05

Similarly, urban cluster students most commonly reported having to travel over five miles to obtain fruits and vegetables. Large metropolitan/inner city students reported most common travel distances of two miles or less. As a follow up, students were asked if they felt they had easy access to fruits and vegetables in school. While the majority of students concluded

yes, response rates of yes were significantly higher (80%) in rural areas than in urban cluster communities (56%) (Table 4.4). To assess consumption, students were asked to appropriately answer the recommended amount of fruit and vegetable intake as set by the United States Department of Agriculture (USDA, 2004); with recommended fruit intake of 2-4 servings and vegetable intake of 3-5 servings. Across demographics 81% of students responded that produce servings vary between 4-7+. Even with this knowledge, only 41% of all respondents consume the recommended daily recommended amount of fruits and vegetable. This leaves 58% consuming 1-3 produce items per day and 1% eating no fruits or vegetables. The CDC reports that less than a quarter of all adolescents are eating the recommended amount of fruits and vegetables each day (CDC, 2013).

Table 4.4. Response rate of student finding easy access to fruits and vegetables.

	Rural	Urban Cluster	Large Metro/ Inner City	Total Student Response
		At home		
Yes	92% a	95% a	97% a	94%
No	7% a	5% a	3% a	5%
		At school		
Yes	80% a	56% b	66% a, b	70%
No	20% a	44% b	34% a, b	30%

Values within rows with different letters are significantly different P= <0.05

Although students previously indicated that they felt they had easy access to fresh fruits and vegetables at home (Table 4.4), they did indicate that they would eat more fruits and vegetables if they were easily accessible to them. When given the response categories of; never, rarely, occasionally, frequently, or always, 78% in large metropolitan/inner city and urban cluster areas, respectively, reported they would frequently or always eat more fruits and vegetables if they were easily accessible. Similarly, 64% of rural students reported the same response. In terms of eating only locally grown vs. processed food if it was easily accessible, there did not seem to be much concern about either for students in any demographic. Occasionally was the

most common answer on if they ate locally grown food, but there were no significant differences amongst responses. In America, there has been an increase in farm-to-school options and school gardening programs around the country (Vallianatos et al., 2004). The idea of local food sources has been projected to not only help alleviate childhood obesity, but also serve as a hands on educational tool to help students better understand the process of food production and the benefits attributed to locally grown or produced food (Vallianatos et al., 2004).

The survey also assessed consumption patterns of meat products. Results indicate that almost all of the study's respondents consumed meat products, with 86% of students in large metro/inner city areas eating meat frequently and always and 91% of students in urban cluster and rural communities, respectively, consuming meat frequently or always on a regular basis. Furthermore, we see that consumption patterns of food remain relatively consistent across demographics. Studies have indicated that those in the inner city have poorer eating habits than those in other demographics due to what some researchers have called food desert (Cummins & Macintyre, 2002). A food desert is found in large urban areas that often suffer from poverty, where purchasing healthier options of food is often unaffordable (Cummins & Macintyre, 2002). In addition, inner city areas have greater concentrations of fast food chains and convenience stores, when compared to other demographics, the food options at these locations are often items prepackaged, prepared, or nutritionally deficient (Drewnowski & Specter, 2004; Hendrickson et al., 2006). Results from this study indicated that there was no difference in eating patterns between large metropolitan/inner city adolescents when compared to their peers from urban cluster and rural areas.

Next the survey delved into understanding what students had been taught about food production. A specific question asked students to indicate how often they have been taught

about food production or where their food comes from in school (Figure 4.3), and while there were no statistical differences across demographics, the majority of students answered occasionally with roughly 40% of students from each demographic.

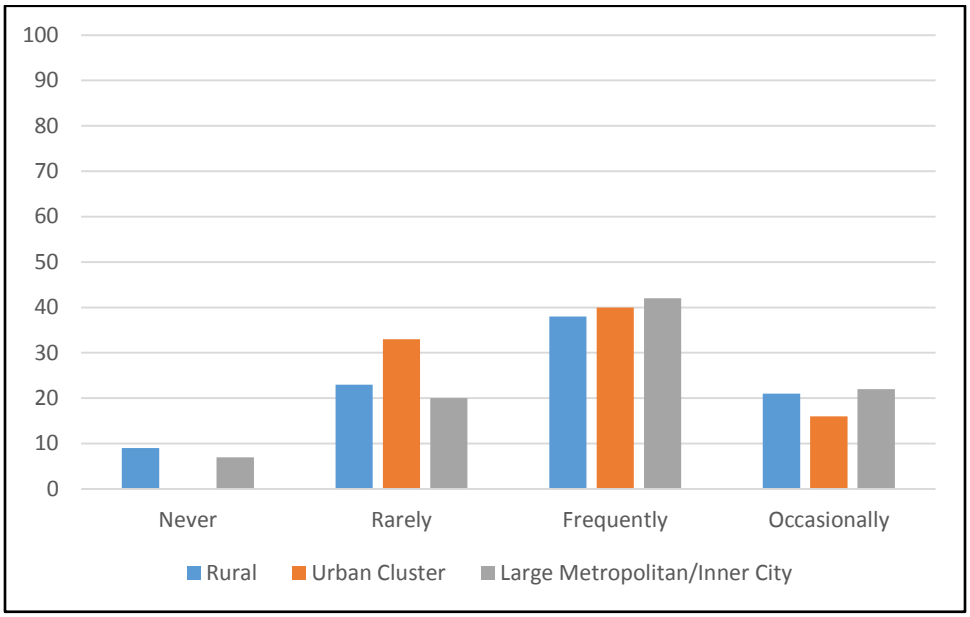


Figure 4.3. Percentage of students reporting to having been taught about food production in school.

Interestingly enough, even though students didn't feel they had been taught about food production often through formal curriculum 86% of respondents felt that they understood the process of what it takes to get food to the table. To further assess their understanding, students were asked how often they were taught about environmental issues at school. Again, there were no significant differences between demographics, but the most common response from students was occasionally, with rarely being the second most common response. Students did however indicate that they are learning slightly more often about general environmental issues in school than they are about where their food comes from and food production.

Due to lack of formal curriculum on food production, students were asked about the importance of agriculture. Students commonly felt that today's farming practices require the use of pesticides and herbicides and that soil is a necessity in producing food (Table 4.5). In fact,

strongly agree was the most common answer across all demographics for the question asking if soil was important. When asked specifically about Minnesota, 59% of students responded that fruits and vegetables were not easily able to be grown year round in the state, which is true due to harsh winters; however, another 27% of students responded that they were unsure. To conclude the questioning on food production, students were asked whether or not they felt it is important to educate adolescents about general environmental issues/concerns. The majority of students across all demographics either strongly agreed or agreed that it is important to learn about these topics, and these same students indicated that they were currently learning about them rarely or occasionally in school. Since knowledge is the precursor to developing any behavior or attitude (Hungerford & Volk, 1990), an argument can be made that in order to develop ones' personal identity or behavioral patterns, one must have knowledge of the topic. Results of this study indicate that students are more interested in learning when compared to what is currently being taught in the school curriculum; thus demonstrating that most students across demographics have a willingness to learn more about food production and environmental topics.

To gauge student understanding of food, where it comes from, and their attitudes towards the agriculture sector, students were asked a series of questions quantified by a Likert scale of strongly disagree, disagree, neutral, agree, and strongly agree (Table 4.5). Across demographics students were most commonly neutral or in agreement with the statement that Minnesota has more than enough farmland (question adapted from Harmon & Maretzki, 2006). This response correlates with the findings of Harmon and Maretzki (2006) where they found that youth agree that Pennsylvania has more than enough farmland (Harmon & Maretzki, 2006).

Table 4.5. Response of student agreement with the following statements.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
	We have more than enough farmland in Minnesota			
Strongly Disagree	2% a	0% a	0% a	1%
Disagree	8% a	13% a	14% a	11%
Neutral	42% a	40% a	53% a	45%
Agree	39% a	40% a	27% a	36%
Strongly Agree	9% a	7% a	7% a	8%
	Most farming practices require the use of pesticides and herbicides			
Strongly Disagree	0% a	4% a	2% a	1%
Disagree	13% a	15% a	20% a	16%
Neutral	26% a	31% a	24% a	26%
Agree	42% a	40% a	36% a	40%
Strongly Agree	19% a	11% a	19% a	17%
	Keeping farmers in business is important			
Strongly Disagree	0% a	0% a	0% a	0%
Disagree	1% a	0% a	0% a	0%
Neutral	4% a	5% a	3% a	4%
Agree	30% a	27% a	31% a	29%
Strongly Agree	64% a	67% a	66% a	66%
	Keeping farmers in business is important for the economy			
Strongly Disagree	1% a	0% a	0% a	0%
Disagree	1% a	0% a	0% a	0%
Neutral	4% a	11% a	8% a	7%
Agree	26% a	29% a	36% a	29%
Strongly Agree	68% a	60% a	56% a	62%
	Keeping farmers in business is important for food sources			
Strongly Disagree	0% a	0% a	0% a	0%
Disagree	1% a	0% a	0% a	0%
Neutral	1% a	4% a	3% a	2%
Agree	27% a	33% a	27% a	28%
Strongly Agree	71% a	64% a	69% a	69%
	Soil is important in producing food			
Strongly Disagree	0% a	0% a	0% a	0%
Disagree	0% a	0% a	0% a	0%
Neutral	3% a	7% a	2% a	4%
Agree	34% a	47% a	32% a	37%
Strongly Agree	62% a	47% a	66% a	59%

Values within rows with different letters are significantly different P= <0.05

Resoundingly, over 95% of all respondents felt strongly, either in agreement or strong agreement, that keeping farmers in business is important. Overall, 92% of students felt that

farming was important for our economy and 97% felt that keeping farmers in business was important to our food sources.

In an effort to go beyond the students own perceived understanding of food production, we developed two blocks of questions allowing students to match everyday food items with their main source. The first matching block question asked students to match animal products with the appropriate animal. Overall, across all demographics over 90% of students understood the source of steak, lamb chops, milk, chicken strips, hamburgers, bacon, eggs, and pork chops. Three meat products seemed more challenging for students: veal, buffalo wings, and venison. Only 14% of students understood that veal came from a cow; the most common answer of where veal came from was rabbit. Only 55% of respondents correctly answered that a buffalo wing originates from a chicken, while 41% of students thought it came from a buffalo. This question did, however, pose some demographic differences in that 74% of respondents from large metropolitan/inner city areas understood correctly where a buffalo wing came from while their peers in the other two demographics were less sure (54% in urban cluster and 53% in rural areas). Finally, while the majority of students understood that venison comes from a deer, results show that respondents in rural areas had a higher accurate response than their peers in urban cluster and large metropolitan/inner city areas. This likely relates back to the question on hunting, as a higher proportion of rural students were hunters, and venison is not a common item on most restaurant menus. While common animal products seem to be more well known, as you find less common items or items with a more confusing name, students seem to be less sure of the origin.

The second matching block question requested students to match everyday food items with its source typically grown in the state of Minnesota or surrounding area. Students were

instructed that some products may have multiple answers and data was quantified accordingly. Students were questioned on the following thirteen products: flour; sugar; pasta; edamame; oil; honey; maple syrup; wild rice; granola; butter; sunbutter; hash browns; and apples. Overall, students across demographics seemed to have a relatively high understanding of these food products origins. Response options to match the products to consisted of: wheat; corn; potatoes; cane; sunflowers; soybeans; cream; canola; olives; bees; tree; grass; beets; oats; barley; and durum. In most cases of accurate matches, response rates exceeded 80%. There were some challenges presented for items that were not as common or not likely known by all students across demographics; for example, only 50% of students understood that sunbutter originates from sunflower seeds. Further, while the majority of students (77%) believed that pasta came from wheat, only 2% of students selected durum, which is the actual origin of the majority of pasta created in the area. The majority of students, though a small majority (37%), understood that wild rice (a common Minnesota food) came from grass, other common answers included barley, wheat, and durum. Students in urban cluster and large metropolitan/inner city areas understood edamame origins, although the large metropolitan/inner city students had a higher response accuracy than urban cluster students. The most common response in rural areas was durum. The general conclusion is that more common products are easier for students to identify their origin, while uncommon products or those with confusing names are hard for some students to identify. Finally, the results from this block of questions showed that while students may understand the source of a product, the source selected is not always the source produced in the local area where the student is living. For example, the overwhelming majority of all sugar created in the state of Minnesota comes from sugar beets. However, when students were asked about the origin of sugar in their area, the majority of students across all demographics (81%)

selected cane as the sugar source in the state of Minnesota and only 8% selected beets. While canola was the most common response (50%), 29% of respondents when asked about oil selected olives as a source typically grown in this area; again there is very little olive oil produced in the state and the main source would be canola oil (vegetable was not given as an option). Other answers selected, in order from highest level of response to lowest were: soybeans; sunflowers; durum; cream; corn; cane; barley; and trees.

4.5. Conclusion

The purpose of this research was to understand student perceptions of our country's expanding and complex food system while evaluating their knowledge of food production, their attitudes towards learning about the food system, and their behaviors as related to consumption and purchasing. In general, it can be concluded that 10th grade high school students across all demographics have an understanding of where their food comes from, but there appears to be a lack of comprehension as to what constitutes "local" and what products actually come from the local region. Additionally, there is more confusion when food items are less common or exist popularly in only one demographic.

Overall, students agree that they have easy access to produce in the home, and the majority of respondents felt that they had easy access to produce in the schools; although students in urban cluster areas felt that they had less "easy" access than other demographics. The results of this study also indicate that the majority of food purchases across demographics come from a grocery store, while big box stores remain popular for urban cluster students, and hunting was more common for rural students as a source of food than any other demographic. Overall, students saw agriculture as an important structure in the economy and for our food sources. While students acknowledged that they were not taught about food production often in school,

there is consensus that they want to learn more and would welcome further instruction in the schools on not only food production, but environmental issues and concerns.

Future research on this topic would be useful in regards to adolescent purchase power and consumption rates and patterns. While adolescents are not the main purchasers of food products in their household, they do have influence over the items that are purchased, and research has concluded that their influence is increasing. Additionally, the survey could be utilized in different areas around the country, to determine if knowledge, perceptions, and behaviors differ dependent on regions of the country and if demographic generalizations remain consistent.

This research is beneficial not only to teachers and educators in the field of environmental education, but also professionals in the agriculture industry and extension who focus on outreach measures to engage youth and increase knowledge. This research could also be beneficial to businesses within the demographic categories; understanding purchase and consumption patterns of adolescents and where they commonly purchase their food can greatly impact business development and strategy.

4.6. References

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1).

Bissonnette, M. & Contento, I. (2001). Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: application of a psychosocial model. *Journal of Nutrition Education*, 33(2).

The Centers for Disease Control and Prevention. (2013).

The Centers for Disease Control and Prevention. (2015). The food production chain: How food gets contaminated. Atlanta, Georgia.

Cobb, N. J. (1992). *Adolescence: Continuity, change, and diversity*. Mayfield Publishing Co.

Contento, I., Williams, S., Michela, J., & Franklin, A. (2006). Understanding the food choice process of adolescents in the context of family and friends. *Journal of Adolescent Health*, *38*(5).

Cummins S, Macintyre S. (2002). Food deserts—evidence and assumption in health policy-making. BMJ

DeLaughter, J. E., Stein, S., Stein, C. A., & Bain, K. R. (1998). Preconceptions about earth science among students in an introductory course. *Eos*, *79*(36).

Drewnowski, A., & Specter, S. E. (2004). Poverty and obesity: the role of energy density and energy costs. *The American Journal of Clinical Nutrition*, *79*(1).

Dykstra, D. (1997). Misconceptions as barriers to understanding science. *Science Teaching Reconsidered.* National Research Council.

Elliott, C. (2008). Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, *9*(4).

Fitzgerald, A., Heary, C., Nixon, E., & Kelly, C. (2010). Factors influencing the food choices of Irish children and adolescents: a qualitative investigation. *Health Promotion International*, *25*(3).

Frick, M. J., Birkenholz, R. J., Gardner, H., & Machtmes, K. (1995). Rural and urban inner-city high school student knowledge and perception of agriculture. *Journal of Agricultural Education, 36*.

George, D., & Mallery, P. (2012). IBM SPSS Statistics 19 Step by Step: A Simple Guide and Reference. Pearson Publishing.

Harmon, A. H., & Maretzki, A. N. (2006). Assessing food system attitudes among youth: development and evaluation of attitude measures. *Journal of Nutrition Education and Behavior*, *38*(2).

Hendrickson, D., Smith, C., & Eikenberry, N. (2006). Fruit and vegetable access in four low-income food deserts communities in Minnesota. *Agriculture and Human Values*, *23*(3).

Hendrickson, J. (1996). Energy use in the U.S. food system: A summary of existing research and analysis. Sustainable Farming-REAP-Canada. Ste. Anne-de'Bellevue, Quebec. Vol 7(4).

Hora, M., & Tick, J. (2001). *From farm to table: Making the connection in the mid-Atlantic food system*. Capital Area Food Bank.

Jones, K., & Doucet, M. (2000). Big-box retailing and the urban retail structure: the case of the Toronto area. *Journal of Retailing and Consumer Services*, *7*(4).

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education, 21*(3).

Kümpel Nørgaard, M., Bruns, K., Haudrup Christensen, P., & Romero Mikkelsen, M. (2007). Children's influence on and participation in the family decision process during food buying. *Young Consumers*, *8*(3).

Liese, A. D., Weis, K. E., Pluto, D., Smith, E., & Lawson, A. (2007). Food store types, availability, and cost of foods in a rural environment. *Journal of the American Dietetic Association, 107*(11).

Lineberger, S. E., & Zajicek, J. M. (2000). School gardens: Can a hands-on teaching tool affect students' attitudes and behaviors regarding fruit and vegetables?. *HortTechnology*, *10*(3).

Lytle, L. A., Kubik, M. Y., Perry, C., Story, M., Birnbaum, A. S., & Murray, D. M. (2006). Influencing healthful food choices in school and home environments: results from the TEENS study. *Preventive Medicine*, *43*(1).

Minnesota Department of Natural Resources. (2012).

Morris, J., Neustadter, A., & Zidenberg-Cherr, S. (2001). First-grade gardeners more likely to taste vegetables. *California Agriculture*, *55*(1).

Neumark-Sztainer, D., Story, M., Perry, C., & Casey, M. A. (1999). Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *Journal of the American Dietetic Association, 99*(8).

Peng, S., Wang, M., & Walberg, H. (1992). Demographic Disparities of Inner-City Eighth Graders. *Urban Education*, *26*(4).

Pirog, R. S., & Benjamin, A. (2003). Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions.

Pirouznia, M. (2001). The association between nutrition knowledge and eating behavior in male and female adolescents in the US. *International journal of food sciences and nutrition, 52*(2).

Poston, S. A., Shoemaker, C. A., & Dzewaltowski, D. A. (2005). A comparison of a gardening and nutrition program with a standard nutrition program in an out-of-school setting. *HortTechnology*, *15*(3).

Robinson-O'Brien, R., Story, M., & Heim, S. (2009). Impact of garden-based youth nutrition intervention programs: a review. *Journal of the American Dietetic Association*, *109*(2).

Stobbelaar, D. J., Casimir, G., Borghuis, J., Marks, I., Meijer, L., & Zebeda, S. (2007). Adolescents' attitudes towards organic food: a survey of 15-to 16-year old school children. *International Journal of Consumer Studies*, *31*(4).

Story, M., & Resnick, M. D. (1986). Adolescents' views on food and nutrition. *Journal of Nutrition Education*, *18*(4).

Turconi, G., Celsa, M., Rezzani, C., Biino, G., Sartirana, M. A., & Roggi, C. (2003). Reliability of a dietary questionnaire on food habits, eating behaviour and nutritional knowledge of adolescents. *European Journal of Clinical Nutrition, 57*(6).

United States Census Bureau. (1994). Chapter 13: Metropolitan Areas. Geographic Reference Manual.

United States Census Bureau. (2015). 2010 Census Urban and Rural Classification. Geographic Reference Manual.

United State Department of Agriculture. (2004). Understanding fruit and vegetable choices: Research briefs. Agriculture information bulletin no. 792.

Vallianatos, M., Gottlieb, R., & Haase, M. A. (2004). Farm-to-school strategies for urban health, combating sprawl, and establishing a community food systems approach. *Journal of Planning Education and Research, 23*(4).

CHAPTER 5. UNDERSTANDING HIGH SCHOOL STUDENTS PERCEPTION OF NATURE AND TIME SPENT OUTDOORS ACROSS DEMOGRAPHICS

5.1. Abstract

Research shows that adolescents today are spending less time in nature and more time on other activities. People assume that this trend is different across demographics, but little research has been done on the topic. This study aimed to assess high school students' perceptions of nature and the time they spend in it. A total of 204 high school tenth graders from different demographic locations around the state of Minnesota were surveyed to gauge how they perceived nature. The three demographic categories were made up from students from: 1) large metropolitan/inner city, 2) urban cluster, and 3) rural areas. Often labeled as a generation with their heads in technology, researchers wanted to expose what perceptions these students actually had about nature. In doing so, students were presented with a survey containing a variety of questions that would indicate their knowledge of nature, their perception of it, and their attitude towards it. Researchers also wanted to gauge what activities students were participating in when outdoors. Results indicate that regardless of demographics, students seem to define and perceive nature similarly. Further, the study also found that time spent on a computer or in front of the television has decreased but that with greater access to personal electronic devices, students are still spending a great deal of time 'plugged in.' The information presented in this research aims to provide information to environmental educators in order to develop lessons or new curriculum that will produce environmentally literate citizens and increase the knowledge of how students perceive the natural world, thus effecting their behavior and attitudes towards it.

5.2. Introduction

Childhood, or how our parent's generations may remember it, has changed significantly over the last 50 years. In 1960, researchers began to see for the first time that children started spending less time in nature (Louv, 2005); an observation that has been echoed in the work of many researchers. This same research has concluded that in recent decades, children have been spending less and less time outdoors (Sobel, 1990; Sanger et al., 1997; Clements, 2004; Kellert, 2005). The literature estimates that children spend between 20-50% less time outdoors than the generations before them (Louv, 2005). The fact that children's exposure to and interaction with nature continues to diminish has been the basis for numerous research topics and studies (Rivkin, 2000; Kahn, 2002; Taylor et al., 2006). The average child is not only spending less time outdoors, but they are given fewer opportunities to spend time outside (Louv, 2005). Whether it is fears or discomforts of what lies outside, fear of strangers or violence, lack of natural play areas, increase in technology and media, or the fact that children's lives are becoming increasingly more scheduled; children have been limited in their ability to actively and easily enjoy the outdoors (Gaster, 1991; Clements & Jarrett, 2000; Louv, 2007; Larson et al., 2011).

At the same time that youth are spending less time outdoors, numerous studies have focused on the countless benefits of children and adolescents spending time in nature (Sobel, 1990; Wells, 2000; Kellert, 2002; Ernst & Monroe, 2004; Louv 2005). Cognitive development and function are readily studied in growing adolescents, and increased interaction with nature has been shown to have positive psychological and physical effects on children (Wells, 2000; Kahn & Kellert, 2002; McCurdy et al., 2010). In addition, studies have linked time in nature to increased attention spans, increased cognitive functioning, and positive environmental attitudes

and behaviors (Kaplan and Kaplan, 1989; Kaplan, 1995; Rivkin, 2000; Wells, 2000; Pyle, 2002; Kellert, 2005; Louv, 2005, Louv, 2007).

Although numerous scholars have detailed the benefits of adolescent's interactions with the outdoors, there remains an abundance of circumstances limiting these interactions. Urbanization seems to be an underlying condition that limits natural space for youth. In 2007, for the first time in history, our world's urban population equaled its rural population (United Nations, 2007). Since then the urban population has been steadily increasing and the percent of people living in rural areas has steadily declined (United Nations, 2014). With more and more people living in urban communities surrounded by an abundance of built infrastructure; disappearing natural space has aided in the disconnect children have with the outdoors (Louv, 2007). Urban areas, not surprising because of their dense populations, see increased levels of crime, congestion, and vandalism that have altered how urban adolescents view and access their neighborhoods (Gaster, 1991). The literature on urban adolescents' interaction with and comfort in natural areas is mixed. A 1998 study found that youth and their parents in an inner city area actively engaged in outdoor activities in the same ways as adolescents from other demographics (Taylor et al., 1998). Though research from 1994 concluded that urban youth demonstrated and experienced great fear and discomfort of natural spaces on a field trip to a wildland area (Bixler et al., 1994). A follow up study with middle school adolescents from rural and suburban areas found that they too exhibited discomfort and fear of natural areas and preferred indoor activities (Bixler & Flyod, 1997). A 2007 study by Milligan and Bingley (2007) found that fears of woodland areas were contributed to by parental fears or lack of being able to freely explore woodland areas as children. The same study found that in woodland areas that are too dark or

dense with foliage there is fear of not being able to find their way out or being attacked; as well as, fear of the animals or insects that populate the woodland area (Milligan & Bingley, 2007).

Another factor that appears to have a direct correlation with adolescents lack of experience or interaction with nature is the growing rate of technology; the use of television, computers, and other electronics are keeping children indoors (Louv, 2007). The United States Forest Service conducted a phone study in 2011 interviewing over 1,400 households with children seeking to find how much time they spent outdoors, what they participated in, and reasons as to why they were not outside (Larson et al., 2011). The most common answers for why children spent time indoors cited activities such as movies, television, internet, music, and use of phone via texting (Larson et al., 2011). Another study focusing on how children utilize their time in a 24-hour period found that between 1997 and 2003 the percent of time spent participating in outdoor activities declined 37%; while time spent watching television remained consistently high (Hofferth, 2009). In 2001, almost half of all households in the United States that have children have access to a home computer and internet (Subrahmanyam et al., 2001), and this number has likely risen. Another study of over 700 high school students found that 66% used the internet mainly as a means for socializing (Peter & Valkenburg, 2006). Therefore, it comes with little surprise that so much time is spent engaging in technological based activities.

There are many conditions that draws youth out of nature and keep them indoors, both in school and at home. It has been widely recommended that environmental education be used as a tool to counteract not only fears and discomforts, but to change youth's perception of nature (Frumkin & Louv, 2007). Environmental education is not a common requirement found in school curriculums. It wasn't until December 2015 that United States President, Barack Obama, signed legislation, Every Student Succeeds Act, granting the ability for environmental education

opportunities and programs to receive federal funds (S.1177-Every Student Succeeds Act, 2015). The National Education Association (NEA) and the North American Association for Environmental Education (NAAEE) have recognized the positive advancements and benefits that teaching environmental education can have on students (NEA, 2016; NAAEE).

To date, literature has assessed discomforts of youth experiencing the outdoors, how students are spending their time, and why students are spending so little time outdoors. However, all of these studies focus on one or two types of demographics and none look comparatively at understanding and perceptions of nature across a variety of demographics to determine what differences and similarities exist. It is important to assess all these demographics and their interactions with nature and technology to determine their overall perceptions of nature in order to expand environmental education curriculum and goals to ensure environmentally literate citizens across all areas in the United States.

The goal of the current study is to quantify how students across the demographics of rural, urban cluster, and large metropolitan/inner city perceive the natural environment. Looking beyond just their fears and discomforts, this research aims to understand their attitudes towards the environment and how much time they spend outdoors compared to their peers in other demographics and if their activities and interactions with nature, or lack thereof, differ based on the location and surroundings in which they live. Furthermore, this research explores behavioral patterns and attitudes towards the use of technology and how increased time on electronics may correlate with decreased time spent in nature.

5.3. Methods and Materials

The state of Minnesota served as the study area for this project. Schools from three demographic groups were selected for this study including large metropolitan/inner city, which

can also be classified as urban. The United States Census Bureau defines urban as any area consisting of more than 50,000 people (USCB, 2015); while it does not specifically define large metropolitan areas, we categorized these as areas of more than 50,000 people that with surrounding communities makes up a centralized hub (USCB, 1994). Further, inner city would be defined as an area dealing with higher rates of poverty, significant gaps educationally, and often not enough proper housing (Taylor et al., 1998). Portions of the school district in the large metropolitan/inner city demographic fit this definition. The second demographic is urban cluster, which is defined as any area of less than 50,000 people but more than 2,500 (USCB, 2015). Therefore, the third demographic, rural areas, although not defined by the US Census Bureau, for the purposes of this study were defined as areas consisting of fewer than 2,500 people. Demographics from the same state were selected to ensure education standards for participants were unchanged and remained consistent. Overall, the study population consisted of 59 tenth grade students from large metropolitan/inner city schools, 55 students living in urban cluster areas, and 90 students from rural communities.

The survey instrument utilized for this project was designed over the course of one year. Questions were derived from past research studies and literature related to natural space (Larson et al., 2011), use of technology, comfort outdoors, and demographic populations along with questions suggested by professionals. The study leveraged focus groups in its initial stages to ensure that the concepts behind the topic of natural space, attitude and comfortability being in the outdoors, and use of technology as a form of entertainment was accurately and appropriately covered. A focus group consisting of nine professionals from the fields of academia, extension, and environmental fields were used to improve the survey instrument. The professional focus group was administered a survey containing 43 questions in order to hone in on the best

questions to meet the specific project objectives. A focus group consisting of students was also utilized to measure whether or not questions were easy to understand and could be answered clearly. The second focus group consisted of 22 urban tenth grade students from a school outside the study area, as not to be used in the final project or for data collection. The survey instrument circulated to the student focus group consisted of 48 questions. The final survey instrument given to the sample population utilized Likert scale questions to assess student behavioral and attitude patterns and perceptions of the natural environment. Yes and no questions were used to measure students activity in nature and their time spent on activities such as cellphone use, gaming time, and time spent on the computer. The survey instrument also utilized pictures in order to understand how students visualize nature and which spaces they would categorize as nature. Example questions that were used in this survey can be found in Figure 5.1. Forty-three questions were contained in the final survey instrument and can be found in Appendix C. Participation in the study required project approval from the project university's Institutional Review Board (IRB). Once approved, the following required criteria needed to be met; permission from the principal of each school, or in the case of larger metropolitan/inner city areas, approval had to be obtained through the superintendent and research and evaluation department. The next approval step needed was from each classroom teacher. Following teacher approval, students were given parental permission forms that needed to be signed prior to each student completing their own youth assent form. The final survey instrument was circulated, supervised, and collected by one of the project's co-investigators to ensure that only students completing all levels of consent participated.

The natural environment survey took approximately 20 minutes to complete. A total of 548 consent forms were distributed for participation and of those, 204 students completed all

required components of the consent process and were able to participate. No identifiable information was gathered as part of the survey instrument. For the purpose of this research, collecting data surrounding age, gender, race, income, household, or parent information was not deemed needed or appropriate. Furthermore, because students are considered a protected research population, collecting identifiable information would have decreased sample size and participation given the restrictions surrounding research with protected populations.

1. How much time do you spend on your phone each day during the school year?
Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

2. What kinds of animals do you think live in the natural environments around your town? (check all that apply)
___ Snakes ___ Bears ___ Insects ___Squirrels
___ Lions ___ Fish ___ Birds ___Deer

3. Using the images below, please circle the pictures that you would label as nature:

4. Please indicate how comfortable you would be doing the following
1 2 3 4 5
Never Rarely Occasionally Frequently Always

_____A. Spending time in nature without any technology or media devices

Figure 5.1. Sample questions from nature questionnaire.

Once all data was collected, surveys were appropriately coded and digitized into Microsoft Excel before being entered into IBM Statistical Package for the Social Sciences (George & Mallery, 2012). Cross tabulation and likelihood ratio was calculated by correlation statistics. To determine the strength of the correlation (Elliot, 2008), Kramer V was used. To

determine significant differences, P = < 0.05. Finally, a Z-test with a Bonferroni correction was calculated to determine significant difference amongst data cells (Bamburg & Moser, 2007).

5.4. Results and Discussion

Student comfort and fears of natural areas were measured through the use of Likert questions to gauge significant differences among the three demographic groups. Research to date on urban and inner city youth has generally concluded that students from these areas have a greater fear of going outside in wildland areas (Bixler et al., 1994; Bixler & Flyod, 1997). The current study assessed the feelings of students across the rural, urban cluster, and large metropolitan/inner city areas and in general found the opposite, that students did not have a lot of perceived fears pertaining to the outdoors (Table 5.1). Over 94% of students across demographics reported never or rarely feeling fearful of being outdoors, and 92% reported never or rarely feeling fearful of exploring a natural area. Furthermore, no significant differences ($p>0.05$) were determined based on demographic (rural, urban cluster, and large metropolitan/inner city) for these questions, meaning that students in urban areas are no more or less fearful of the outdoors than their rural counterparts. Additionally, 88% of students reported that they always or frequently go outside for activity. These same students were more likely to select occasionally, frequently, and always as most common response to if they are spending time in nature while outside. This would also indicate that the adolescents in the study are not overly fearful of nature. Over 85% maintained that they rarely or never felt fearful of going outside; however, 18% of urban cluster students reported feeling fearful occasionally, while 15% of large metropolitan/inner city students and 8% of rural students reported occasionally feeling fearful. Overall, students disagreed and strongly disagreed (85% combined) that nature was a scary place to explore. Also, 90% of all students regardless of demographic, said they did not

have any fears or discomforts exploring natural areas or being outside. It appears that fears and discomfort with being outside may lie more with the animals or insects found in those spaces, as on average, 28% of students reported having fears of the insects or animals in natural areas; 27% of rural students, 29% of urban cluster, and 29% of large metropolitan/inner city students reported having these fears. A study by Milligan and Bingley (2007) also found that a common fear amongst young adults in a natural setting was the animals and insects that lived in the area (Milligan & Bingley, 2007).

Table 5.1. Response of students to fear of questions involving spending time outdoors.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Felt fearful of going outside		
Never	71% a	71% a	58% a	67%
Rarely	22% a	22% a	39% a	27%
Occasionally	6% a	7% a	3% a	5%
Frequently	0% a	0% a	0% a	0%
Always	1% a	0% a	0% a	0%
		Exploring a natural area		
Never	74% a	65% a	59% a	68%
Rarely	17% a	27% a	32% a	24%
Occasionally	8% a	7% a	7% a	7%
Frequently	0% a	0% a	2% a	0%
Always	1% a	0% a	0% a	0%
		Being alone in a natural area		
Never	62% a	45% a	47% a	53%
Rarely	28% a	35% a	36% a	32%
Occasionally	8% a	18% a	15% a	13%
Frequently	1% a	2% a	0% a	1%
Always	1% a	0% a	2% a	1%

Values within rows with different letters are significantly different P= <0.05

To gauge student perception and knowledge regarding animals in natural environments, pupils were asked what animals they thought lived in the natural environments around their town. Through a check all that may apply question, the survey concluded that the majority (over 90% in all cases) understood that deer, squirrels, insects, birds, fish, and mice/rats lived in the environments surrounding their homes. Students were also asked if snakes and bears were found

in the natural areas near their town, and for these two questions there were differences amongst the demographics. To give reference, yes there are both snakes and bears found in natural areas throughout most of Minnesota. The most common response (75%) of students felt that, yes, snakes do live in these areas, though more large metropolitan/inner city students than not (53%) reported that snakes were not found in the natural areas around their town. Interestingly, rural students were unsure of whether or not bears lived around their communities, half agreed that they did and half of the respondents said no. This was significantly different than the urban cluster and large metropolitan/inner city pupils whose most common answer was no. A 1984 study by Stephen Kellert found that residents in rural areas and communities possessed more knowledge regarding animals than their peers in urban cities (Kellert, 1984). Results of this study indicate that while there were differences found between the rural and urban students when students were asked about snakes and bears, they were able to identify all other animals that were and were not found in the natural environments in the same ways as rural students.

The questionnaire next delved into understanding students use of technology in their daily life. Results showed that over 91% of students across demographics use some sort of electronic device always or frequently for entertainment, 93% have their own personal cell phones, and 91% have their own personal electronic devices. Similar results were found by Lenhart et al. (2005) in that the majority of teens personally own at least one electronic and just under half reported owning at least two. Students also reported that 95% of them have access to a computer outside of school, and 99% have access to the internet outside of school (Figure 5.2). These findings echo research by the Kaiser Family Foundation showing that adolescents today are considered a media generation with greater access to media and electronics than ever before (Rideout et al., 2010).

Once we determined the types of electronics students had, this led to questions regarding how comfortable students would be to abandon their electronics and explore nature without them. Overall, 60% of students regardless of demographic, indicated that they would occasionally or frequently be comfortable exploring nature without any technology or media devices (not including their cell phones). When asked how comfortable students would be spending time in nature without cellphone service or wireless capability available on their phones, responses were equally distributed across the five response options of never, rarely, occasionally, frequently, and always showing no significant differences across demographics. While over 60% of students agreed or strongly agreed that spending time exploring natural areas without electronics was important, they felt less comfortable spending time alone in nature without access to cell phone service or wireless capability. Only 80% of students said that they would consider spending time exploring nature without their phone or electronic device. Richard Louv (2005) contends that use of electronics is contributing to youth becoming more and more detached from nature (Louv, 2005).

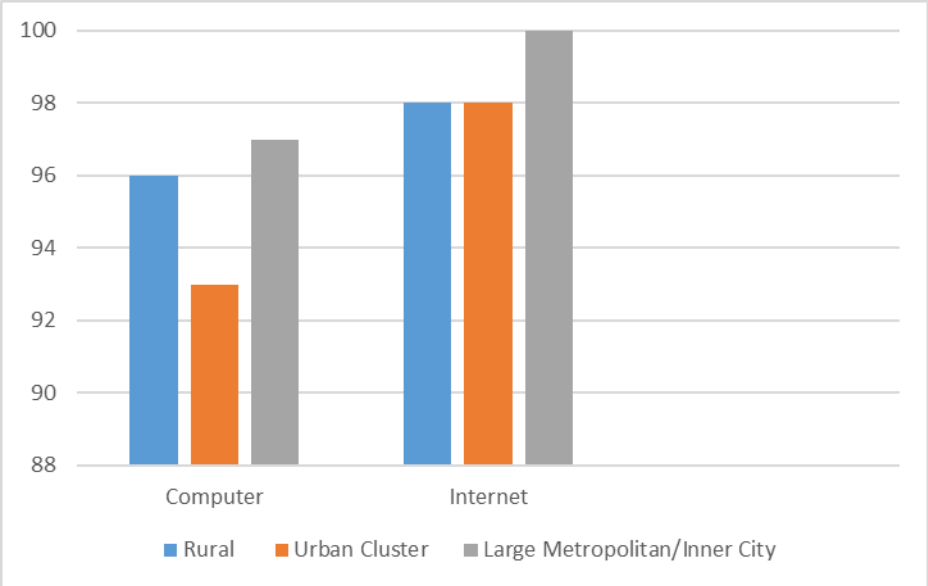


Figure 5.2. Percentage rates of students' access to computers and the internet outside of school.

Electronic devices, technology, and the constant need to be "plugged in" are all factors used to consider why children are spending less time outdoors (Louv, 2005; Hofferth & Curtin, 2006; Zaradic & Pergams, 2007; Rideout et al., 2010; Larson et al., 2011). In addition to understanding student knowledge and perceptions, this study aimed to quantify behavioral patterns and how much time students actually spend being plugged in; for purposes of this research students were asked to answer questions that accounted for time spent during the school year and also during the summer (Table 5.2 and Table 5.3 respectively). On average, respondents reported that during the school year they are watching between 1-4 hours of television per day. Significant differences were found between urban cluster and large metropolitan/inner city youth in that it was more common for large metropolitan/inner city students to only spend 1-2 hours per day watching television during the school year while students from urban cluster areas spend 3-4 hours per day during the school year. Students were also asked about their summer time activities, as students in the state do not have school in the summer time. During the summer months the most common response was that students spend less than two hours per day watching television; although, when compared to during the school year, results did account for a slight increase in respondents watching 3-4 hours of television during the summer. Information from the Kaisler Family Foundation reports that while television time has decreased, adolescents are still watching television shows on other mediums or devices, thus actually increasing overall screen time (Rideout et al., 2010).

Students were also asked about other "screen time" activities. The majority of students across demographics reported that both during the school year (outside of regular school hours) and during the summer they are actively spending less than 1 hour per day on the computer (Table 5.2 and 5.3). When asked how often students played video games, 71% of respondents

answered that they played less than 1 hour of video games during the school year and 63% said they participated in gaming for less than one hour during the summer. Not surprisingly, students in the category of 4+ hours grew from 3% during the school year to 12% during the summer months; showing that students who enjoy video games greatly increase their use of those games as they have free time. Lenhart et al, (2008) found that the majority of pupils between the ages of 12-17 participate in gaming and that active gamers spend at least an hour playing per day. While results from our study indicated that only 30% of all students spent more than 1 hour per day gaming during the school year and 37% spent more than 1 hour during the summer.

Students were also asked about their iPod, MP3 player and cell phone use, keeping in mind that some students have started to use their phones as a surrogate for iPod and MP3 players (Table 5.2 and 5.3). Across demographics, 78% of students listen to an iPod or MP3 player for less than 1 hour per day. Trends changed throughout the summer months and students reported spending more time listening to music, as 51% during this time period spent over 1 hour per day on their iPod or MP3 players. There was a fairly equal distribution amongst response categories when students were asked how often they spent on their phones; the most common response and majority (34%) of pupils said they spend 1-2 hours per day on their phone; however, 23% acknowledged spending more than 3 hours per day. This number increased during the summer, with over half (55%) of all students reporting spending over 3 hours per day on their phone with 31% of them spending more than 4 hours. This information echoes the Pew Research Center findings that almost a quarter of all teenagers say they are online all the time and over 90% of all teenagers indicate that going online is a daily occurrence (Lenhart, 2015).

Table 5.2. Response rates of students using different electronics per day during the school year.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Time spent on electronic devices		
Less than 1 hour	8% a	4% a	8% a	7%
1-2 hours	29% a	29% a	29% a	29%
3-4 hours	38% a	38% a	20% a	33%
More than 4 hours	26% a	29% a	42% a	31%
		Watching TV		
Less than 1 hour	42% a	35% a	64% b	47%
1-2 hours	42% a, b	53% b	27% a	41%
3-4 hours	10% a	13% a	3% a	9%
More than 4 hours	4% a	0% a	5% a	3%
		Computer		
Less than 1 hour	61% a	45% a	44% a	52%
1-2 hours	24% a	44% b	36% a, b	33%
3-4 hours	8% a	7% a	14% a	9%
More than 4 hours	7% a	4% a	7% a	6%
		Video Games		
Less than 1 hour	70% a	73% a	71% a	71%
1-2 hours	20% a	16% a	15% a	18%
3-4 hours	7% a	7% a	12% a	8%
More than 4 hours	3% a	4% a	2% a	3%
		iPod or MP3 player		
Less than 1 hour	52% a	47% a	47% a	50%
1-2 hours	31% a	31% a	24% a	29%
3-4 hours	8% a	11% a	19% a	12%
More than 4 hours	9% a	11% a	10% a	10%
		Cell Phone		
Less than 1 hour	17% a	20% a	20% a	19%
1-2 hours	36% a	35% a	32% a	34%
3-4 hours	22% a	24% a	25% a	24%
More than 4 hours	24% a	22% a	22% a	23%

Values within rows with different letters are significantly different P= <0.05

Table 5.3. Response rates of students using different electronics per day during the summer.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Time spent on electronic devices		
Less than 1 hour	7% a	11% a	5% a	7%
1-2 hours	28% a	27% a	20% a	25%
3-4 hours	29% a	24% a	37% a	30%
More than 4 hours	37% a	38%	37% a	37%
		Watching TV		
Less than 1 hour	32% a	36% a	46% a	37%
1-2 hours	42% a	35% a	34% a	38%
3-4 hours	19% a	18% a	19% a	19%
More than 4 hours	7% a	11% a	2% a	6%
		Computer		
Less than 1 hour	67% a	53% a, b	42% b	56%
1-2 hours	16% a	29% a	22% a	21%
3-4 hours	8% a	13% a, b	22% b	13%
More than 4 hours	10% a	5% a	14% a	10%
		Video Games		
Less than 1 hour	62% a	62% a	66% a	63%
1-2 hours	21% a	16% a	12% a	17%
3-4 hours	9% a	5% a	8% a	8%
More than 4 hours	8% a	16% a	14% a	12%
		iPod or MP3 player		
Less than 1 hour	50% a	51% a	46% a	49%
1-2 hours	26% a	18% a	22% a	23%
3-4 hours	17% a	22% a	17% a	63%
More than 4 hours	8% a	9% a	15% a	10%
		Cell Phone		
Less than 1 hour	9% a	20% a	17% a	14%
1-2 hours	34% a	35% a	19% a	30%
3-4 hours	22% a	22% a	27% a	24%
More than 4 hours	33% a	24% a	37% a	32%

Values within rows with different letters are significantly different P= <0.05

Taking into consideration all of the different devices at the fingertips of today's adolescents, the questionnaire also asked students to respond to how much time they felt they spent using any form of electronic device during the day. There was an even distribution

amongst the response categories across all demographics during the school year: 29% of students across demographics reported to using electronic devices 1-2 hours per day; 33% for 3-4 hours per day; and 31% spend 4+ hours per day on some sort of electronic device. Since the study did not specify whether or not electronics were used during the school day, these numbers account for the entire day during the school year. Student responses to the same questions involving the summer months remained fairly consistent; however, there was a slight increase in students reporting spending 4+ hours per day on electronic devices (37%).

Students were also asked about their time spent outdoors to compare to electronic use, specifically how often they spend time outside each day during the school year (Table 5.4). The most common response across demographics was only 1-2 hours. Significant differences were seen between large metropolitan/inner city schools and urban cluster and rural schools in that large metropolitan/inner city students spent less time outside when compared to students in the other demographic categories. During the summer months, the majority of students reported spending over 4 hours outside each day. As time outside does not need to be in direct competition with time spent on electronics, students were asked how much time they spend outside each day on an electronic device. Students reported that they spend less than one hour outside per day while on an electronic device, and results indicate that students from rural areas are spending more time than their peers from other demographics outdoors on electronic devices. The majority (84%) of students reported spending less than two hours per day in nature and 1-2 hours per day in nature using some sort of electronic device. Similar results were reported in a national kids survey from 2011 finding that over 65% of those surveyed responded that using electronic media was one of their frequent outdoor activities. Additionally, they found that a majority of children spent a minimum of two hours outside each day (Larson et al., 2011).

Table 5.4. Response rates of students to spending time outside.

	Rural	Urban Cluster	Large Metro/ Inner city	Total Student Response
		Time outside each day during the school year		
Less than 1 hour	17% a	31% a	27% a	24%
1-2 hours	47% a, b	38% b	61% a	49%
3-4 hours	29% a	24% a	7% b	21%
More than 4 hours	8% a	7% a	5% a	7%
		Time outside each day during the summer		
Less than 1 hour	1% a	5% a	2% a	2%
1-2 hours	6% a	15% a	17% a	11%
3-4 hours	31% a, b	15% b	34% a	27%
More than 4 hours	62% a	65% a	47% a	59%
		Time outside each day on an electronic device		
Less than 1 hour	59% a	80% b	68% a, b	67%
1-2 hours	22% a	9% a	22% a	19%
3-4 hours	8% a	5% a	3% a	6%
More than 4 hours	11% a	5% a	7% a	8%
		Time spent in nature each day		
Less than 1 hour	37% a	47% a	46% a	42%
1-2 hours	41% a	40% a	44% a	42%
3-4 hours	16% a	11% a	5% a	11%
More than 4 hours	7% a	2% a	5% a	5%
		Time spent in nature on an electronic device each day		
Less than 1 hour	66% a	84% a	78% a	74%
1-2 hours	23% a	11% a	20% a	19%
3-4 hours	6% a	4% a	2% a	4%
More than 4 hours	4% a	2% a	0% a	2%

Values within rows with different letters are significantly different P= <0.05

To gauge how students perceived nature and how they defined it, the survey asked students a series of picture questions from a variety of rural to urban landscapes and asked students to circle images they feel would constitute nature. Overall, when students were asked to circle which images they define as nature, there were no significant difference amongst demographics. Students, regardless of their demographics, perceived nature very similarly. Based on the range of questions student tend to define nature as an area with mature green space

(trees, plants, grass), water, and a lack of impermeable surfaces or infrastructure (roads, buildings, sidewalks). A study gauging the perceptions of teens and adults about green space in Los Angeles found similar findings. Teens in the study stressed the importance of green spaces and when discussing parks located in the urban setting, there was distaste for all impermeable surfaces or as they described, "all the paved cement" (Gearin & Kahle, 2006).

To conclude, the study attempted to understand the types of activities students participated in while in nature and gave the following options: biking; camping; climbing; boating/canoeing; sports activities; fishing; swimming; skiing; reading; hiking/walking; hunting; snowshoeing; and bird/plant watching. In most cases, there was little to no differences amongst demographics with the following percent of students across demographics reporting: 75% bike, 64% camp, 64% boat or canoe, 75% participated in sport activities, and 79% swim as an activity (Table 5.5). The majority of students (87%) do not partake in bird/plant watching or snowshoeing (92%). Additionally, 82% of students do not participate in climbing and the most common responses across demographics indicated that students do not actively participate in reading outdoors or skiing. In terms of hunting, significant differences were found between rural students and pupils from large metropolitan/inner city and urban cluster areas; 64% of rural students reported hunting while only 33% of urban cluster students and 20% of large metropolitan/ inner city students participate in hunting. Significant differences were also found when students were asked if walking/hiking was an activity they participated in while in nature; 56% of rural students indicated that they do, while 76% of urban cluster and 85% of large metropolitan/inner city students reported that they also walk and/or hike in nature. This indicates that either students in urban areas walk/hike more often, or they take part in these activities

outside more often than rural students. A national kids survey by Larson et al. (2011) also attempted to quantify the outdoor activities that youth around the nation take part in.

Table 5.5. Activities students participate in outdoors.

Activities in nature	Rural	Urban Cluster	Large Metropolitan/Inner City	Total Student Response
Biking	71% a	84% a	75% a	75%
Camping	67% a	64% a	61% a	64%
Climbing	10% a	25% b	24% a, b	18%
Boat/Canoeing	59% a	69% a	68% a	64%
Sports	78% a	76% a	71% a	75%
Fishing	71% a	55% a, b	51% b	61%
Swimming	79% a	80% a	78% a	79%
Skiing	19% a	38% b	34% a, b	28%
Reading/Study	34% a	31% a	51% a	38%
Hike/Walking	56% a	76% b	85% b	70%
Hunting	64% a	33% b	20% b	43%
Snowshoeing	8% a	9% a	7% a	8%
Bird/Plant watching	11% a	15% a	14% a	13%

Values within rows with different letters are significantly different P= <0.05

The survey found nationally that 30.7% of students were taking part in bird watching and wildlife viewing and 29% were taking part in hiking and camping (Larson et al., 2011). Comparing these results to Minnesota and the current survey, it appears that Minnesota youth are taking part in camping and hiking more much more often than the national average, but Minnesota students are doing less bird watching.

5.5. Conclusion

The purpose of this study was to understand how students across the demographics of rural, urban cluster, and large metropolitan/inner city understand the natural environment. The study aimed to understand their knowledge, perceptions, and behavioral patterns regarding the outdoors and what may constitute as nature. With research indicating that an adolescent's

detachment from nature may be due to increased technology, this study also sought to gauge how often students are using different forms of technology.

The results indicate that time spent in front of the television or computer have actually diminished when compared to rates of the past. However, with each student having on average at least two personal electronic devices, there is no doubt that adolescents have more access to phones, the internet, and other electronics than ever before and are likely spreading their time between those electronics. While students are still spending some time outdoors, greater time outdoors is being spent plugged into these devices. Students were more inclined to feel discomfort with the insects and animals they may find in nature, but not nature itself; though they did not necessarily understand which animals naturally lived in their area. Additionally, we found that students across demographics generally view nature the same; as an area devoid of impermeable surfaces and infrastructure and rich in mature green space.

With the NAAEE setting a priority to create environmentally literate citizens (NAAEE, 2011), student interactions and perceptions with nature will play a significant role in understanding how to create these literate citizens. This research can assist environmental educators in developing appropriate curriculum that can be utilized to meet the goal of building environmentally literate citizenry. A one size fits all approach may not work across all demographics; therefore, it is imperative to understand differing perceptions and knowledge bases in order to educate students properly. This survey may also be further developed, expanded, or replicated to gauge if adolescents from other regions of the country interpret and perceive the environment the same way and how their behavioral patterns towards nature are impacted by their understanding of it.

5.6. References

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1).

Bixler, R. D., Carlisle, C. L., Hammltt, W. E., & Floyd, M. F. (1994). Observed fears and discomforts among urban students on field trips to wildland areas. *The Journal of Environmental Education*, *26*(1).

Bixler, R. D., & Floyd, M. F. (1997). Nature is scary, disgusting, and uncomfortable. *Environment and behavior*, *29*(4).

Clements, R., & Jarrett, O. (2000). Elementary school recess: then and now. *Streamlined Semin*, *18*(4).

Clements, R. (2004). An investigation of the status of outdoor play. *Contemporary issues in early childhood*, *5*(1).

Elliott, C. (2008). Assessing 'fun foods': nutritional content and analysis of supermarket foods targeted at children. *Obesity Reviews*, *9*(4).

Ernst, J., & Monroe, M. (2004). The effects of environment-based education on students' critical thinking skills and disposition toward critical thinking. *Environmental Education Research*, *10*(4).

Frumkin, H., & Louv, R. (2007). Conserving land; Preserving human health. *The Future of Land Conservation in America*.

Gaster, S. (1991). Urban children's access to their neighborhood changes over three generations. *Environment and Behavior*, *23*(1).

Gearin, E., & Kahle, C. (2006). Teen and adult perceptions of urban green space Los Angeles. *Children Youth and Environments*, *16*(1).

George, D., & Mallery, P. (2012). IBM SPSS Statistics 19 Step by Step: A Simple Guide and Reference. Pearson Publishing.

Hofferth, S. L., & Curtin, S. (2006). *Changes in children's time*. 1997–2002/3: An update.

Hofferth, S. L. (2009). Changes in American children's time–1997 to 2003. *Electronic International Journal of Time Use Research*, *6*(1).

Kahn, P. H. (2002). Children's affiliations with nature: Structure, development, and the problem of environmental generational amnesia. *Children and nature: Psychological, sociocultural, and evolutionary investigations*.

Kahn, P. H., & Kellert, S. R. (2002). *Children and nature: Psychological, sociocultural, and evolutionary investigations*. MIT Press.

Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. CUP Archive.
Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, *15*(3).

Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. *Children and nature: Psychological, sociocultural, and evolutionary investigations*.

Kellert, S. R. (1984). Urban American perceptions of animals and the natural environment. *Urban ecology*, *8*(3).

Kellert, S.R. (2005). *Building for life: Designing and understanding the human-nature connection.* Island Press, Washington, DC.

Larson, L. R., Green, G. T., & Cordell, H. K. (2011). Childrens time outdoors: Results and implications of the National Kids Survey. *Journal of Park and Recreation Administration*, *29*(2).

Lenhart, A., Maddenn, M., & Hitlin, P. (2005). Teens and technology: Youth are leading the transition to a fully wired and mobile nation.

Lenhart, A., Kahne, J., Middaugh, E., Macgill, A. R., Evans, C., & Vitak, J. (2008). Teens, video games, and civics: teens' gaming experiences are diverse and include significant social interaction and civic engagement. *Pew internet & American life project*.

Lenhart, A. (2015). Teens, social media & technology overview 2015. *Pew Research Center*, *9*.

Louv, R. (2005). Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder. New York, NY: Workman Publishing Company, Inc.: 2.

Louv, R. (2007). Leave no child inside. *Orion Magazine*, *57*(11).

McCurdy, L. E., Winterbottom, K. E., Mehta, S. S., & Roberts, J. R. (2010). Using nature and outdoor activity to improve children's health. *Current problems in Pediatric and Adolescent Health Care*, *40*(5).

Milligan, C., & Bingley, A. (2007). Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. *Health & Place*, *13*(4).

National Education Association. (2016). Green schools and environmental education. Accessed August 16, 2016; http://www.nea.org/home/Green-Schools-Environmental-Education.html.

North American Association for Environmental Education. (2011). Environmental literacy framework. Accessed August 4, 2016; https://naaee.org/our-work/programs/environmental-literacy-framework. Washington, D.C.

Peter, J., & Valkenburg, P. M. (2006). Adolescents' internet use: Testing the "disappearing digital divide" versus the "emerging digital differentiation" approach. *Poetics*, *34*(4).

Pyle, R. M. (2002). Eden in a vacant lot: Special places, species, and kids in the neighborhood of life. *Children and nature: Psychological, sociocultural, and evolutionary investigations*, 305-327.

Rivkin, M. S. (2000). Outdoor Experiences for Young Children. ERIC Digest.

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). Generation M [superscript 2]: Media in the Lives of 8-to 18-Year-Olds. *Henry J. Kaiser Family Foundation*.

Sanger, J., Wilson, J., Davies, B., & Whittaker, R. (1997). *Young children, videos and computer games: Issues for teachers and parents*. Psychology Press.

Sobel, D. (1990). A place in the world: Adults' memories of childhood's special places. *Children's Environments Quarterly*.

Subrahmanyam, K., Greenfield, P., Kraut, R., & Gross, E. (2001). The impact of computer use on children's and adolescents' development. *Journal of Applied Developmental Psychology*, *22*(1).

Taylor, A. F., Wiley, A., Kuo, F. E., & Sullivan, W. C. (1998). Growing up in the inner city green spaces as places to grow. *Environment and Behavior*, *30*(1).

Taylor, A. F., Kuo, F. E., Spencer, C., & Blades, M. (2006). Is contact with nature important for healthy child development? State of the evidence. *Children and their environments: Learning, using and designing spaces*, *124*.

United Nations. (2007). World urbanization prospects the 2007 revision. Accessed August 24, 2016; http://www.un.org/esa/population/publications/wup2007/2007WUP_Highlights_web.pdf. New York, NY.

United Nations. (2014). World's population increasingly urban with more than half living in urban areas. New York, NY.

United States Census Bureau. (1994). Chapter 13: Metropolitan Areas. Geographic Reference Manual.

United States Census Bureau. (2015). 2010 Census Urban and Rural Classification. Geographic Reference Manual.

Wells, N. M. (2000). At home with nature effects of "greenness" on children's cognitive functioning. *Environment and Behavior*, *32*(6).

Zaradic, P. & Pergams, O. (2007). *Kids Picking TV Over Trees.* Children and Nature Network: http://www.childrenandnature.org/news/detail/kids_picking_tv_over_trees/.

CHAPTER 6. THE CHALLENGES OF CONDUCTING RESEARCH WITH ADOLESCENTS IN A PUBLIC SCHOOL SETTING

6.1. Abstract

Understanding the knowledge, perceptions, and behavioral patterns of adolescents is an integral part of creating better curriculum and educational requirements. Research with children is a fundamental asset in the evolution of educational standards and requirements. This study explores the challenges presented while working with a protected population in a public school setting in terms of Institutional Review Board standards, the complex process of a researcher gaining access to the public schools, and the difficulty in attaining both parental consent and youth assent. A total, of 39 school districts throughout the state of Minnesota were invited to participate in this study; school districts were contacted from three demographics including: 1) large metropolitan/inner city; 2) urban cluster; and 3) rural. Overall, participation rates among all demographics were challenging and fell short of the intended goals of researchers, though rural populations were the easiest to gain access to when compared to the urban cluster and large metropolitan/inner city students. The ongoing complexities of gaining access to adolescents in a public school setting will likely hinder ongoing education research and may cause future problems in determining what students actually know and creating appropriate education materials based on this information. Information from this study can be utilized by researchers and educators to better understand the current challenges that exist when using children as research subjects in a school setting. Further, the challenges set forth in this study can help individuals better navigate the process of working with children and can be applied to future studies.

6.2. Introduction

Research endeavors surrounding children have allowed researchers to gain insight into the lives of youth for many years. However, research in the social realm has just recently become a norm (France, 2004) with greater interest into the social study of children (Mayall, 2001). Judith Masson contends that one cannot understand education without incorporating the perspective of a child (Masson, 2004). Further, many researchers argue that in order to fully understand the development of a child and how they go about constructing their lives, research on children is imperative (France, 2004; Lewis, 2004; Masson, 2004; Einarsdóttir, 2007). Additionally, giving children a voice and interpreting that voice allows researchers to better understand their perceptions, perspectives, and lives (France, 2004; Dockett et al., 2009).

Even though understanding the perspectives of children and adolescents is very important, it is very challenging in today's world to conduct research that involves this population. Part of the reason research with children is so challenging is because children are considered a vulnerable and protected population (Belmont Report, 1979). Following the Tuskegee Study of Untreated Syphilis in the Negro Male between the 1930s and the 1970s, congress signed into law the National Research Act (1974) that addressed biomedical and behavior research in the United States. Out of this act came the Belmont Report of 1979 which set guidelines for conducting biomedical and behavior research and establishing definitions for protected and vulnerable populations, one being children; those under the age of 18 as defined by the United Nations Convention on the Rights of a Child (CRC) (1989). In addition to the CRC (1989), numerous other countries also have laws in place protecting children in regards to medical and social research including: The Children Order 1995 (Northern Ireland); The

Children Act 1989 (United Kingdom); and The Children Act 1995 (Scotland) which all set parameters for research on children.

To date, numerous articles discuss the ethical concerns of working with children (Morrow & Richards, 1996; Cree et al., 2002; Einarsdóttir, 2007; Dockett et al., 2009; Fargas-Malet et al., 2010), but relatively few articles look at the specific challenges of working with children in a public school setting (Oakley, 2000) and none focus on public school settings across demographics. This article was written to inform new researchers planning to work with adolescents under 18 in their research and the challenges they may face in the process. The specific objectives of the study are to explain the challenges presented while conducting research with adolescents in a public school setting, outline how to obtain approval from different gatekeepers within a school setting, and explain how these challenges may differ across demographics.

6.3. Methods

The process to gain access to public schools throughout the state of Minnesota began in February of 2015 and concluded in October of 2015. The study focused on schools located within the state of Minnesota in order to ensure that all students were held to the same education standards. Three demographic areas were defined and utilized in this research: 1) large metropolitan/inner city; 2) urban cluster; and 3) rural. Large metropolitan/inner city was adapted from the United States Census Bureau's definition of urban which consists of any area with populations exceeding 50,000 people (USCB, 2015). Further, large metropolitan areas are considered centralized areas made up of surrounding communities to form large populations (USCB, 1994), for the current project the metropolitan area was over three million. In the case of this research, inner city populations existed within the school district of our large metropolitan

areas, hence why the two have been combined to form one demographic category. The inner city can be considered a disadvantaged area that suffers from 'physical deterioration' and 'social disturbances' (Peng et al., 1992). The second demographic used in the study is an area that is less than 50,000 people, but greater than 2,500 and is defined by the US Census Bureau as an urban cluster (USCB, 2015). Finally, although not specifically defined numerically, the United States Census Bureau eludes to the definition of rural as being anything not classified as an urban area (USCB, 2015). Thus, for the current study we defined a rural population as one that consists of 2,500 residents or less.

The information for this article is based on research data that was taken as part of a larger research project. The objectives of the project were to assess tenth grade high school students across the demographics of rural, urban cluster, and large metropolitan/inner city area understanding of environmental topics. An initial goal was to support a sample size of 100 high school students from each demographic area. A survey questionnaire using Likert scale, matching, yes/no, and picture questions were to assess the students' knowledge on the topics.

6.4. Results and Discussion

Conducting research using the responses of adolescents proved both challenging and at times, problematic for researchers. Following the implementation of the process, and results of the final study, three challenges presented themselves: 1) the prolonged and labor intensive process of gaining Institutional Review Board (IRB) approval and working with a protected population, 2) the process of gaining consent for participation varied with each demographic area and proved troublesome at numerous points throughout the study period, and 3) gaining parental consent and written youth assent.

To ensure that the rights of the sample population (tenth grade students) were protected, a comprehensive research proposal containing parameters of the projected study, a completed survey document, parental permission slips, and youth assent forms were submitted to the research institution's (North Dakota State University (NDSU)) IRB. According the United States Department of Health and Human Services (HHS), an IRB must review research proposals based on the following: minimal risk to participants; equitable selection of participants; the inclusion of safeguards if the research project is using vulnerable participants; documentation of informed consent must be obtained; data must be monitored continuously; and participant privacy is to be maintained (HHS, 1979).

Once researchers had completed the original application process to the IRB at NDSU and been approved, researchers had to complete three additional rounds of edits prior to being granted final permission to work with the schools selected to participate in the study. Since children are considered a protected population (Belmont Report, 1979), any changes to verbiage in any document had to be resubmitted to the IRB for re-approval to ensure that research criteria were still maintained. Since this research project was seeking perceptions, knowledge, and behavioral patterns with youth, the process had to ensure that there was little no minimal risk being done to the respondents and that their rights were considered. Since researching youth in regards to the social sciences has only become more sought after only recently (France, 2004), more and more researchers are utilizing the idea of completing research *with* the child as opposed to conducting research *on* the child (O'Kane, 2000; Curtis et al., 2004; Masson, 2004; Neill, 2005; Einarsdóttir, 2007; Fargas-Malet et al., 2010).

Following final approval of the research application, investigators began to contact schools within each of the demographic categories previously selected throughout the state of

Minnesota. This process brought about the second challenge to researchers; it became apparent early on in the study that different demographic locations and school districts have different standards in terms of consent and research approval. Table 6.1 details the consent process of the schools in each demographic area, as experienced by researchers. Eleven school districts defined as rural were invited to participate in this research, a total of 19 urban cluster school districts, and 9 large metropolitan/inner city school districts. Figure 6.1 shows percentage rates of schools contacted versus those that participated. It is important to note that the state of Minnesota currently contains five areas that would qualify as large metropolitan areas with different schools located within these areas (USCB, 2015).

Table 6.1. Process of obtaining permission to conduct a survey in different public school settings across demographics.

Rural Areas	**Urban Cluster Areas**	**Large metropolitan/ Inner City Areas**
Complete Proposal with all needed portions	Complete Proposal with all needed portions	Complete Proposal with all needed portions
Conduct Institutional IRB Review	Conduct Institutional IRB Review	Conduct Institutional IRB Review
Consent Required from the following:	Consent Required from the following:	Consent Required from the following:
School Principal	School Principal	Research and Evaluation Department
Teacher	Department Chair	Superintendent
Parent Permission	Teacher	School Principal
Youth Assent	Parent Permission	Teacher
	Youth Assent	Parent Permission
		Youth Assent

As referenced above in Table 6.1, the larger the populations of the area, the more steps were needed in the consent process to work with children in the public school systems, thus making the permission process more complex in large metropolitan/inner city school districts than those of urban cluster or rural.

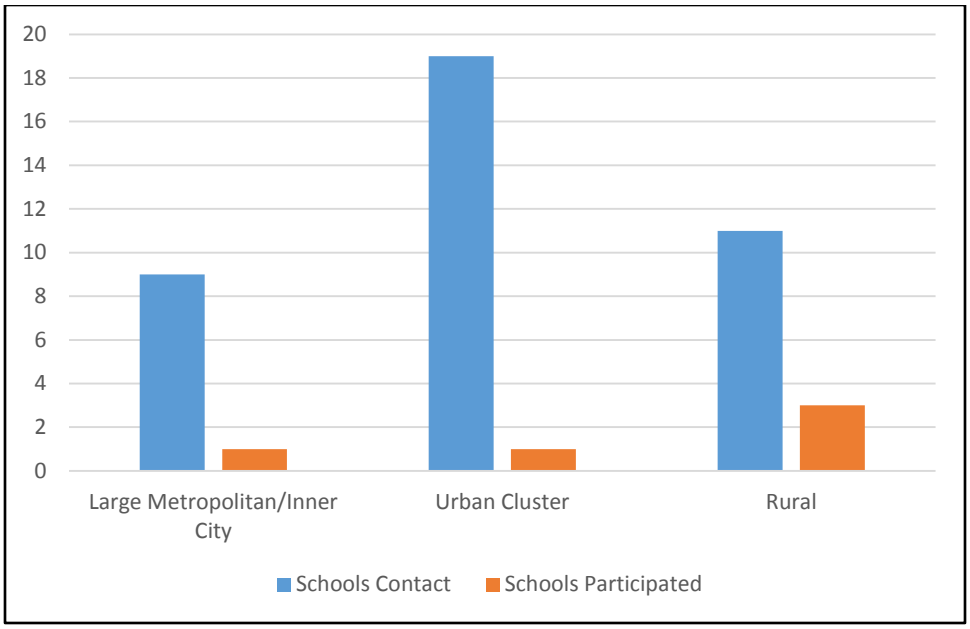


Figure 6.1. Participation rates of schools contacted versus schools participated.

In February of 2015, permission was obtained to research in a large metropolitan/inner city school district in the state of Minnesota. This district served multiple high schools, thus accounting for more than 100 participants between all of the schools. In August, researchers were made aware that an administrative shift over the summer months negated original approval and the study was forced to seek out other large metropolitan/inner city school districts to fulfill the sample goal. School district policy had changed allowing only district staff and faculty to conduct research for continuing education purposes or those staff members seeking master or doctoral degrees; a trend that is becoming more common with large school districts. Further, another trend emerged as researchers were made aware that under no circumstances were surveys as a method of research allowed to be distributed due to the time it would take away from class time.

In late August of 2015 researchers began contacting the remaining four urban areas in the state of Minnesota and their respective school districts to obtain approval to research in the schools. Four of the schools/districts immediately rejected the request. One district never

responded and the other three cited lack of time, not sure of the benefits and how results would be significant for their students or districts. Additionally, they also stated that all research conducted in the schools was reserved for current district faculty. Three additional school districts were contacted and requested that researchers complete an application process similar to that of an IRB through the district research, evaluation, and assessment departments. These applications also consisted of study proposals, definitions, the survey document, parental permission forms, youth assent forms, and an approval form verifying that the research institution's IRB had approved the project. In each of these cases, all applications were denied citing responses similar to those mentioned above. In the end only one school district/principal within an urban area and containing demographics consistent with that of large metropolitan/inner city, allowed researchers to contact tenth grade science teachers and approved the study to be conducted within the school.

The next phase in the process, and for some demographics this served as the initial phase, was to contact school principals. In the demographic areas of rural and urban cluster this was the initial step and in large metropolitan/inner city areas this was done once and if approval was granted from the research, evaluation, and assessment department. School principals were originally called via telephone and if unavailable, a voicemail was left followed by email correspondence. If there was no response the principals were then contacted for a final time 14 days after initial contact. Principals cited reasons such as not enough time, it would be up to the discretion of the teacher and they do not see the benefit to their particular school due to it being an environmental education study, collection of consent forms is too challenging, for not participating. Communication with school principals and superintendents in the other demographic areas proved, at times, just as challenging (Figure 6.1). Nineteen school

superintendents and/or principals within the demographic of urban cluster were contacted to participate in the study; only one school opted to take part in the research. Of the eleven rural school principals contacted, three agreed to participate in the project. These challenges were not surprising as other studies have also reported that research using children as participants is often complex and challenging; requiring access from multiple 'gatekeepers' (Butler & Williamson, 1996; Morrow & Richards, 1996; Masson, 2004; Oakley, 2000).

If school principals were in agreement to participate in the research, contact was made with the classroom teachers directly or through department chairs, who then made contact with the individual teachers. Teachers were asked to collect parental permission slips and youth assent forms for each child to ensure that only children with all levels of consent provided were allowed to participate in the study. Additionally, teachers were asked to allow up to 30 minutes of one class period to conduct the survey. Teachers and students were not provided with any incentives to participate in the research study. Parents and students were allowed to request a copy of the final research results at the completion of the project if they were interested. To the benefit of this study, once approval was granted from the respective school principals, the teacher participation rate was 100%. Further, challenges seemed to emerge amongst higher level gatekeepers such as superintendents and principals, as researchers found that a willingness to be flexible and accommodating to teacher schedules yielded active and friendly communication and concluded such actions led to a higher response rate from teachers willing to participate.

The original goal of researchers was to obtain 100 research participants from each demographic area surveyed. Figure 6.2 shows the breakdown of participation rates of students by demographic. In total, 204 participants out of a potential 543 participated in the research study, thus accounting for a 37% participation rate in the study. Participation rates in rural

schools was over 95%, while urban cluster was 26% and large metropolitan/inner city yielded a 30% participation rate. We did not analyze the reason for participation or lack thereof across demographics as these were not built into our IRB questionnaire, but it is important to realize participation rate can take into account many factors such as, students being absent the day of the survey, lack of parental permission slip, or simply not wanting to participate in the research. Difficulty obtaining permission to research in the schools as opposed to students not wanting to participate proved to be the greatest challenge of the study.

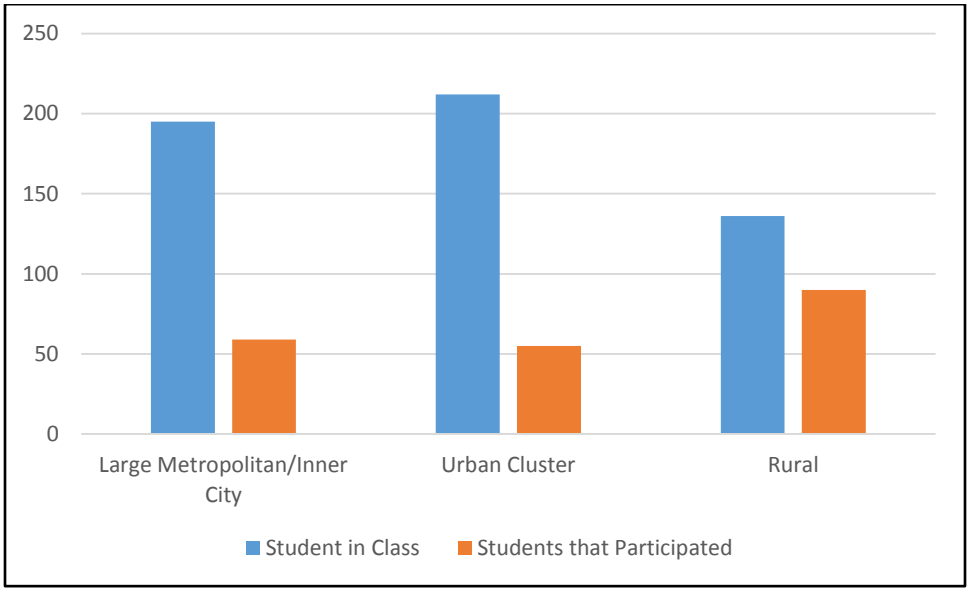


Figure 6.2. Student participation in survey by demographic.

The final challenge presented to researchers was obtaining written parental permission and written youth assent, an issue also identified by other researchers (Lewis, 2004; Einarsdóttir, 2007; Dockett et al., 2009). Using the definition of child as set forth by the United Nations CRC, Alderson (1995) indicated that when someone is under the age of 18, the main consent is provided by the pupil's parents or legal guardians (Alderson, 1995), and researchers should realize parental permission is required from a legal standpoint (Masson, 2004). As per regulations from the Federal Government and NDSU's IRB, parental consent had to be granted by one or both parents in order for a child to participate in the research study. While not drawing

on one specific reason for low participation rates, researchers of this study were able to conclude that lack of parental permission was a contributing factor.

Youth assent is the second part to this challenge; defined by Ford et al. (2007) as an 'agreement obtained from those who are not able to enter into a legal contract'. A concern regarding youth assent is that children (youth) must be able to fully understand what the research entails and how it effects them (Morrow & Richards, 1996; Thomas & O'Kane, 1998; Cree et al., 2002; Masson, 2004). An important factor for children to understand, as they become a population that is more readily researched, is that their choice to participate in research is not dependent on their parent's choice to sign a permission slip. Some researchers even argue that having parents provide permission or consent in a sense can rob the child of having a say in their own participation (Masson, 2004; Neill, 2005). Youth assent is another contributing factor that this study can only assume impacted response rates. Dockett et al. (2009) refers to two studies; one from Iceland and one from Australia, in which, for some of the participants, parental permission was obtained for a research project but assent from the child was not. Fortunately, for the purposes of this study, all parental permission slips obtained were accompanied by a signed youth assent form.

6.5. Conclusion

Working with children in a public school setting proved both challenging and rewarding. In order to work with children for research purposes, there needs to be access and approval granted from multiple gatekeepers. These gatekeepers control the ability to reach the student population. This study found that, while there were issues getting permission from higher level gatekeepers, working with the actual classroom teachers was relatively easy. Additionally, while

obtaining parental and student permission did present a challenge, it is something that can be overcome once access to students is granted.

The study also found that more gatekeepers existed in larger school districts and areas with greater populations. Working to obtain access to the school becomes increasingly harder and less likely when more levels of permission are needed. If access to working with children and research continues to be limited, especially in larger urban areas, it will only limit the amount and type of research conducted, thus making it a greater challenge to understand what adolescents know and perceive. While conducting research on smaller schools was easier, one must consider that researching only students in certain demographics would bias information obtained about those students understanding of any given topic and would potentially then bias any curriculum based on the research. Additionally, the requirement in many large urban areas to only let faculty and staff within the school district conduct the research as part of their graduate work will greatly limit the potential of larger research studies conducted across multiple areas (regions, states, nations). These implications are important to keep in mind for anyone planning to conduct research with adolescents or other protected populations.

6.6. References

Alderson, P. (1995). *Listening to Children: Children, Ethics and Social Research.* London: Barnardos.

Butler, I. & Williamson, H. (1994). Children speak: children, trauma, and social work. London: NSPCC.

Cree, V. E., Kay, H., & Tisdall, K. (2002). Research with children: sharing the dilemmas. *Child & Family Social Work, 7*(1).

Curtis, K., Roberts, H., Copperman, J., Downie, A., & Liabo, K. (2004). 'How come I don't get asked no questions?'Researching 'hard to reach'children and teenagers. *Child & Family Social Work, 9*(2).

Dockett, S., Einarsdottir, J., & Perry, B. (2009). Researching with children: Ethical tensions. *Journal of Early Childhood Research*, *7*(3).

Einarsdóttir, J. (2007). Research with children: Methodological and ethical challenges. *European Early Childhood Education Research Journal*, *15*(2).

Fargas-Malet, M., McSherry, D., Larkin, E., & Robinson, C. (2010). Research with children: Methodological issues and innovative techniques. *Journal of Early Childhood Research*, *8*(2).

France, A. (2004). 'Young people,' in S. Fraser, V. Lewis, S. Ding, M. Kellett, & C. Robinson (eds). *Doing research with children and young people.* London, Sage.

Ford, K., Sankey, J., & Crisp, J. (2007). Development of children's assent documents using a child-centred approach. *Journal of Child Health Care*, *11*(1).

Lewis, V. (2004). 'An introduction,' in S. Fraser, V. Lewis, S. Ding, M. Kellett, & C. Robinson (eds). *Doing research with children and young people.* London, Sage.

Masson, J. (2004). 'The legal context,' in S. Fraser, V. Lewis, S. Ding, M. Kellett, & C. Robinson (eds). *Doing research with children and young people.* London, Sage.

Morrow, V., & Richards, M. (1996). The ethics of social research with children: An overview. *Children & society*, *10*(2).

Mayall, B, (2001). 'Understanding Childhoods: A London Study', in Alanen, L., Mayall, B. *Conceptualising Child-Adult Relations.* Routledge, London.

Neill, S. J. (2005). Research with children: a critical review of the guidelines. *Journal of Child Health Care*, *9*(1).

O'Kane, C. (2000). *The development of participatory techniques*. Falmer Press: London.

Oakley, M. (2000). 'Children and Young People and Care Proceedings' in Lewis A, & Lindsay G, (eds) *Researching Children's Perspectives,* Open University Press, Buckingham.

Peng, S., Wang, M., & Walberg, H. (1992). Demographic Disparities of Inner-City Eighth Graders. *Urban Education*, *26*(4).

Thomas, N., & O'kane, C. (1998). The ethics of participatory research with children. *Children & Society*, *12*(5).

Unicef. (1989). Convention on the Rights of the Child. Retrieved September 11, 2016.

United States Census Bureau. (1994). Chapter 13: Metropolitan Areas. Geographic Reference Manual.

United States Census Bureau. (2015). 2010 Census Urban and Rural Classification. Geographic Reference Manual.

United States Department of Health and Human Services. (1979). The Belmont Report. *Office for Human Research Protections (OHRP).* Retrieved September 9, 2016.

APPENDIX A. RECYCLING PERCEPTION SURVEY

Please indicate how often you have done each of the following in the last year

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____1. Recycled newspapers
_____2. Recycled magazines
_____3. Recycled pop or soda cans
_____4. Recycled aluminum food cans
_____5. Recycled plastic products
_____6. Recycled glass containers
_____7. Purposely purchased products in reusable or recyclable container
_____8. Purposely purchased products in a biodegradable container

Please indicate how often you do or have done the following

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____9. Recycle at home
_____10. Been taught about recycling in school

Please indicate how likely you would be to do the following if it were easily accessible

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____11. Recycle at school
_____12. Recycle at home

Please indicate how likely you are to agree with the following statements

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

_____13. Recycling is important to helping our planet
_____14. It is important that I recycle

15. Please identify recyclable products from the list shown below:

___ Newspaper ___ Glass Bottles ___ Food Waste

___ Pizza Boxes ___ Plastic Containers ___ Yard Waste

___ Plastic Bottle Lids ___ Aluminum Cans

___ Old Paint Cans ___ Used Notebook or Computer Paper

___Cell Phones ___Aluminum Foil

___Electronics ___Computers

16. Does your school currently have a recycling program in place?

Yes No I am not sure

17. What products are you able to recycle at school?

___ Beverage Cans ___ Paper ___Other, please specify:

___ Food Waste ___ Bottles _____

___ Biodegradable Utensils ___ Cardboard _____

18. Does your town currently have a recycling program in place or offer recycling options?

Yes No I am not sure

19. How likely would you be to recycle if you knew you were able to do so?

Always Sometimes Never Indifferent

APPENDIX B. FOOD PRODUCTION PERCEPTION SURVEY

Please indicate how often you have done each of the following in the last year

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____1. Purchased food from a grocery store
_____2. Purchased food from a gas station
_____3. Purchased food from a farmers market or farm stand
_____4. Looked at a food label to see where your food comes from
_____5. Purposely purchased organic food
_____6. Purposely consumed organic food
_____7. Consumed meat products
_____8. Gardened

Please indicate how often you do or have done the following

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____9. Been taught about food production or where food comes from in school
_____10. Been taught about environmental issues/concerns at school

Please indicate how likely you would be to do the following if it were easily accessible

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____11. Eat more fruits and vegetables
_____12. Grow your own food if you were taught
_____13. Eat only locally grown or processed food

Please indicate how often your household gets food for meals from the following sources

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____14. Grocery Store
_____15. Co-Op/ Health Store/ Natural foods store
_____16. Gas Station
_____17. Factory (Buy direct from the source, example: bakery)

_____18. Farmers Market
_____19. Garden
_____20. Hunting
_____21. Retail Store/Warehouse Store (Target, Walmart, Sam's Club, Costco, etc.)

Please indicate how likely you are to agree with the following statements

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

_____22. We have more than enough farmland in Minnesota
_____23. Most farming practices today require the use of pesticides and herbicides
_____24. Keeping farmers in business is important
_____25. Keeping farmers in business is important for our economy
_____26. Keeping farmers in business is important for our food sources
_____27. Soil is important in producing food
_____28. It is important to educate students about food production

29. How many fruits **and** vegetables do you consume on a daily basis?

0 1-3 4-6 7 or more

30. What is the daily-recommended serving of fruits **and** vegetables?

0 1-3 4-6 7 or more

31. Do you have easy access to fresh fruits and vegetables at home?

Yes No

32. How far do you travel to obtain fruits and vegetables for your home?

Less than 1 mile 1-2 miles 3-4 miles 5 miles or more

33. Do you have easy access to fresh fruits and vegetables at school?

Yes No

34. Here in the Midwest we are easily able to grow fruits and vegetables locally all year round?

Yes No I am not sure

35. Do you feel like you understand the process of what it takes to get food to the table?

Yes No

36. Match the following animal products with the animals they come from:

1. ___ Steak	
2. ___ Lamb Chops	
3. ___ Venison	A. Cows
4. ___ Milk	B. Pigs
5. ___ Chicken Strips	C. Sheep
6. ___ Hamburgers	D. Chickens
7. ___ Bacon	E. Deer
8. ___ Eggs	F. Buffalo
9. ___ Buffalo Wings	G. Rabbit
10. ___ Pork Chops	
11. ___ Veal	

37. Match the following products with its source that is typically grown in this area. (There may be multiple answers but you only need select one of them)

A. ___ Flour	A. Wheat
B. ___ Sugar	B. Corn
C. ___ Pasta	C. Potatoes
D. ___ Edamame	D. Cane
E. ___ Oil	E. Sunflowers
F. ___ Honey	F. Soybeans
G. ___ Maple Syrup	G. Cream
H. ___ Wild Rice	H. Canola
I. ___ Granola	I. Olives
J. ___ Butter	J. Bees
K. ___ Sunbutter	K. Tree
L. ___ Hashbrowns	L. Grass
M. ___ Apples	M. Beets
	N. Oats
	O. Barley
	P. Durum

APPENDIX C. NATURAL ENVIRONMENT PERCEPTION SURVEY

Please indicate how often you have done each of the following in the last year

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____1. Gone outside for activity
_____2. Gone outside to spend time in nature
_____3. Used some form of technology or media device for entertainment
_____4. Felt fearful of going outside
_____5. Felt fearful of exploring a natural area
_____6. Felt fearful of spending time in a natural area by yourself
_____7. Seen a live farm animal
_____8. Visited a farm where crops or animals are grown

Please indicate how comfortable you would be doing the following

1	2	3	4	5
Never	Rarely	Occasionally	Frequently	Always

_____9. Spending time in nature without any technology or media devices
_____10. Spending time in nature without any cell phone service or wireless capability
_____11. Exploring nature without your phone or electronic device available
_____12. Spending time alone in nature without any cell phone service or wireless capability

Please indicate how likely you are to agree with the following statements

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

_____13. It is important to spend time exploring natural areas without electronics
_____14. It is important to learn about environmental issues at school
_____15. Nature is a scary place to explore

16. Do you have your own personal cell phone?

Yes No

17. Do you have your own personal electronic devices (tablet, game system, etc)?

Yes No

18. Do you have access to a computer outside of school?

Yes No

19. Do you have access to the Internet outside of school?

Yes No

20. Using the images below, please circle the pictures that you would label as Nature:

21. On average, how much time do you spend outside each day during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

22. On average, how much time do you spend outside each day during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

23. One average, how much time do you spend **OUTSIDE** on an electronic device each day? (ex: cell phones, computers, video games, television, mp3/iPods, internet, etc.)

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

24. On average, how much time do you spend in a nature each day?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hour

25. On average, how much time do you spend in a nature each day using an electronic device?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

26. What kinds of activities do you partake in when in a nature?

___ Biking ___ Fishing ___ Hiking/Walking

___ Camping ___ Swimming ___ Hunting

___ Climbing ___ Skiing ___ Snowshoeing

___ Boat/Canoe ___ Reading/Study ___ Bird/Plant viewing

___ Sports Activities

27. On average, how much time do you spend using electronic devices (ex: cell phones, computers, video games, television, mp3/iPods, internet, etc.) each day during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

28. On average, how much time do you spend using electronic devices (ex: cell phones, computers, video games, television, mp3/iPods, internet, etc.) each day during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

29. How much time do you spend each day watching TV during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

30. How much time do you spend each day watching TV during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

31. How much time do you spend each day on the computer (outside of school) during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

32. How much time do you spend each day on the computer (outside of school) during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

33. How much time do you spend playing video games every day during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

34. How much time do you spend playing video games every day during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

35. How much time do you spend on an iPod or MP3 player every day during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

36. How much time do you spend on an iPod or MP3 player every day during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

37. How much time do you spend on your phone each day during the school year?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

38. How much time do you spend on your phone each day during the summer?

Less than 1 Hour 1-2 Hours 3-4 Hours More than 4 Hours

39. Would you spend time exploring nature without your phone or electronic device?

Yes No

40. Do you have any fear or discomforts being outside?

Yes No

41. Do you have any fear or discomforts exploring natural areas, i.e.- the woods, a secluded trail?

Yes No

42. Do you have any fears of or discomforts around insects or animals in natural areas?

Yes No

43. What kinds of animals do you think live in the natural environments around your town? (check all that apply)

___ Snakes ___ Bears ___ Insects ___Squirrels

___ Fish ___ Birds ___ Deer ___Mice/Rats