An Evaluation of Homeschool Students' Interest In Science and Science Careers

Capstone Project

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Abstract

This paper evaluates homeschoolers' interest in science and science careers. Studies by Phillips (2010) and Wheaton (2010) found that homeschool students do not major in natural science as frequently as non-homeschool students, or take as many, or high as level, of science courses as non-homeschool students. The purpose of this study was to determine if interest in science was a factor in homeschool students not majoring in natural science in college or taking as many science courses in high school. The study found that young homeschool students are interested in science but there was not conclusive data on whether homeschool students are interested in science careers. This paper also highlights some problems with teaching science in homeschool and provides recommendations for further research.

CHAPTER 1

Introduction

Twenty years ago, home schooling was illegal in the United States. The practice has faced much criticism and legal battles, but today, homeschooling is legal in all 50 states and is flourishing. According to a federal report, in 2008, 3% of the total K-12 population in the United States were homeschooled their children (Cogan, 2010). Although 3% may not seem like much, it is more than all the public school children in New York City and Los Angeles combined (Cogan, 2010). In 2009, there was an estimated 2 million homeschooled children in the United States and it is estimated that homeschooling will continue to grow by 11-15% every year (de Walle & Theron, 2003; Ray, 2010; Cloud & Morse, 2001; Reich, 2002). One of the reasons that homeschooling is growing is because of positive academic results.

Parents, school teachers and political leaders have curiously watched as homeschoolers have excelled as national spelling bee winners, state representatives and Supreme Court judges. Literature reports that homeschoolers perform as well, even outperform, non-homeschooled students on state and national achievement tests. Home schooled students go on to college at the same rate as non-homeschooled students (50%), and achieve similar college grade point averages (GPA) and graduation rates as non-homeschooled students (Aasen, 2010; Ray 2004; Ray, 2010; Wichers, 2001; Jones & Gloeckner, 2004; Klicka, 2007; Cogan 2010; Sorrey & Duggan, 2008).

Although there are many positive results attributed to homeschooling, some recent research reported that homeschooled students may not be as interested in science, as non-homeschooled students. A report by Philllips (2010) found that homeschoolers do

not choose natural science college majors as frequently as non-homeschooled students. It has also been reported that homeschoolers do not take as many, or as high of a level, of science classes in high school as non-homeschooled students (Wheaton, 2010). As the United States is trying to remain present in the science fields, this could be discouraging news.

What is causing homeschool students' to not choose science majors, or to take any more than the minimal requirements of science in high school? Phillips (2010) hypothesized that homeschool students lack science lessons taught by a professional science teacher, who could inspire them with a love of science. She went on to say that a lack of laboratory materials and equipment may make science seem boring. Wheaton (2010) found that parents might not have confidence to teach science, which may turn off many students. However, homeschool parents will go to great lengths to provide educational opportunities for their children, if the child shows interest in it (Aasen, 2010).

Learning environment can affect a student's positive or negative attitude toward science. If homeschool students are not being taught science in a method that sparks their interest, it could affect many other areas. Students' attitude about science can affect how well they perform in the subject. Students with positive attitudes toward science have higher achievement scores in science. Students with positive attitudes towards science also participate in more science classes and activities. Accordingly, science achievement and the number of science classes taken in high school are factors that influence students choice in a science college major (Jahangard, Soltani & Alinejad, 2016; Shaw & Barbuti, 2010; Trusy, 2002). Other than achievement scores, we know very little about how science is taught in homeschooling.

President Barack Obama (2007) said, "Today, more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation. It's time we once again put science at the top of our agenda and work to restore America's place as the world leader in science and technology". With a push to graduate more students in science, it will be important to universities, parents and curriculum providers to understand if the growing population of homeschooled students is being provided with necessities to create an interest in science.

Problem Statement

Research from Phillips (2010) and Wheaton (2010) reports that homeschooled students are not entering the field of natural science. This could be troubling information as the population of homeschoolers is growing and the United States is lacking qualified job applicants in the area of mathematics and science. Additionally, Wheaton (2010) reports that homeschool students do not take as many science courses as public school students, which could affect homeschooled students' interest in the science field.

It has been reported that "fewer than one in seven students in the United States receive a degree in science or engineering, compared to one out of every two students in China and two out of every three students in Singapore" (Soldner, Rowan-Kenyon, Kurotsuchi, Inkelas, Garvey, & Robbins, 2012, p. 311) . With a declining workforce in the sciences, it has been argued that America is less competitive in the global economy. With even less homeschoolers going into the science fields than non- homeschooled students, it is clear that there is a need for more research to be dedicated to studying homeschoolers interest towards science.

Purpose of the Study

The purpose of this study was to determine why students are not majoring in natural science or taking as many high level science courses. This study examined homeschooled students' interest in learning science and science careers to determine if interest is a reason why homeschool students are not majoring in natural science or taking as many high level science courses in high school. According to Holland's Career Theory, interest plays a role in choosing a career. Evaluating homeschool students' interest in science helps to determine why homeschool students are not majoring in science as much as students who do not homeschool.

Research Questions

What are homeschool students' interests in science classes and careers in science?

Setting/Participants

The participants are members of the Northland Core Facebook group, with most members located in Duluth, Minnesota; Superior, Wisconsin and surrounding towns in Northwest Wisconsin and Northeast Minnesota. The Northland Core Facebook group reports 383 members. The group provides information about local events and educational opportunities, along with a place for homeschoolers, or potential homeschoolers, to ask questions. Members can also ask for recommendations about curriculum, or sell curriculum. Duluth has a fairly large and organized homeschool community and a variety of local science, art, music and community centers.

Assumptions

Homeschoolers are very guarded and typically do not want information collected about them (Soczka, 2007). I did not get a very large response rate for this survey. Also, parents' whose children are interested in science will more readily provide information and return the survey as they want to disprove that homeschoolers do not choose science as a college major or career path. Homeschool families typically do not want to point out any negatives in the practice, even if it is to improve it. I homeschooled my daughter and from that experience I have some assumptions. I believe that homeschoolers get an abundance of hands-on science learning at a young age, but it is hard to provide in higher levels.

Limitations

Researching the homeschool population proves to have many limitations. The first for this research project is that the participants were limited to those on the Northland Core homeschool Facebook group site. There are homeschoolers that do not use the Facebook groups, but it is difficult to reach them. Additionally, the number of homeschooled students decrease as students get older. For many reasons, students will stop homeschooling as they get older and go to a public or private school. This study did not distinguish if a homeschool student has taken a science class from a public high school or community college. For this research project, reporting favorite subjects and career interests of younger students may not provide accurate information for what they may choose years later as a college major.

Definition of Key Terms

Non-Homeschooled - Students educated in a K-12 public, private or charter school

Homeschool- A method of education where the parents or guardian(s) provide the majority of the students' education.

Interest- The Merriam-Webster dictions define interest as, "a state of wanting to know or learn about something or someone".

Summary

Homeschooling is an alternative education method that has been growing in popularity over the past 20 years. Research on homeschooling has shown that homeschooling can produce high academic results and college-ready students. Overall, academic success is possible from homeschooling and it is a viable alternative education method. However, we still know very little about this population, specifically in college and adulthood. Recent research results indicated that homeschool students do not pick science as college majors and they are not completing as many high school science courses as non-homeschooled students. This is still an area that lacks sufficient research and more needs to be done to understand homeschooler's interest in science. This paper will explore what subjects homeschool students like, interests in science and science career

CHAPTER 2

Literature Review

There is a vast amount of opinion based information available about homeschooling, but little scientific research is available. I have seen no research papers that address homeschoolers interest in science. This research paper seeks to fill some of the gaps in knowledge about homeschooled students and science.

This literature review provides a brief background of homeschooling, including reasons why parents homeschool, the importance of support networks, curriculum styles, academic achievement and college admission processes. The research on interest in science and science careers is also reviewed.

Reasons Parents Homeschool

The reasons why parents decide to home school are vast, but religion, concern over the school environment and dissatisfaction with institutionalized academics are among the top reasons parents choose to home school (de Walle & Theron, 2003; Isenberg, 2007, nces.ed.gov, n.d.). Parents' reasons for home schooling are separated into two categories- pedagogical or ideological (Collom, 2005; Knowles, Marlow & Muchmore, 1992).

During the 1960s and 1970's, parents who were dissatisfied and mistrusting of public education formed a group. They were referred to as the pedagogues because of their pedagogical differences with public education (Duggan, 2009; Martin, 1997). "In general, these homeschoolers stood against the bureaucratization and professionalization of public schools and sought personalization and decentralization under family control"

(Collom, 2005, p. 309). Pedagogues believe that the quality of education at public schools is not adequate and that their children will not be given the help and attention that is necessary to succeed. This group of homeschoolers is very holistic and learner centered. This learning looked very different from public education as creativity and individuality was encouraged (Hanna, 2012).

By the 1980's, another influential group was formed – the ideologues. These families were concerned about the lack of faith teachings in public school and turned to homeschooling. These families are referred to as ideologues because of the ideological differences with public or private schools' ideas. Ray (2004) reported that nearly 75% of homeschooling families regularly attend religious services. Ideologues believe that homeschooling strengthens the family bond (Hanna, 2012). Martin (1997) found that parents like to incorporate religious teachings into all aspects of curriculum and pass along their values. Hanna (2012) reported that "Although the ideologues desired to be more controlling of their children's education, they oddly enough relied on publishers to provide materials/instruction for their children's education" (Hanna, 2012, p. 612). Parents follow published textbooks and simply take out the portions of the curriculum that they do not want their children to learn. Parents in this group also tend to dislike discipline methods of public or private institutions and want to protect their child from unwanted influences and beliefs.

There are many different reasons why parents decide to home school their children; whether it is an ideological or pedagogical reason, homeschooling parents are trying to foster the moral and mental well-being of their child while also providing them with a strong academic foundation. More research needs to be performed on

homeschooling to ensure homeschoolers are getting everything they need to be successful in all areas of life.

Formation of the HSLDA and Support Networks

Support networks are very important to home schooling families and have been monumental in shaping homeschooling (Martin, 1997). Support networks provide resources for families, a place to talk about homeschooling issues and also curriculum support (Martin, 1997). Support networks have fought some important battles in the home school movement, including legalization and providing homeschooling families the freedom from state education regulations and data collection.

During the 1980's, many school districts, following mandatory attendance rules, would treat homeschooling as truancy (Isenberg, 2007). In response to these regulations, and what some saw as personal attacks, home schooling families developed support networks. The networks of homeschooling families were in support of suppressing state regulations on homeschooling and legalizing it. In 1983, Moral Majority Leader, Michael Ferris, started the Home school Legal Defense Association (HSLDA), which is a national organization that provides legal assistance to homeschoolers (Isenberg, 2007). The formation of the HSLDA was seen as a great success as it gave homeschooling families national recognition and support. With the help of local and national homeschooling networks, homeschooling became legal in every state in 1993. Along with legalizing homeschooling, the networks of parents were also able to restrict the data collected and state regulations on them. In 1994, an amendment to the Elementary and Secondary Education Act tried to require that every full-time teacher be certified, including anyone

teaching in a home school (Isenberg, 2007). Homeschooling parents and organizations argued that the act was an attempt to abolish homeschooling. Through phone calls to state representatives, home school networks were able to get the amendment turned down by the House (Isenberg, 2007). In 2001, with the reauthorization of the act (called No Child Left Behind), Congress was clear that homeschooling was free from such provisions and the home school movement grew further (Isenberg, 2007).

Support networks are important for socialization and are helpful for curriculum sharing and questions. In Duluth, Minnesota, Northland Core is the homeschooling network with over 350 members on Facebook. The Northland Core group organizes field trips, classes, park days and special events for homeschool students. They also help homeschool families understand Minnesota homeschooling laws. Social networking has made connecting with homeschool networks easier and provided a platform for asking questions.

Large support networks, like the HSLD, continue to fight for legal rights of homeschoolers (Martin, 1997). The freedoms they fought for are still in place - homeschooling is legal in every state, very little data is collected on homeschooling children and individual states are able to regulate homeschooling policies (Lebeda, 2007). The smaller, community-based homeschool support networks continue to be important in providing homeschooling families curriculum support and socialization opportunities. If there are deficiencies in homeschool science curriculum, homeschool networks could work on bettering science learning for homeschoolers.

Teaching Methods

There are many different methods and curriculums that parents can choose to use for home schooling. Parents are often introduced to these methods through other parents, support networks and at homeschooling conventions (Martin, 1997). Some basic homeschool teaching methods are textbook, literature-based, internet-based and letting the student explore as he or she wishes. Homeschoolers also rely on public libraries, museums, community members, field trips and computer simulations for learning (Hanna, 2012). A homeschooling parent will typically use a range of methods and curriculums during their homeschooling years. Currently, there is a lack of literature available that indicates the effectiveness of these methods.

Textbook-based home schooling most resembles traditional school. There is a textbook for a specific subject that is for a specific grade level. Included in the materials are textbooks, workbooks, worksheets and tests. There are many textbook-based curriculums available from a range of publishers and at many different prices. Most of the text-books curriculums come from well-known authors and publishers (Clements, 2003). Parents using this method often purchase a complete curriculum, a package of textbooks that cover all subjects. Parents can choose a religious based curriculum or a secular one from a variety of publishers. "Approximately half of homeschooled students used curriculum or books from homeschooling organizations. Thirty-seven percent of homeschooled students used curriculum or books from a church, synagogue or other religious institution and 23 percent used a curriculum or books from their local public school or district" (National Center for Education Statistics, 2003). Many parents start out using this method and then veer from it as they become more comfortable with home

schooling. A qualitative study by Clements (2003) found that parents report making curriculum decisions to "accommodate weaknesses in the teaching parent" and also to accommodate "characteristics of the children" (p. 5). Textbook-based homeschooling a very structured approached. In a study by Martin-Chang, Gould and Meuse (2011) it was found that homeschooled students in a structured environment outperformed students in public school in seven areas of the Woodcock-Johnson subtest: letter-word, comprehension, word attack, science, social science, humanities, and calculation. Martin-Chang, Gould and Meuse (2011) also concluded that structured homeschooling can provide experiences beyond what can be found in public schools.

Another approach for teaching home school is literature-based. Instead of using textbooks, a literature book is used to gain biographical or historical information. This approach is also referred to as the Charlotte Mason Method after British Educator Charlotte Mason who was revolutionary in using living books for learning. Literature-based curriculum can be a cheaper option to buying a textbook as many books can be located at a public library. Parents using this approach would need to be rather familiar with literature and understand how to develop an assessment (Clements, 2003). However, you can buy a pre-packaged literature-based curriculum from a supplier.

Much like the text-book method, computer/internet based approaches are also used. Students can be taught through computer software, a variety of activities, lectures and quizzes. By utilizing the internet or video streaming, a student can watch classroom teacher teaching in front of an actually class and then follow along in with a textbook. In this case, the student is taught by someone other than a parent.

Indirect study; also known as "unschooling" or "de-schooling" is a less conventional form of homeschooling (Clements, 2003). "Unschooling" is the most unstructured type and also the most controversial (Clements, 2003). Unschooling assumes that children are "naturally curious and have an innate desire to learn and grow. "If left unfettered, uncovered, and unmanipulated, children will vigorously and with gusto pursue their interests, and thus learn and make meaning on their own and in concert with others" (Morrison, 2007, p. 43). Although unschooling is largely led by the students' interests and talents, the parent is also responsible for creating real-life learning experiences for the students in which the student is to "accumulate an understanding of the world" (Clements, 2003, p. 3). Students are often "free to decide what they study, and how and when they study it (Morrison, 2007, p. 43). Martin-Chang, Gould and Meuse (2011) found that homeschooled students using an unstructured curriculum performed lower than those using a structured curriculum. Martin (1997) reported that parents like that they can pick and choose curriculum as family and student needs change.

Benefits of Engaging in Hand-On Learning

Years of research has told us that hands-on learning is beneficial. Explorative learning can help students understand and connect with the information learned in their textbooks and also help with motivation and interest (Bonderup Doh, 2010; Nadelson & Jordan, 2012). "My belief is that if teachers can't relate what goes on in the classroom to the broader world outside of it, students are justified in questioning why their lessons are important" (Kropidlowski, 2006, p.70). The flexibility of homeschooling allows students ample time for hands-on exploring and learning. Hands-on learning has been shown to

increase students' critical thinking and also has been shown to help math and science scores and to increase students' interest in these fields.

In a study by Greene, Kisida and Bowen (2014) 10,912 surveys were administered to students at 123 different schools, three weeks after they had been on a tour of the Crystal Bridges Museum of American Art in Northwest Arkansas. It was discovered that students could recall a high percent of details and historical information about the paintings-70-80%. By having students write an essay about a painting, critical thinking skills were also analyzed. It was found that the students who visited the museum improved their critical thinking abilities about art by 9%, relative to the control group. The benefits for disadvantaged groups was considerable larger (Greene, Kisida and Bowen , p. 82). Researchers also found that students who visited the museum had higher historical empathy and tolerance for people and cultures that "lived in a different time and place" (Greene, Kisida and Bowen, p. 82). It was concluded from students' interest in the museum that such trips could cultivate a "lifetime of enhanced critical thinking, tolerance and historical empathy" (Greene, Kisida and Bowen, p. 84). In a study by Vacc, Ervin and Travis (1995), it was found that students in informal learning environments, like the zoological park used in the study, socialized and learned from each other more than if they were in a typical classroom environment. The researchers also found that the students were excited about mathematics and wanted to perform mathematics. The authors discovered that the zoo environment encouraged "students to raise questions, formulate conjectures and make sense of mathematics" (Vacc, Ervin and Travis, 1995, p.494). Similarly, Paris, Yambor, and Wai-Ling Packard (1998) found that students'

general attitudes about science became more positive after a 6-week extracurricular, hands-on, biology program.

The Danish Ministry of Education (UVM, 2008) and the National Research Council (NRC, 1996) both recommend that science teaching should be supplemented with field trips to museums and other institutions in order to stimulate students' interest and learning motivation" (as cited in Bonderup Doh, 2010, p 338).

With the flexibility of homeschool, parents are able to create hands-on learning experiences for their children. These experiences should increase students' interest in math and science. More research needs to be performed to describe hands-on learning experiences and how they may help increase homeschool students interest in STEM fields.

College Preparedness and Admission

Some administrators, policy makers and the general public are skeptical of homeschooling and wonder how students can learn from untrained teachers (Ray, 2010). Research has found that homeschooled children perform as well as non-homeschooled students on college preparation tests and in college (Wichers, 2001; Jones & Gloekner, 2004; Klicka, 2007).

Homeschooled students perform as well as non-homeschooled students on the college entrance exams, the American College Test (ACT) and Scholastic Aptitude Test (SAT). The 2006 average ACT composite score for home schooled students was 22.4 and the national average composite was 21.1 (Klicka, 2007). Ray (2004) reported, "Both the SAT and ACT publishers have reported for several years that the scores of the homeschooled are higher, on average, than those from public schools" (p. 8). Ray (2010)

reported that a national study performed in 2007 by Dr. Ray of the National Home Education Research Institute and the Home School Legal Defense Association (HSLDA) found that no gender differences exist on standardized tests amongst the home schooling population, which is typically observed with non-homeschooled students.

Homeschooling can prepare students to go to college after high school and perform well. Aasen (2010) states "Almost 75 percent of homeschoolers 18-24 years old attended college, completed a bachelor's, master's, doctoral, or professional degree" (p. 13). Additional research by Jones and Gloeckner (2007) found that, although not statistically significant, the average first-year GPAs, credits earned in the first year, ACT Composite test scores, were higher for home schooled students. However, Sutton and Galloway (2000) compared high school students from public, private and home school and found little difference in the areas of "achievement, professional aptitude, social behavior, and physical activity" and concluded that all three settings can prepare students well for college (as cited in Wessel & Bolle-Brummond, n.d., p. 226). Home schooling may have something that traditional schooling cannot provide; independence. Aasen (2010) says that homeschooling is good training for college as it fosters "independent learning" (p.13). Students learn how to find answers on their own and develop good study skills that make them able to dedicate time to learning and studying (Aasen, 2010). Although several factors in homeschooling achievement have been studied, nothing clearly points to having an effect on achievement (Ray, 2010).

Some colleges have started actively recruiting homeschooled students because of their high academic achievement (Ray, 2004; Wichers, 2001; Klicka, 2007). Home schooled students are a relatively new population for colleges and many are still working

on their admissions policies (Jones & Gloekner, 2004; Klicka 2007). Wood (2003) reported that The Homeschoolers College Admissions Handbook estimated three-quarters of universities have home school admission policies. Many times, college entrance exams are heavily weighed when home schooled students are considered for college admission because typically, homeschooled students lack an official high school transcript and class rank (Sorrey and Duggan, 2008). A portfolio of completed coursework is oftentimes accepted in lieu of high school transcripts (Klicka, 2007). More institutions are recognizing the needs of home schooled students and are creating admission processes so that college can be more easily accessible.

Although research states homeschoolers can perform well academically in college, there is a lack of research on the psychosocial aspects of homeschoolers in college. Additionally, because most states do not track the number of homeschooled students in the state, the numbers of students going on to college and doing well may not be an adequate representation of the homeschool population. More research needs to be performed in these areas to draw any clear conclusions on the performance of homeschooled students in college and what areas they are majoring in.

Career Development

Declaring a college major can be the first step to a career path. There are two career development theories that explain how people choose their majors or careers and if they will be satisfied doing them- Holland's (1993) Career Theory and the Social Cognitive Career Theory (SCCT). Both theories state that interests and environment are important in deciding a career. This section seeks to explain these theories and how they may apply to home school students' decision about majoring in science.

John Holland has numerous years of research on the subject of career decisions and his theory on the person-environment interaction is widely taught and used within the field of applied psychology. Holland's (1993) Career Theory states that, "A child's unique biological characteristics influence the child toward some activities and away from others. Environments (e.g., family, school, peers) offer reinforcement of particular activities as children learn and grow. This reciprocal socialization process results in the development of interests, skills and achievements, self-perceptions, styles, values, and traits. Individuals choose educational and work environments consistent with these personality characteristics" (as cited in Trusty, Ng & Ray, 2000, p. 50). Holland states that most people have one of these six personality types: R-realistic, I-investigative, A-artistic, S-social, E-enterprising, and C-conventional (Trusty, Ng & Ray, 2000). Accordingly, there are six work environments: R-realistic, I-investigative, A-artistic, S-social, E-enterprising, and C-conventional. To be most satisfied with your work, individuals should work in an environment that will best suit their personality; for example, artistic personalities would be most satisfied working in an artistic environment.

Research is needed to determine if homeschool students are developing an interest in science. Because homeschool students' environment is so different than other children it will be helpful to know if the environment lends itself to developing interests in science or if more will have to be done by parents and the community to facilitate that interest.

The Social Cognitive Career Theory (SCCT) is another leading career development theory. The roots of the Social Cognitive Career Theory are from Albert Bandura's social cognitive theory, which is based on the idea that people learn from watching other people's behavior. As children are exposed to activities and people they

form ideas about the type of work done and career options. As the children are going through and performing these different activities they get reinforcement. The reinforcement influences the children's beliefs about how they can perform at certain activities. These beliefs about how well one can perform a task are called self-efficacy. Self-efficacy effects which activities people want to do. The SCCT theorizes that ," self-efficacy and outcome expectations lead to the formation of vocational interests, which lead to the intention of becoming involved in activities that are congruent with those interests" (Kelly, 2009, p. 35). Heilbronner (2011) interviewed 360 Science Talent Search students. The author found that the students' beliefs that they could perform well in the subject area was a factor in whether or not the students' persisted in a STEM major. The belief that the student could perform well was more important than their actually ability. A second part of the SCCT is perceived barriers. Even though someone might be interested in a field, perceived barriers like length of schooling or location of job may prevent someone from choosing that career. When looking at perceived barriers, it is also important to understand an individual's coping efficacy and if they might attempt to overcome some perceived barriers (Lindley, 2005).

The two theories on career development tells us that career decisions are shaped as children: how exposed we are to certain careers and also how well we feel we perform at certain activities. It is important for parents and educators to begin flourishing an interest in science early in their children's lives. It would also be important for homeschool parents to expose their children to people who have careers as scientists so that they can form ideas and interests about scientists and careers in science.

Career Interest

Interest is a factor for people choosing a career. Research has shown that interest can be increased by certain activities and also that interest has ebbs and flows. In order for a student to pick a major, they need to have interest in that area.

Beggs, Bantham and Taylor (2008) used qualitative and quantitative methods to obtain data from 30 students on the factors that most influenced their choice of college major. Students reported Match with Interests, Job Characteristics, and Major Attributes as the three highest factors affecting college major. In additional research by Nyamwange (2016), she surveyed 296 first year students from six university and concluded that student interest plays a large part in students choosing a career path. These results align with Holland's career theory that picking a career, or college major, matches interests with career environments.

There are many things that can affect students' interest in a subject. In a study by Bergstrom, Sadler, and Sonnert (2016), they found that extracurricular activities in astronomy helped students hold an interest in the subject and pursue a career in astronomy after high school. Ardie, De Maeyer and Gijbels found that students' interest in technology decreased over time the time of the course, but interest increase at the beginning of the next course (2013). Interestingly, Dika, Alvarex, Santos and Suarez (2016) found that students' interest was affected by the perceived value of the career.

If homeschool parents do not value science and teaching it, it may affect how interested their child(ren) are in learning about it. Determining if homeschool students are

showing interest in science and science careers helps answer why homeschool students are not going into science careers.

STEM majors

There has been a fair amount of literature dedicated to understanding why some students do, or do not, go into the field of science. However, there has not been any clear conclusion drawn as to what makes a student want to major in a STEM area or persist in this challenging field.

A majority of the current research on STEM looks at the effect high-school courses have on choosing a STEM major. Wilson-Jones (2011) interviewed women who were currently enrolled in a STEM major at Fayetteville University. Some women reported that they knew early-on in junior high or high school that they wanted to pursue a career in the STEM field and took courses accordingly. Other women reported that the early years had no effort on their decision and their love for the subject came during the early college years. It was also reported that mentors in the field were very helpful. Trusty (2002) found that the level of high school courses made a difference for women wanted to major in STEM. Women who took calculus in high school doubled the odds that the women would choose a science or mathematics major. These effects were not found in the men participants. The number of science and mathematics courses had the most effect on the male participants' choice of science or mathematics major. It was also found that men "value math-related skills and tasks more than women do" (Trusy, 2002, p. 472). Shaw, Lee, Borman & Hanson (2007) also found results consistent with Trusty-high school coursework in physics and calculus can help students choose and complete a STEM major. "Maltese (2008) also found that most students who completed the

majority of their college coursework in STEM had taken at least 3 to 4 years of STEM courses in high school. An even greater proportion of those completing STEM majors had taken advanced math and science courses in high school" (as cited in Shaw & Barbuti, 2010, p. 20).

The number of science courses a student takes increases the chances the student will major in science. Homeschool students take a lower number of high school science courses compared to non-homeschool students. Taking a smaller amount and lower level of science classes may be affecting homeschool students' decision to major in science.

Homeschool and STEM

Research by Phillips (2010) has found that homeschool students are not choosing natural science majors as frequently as non-homeschool students. Additional research by Wheaton (2010) found that a possible reason for this could be that homeschool students are not taking as many science classes in high school as non-homeschool students.

Phillips (2010) performed a study on college major of homeschooled students. She was specifically looking to see the percentage of homeschooled students who majored in natural science compared to non-homeschooled students. Surveys were administered to 878 students at a private Midwestern university. The author found that 17.8 percent of public school graduates and 17 percent of private school graduates choose science and 7.7 percent of homeschooled students major in natural science. The author found these results true for all students who have been homeschooled, regardless of length of time. Phillips (2010) called for additional research on this subject to test her findings.

High school courses in science could help students determine if they want to pursue a science major in college. This may indicate why Phillips (2010) found that homeschooled students do not choose natural majors as much as non-homeschooled students. Research completed by Wheaton (2010) with the Department of Institutional Research at Austin College found that "On average, each traditional Austin student completed 1.9 Math courses and 3.2 Science courses vs. homeschoolers 0.8 Math and 1.9 Science courses" (Wheaton, 2010). A group of mothers of the homeschooled Austin College students was shown the data on the math and science preparation of homeschooled students and was not surprised

"She commented that good home school Math and Science curriculums are more difficult to come by, as most of the home school materials are geared more towards the humanities. Another mother commented that many of the home school mothers don't feel comfortable teaching college prep Science and Math courses"

(Wheaton, 2010).

However, it should be noted that homeschool students test as well as non-homeschooled students on science SAT tests and Wheaton (2010) also reported that 22% of incoming homeschool students reported that they would like to become a doctor, a highly science based profession.

Clearly, more research needs to be performed on homeschool science curriculum, instructional methods, and hands-on learning opportunities to determine what may be preventing homeschool students from entering natural science majors and if there is a need for improving science curriculum for homeschoolers.

Summary

Homeschooling families feel that there are many benefits to homeschooling, such as: more influence in their children's moral upbringing, control over curriculum, and individualized instruction that has high academic results. Homeschooled students perform well on college entrance exams and go on to college at the same rate as non-homeschooled students. Although we have a snap-shot of what the homeschooled student in college looks like, there is a need for more research in this area. Phillips (2010) performed research in the area of college majors of students who were homeschooled and found out that homeschooled students choose natural science majors less than non-homeschooled students. Literature reports that self-efficacy, interest and a lack of math and science in the younger years are factors that affect STEM major selection and the number of classes and hands-on learning can increase STEM interest. Additional research by Wheaton (2010) concluded that poor homeschool science curriculum and a lack of confidence in teaching science may affect students' interest in science careers. Much confusion seems to surround this area and there is a need to perform more research to understand homeschool students' attitudes about science.

CHAPTER 3

Methodology

The purpose of this paper is to evaluate homeschool students' interests about science and science careers. This chapter will first describe the setting and participants studied, the development of the survey, and will conclude with a description of the process used to gather and analyze the data.

Participants

The participants of this study are all parents of homeschoolers in Duluth, Minnesota; Superior, Wisconsin and surrounding towns in Northwest Wisconsin and Northeast Minnesota. The participants are members of the Northland Core Facebook group. The Northland Core FaceBook group reports 383 members. Both groups provide information about local events and educational opportunities, along with a place for homeschooler, or potential homeschoolers to ask questions.

Duluth, Minnesota has a fairly large and organized homeschool community and a variety of local science, art, music and community centers. Minnesota has been a national leader in creating schooling options for parents. Some of these options include private, charter, homeschool, virtual, post-secondary, and second-chance schools (Dahlquist, York-Barr & Hendel, 2006). Between the years 1987 and 1999, homeschooling in Minnesota increased 600%, from 2,322 to 13,638 (Dahlquist, York-Barr & Hendel, 2006). Because Minnesota has so widely accepted the practice, it is quite ideal for conducting a homeschool study.

Setting

Participants of the study were contacted through the Northland Core Facebook page. All members of the Northland Core FaceBook group had voluntarily asked to become a member of the group to gain access to other homeschoolers and learn about homeschooling events in the area. This sampling was of convenience. I determined I could reach a large number of homeschoolers through the site. The FaceBook site has notification features so whenever a post is made to a site, all member receive a notification through FaceBook, and also many receive the notifications in their e-mail accounts as well. This feature helped spread my post about the research survey. I am a member of the Northland Core Facebook site so I had the ability to post to the page. However, the organizer of the Northland Core group gave me permission to advertise about the research on the Northland Core Facebook site and volunteered to make the post. The initial post explained that the research project was towards completion of my Master's Degree and that if they were interested in participating in the survey, they should click the link on the post (appendix A).

Research Design

For this study, a quantitative approach was used. I took on a post positivist worldview that examined "causes that influence outcomes" (Creswell, 2009). I wanted to determine if interest level was causing homeschool students to not take sciences courses, or pick science as a college major. Surveys are often used in quantitative research. Parents were expected to complete their survey in conjunction with their child. Stated in Creswell's (2009) book, "Surveys include cross-sectional and longitudinal studies using questionnaires or structured interviews for data collection, with the intent of generalizing

from a sample to a population. Permission for the research was granted from the University of Minnesota IRB office (Appendix B).

Survey questions were adapted from the Test of Science-Related Attitudes (TORSA) (Fraser, 1982). The test groups attitudes into seven groups: Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science and Career Interest in Science. I looked at the questions in the categories of Leisure Interest in Science, Enjoyment of Science Lessons, and Career Interest in Science and composed a variation of the question that could be asked to a parent of a child, instead of the child, like the original test was designed to measure. I choose those specific categories because my study is evaluating student interest in science, instead of student attitude, and those questions best addressed student interest. Appendix II of the test showed which category each question was from. Enjoyment of Science Lessons is defined as "enjoyment of science learning experiences" (Fraser, 1981, p.2). Leisure Interest in Science is defined as "development of interest in science and science-related activities" (Fraser, 1982, p.2). Career Interest in Science is defined as "development of interest in pursuing a career in science" (Fraser, 1982, p.2). The survey had 29 questions, with six demographic questions and the remaining fifteen asking about science interest. The first eleven science interested related questions ask to rate the child's interest in subjects, careers and there were also three open ended questions asking why a student responded the way they did. The remaining eleven questions asks students to rate questions from 1-5 from disagree to strongly agree. The final question was open ended giving participants an area to tell me anything that wanted about teaching science to homeschoolers.

Data Gathering

My survey was created in Google Docs and the results were automatically captured for each question. For the demographic questions, the answers were put into groups by similarities and then a percentage of the total responses for that question was reported for each group. For the first five science interested related questions, a percentage was figured for each answer and then open ended questions were grouped by similarities and a percentage of the total responses was reported. The last ten interest questions were reported by percentage of the total responses for each question.

Summary

For this research I created a survey in Google Docs with questions adapted from Test of Science-Related Attitudes (TORSA) (Fraser, 1982). The survey was distributed to the Northland Core Homeschool group through their Facebook site. Participants answered questions related to their child's interest in science and science careers. The results of the survey were captured in percentages and will be stated in the next chapter.

CHAPTER FOUR

Results and Discussion

A survey on homeschoolers' interest in science and science careers was created to determine if interest in science was a factor in homeschool students not majoring in natural science in college or taking as many science courses in high school. The survey had 29 questions, with six demographic questions and the remaining fifteen questions asking about science interest and career interest. The science and career interest questions were broken down into groups depending on the question's purpose. The first eleven science interest questions asked the parent to rate the child's interest in subjects, careers and there were also three open ended questions asking why a student responded the way they did. The remaining eleven questions ask students to rate questions from 1-5 from disagree to strongly agree. The final question was open ended giving participants an area to tell me anything that wanted about teaching science to homeschoolers. The questions were adapted from Test of Science-Related Attitudes (TORSA) (Fraser, 1982). This chapter will report the results of the survey and also discuss the meaning of the results.

Results

A survey asking homeschool parents questions about their child's interest in science and science careers was posted on the Northland Core Facebook site, which has 383 members. Fifteen surveys were completed. The first six questions asked demographic information and the remaining questions asked questions about their child's interest in science and science career.

The first three questions asked the age of the student, sex of child, and the number of years the students has homeschooled. 60% of students were 5-8 years old, 33.3% were 9-12 years old and 6.7% were 13-16 years old. Also, 80% were female and 20% were male. 40% of the students have homeschoolers for 1-2 years, 40% 3-5 years, 13.3% have homeschooled for 5 of more years and 6.7% have homeschooled for less than one year. The next two questions asked if the participant was a license teacher or had formal teacher training. 64.3% reported that they are not teachers, or had teaching training and 35.7% were licensed teachers or had completed some formal training. 66.7% of the participants reported that they use unschooling or eclectic homeschooling methods and 33.3% reported that they use a boxed curriculum or text books. The final demographic question asked about participants locations. 50% live 5-10 miles outside of Duluth, MN, 35.7% live in the city of Duluth, and 14.2% live farther than 15 miles outside of Duluth, MN.

The next series of questions on the survey asked about the child's likes and dislikes of subjects. 33.3% of the participants reported that their child's favorite school subject is math. Other subjects and percentages were: Art - 13.3%. PE- 13.3%, Reading- 20%, History – 6.7%, Science – 6.7% and Not Sure – 6.7%. The reasons the students like the subjects are listed in Table 1 below.

Table 1

What does your child like about their favorite subject?

1. That there are many opportunities for her to learn locally, as well as a huge variety of different facets of science that she enjoys
2. Creativity
3. Does it well
4. Figuring out how to manipulate numbers
5. It's fun
6. It's interesting
7. Problem solving
8. That she can do it now
9. That she learns stuff
10. The stories
11. To create things
12. Moving around
13. To be able to move around

Table 1

Question nine asked about the student's least favorite subject. Math – 46.7%, History – 26.7%, Spelling – 6.7%, Writing 6.7%, Language Arts – 6.7% and None – 6.7%. Table 2 below describes the reasons for not liking a subject.

Table 2

Why does your student not like a subject?

1. Memorizing facts
2. Boring
3. Hard
4. Tedious
5. Dislikes when she struggles with new concepts
6. She likes learning about current events and things that are immediately applicable today
7. He thinks it's too hard
8. She doesn't feel like she knows enough about it
9. Always having to be corrected
10. Loses focus before finishing a page

Table 2

Students were asked what their current career interests were. 46.7% choose a science related career of scientist, astronaut, veterinarian or biologist. The remaining 53.3% responded as: Artist, Teacher, FBI, Animal Trainer, and Professional Athlete.

The next set of questions asked parents about opportunities in their community to engage in science opportunities. 100% of the participants reported that there are science related opportunities in their community. 53.3% of the participants responded that they do not choose to participate in those activities and 46.7% reported that they do choose to participate in science learning opportunities in their community. The next survey question asked how homeschool curriculum could be improved. Table 3 below shows the results of the question.

Table 3

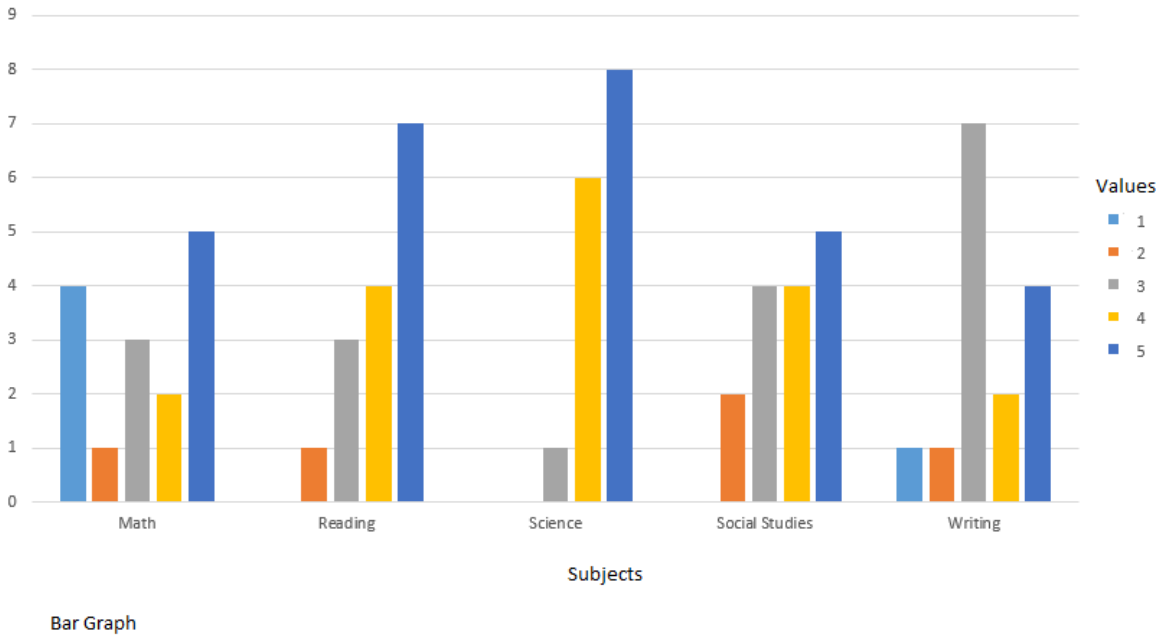
How could homeschool science curriculum be improved?

1. Weekly opportunities
2. If science curriculum came with experiments to follow
3. If the curriculum included more hands-on activities
4. Guided weekly activities
5. At this point in her education, science "experiments" are fairly easy to perform since they are very simple. As she gets older and experiments become more difficult and require less common items, it would be wonderful to have access to a place or co-op that offers machines and items that are harder to come by
6. There are ample opportunities, especially for a child this age.
7. I would like more hands on activities.
8. More hands on learning
9. More of a Central area for outside of Duluth families
10. Cost is usually a factor. If it costs too much, we can't participate.
11. We do a lot of Pinterest science activities. We are also lucky enough to be in an area with a lot of education programs for young kids.
12. Finances are our barrier to participation
13. Most activities cost too much for us to be able to participate.

Table 3

Additionally, 100% of the participants reported that they feel confident in their abilities to teach their child science. 80% reported that science labs are difficult to perform.

Participants were asked to rate the subjects of Math, Reading, Science, Social Studies and Writing from 1-5. A one rating meant that the student "does not like learning about it" and a five rating was the highest and meant "likes learning about it and engages in related activities on their own". The results of the questions are broken down in Graph 1.



Bar Graph

In the next eleven questions, participants were asked to rate statements from 1-5. One was "disagree with statement" and five was "strongly agree with statement". The results are shown in Table 4 below.

Table 4

Rate the follow questions from 1 -5 (1 disagree – 5 strongly agree)

Statement	1	2	3	4	5
I like doing experiments, and hands-on learning, rather than just reading about something	0%	0%	0%	33.3%	66.7%
I would like to work in a science laboratory after I'm done with school	26.7%	13.3%	26.7%	6.7%	26.7%
Science is boring	53.3%	33.3%	13.3%	0%	0%
Going to a science museum would be fun	6.7%	0%	0%	13.3%	80%
Science can help make the world a better place	0%	0%	6.7%	46.7%	46.7%
Science is fun	0%	0%	6.7%	40%	53.3%
I understand what scientists do for work	13.3%	20%	40%	6.7%	20%
Science experiments are fun	0%	0%	6.7%	40%	53.3%
Having a job as a scientist sounds boring	33.3%	60%	0%	6.7%	0%
I like watching TV shows about science	7.1%	7.1%	50%	7.1%	28.6%
I would like to learn more about science	0%	6.7%	26.7%	33.3%	33.3%

Table 4.

The final question gave participants an opportunity to tell me anything they would like about teaching homeschool science. This question was not required and only two participants answered it. One participant reported, "There are many activities online that parents can search for." Another participant said, "This is my very favorite subject to teach! WE have so much fun in hands on learning and that we can make messes. I love it so much I'm in the process of writing a blog post about it."

Discussion

The results of this survey gave mixed results on how much students like the subject of science, but I think it verified some of the conclusions brought by Phillips (2010) and Wheaton (2010), highlighted a need for homeschoolers to be given information on careers in science and brought about some new information about teaching science in homeschool.

In multiple survey questions, participants were to ask their child about their favorite and least favorite subjects. Only one participant reported that science was their favorite subject and no one reported that science was their least favorite subject. However, when participants were asked to rate subjects on 1-5 Likert Scale, Science overwhelming scored the highest percentage in students who "likes learning about it and engages in related activities on their own". Given that such a high percentage of participants are using an unschooling or eclectic method of schooling, it is possible that students do not think of science as a subject because it is not a subject that is taught formally and perhaps not a subject that would be taught as frequently as other subjects, such as reading or math. When the researcher compared the answers of participants who use an eclectic method versus a box curriculum, no differences were seen. Even though the percentage of students that reported science as their favorite subject was low, a high percentage of participants answered that they like learning about science. This shows that homeschool students have interest in learning the subject. This is additionally supported by the favorable response to questions about hands-on learning and learning science. Particularly, 66.6% of participants answered either a 4 or a 5 on the Likert-type scale, which correlates to agree and strongly agree, to the question, "I would like to learn more

about science". The survey results show that homeschool students are interested in science and the following paragraphs will examine some of the conclusions reached by Phillips (2010) and Wheaton (2010).

In Phillips (2010) research, she found that homeschool students were not choosing a natural science major as frequently as non-homeschooled students. She hypothesized that because the parents are teaching the science, they lack some of the enjoyment and excitement that a professional science teacher might bring. She went on to say that a lack of labs and equipment might make science seem boring. 86% of participants reported that they do not find science boring. However, when participants answered the open-ended question about how to improve homeschool curriculum, the most frequent answer was more guided activities. Two participants reported that they find experiments online or on Pinterest. Philips (2010) seems to be partially correct in her evaluation that there are not enough labs or equipment to make science seem interesting, or significant. Additional research would be needed to evaluation just how unstructured science is. Perhaps more of an emphasis put on science would increase students' interest in pursuing it as a career field.

Wheaton (2010) performed a study on homeschool students at Austin College and found that homeschool students had taken less science classes in high school, compared to non-homeschooled students. She hypothesized that it could be because of their parent's confidence in teaching the subject. In the current study, all the participant's children were elementary to middle school age, but 100% reported that they feel confident enough to teach science to their children. It would be beneficial if this question was asked to parent's who had high school aged students. An additional reason that homeschoolers

only take the minimum requirements of science may again go back to needing an easier way to access lab equipment. Participants reported that classes in the community are often too costly to participate in. As there is a need for more experiments available for homeschool families, there is a need for career information.

Survey results showed that homeschool students have an interest in science, however, it was not clear whether homeschool students have career interests in science. The data gathered about career interest in science was very widespread, this says that there's uncertainty or confusion around the subject. Only one student reported wanting to be scientist when older, but six others choose a science related career such as veterinarian. When asked "I understand what scientists do for work" 40% answered with a "3" which is neutral. When asked "Having a job as a scientist sounds boring", 93.3% answered that it did not sound boring. However, answers were spread, almost evenly, between all choices when asked "I would like to work in a science laboratory after I'm done with school." These responses show uncertainty and confusion around career questions. Information on careers in science could be beneficial to more students picking the area for study.

Theories on career development tell us that how well a person feels they perform at something plays into choosing it for a career. With so many of the participants using an unschooling method or eclectic method, it raises questions about this method for teaching science and how assessment methods might be enhanced. If parents never assess their child's learning in science, only let them explore, a student may never feel that they excel at the subject. This may deter some students from choosing science as a career path.

Summary

This research set out to determine if homeschool students are interested in science. The results showed that homeschool students are interested in science, but there are opportunities to improve science curriculum through providing an easy way for parents to perform experiments and rent equipment. The interest in science career was not determined. There is a need for homeschool students to get information on career in science.

CHAPTER FIVE

Summary and Conclusions

Research by Phillips (2010) and Wheaton (2010) showed that homeschool students do not pick science majors as frequently as non-homeschooled students or take as many, or high of a level, of science courses as non-homeschooled students. The purpose of this research was to determine homeschool students' interest in science and science careers. It was thought that lack of interest in the subject could perhaps prevent homeschool students from taking science classes or choosing science as a college major.

This chapter will discuss the educational implications of the student and recommendations for future research.

Educational Implications

This researched aimed to understand how homeschoolers felt about science. The surface of the subject was cracked and the information obtained has been beneficial to understanding how homeschool science curriculum can be improved and how we can raise the rate of homeschool students choosing science as a career path.

It was important to learn that, at least for younger students, they are very interested in science. The structure of homeschool gives students ample opportunity to explore and indulge in hands-on activities and learning. It was also important to learn that there are some features of homeschooling that are not supporting student's interest in the subject. Those issues are outlined in the paragraphs below.

Parents reported that they need access to more affordable options to provide their students with science activities and lab equipment. This problem has not be reported in literature about homeschooling. This information may be invaluable to curriculum developers. Parents need a better way to provide experiments. Some parents reported turning to the internet for experiments, but this can be time consuming and might prevent parents from teaching science as much as need to keep interest in the subject, especially as the child moves into high school.

This research also exposed some questions about how science is taught in homeschool. If students are unschooling and learning as they explore with no real curriculum or assessment, is there a way for students to evaluate themselves on the subject. Would a student realize that they were good at science? Unlike, math or writing, most parents are not using worksheets or time testing to evaluate their students. Although the unschooling method works well with a variety of subjects, it may be a downfall in teaching science in homeschool.

Lastly, this research exposed the need for career information for homeschoolers. When looking for literature on homeschool careers or college majors, information is very difficult to find. This issue should be addressed so that homeschool students have access to career information like non-homeschool students have.

This research exposed problems in homeschooling that no other research has done. Addressing these deficiencies with only strengthen the practice and benefit the students' experience. It will also help homeschool students better prepare for a career in a science field.

Recommendations for Future Research

There is a need for more research in this area. Science is an important subject for our society that there is a need for more emphasis in homeschooling to be put on it. Although the research survey was available to a large group of homeschoolers, completion rate was low. This is not unusual for homeschool studies. Ideally, a survey on interest in science would have a much larger completion rate. The research could also be strengthened by having the survey completed by high school homeschool students. When science concepts and experiments get more difficult, it would be beneficial to understand how parents deal with the situation and look at any resources available to homeschool families.

After completing the research, I believe there are more problems with homeschool science curriculum than when I started this project. The parents' ability to perform science experiences is limited by cost and access. Even if curriculum developers included more experiments, not every homeschool family could afford a boxed curriculum. Co-ops and national homeschool organizations need to take it upon themselves to provide a fuller science curriculum for homeschoolers. More research could be performed to understand how frequently science is taught in homeschool. Because parents reported that they need more access to experiments and equipment, does it mean that they are simply skipping teaching science with labs, or do they make do through interest searches and items found around the house.

The open ended questions on the survey provided the greatest wealth of information. I wish that I had included more open ended questions addressing how

science is taught in homeschool. It would have also been beneficial to not only capture the students' interest in science, but the parent's interest in science. Also, because this subject is fairly new and there is not much literature on the subject, it was difficult to create survey questions. Creating more open-ended questions would have given more information than the Likert-type scale questions.

This research project exposed some deficiencies in teaching science in homeschooling. Some of the issues are access to lab equipment and experiments, the method of unschooling for teaching science and more information needed about careers in science and what a job in science looks likes. There is a need for future research in these areas to determine how homeschool curriculum and the homeschool community can address these issues to empower homeschool students to become future scientists.

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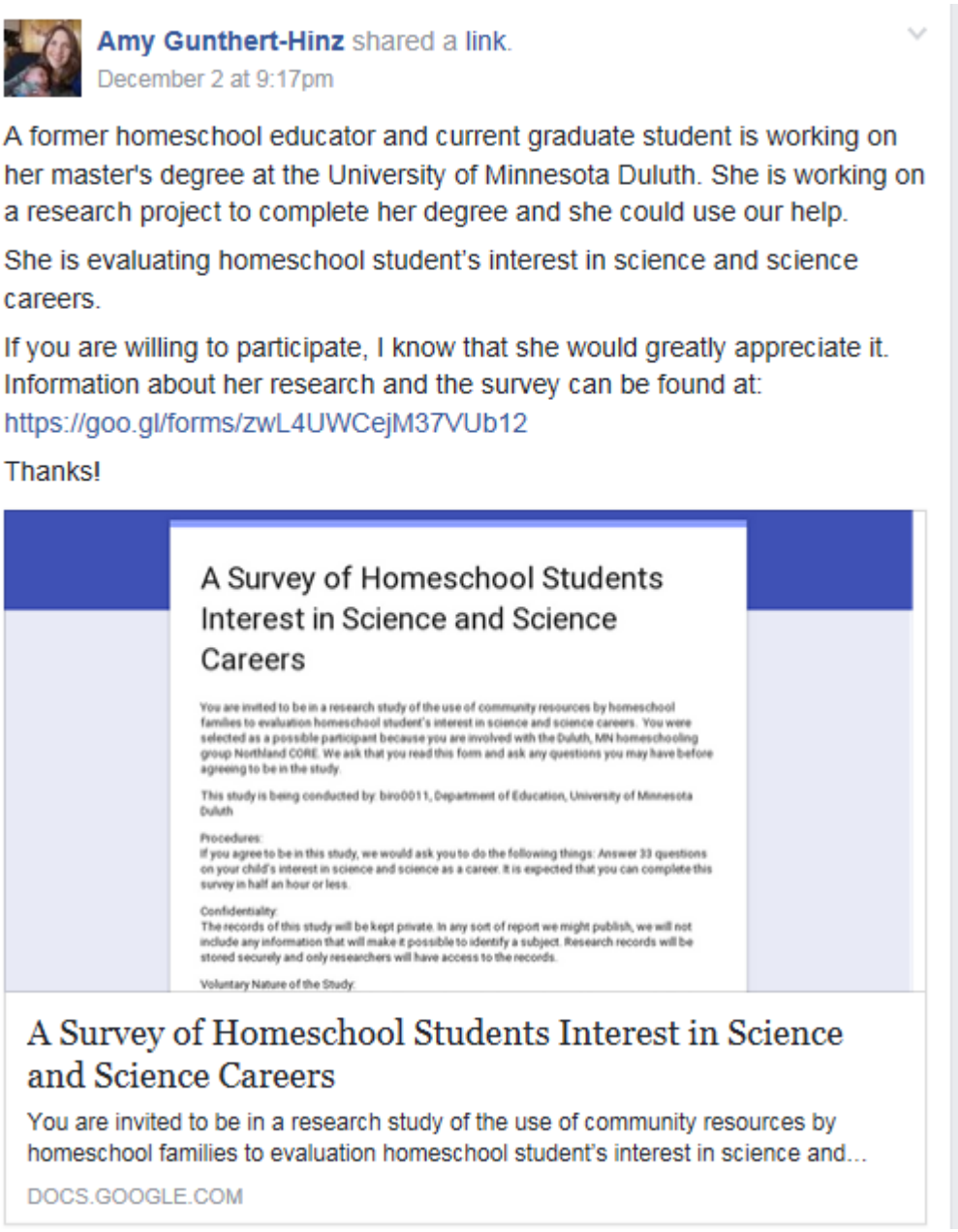
Appendix A

Research Posting



Appendix B

IRB Approval for Exempt Research

1611E99081 - PI Biros - IRB - Exempt Study Notification Inbox x

irb@umn.edu Nov 23

to biro0011

TO : fguldbra@umn.edu, biro0011@umn.edu,

The IRB: Human Subjects Committee determined that the referenced study is exempt from review under federal guidelines 45 CFR Part 46.101(b) category #2 SURVEYS/INTERVIEWS; STANDARDIZED EDUCATIONAL TESTS; OBSERVATION OF PUBLIC BEHAVIOR.

Study Number: 1611E99081

Principal Investigator: Anne Biros

Title(s):
An evaluation of homeschool students' interest in science and science careers

Appendix C

Informed Consent Form

You are invited to be in a research study of the use of community resources by homeschool families to evaluation homeschool student's interest in science and science careers. You were selected as a possible participant because you are involved with the Duluth, MN homeschooling group Northland CORE. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: biro0011, Department of Education, University of Minnesota Duluth

Procedures:
If you agree to be in this study, we would ask you to do the following things: Answer 33 questions on your child's interest in science and science as a career. It is expected that you can complete this survey in half an hour or less.

Confidentiality:
The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records.

Voluntary Nature of the Study:
Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:
The research conducting this study is: Anne E. Carlson. You may ask any questions you have now. If you have questions later, you are encouraged to contact them at 218-428-2727; biro0011@d.umn.edu. Students' advisor: Frank Guldbrandsen, fguldbr@d.umn.edu; 218-726-8172

If you have any questions or concerns regarding this study and would like to talk to someone other than the research, you are encouraged to contact the Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

Appendix D

Survey Questions

1) Age of student?
2) Sex of student
3) Number of years the student has homeschooled?
4) Are you are licensed teacher or have you had formal teacher training?
5) What method of homeschooling to you use? (ie. Unschooling, boxed curriculum, online public school, combination of methods, etc.)
6) Where do you live?
7) What is your child's favorite school subject? (ie. Reading, writing, math, science, art, music, social studies, etc.)
8) What does your child like best about this subject?
9) What is your child's least favorite school subject? (ie. Reading, writing, math, science, art, music, social studies, etc.
10) What does your child dislike about this subject?
11) What does your child want to be (career) when they grow up?
12) Please rank these 5 subjects in order (1-5) of how much your child enjoys learning about them and engaging in them: Math, science, social studies, reading, writing.

    (1-most enjoys-5- least enjoys)
13) Are there science related learning opportunities and activities for your child within your community, or in nearby communities?
14) Does your child participated in them? Why or why not?
15) How could homeschool science curriculum and resources be improved upon to create a more engaging and interesting experience?

    Please ask your child to rate the following statements from 1-5. 1 being "disagree", 5 being "strongly agree"

16) I like doing experiments, and hands-on learning, rather than just reading about something 1 2 3 4 5
17) I would like to work in a science laboratory after I'm done with school
18) Science is boring

19) Going to a science museum would be fun

20) Science can help make the world a better place

21) Science is fun

23) I understand what scientists do for work

24) Science experiments are fun

25) Having a job as a scientist sounds boring

26) I like watching TV shows about science

27) Would like to learn more about science

28) Anything more you would like to tell me about teaching homeschool science?