THESIS

ENVIRONMENTORS: ADDRESSING THE NEED FOR STEM EDUCATION

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ABSTRACT

ENVIRONMENTORS: ADDRESSING THE NEED FOR STEM EDUCATION

This study is an evaluation of the EnvironMentors program. A nationwide program, EnvironMentors seeks to boost participation in environmentally-related STEM fields through academic mentorship. Chapter one provides an overview of the issue and need for this research. In chapter two, survey data is analyzed in order to determine the importance of student demographics. In chapter three, an interpretive review of the mentor experience is explored. The final chapter provides synthesis and recommendations for EnvironMentors administrators.

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THE NEED FOR SCIENCE EDUCATION

"When a young person, even a gifted one, grows up without proximate living examples of what she may aspire to become--whether lawyer, scientist, artist, or leader in any realm--her goal remains abstract. Such models as appear in books or on the news, however inspiring or revered, are ultimately too remote to be real, let alone influential. But a role model in the flesh provides more than inspiration; his or her very existence is confirmation of possibilities one may have every reason to doubt, saying, 'Yes, someone like me can do this."

— Sonia Sotomayor, Supreme Court Justice

In a 2006 United States Congressional report, a committee of domestic policy experts delivered a critical analysis of the state of science, technology, engineering and math (STEM education in the U.S. (Kuenzi, Matthews & Mangan, 2006). According to the authors, a majority of U.S. secondary school students fail to reach proficiency in STEM fields and are often taught by teachers who lack the necessary knowledge to be effective STEM educators. The result of this shortcoming is that in a recent international study of 15 year-olds, the U.S. ranked 24th in science literacy and the World Economic Forum recently ranked the U.S. 48th in the quality of mathematics and science education. (Augustine, 2010).

Central to the issue is the anemic rate at which U.S. college students are earning degrees in STEM fields, one of the lowest in the world. In 2002, STEM degrees accounted for 16.8% of all degrees awarded, compared to 26.6% in Europe and 33.3% in Asia (Kuenzi, Matthews & Mangan, 2006).

In 2010, the National Academy of Sciences issued its own suggestions on how to solve the problem of poor STEM education in its report titled, "Rising above the gathering storm, revisited." Of four recommendations issued in the report, the third is particularly relevant to this study: “Encourage more United States citizens to pursue careers in mathematics, science, and engineering”

EnvironMentors is a national program that has been addressing this need by providing high school students expanded STEM education opportunities since 1992, well before the Congressional reports and warnings about the ‘gathering storm.’

The role of EnvironMentors

Since the earliest periods of human civilization, people have learned through experience, taking the lessons of those around them and applying them to their own lives. In Homer's epic poem *The Odyssey,* Ulysses, before leaving home for ten years, entrusts the care of his son to his esteemed friend, Mentor. In modern times, the term mentor has come to be interpreted as a role model, guide, and counselor, who opens doors and exposes protégées to new occupational and social worlds (Beck, 1989).

The sciences, specifically, STEM fields, benefit from mentorship programs. In a study of science-specific mentorships between undergraduate science students and high achieving high school students, researchers found that a mentorship in the sciences offers multiple benefits to participants such as the opportunity to develop library research and science process skills within the framework of an ongoing and valid scientific investigation(Templin, 1999). In addition, science mentorships provide students with a chance to study science as a member of a research team within a lab, and most importantly, it gives students an opportunity to examine the life of a scientist, an experience that may assist them in considering a career in science(Templin, 1999).

Understanding the Issues

Over the past five years, the EnvironMentors program has been the subject of repeated academic study, with the focus being largely on student outcomes. In this study, two new facets of the EnvironMentors program were examined in order to better understand separate pieces of the whole (i.e., student attitudes and mentor satisfaction) with the goal of informing future practice and ultimately promoting program success for students and mentors. .

The audience

Understanding your audience is a fundamental and important step in teaching; it provides an essential piece for planning of specific outcomes. Student demographics, while not the sole determining factor, can have important implications in determining interest in STEM fields. In a study released last year, it was found that gender and racial backgrounds largely impact STEM aspirations among high school students (Wang, 2012). In order to meet program goals and provide the best programming possible, EnvironMentors educators and administrators need to understand and recognize complex barriers to student's entrance into STEM fields. A complete review of those barriers is impractical for the scope of this study, therefore consistent with the theory of planned behavior, which states that attitudes influence behavior (Ajzen, 1991), student attitudes will be the yardstick used in this study.

The mentors

According to the U.S. Department of Education Mentoring Resource Center (MRC, 2000), as many as one-half of volunteer mentoring relationships terminate within the first few months of the match. Findings from recent mentoring research clearly show that youth in matches that end prematurely actually have worse outcomes in several key areas than youth who are never mentored. Thus is terms of youth outcomes, keeping volunteers is at least as important as recruiting them in the first place (U.S. Department of Education, 2000).

According to the MRC, mentor motivation and satisfaction are directly related to retention. Common reasons for mentors dropping out of programs include, poor organization, lack of training, time or skills not used well, lack of clarity about assignment, and lack of support or supervision. In order to minimize mentor loss, the MRC suggests the following steps, which are applicable to the EnvironMentors program.

1. Set up expectations during mentor recruitment and selection
2. Prepare mentors for their role through pre-service training.
3. Create a supportive environment.
4. Provide ongoing training and supervision.
5. Build connection and belonging.
6. Show appreciation through mentor recognition

The current research

Chapter two of this document addresses student-focused research and examines student demographics and how they impact attitudes toward STEM careers. Chapter three takes a qualitative look at the mentor experience in order to understand their satisfaction. Chapter four provides a synthesis of the diverse findings and make practical recommendations to EnvironMentors administrators. The final chapter also includes reflections of the researcher on the EnvironMentors program in general and the research process in particular.

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UNDERSTANDING STUDENT ATTITUDES ABOUT STEM CAREERS

This article examined student perspectives on science, technology, engineering and math (STEM) careers for the EnvironMentors program, a National Council for Science and the Environment (NCSE) initiative. Founded in 1992, EnvironMentors is a national program with 12 chapters (Alabama State University, Alabama A&M University, Arkansas State University, Colorado State University, Heritage University, Kean University, Louisiana State University, North Carolina State University, University of California- Davis, University of the District of Columbia, University of Nebraska- Lincoln, and West Virginia University) dedicated to promoting interest in environmentally-related STEM careers and encouraging environmental citizenship among traditionally underrepresented groups.

The program is centered around a six month academic mentorship between a high school student and a college student or professional, studying or working in the STEM field. Participants are responsible for conducting an environmental science project which they present at a year-end chapter fair at their location. Selected students from the chapter fair are chosen for participation in the national fair where they compete for scholarship dollars. To help maximize the effectiveness of the EnvironMentors program, it is important to have a basic understanding of student attitudes towards STEM. This research will allow EnvironMentors program administrators to identify opportunities as well as potential challenges, and tailor activities to address specific needs and maximize program effectiveness.

Literature Review

Over the past decade, the demand for professionals with STEM skills has come to the forefront of public attention as organizations such as the European Commission and the National Academy of Sciences have released reports which highlight perceived shortcomings in STEM education (Fouad, Byars, Winston & Angela, 2005). Programs such as EnvironMentors, have been developed to address this need. Research indicates that the EnvironMentors model is a strong one. In a recent meta-analysis of academic mentoring, support for the effectiveness of the mentoring model was found and academic mentors shown to be effective in positively impacting student behavior, attitudes, health, motivational and career outcomes (Eby, Allen, Evans & Dubois, 2008).

The goals of the EnvironMentors program directly address the need for STEM professionals. According to current research, a career in STEM starts early in the life of a student. In a longitudinal study of American 14-year old, researchers found that 45% of the youth surveyed were interested in a career in science and students with expectations of science-related careers were 3.4 times more likely to earn a physical science or engineering degree than those without similar expectations (Osborne, Simon & Tytler, 2009). This data illustrate the importance of establishing career aspirations in youth, a core goal of the EnvironMentors program.

The formula for a successful mentoring program is complex. In a comprehensive review of mentoring research, Dubois, Holloway, Valentine, and Cooper (2002) identified 48 factors which influenced positive outcomes. With such a broad base of contributing elements, it is difficult to pinpoint a short list of influential characteristics. Certainly, considerations such as institutional barriers, cultural background and socio-economic status of the student contribute to the overall picture. In the aforementioned meta-analysis the gender, race, and developmental level of the student played a significant role in program success. Therefore, mentee characteristics such as age, sex and race, not only impact the way students feel about STEM careers as shown previously, but also the degree to which students benefit from such programs. While interest in STEM fields cannot be explained entirely through demographic analysis, age, sex and race are the most applicable to the current study. Therefore, this research will seek to understand differences in attitudes among diverse demographic specific to the EnvironMentors program.

The first variable to be reviewed in this study is gender. Previous findings indicate that girls are less likely to be interested in science than boys (Osborne, Simon & Tytler, 2009). While traditional achievement gaps between boys and girls in the sciences have diminished in recent years, an enthusiasm gap remains. According to Catsambis (1995), female students do not lag behind their male classmates in science achievements tests, grades, and course enrollments. However, female students have less positive attitudes toward science, participate in fewer relevant extracurricular activities, and aspire less often to science careers than males. Indeed, engaging young girls and young women with the study of science remains a chronic problem and a matter of concern (Adamuti-Tache & Andres, 2008).

In 2002, Haussler and Hoffman outlined an approach to science curriculum which aimed to reverse the trend of declining interest of girls in science during high school. Their strategy is a strong template for EnvironMentors, and focuses on recognizing the specific experiences of girls and improving the ability of teachers to support girls. Krogh and Thomsen (2005) suggested that girls would be more interested if science instruction included more daily life related content. In 2005, Jenkins & Nelson outlined practical examples of different curricular interests for boys and girls as shown in Table 1. The discrepancies between what girls are interested in learning and what is taught in school, may contribute to a lower interest in STEM careers among women and girls.

Table 2.1

The 5 top ranked items boys and girls would like to learn about science. (Jenkins & Nelson, 2005).

Boys	Girls
Explosive Chemicals	Why we dream when we are sleeping and what the dreams might mean
How it feels to be weightless in space	Cancer-what we know and how we can treat it
How the atom bomb functions	How to perform first aid and use basic medical equipment
Biological and chemical weapons and what they do the human body	How to exercise the body to keep fit and strong
Black holes, supernovae and other spectacular objects in outer space.	Sexually transmitted diseases and how to be protected against them

The second variable addressed is race. According to a 2010 National Science Foundation report, “Blacks, Hispanics and other under-represented minorities together comprise 24% of the U.S. population. Yet only 13% are college graduates and only 10% of those graduates have science and engineering occupations.” Some researchers have suggested that this underrepresentation is more of a reflection of institutional barriers to participation rather than interest (Fouad, Buars-Winston & Angela, 2005). Other researchers argue that gaps in science performance based on minority/majority status are due to the way science is portrayed in school and how it marginalizes students from a non-Eurocentric social and cultural background (Aikenhead & Ogawa, 2007). In his discussion of Identity theory, Lee (2002) explores how student's social relationships and experiences affect their involvement in science and technology. Lee suggests that educators can minimize social barriers by framing career aspirations in terms of social relationships and self-processes. In this way, decisions to participate in STEM should be framed with an emphasis on relationships with family, teachers and peers, in an attempt to bring the pursuit of STEM in harmony with the experience of their everyday lives. In other words, many students have low interest in STEM careers because they have few role models from STEM fields and their peers discourage the pursuit of STEM careers. Identity theory is therefore useful in explaining why an attitude gap may exist in minority students.

The final variable for study is age. According to the Theory of Planned Behavior mentioned in chapter one, values formed early in life impact the development of beliefs and attitudes later in life Ajzen, 1991). This is concept is supported in mentoring and STEM research. In the 2002 meta-analytic research of moderators of success in mentoring programs of Dubois, Holloway, Valentine and Cooper it was found that late childhood/early adolescent (under 12 years of age) students experienced greater benefits from mentoring than middle or late adolescents (12+). This is supported by findings from Tai, QILiu, Maltese and Fan (2006) who suggested that by age 14 interest in pursuing science has largely been formed (or not). This indicates that student perspectives on STEM should be formed by the time students are freshman in high school. In a Royal Society survey (2006) researchers found that 28% of respondents first starting thinking about science careers before age 11 (elementary school age) and 35% between the ages of 12-14 (8^{th}-9^{th} grade). This evidence is supported by Maltese and Tai (2008) who found that 65% of scientists reported developing an interest in science before high school.

In order to better understand how these factors influence the EnvironMentors program, this article will answer the following research question: How do EnvironMentors participants feel about STEM college and career paths and how do those differ by demographic variables? Because women and underrepresented minorities are disproportionately absent from many STEM disciplines, identifying and supporting these students are vital to both the concept of equity and ensuring a robust, diverse workforce for the future. Complicating the issue, talented students from many demographics may face a social stigma that too often accompanies academic success and as a result have lower academic and career aspirations compared to white male students, even when they have the required skills and training. (National Science Board, 2010). Furthermore, because institutional barriers have contributed to under-representation of minority groups and women in STEM fields, there exists a shortage of role-models, which in turn this paper argues, results in lower interest among those groups.

It is expected that prior to participation in the EnvironMentors program, participants will adhere to general patterns reported elsewhere in the literature. In order to test that assumption, the concept of student attitudes will be operationalized as the variable interest in STEM careers. Therefore, the following three null hypotheses are put forth:

H1 – Gender will not influence interest in STEM careers.

H2 - Race will not influence interest in STEM careers.

H3 - Year in school will not influence interest in STEM careers.

Methods

In order to understand the EnvironMentors audience, this research outlines general attitudes towards STEM careers and analyzes differences among demographic groups. At each of the 12 EnvironMentors chapters, participant numbers varied across the years of this study. As part of their participation in the program, high school students are asked to complete an online survey each year. Each survey is completed anonymously at the discretion of the student. Results represent pre-test scores taken from surveys completed before the EnvironMentors program began. Each survey contains 45 questions in eight categories. Data collection began in the academic year 2009-2010 and continued for two additional years, ending in 2011-2012. Beginning in 2012-2013 a revised version of the survey was administered, though many of the same questions from the original survey were retained. During the three year period for which data was analyzed in this report, the sample size was n=625. Tables two (2) throughfive (5) show the breakdown of respondent demographics, who were 48% African-American, 65% female and relatively evenly distributed across the four years in school.

Table 2.2

Breakdown of Survey respondents

		Race	School Year	Gender
N	Valid	488	493	326
	Missing	137	132	299

Table 2.3

Respondents by race

Race	N	Percent
African-American	232	47.5
Asian	38	7.8
Caucasian	88	18.0
Latino/Hispanic	78	16.0

Table 2.4

Respondents by gender

Gender	N	Percent
Male	113	34.7
Female	212	65

Table 2.5

Respondents by year in school

Year in School	N	Percent
9th	56	11.4
10th	179	36.3
11th	145	29.4
12th	113	22.9

Independent Variables

The independent variables for this analysis were gender, race and year in school. Gender (male/female) was a dichotomous variable. Year in school (9^{th}, 10^{th}, 11^{th} and 12th) and race (African American, Caucasian, Latino, Asian) were categorical variables.

Dependent Variables

Each of the dependent variables analyzed in this study were measured on a 5-point scale from strongly disagree (1) to strongly agree (5). Questions were developed to measure career interest in four STEM-related fields.

I am interested in a job that involves working with the environment.

A job that involves science is of interest to me.

I am interested in a job that involves technology.

A job that involves engineering is of interest to me.

Data Analysis

In order to understand the results, several analysis methods were used. First, frequencies allowed for a broad review of the data. Initial patterns were identified and T -Tests were performed to identify differences for the variable gender, while for the variables race and year in school, Analysis of Variance (ANOVA) tests were used.

Results

An analysis of data based on gender revealed mixed results. For job interest in science and the environment, there is no significant difference between the male and female scores. For questions about job interest in technology and engineering fields, there were significant differences. For jobs in technology, males were well above neutral, with an average of 4.20, almost an entire point higher than females who reported an average of 3.29, just slightly above neutral. The effect size was relatively high, .352 indicating a strong result. For engineering jobs, females reported an average score of 2.67 or slightly disagree, more than a full point lower than males who averaged 3.68. Again, the effect size was substantial, .366. A complete report of the results according to gender can be found in table 6.

Table 2.6

Gender and Job Interest

Variable	**Male**	**Female**	***SD***	***T***	***p-value***	***Eta***
Job Environment	3.05	3.10	1.14	.291	.771	.022
Job Science	3.77	3.75	1.25	-.106	.916	.008
Job Technology	4.20	3.30	1.22	-5.310	<.001**	.352
Job Engineer	3.68	2.67	1.31	-5.043	<.001**	.366

*Statistically significant at the .05 level

** Statistically significant at the .01 level

Results for analysis based on race yielded different results. A significant difference at the .01 level with a strong effect size (.260) was found for interest in jobs working in science. Asian students reported the highest scores (M=4.15) while African-Americans reported the lowest (M=3.16). A significant difference at the .05 level was found for interest in a job working with technology, with a smaller effect size, .201. Again, Asian respondents reported highest interest (M=4.03) while Caucasians were lowest with an average of 3.25. No significant differences were found for questions about jobs with the environment. For jobs with engineering, a significant result was found, but the effect size was minimal, .185. Again, Asians scored highest (M= 3.50) while Caucasians scored lowest (M=2.67). Complete results appear in table 7.

Table 2.7

Race and Career Interest

Variable	**African-American**	**Asian**	**Caucasian**	**Latino**	***SD***	***F***	***p-value***	***Eta***
Job Environment	2.83	3.09	3.27	3.07	1.13	2.19	.054	.163
Job Science	3.16_b	4.15_a	3.60	3.32	1.28	5.83	<.001**	.260
Job Technology	3.45	4.03	3.25	3.27	1.22	3.40	.005*	.201
Job Engineer	2.85	3.5	2.66	3.02	1.28	2.85	.015*	.185

*Statistically significant at the .05 level

** Statistically significant at the .01 level

Note: Means with differing subscripts within rows indicate significantly differences at the p<.05 level based on Scheffe post hoc paired comparisons.

The variable year in school had significant difference for all four questions. For interest in jobs the environment, 9th and 10th graders scored lower (M=2.71 and M=2.77 respectively) than 11th and 12th graders (M=3.26 and M=3.27) with an effect size of .236. For jobs in science, juniors and seniors again showed significantly higher scores (M=3.62 and M=3.90) than 9th and 10th graders (M=2.94 and M=3.11) with an effect size of .271. Responses to jobs with technology and engineering follow similar patterns with slightly less pronounced scores. For technology the range of scores is M=3.02-3.66 with a peak in 11th grade and for engineering, M=2.59-3.14 again with 11th graders scoring highest. Effect sizes for technology and engineering were .158 and .150 respectively. Results for the variable year in school are found in table 8.

Table 2. 8

Year in School and Job Interest

Variable	**9th**	**10th**	**11th**	**12th**	***SD***	***F***	***p-value***	***Eta***
Job Environment	2.77_{b}	2.71_{cd}	3.26_{bd}	3.27_{bc}	1.11	8.06	<.001**	.236
Job Science	2.94_{bd}	3.11_{ad}	3.62_{d}	3.90_{ab}	1.27	10.745	<.001**	.271
Job Technology	3.02	3.40	3.59	3.65	1.23	3.46	.016*	.158
Job Engineer	2.59	2.76	3.02	3.14	1.29	3.12	.026*	.150

*Statistically significant at the .05 level

** Statistically significant at the .01 level

Note: Means with differing subscripts within rows indicate significantly differences at the p<.05 level based on Scheffe post hoc paired comparisons.

Based on the findings of this report, we partially reject the first hypothesis because the results are mixed depending on the specific STEM discipline. Females scored lower on two subjects, but there was no difference for the other two. We partially reject the second hypothesis for the same reasons. Finally, we reject the third hypothesis because significant differences were found for all four questions demonstrating a recognizable trend.

Discussion

These results indicate that generalizations about EnvironMentors students cannot be easily drawn. Nevertheless, these findings do provide EnvironMentors administrators with good actionable information about their audience. In recruiting participants for the EnvironMentors program, staff should be mindful regarding student demographics particularly gender and age in school. Furthermore, gender and age specific programming may be appropriate in some situations.

In working with females, there is good news and bad. In the fields of science and the environment, girls and women show interest equal to their male counterparts. EnvironMentors staff should be aware however that in the traditionally male-dominated fields of technology and engineering, an “enthusiasm gap” exists among EnvironMentors participants. Gender-specific programming, as suggested by table 1, may be appropriate here. Further research should be conducted to assess the ability of special programming to impact attitudes of high school age females. Another option would be for EnvironMentors staff to recruit female professionals from the technology and engineering fields to speak with students, providing real-life examples and role models.

In understanding the role that race plays in participation in STEM fields, the picture is more complicated. While race definitely impacted scores, the patterns varied depending on the field in question. In general, interest in science jobs is relatively high across all racial groups (3.35-4.30) but scores for jobs with the environment are lower (2.98-3.33). This suggests that programming which focuses on the differences among STEM fields, for example, separate informational sessions, which present environmental science careers as separate from technological development, or engineering, or math careers may be appropriate. Finally, while significant differences were found for 3 out of 4 questions, effect sizes were generally low indicating a weak influence.

In terms of understanding the importance of student age, the current study shows a higher interest in STEM for juniors and seniors than freshman and sophomores. This may reveal simply that older students are more career-oriented. More importantly, it shows that older students have already formed opinions about STEM careers and participation in EnvironMentors will not affect attitudes as strongly as with younger students. Coupled with research that shows attitudes about STEM are often formed early, EnvironMentors administrators should consider their program goals when shaping recruitment strategy. Do EnvironMentors chapters want to expand the pool of students interested in STEM careers? If so, they should strive to enroll more 9th and 10th graders. If instead, the goal is to take students who are already interested in STEM careers and groom them for future success, recruiting juniors and seniors makes more sense.

In order to address these challenges, we recommend a few suggestions. First, EnvironMentors should develop gender-specific programming which highlight women's experiences with science. Second, EnvironMentors should consider their goals in developing an age-based recruitment strategy. Finally, in understanding new approaches for racially diverse students, further research is needed. Embracing Lee's identity theory which incorporates social influence in student attitudes could lead to the development of new group based lesson planning, and may be appropriate in certain contexts.

Recommendations for Future Research

Future research should attempt to identify additional programmatic variables relevant to student outcomes. One possible area for analysis is the importance of socio-economic factors. As Fusco (2001) points out in his study of student achievements in science, the manner in which science is taught often reflects typical middle-class experiences while excluding the life experiences of students most on the margins of science. It is therefore reasonable to infer that socio-cultural background of the student may have a more specific influence on their STEM interest than gender, race or grade level alone. Existing surveys collect no data on individual economic status, and the personal nature of this issue may make data collection impossible. Therefore it is suggested that data collection of this type may be done more effectively on a chapter by chapter analysis. Data on income may be collected based statistics kept by participating high schools.

Another concept which may be measured by the EnvironMentors program is student's practical epistemologies as they relate to science and STEM. Epistemologies are different from career interest in that they represent student's beliefs about the nature of science. Epistemologies are important because they define how student's conduct science as well as how they understand the foundations of scientific knowledge and the scientific process. (Sandoval, 2004). While not directly related to student participation in the sciences, an understanding of their epistemologies may help EnvironMentors administrators identify areas of concern as well as strategies for addressing misconceptions.

Limitations of the Current Study

The most obvious challenge to validity to this analysis comes from the amount of missing data. This deficiency may or may not qualify as nonresponse error (Vaske, 2008) as it is difficult to say with certain that students who did not respond to the survey are different than those that did. A phone nonresponse bias check would be recommended to minimize this error, however it would be impossible to conduct due to the anonymous nature of the survey. For this reason, it is recommended that survey implementation procedures be revisited by EnvironMentors staff and the anonymous format be reconsidered as more effective survey implementation and higher response rates would increase sample sizes and improve ability to analyze data.

Conclusion

The current study identifies several key findings concerning the EnvironMentors program. First, scores across all variables indicate neutral, relatively low interest in STEM reinforcing the need for programs which address these concerns. Second, gender and year in school each have an influence on incoming student scores on the same variables. Race is found to impact STEM interest, but further research is necessary to understand the complexity of this issue. Several recommendations are made based on these results, including reforms in the manner in which the survey is implemented and data is collected.

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INFORMING PRACTICE THROUGH UNDERSTANDING THE MENTOR EXPERIENCE

In the field of conservation biology, education serves an essential function: communicating subject material across demographic and disciplinary boundaries. Without effective outreach, scientific knowledge remains the domain of the practitioner and conservation goals remain unfulfilled. As a recent article appearing in the journal *Conservation Biology* correctly points out, there exists an identified need for understanding the way in which societies' access and distribute information about science and the environment (Sutherland, et. al, 2009).

The EnvironMentors program, a national program funded by the NCSE, addresses the need for educational programs by promoting scientific literacy and participation as well as engaging traditionally underserved communities in the field. EnvironMentors was established in 1992 in order to encourage young adults from diverse ethnic and socio-cultural background to become active stewards of their communities and the environment. Furthermore, EnvironMentors aims to provide underserved youth with an avenue to explore STEM in college, and open pathways for them to move towards successful environmental careers (EnvironMentors, 2013). An important aspect of EnvironMentors is the intended outcome to increase diversity in college programs and professions related to natural resource fields.

Over the past five years, the EnvironMentors program has been the subject of much academic study, with the focus largely on student outcomes. Through this process, the need for understanding the mentor experience was identified. This study focuses on improving management of the mentors through understanding varied administrative approaches. By applying these approaches, mentor satisfaction and quality can be increased, directly impacting program outcomes. Direct lessons from existing resources can be applied to the EnvironMentors program such as the recommendations of the U.S. Department of Education Mentoring Resource Center (MRC) which point to the importance of mentor retention.

According to the MRC, as many as half of volunteer mentoring relationships terminate within the first few months of the match. In addition, research clearly shows that youth in matches that end prematurely actually have worse outcomes in several key areas than youth who are never mentored. Therefore, in terms of youth outcomes, keeping volunteers is at least as important as recruiting them in the first place.

Mentor motivation and satisfaction are directly related to retention. Common reasons for mentors dropping out of programs include, poor organization, lack of training, time or skills not used well, lack of clarity about assignment, and lack of support or supervision (The U.S. Department of Education Mentoring Center, 2000). In order to minimize mentor loss, the MRC suggests the following steps, several of which echo points made earlier in this review.

1. Set up expectations during mentor recruitment and selection.
2. Prepare mentors for their role through pre-service training.
3. Create a supportive environment.
4. Provide ongoing training and supervision.
5. Build connection and belonging.
6. Show appreciation through mentor recognition (The Mentoring Fact Sheet, 2000).

An analysis of these points represents a blueprint which could reasonably be applied to the EnvironMentors program. The current study will examine the EnvironMentors program through the eyes of the mentors in an attempt to identify opportunities for development and inform future administrative practices. The goal of this research is to produce findings and recommendations that could be directly applied by EnvironMentors staff in conjunction with objectives outlined in the 2012-2015 strategic plan. (J. Soule, personal communication, October 2013).

Literature Review

Several theoretical concepts apply directly to the current study. Existing research on the efficacy of mentorship programs in developing environmental and scientific literacy establish the rationale for EnvironMentors (Dubois, 2002; Hill, 2009). In a series of white papers funded by the American Recovery and Reinvestment Act, researchers suggested eight key characteristics for effective mentoring:

1. Leadership
2. Empowerment
3. Strategic Perspective
4. Integrity Skills
5. Judgment Skills
6. Political Skills
7. Creative Thinking
8. Communication Skills (Abedin et. al, 2012).

The most direct way for mentorship programs to support their mentors in obtaining and maintaining these skills is through ongoing training. A review of scholarship yields another perspective on best methods and benefits of mentor training. In 2013 a study conducted by the Institute for Clinical and Translational Research, conducted and then measured the efficacy of a mentor training program which consisted of four two-hour sessions over the course of two months. The training covered the following topics: introduction, effective communication, establishing expectations, assessing understanding, addressing diversity, fostering independence, promoting professional development and articulating your mentoring philosophy and plan (Pfund et.al, 2013). The results of the study were compelling.

Overall, mentors were very satisfied with the training; 88% (n=122) reported that the eight hours of training was a valuable use of their time. Moreover 90% of participants responded that they were either likely or very likely to recommend the training to a colleague. Feedback from participants supported the quantitative data. According to participants in the study, many of the mentors never thought about the process in a formalized manner. Training sessions provided useful focus to identify and address key and current mentoring issues, particularly through the discussion of the case studies. They also allowed participants to articulate their mentoring philosophy, to hear and share others' mentoring philosophies, and integrate some of the approaches and philosophies into their own mentoring paradigm and practices (Pfund, et.al, 2013).

More important to the current study is contemporary pedagogy for effective mentor training. Established mentoring best practices provide a workable roadmap for optimizing the impact of EnvironMentors. Background in this area is provided in studies which recommend a reflective and interactive model for program management (Heirdsfield et. Al, 2008, Anderson, 2003).

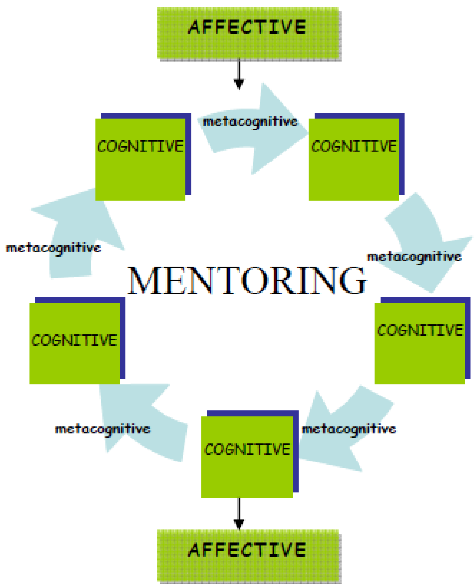

Figure 3.1

A Relational Model of Mentoring (Heirdsfield et. al, 2008).

In short, providing mentors' opportunities to share their experiences in a group setting has been shown to improve practice. Figure 2 demonstrates how existing theoretical findings relate to variables in the current research to form a working conceptual framework.

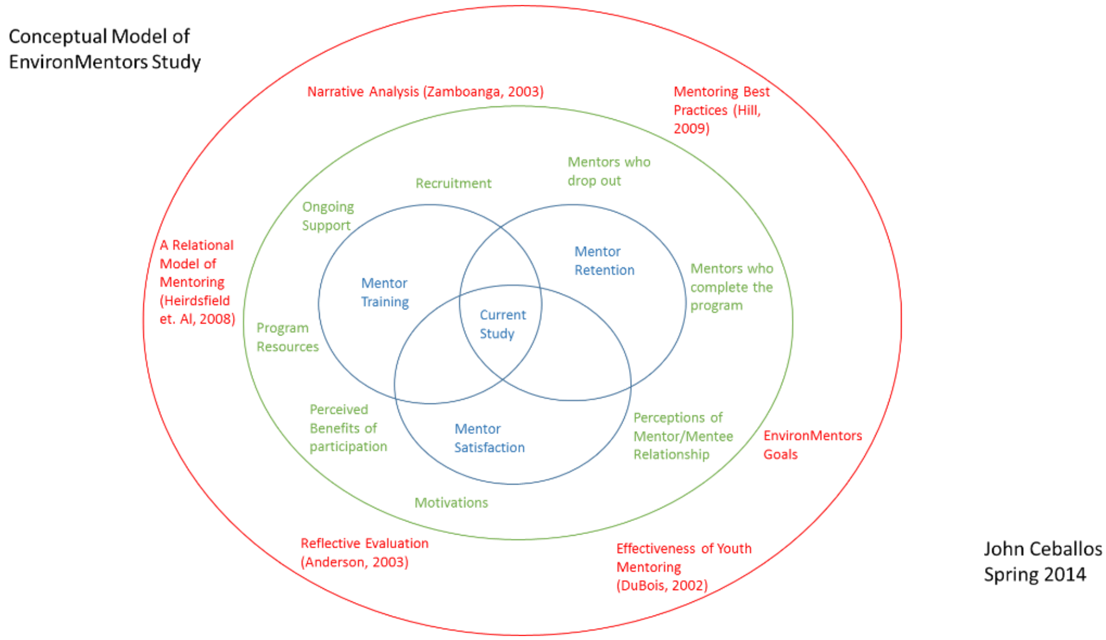

Figure 3.2

Conceptual Framework

Further, methodological precedent for the current study is set in Zamboanga's 2003 study of the Latino Achievement Mentoring Program (LAMP). Zamboanga made two recommendations consistent with the findings of Anderson and specifically relevant to EnvironMentors:

1. Recruit committed college mentors willing to serve at least one academic year to allow the rapport building process to unfold.
2. Provide mentor training in rapport building, specifically in developmentally appropriate communication strategies for youth. Focus should be placed on assisting mentors in developing realistic expectations for mentee-initiated contact and may include encouraging experienced mentors to discuss the course of their mentoring relationships (Zamboanga, 2003).

By building on this foundation, the research questions this study addressed were:

1. What motivates mentors to participate in EnvironMentors, and what benefits do they receive through their participation?
2. What aspects of the Environmentors program are most important to the mentors?
3. How do mentors feel about the training and support they received?
4. What challenges do mentors face and how do they overcome them?
5. How do mentors assess their own satisfaction with the program?

Methods

In order to represent the individual nature of the mentor experience, a thematic, qualitative, interpretive paradigm was selected. As a mentor and a full participant in program activities, I was able to explore the emic (insiders) perspective. I had full access to all organizational documents for both programs, was present at all meetings for the chapter with undergraduate mentors, and personally fulfilled all the responsibilities of the other mentors.

My positionality as it relates to the interview participants provided strong opportunities for data triangulation and establishes study trustworthiness. Research memos provide an audit trail in this regard, allowing for disclosure of my own subjectivity and decision-making process (Merriam, 2009). This approach is operationalized as an elicitation study which allows the researcher to identify key variables of the mentor experience which could be measured and tracked quantitatively in the future.

Participants/Setting

This study measured the experience of two groups of mentors (see table 1) over the course of the 2013-2014 academic year. Group A consisted of four graduate students from the EnvironMentors program at Louisiana State University, and Group B was composed of five undergraduates from the program at Colorado State University. Five of the participants were female and four were male. Pseudonyms have been used in the presentation of findings.

Table 3.1

The mentors

Mentor	A	B
Clara		x
Katness		x
Taylor		x
Red		x
Jolene		x
Peter	X	
Nate	X	
Casandra	X	

**Bold denotes female*

Participants were purposively sampled based on the following criteria: the depth and quality of responses to an initial survey distributed to a larger sample, and their diversity of backgrounds and interests, as revealed in the initial survey. Data were collected through a sequence of online surveys and one-on-on individual interviews. Two rounds of open-ended online surveys were completed, one in December 2013 and a second in January 2014. Surveys were short and addressed first impressions and motivations for participating. The results were analyzed and based on the analysis, a sub-sample was selected. From an initial pool of 23 respondents, 12 surveys were identified for one-on-one interviews based on depth and quality of survey responses. Nine mentors participated in the interviews. Individualized interview questions were designed to address research questions and interviews were conducted in late February and early March 2014. Table 2 shows a rough script for interviews which started with broad questions and moved towards more specific ones, guided by the participants themselves.

Table 3.2

Sample Interview Protocol

1. Greeting and thanks for participating

2. Disclosure of usage of transcripts

3. Can you tell me about your mentee and their project? How is everything going so far?

4. Can you talk about some of the challenges you've faced so far and what you've done to try to overcome them?

5. What are you getting out of the program?

6. How would you like the program to end?

7. How does your participation in EnvironMentors fit into the rest of your life?

8. Can you describe EnvironMentors to someone who might be unfamiliar with it?

9. Would you do it again? Why or why not?

10. Is there anything we've missed?

Five interviews were conducted in person and four through an online video format. Interviews lasted between 20 and 40 minutes. Questions were open-ended and participants were encouraged to elaborate on responses. Audio and/or video recordings of each interview were transcribed by the researcher and a team of assistants.

Data Analysis

For this study, data collection and analysis informed each other and often happened at the same time. Data were collected as it were analyzed and preliminary results helped the data collection methods evolve throughout the research process. Organizational documents and participant observation provided important contextual information for interpreting the interview data.

Transcriptions were analyzed using traditional thematic analysis (Braun & Clark, 2006). Initial codes for the data set were formed deductively based on previous research on mentoring, and inductively as suggested by the data. Initial coding was checked and peer debriefing was conducted throughout the process. Final codes were established based on repeated readings of the transcripts and comparative analysis. Domains and matrices were constructed in order to identify similarities and differences in the data. Findings were triangulated using the variety of data collected and final, end of study member-checking was conducted to provide increased trustworthiness to the report.

Results

A thematic analysis of the interview transcripts yielded several main themes and associated sub-themes including, the perceived challenges of being a mentor, the nuance of the mentor/mentee relationship, the benefits of the program and feedback regarding program training and support. Additional themes which were present include conceptualizations of the mentor role and the impact of previous experience on participation.

A few key differences between the two mentor groups are relevant to the analysis.

The impact of the differences in the model of the program surfaced through the interview process. For example, mentors from Institution A appeared to be more intrinsically motivated than mentors from institution B. Another key consideration is that group B mentors reflect the socio-cultural background of their mentees more closely than mentors from group A.

Table 3.3

Chapter Model

Variable	A	B
Total number of mentors	20-25	10
Location of meetings	On campus	At high school
Number of Mentors per mentee	2	1
Meeting Times	Mondays 3-5	Variable
Mentor demographic	Grad Students	Undergraduate
Mentee demographic	Majority African American	50% Latino, 50% Caucasian

Mentor/Mentee Relationship

Much of the data analyzed related directly to the relationship between the mentors and their mentees. For the majority of the mentors, success was measured not only in the quality of the final science project, but in the close relationship they formed with their mentees. Katness, one of the group B mentors, reflected on the satisfaction of being a role model,

> It's nice just to talk to someone. I mean about projects as well as just someone who's a teenager still. We gossip sometimes about the school and what's going on…it's been a pleasant experience and it's great to have someone that looks up to me and I can actually do things for the project and help her out and feel like wow, maybe I'll actually use this education that I've got.

Jolene echoed this sentiment and broke down her relationship with her mentee,

> About 70% of the time when I'm with her we're talking about her project, but then 30% you know I'm getting to know her better, she's getting to know me better. She's asking about my personal life in an appropriate way and it's just really great. When I leave I just feel very accomplished. I mean I'm getting a lot

> more out of this than I thought I would…it almost feels like a big sister little sister experience. I've never thought of myself as a mentor like this.

Most of the mentors expressed similar feelings of closeness to their mentees. Like several of the group B mentors, Red is from the town where institution B is located and was able to identify closely with his mentee, "He has a similar personality to mine, really fun loving, likes to talk, a really social guy… he reminds me of myself. Just kind of a smarter, righter version of myself."

Institution A mentors, who on average are older than group B mentors, reflected on the value of the relational bond with their mentee in a more reserved way. Peter recognized the importance of building a connection with his mentee and the impact it had on the success of the project. He also reflects on the challenge of relating to the high school students at the group B chapter,

> The big one (strategy for success) is making a connection with your mentee. I've seen other groups where the mentee is completely uninterested, he doesn't want to do the experiment...You meet somebody in September and you see them once a week. You can communicate by email so it's really tough to form a relationship to where you can get an experiment going and you can have them talk candidly, how know how notoriously quiet some high school kids are.

When asked to reflect on building an interpersonal bond, he responded, "The whole demographic, socioeconomic differences, if you're not from that background it's hard to relate sometimes." His view, was more typical of group A mentors.

In general, mentors from both groups stressed the importance of creating a strong interpersonal bond with their mentees. This supports the finding that the interpersonal relationship with the mentee is equally important to the mentor as the completion of the science project.

Benefits of being a mentor

The range of personal and professional benefits of the program cited by mentors represents one of the most diverse themes from the data. Responses ranged from the intrinsic, inward sense of fulfillment to the concrete development of job skills. Across the board, it is clear that participants gained many benefits from their mentoring experience.

Communicating with young people was a skill that the mentors referenced often, particularly as it relates to promoting scientific literacy. Katness shared how learning to be leader was an important aspect of her EnvironMentors experience,

> I don't have a lot of experience being a leader but I would like to try to become a leader so that's why I joined and I'm glad they accepted me. I think it's very important especially if you're going into a science based field you need to have those skills to talk to people and actually make them listen to you. Because you can't just do the research and then not be able to tell people about it in a way they can understand.

Several mentors made a connection between skills learned through EnvironMentors and applying for a job. Peter summarized the idea,

> Working with high schoolers is great and professionally you can talk about that. At my first job interview after my undergrad degree we talked at length about that and they were very impressed about it. So it's kinda like an ancillary benefit. I don't do it to put it on my resume, but at the same time it really does help if some employees see you are working with youth.

In addition, mentors often cited the educational value to themselves of teaching someone else, "The best way to memorize stuff is teaching it to others," said Jed. Casandra elaborated on the idea more fully, "I appreciate the fact that putting together a science fair project and looking for a hypothesis and the results uses a different part of my brain than I use daily. It's kind of a refresher and you know they say that teaching something helps you retain it."

Some, like Nate commented that their experience with EnvironMentors was a way to give back to the community, "I had a really great 8th grade English teacher…we kept a strong relationship all throughout my high school career, while I was there and even after high school….he was a teacher I guess, but he was a mentor too. When I think about wanting to do education, he is that person I'll think back to." Casandra, had a similar motivation for being an EnvironMentor, "one of the TA's for my lab…mentored me in being more out of the box because I was a really shy person when I was a freshman…it helped me be the person I am so I love the idea of doing that for someone else like Trevor (her mentee)." Peter offered a more straightforward reason: "The one thing that I really focus on as far as from a life perspective is the service component of whatever I do….I love to give back."

Ultimately, the mentors framed program benefits more for their mentees than themselves. Raising awareness of science and the scientific process was a goal shared almost universally by the mentors. Casandra nearly echoes the EnvironMentors mission statement when she said,

> I would love for Trevor to have more of an appreciation for science whether it's biology of environmental science, animal science or any kind of science, engineering, physics. Anything that helps him realize there are other options out there because I know in high school my knowledge of what I could do in college was very limited. I didn't know they had all these different options and I want Trevor to appreciate that there are these options and I know that science can be boring and frustrating but science is really exciting because it's always evolving

> and you can learn so much and I want him to be more open to the idea of schooling and doing research.

This quote shows the big picture perspective that Casandra used when dealing with her mentee. Nate, has a similar perspective when he summed up his desired outcomes for the students in a broader context,

> As far as the lasting value, you know, I live in a state that's literally falling into the ocean – there's scary stuff and I also live in a state that does not value science so I think it's very important for high school kids to understand how the environment works, what society's place within the environment is and that these arcane definitions they learn in science class that don't make any sense, actually have a real impact on their lives. And I think even if they don't learn anything but come away with a sort of respect for the environment and for the importance it plays in their lives, even if they don't realize it, or hadn't realized it before, I think that's value enough.

These quotes from Casandra and Nate show their goal-oriented perspectives. In general, group A mentors seemed to focus on the long term academic and intellectual results of the EnvironMentors program, particularly for the mentees. In contrast, the group B mentors were more focused on the benefits they received themselves. This data indicates that the benefits of EnvironMentors are different for each mentor.

Training and Support

In general, participants had positive feedback regarding their training and support. Katness expressed her pleasure with the role her chapter coordinator had played: "It's nice to have someone who oversees this staff and they can organize everything for me so I don't have to…I think it's really helpful that she has those weekly meetings even though I can't be there, knowing that someone else has helped Rachel…I think it's pretty good."

Several mentors however, had recommendations. Casandra in particular highlighted the potential use of an expanded training module,

> I don’t think any of us are education majors of any sort or doing education research. We’re all in science of some sort so it’s not like we’ve had experience or classes to teach you that sort of stuff. I mean we did have a guest speaker talking about motivating students but I feel like we could benefit from another maybe more practical or hands on approach. Maybe doing the role playing and saying like you’re the difficult student and you’re the mentor, what are you going to do?

Other mentors suggested that more time be dedicated to opportunities for informal getting to know each other. Taylor made an interesting point, which other mentors also shared,

> At the beginning I felt like the college students didn’t get to talk about themselves enough. Which it’s kind of weird to say, when we’re meeting the high school students, the ice breaker game, we learned about the high school students and I felt like the high school students were never able to learn about us and know what our interests were and our backgrounds, where we’re coming from and so I think it’s harder for the high school students to connect to us.

Clara made a similar comment,

> I feel like at the beginning I felt a little lost like what exactly am I supposed to be doing…Maybe more of like a workshop or something to help us have a little more tools of how to help them get through a project that they’re excited about. We had a field trip to the museum and to the physics lab, maybe like one or two more of those so that we can observe students in informal settings to kind of be like, well I saw you looking at that, you seemed excited about this, versus having to pull stuff out of them.

These quotes show that mentors wanted to be included in all steps of the process right from the beginning. While they acknowledged that this would mean more work, they thought the payoff with the mentees was worth it.

Nate felt that more information could be provided the mentors at the beginning, “I think the biggest challenge I’ve experienced is how to interact with these students who come from a very different background than the one I come from…more information on the school and these students backgrounds would help a lot.”

Taylor made a suggestion on how to address this issue,

> One thing that would be kind of neat is if the college students were more involved in the recruiting process. I talked about this with some of the other EnvironMentors and kind of just the idea that we could go meet high school students and show them what it’s about. I mean a lot of mentees have dropped out and I think being able for us to go wrangle up a crowd that is more into the project and wants to be part of it after seeing the college students, essentially what these high school students will be becoming in four, five years, and I think it would be cool to be part of the recruiting process.

Based on this data, it is found that mentors would appreciate a more formal training module. In addition, some mentors would be willing to participate in student recruitment.

Challenges of Being a Mentor

Serving as a mentor for the EnvironMentors program presented a range of challenges. The most consistent issues mentioned were logistical challenges. Balancing the competing demands of being a student and a mentor was a strain on the schedules of several mentors. Casandra, a graduate student from group A provides an example:

> This semester has just been packed, I took on way too many responsibilities, I joined too many clubs because I was like oh, I’m graduating, why don’t I just join everything and all of a sudden everyone was like well you need to be at this and you need to be at this and I have two jobs and EnvironMentors and it’s just oh my gosh how am I going to accomplish everything?

Mentors repeatedly mentioned their desire to start early in order to stay on schedule. Clara, whose mentee eventually dropped out of the program expressed her frustration with the timeline: “I think having it start halfway through, like towards the end of last semester like it’s when things are getting kind of crazy for us so like I think mostly I just felt pretty detached from it, the whole first section.”

One returning mentor, Pete, cited his previous experience with EnvironMentors as a benefit: “ We started planning very early on, basically being proactive about everything and that kind of helped us get our project online and ready to go…I wanted to get a quick result from the experiment based on previous experience.”

While both groups of mentors shared a sense of being pressed for time, the perceptions on how to best address scheduling and time commitment issues varied between the two groups. The institution A model, which has a rigid structure and limits activities to Monday afternoon meetings on campus, worked well for most mentors. Nicole in particular, appreciated the organization, “We get weekly emails from them about what exactly we need to do for Monday and it’s laid our super easy to follow like bold and underlined… I feel like I’m normally an organized person and looking at their emails I barely have to even think about what I have to do because they’ve laid it out entirely.”

Conversely, institution B students were encouraged to meet with their mentees off campus on their own time. Several mentors, like Jolene, preferred a flexible approach to meeting with their mentees:

> I talked to my mentee and said, hey look, it’s nice that we’re able to meet on Mondays but let’s find some times outside of this in a different setting because

> they're more relaxed, and it's just easier to do things….so I bring my laptop to her house and her parents are there, her siblings are there. They leave us alone in the kitchen but sometimes they'll come in and out and chat with us.

Other mentors, like Taylor thought that an on campus meeting would be better because of the resources available for mentors and students.

For many of the mentors, participating in this research was rewarding and enjoyable. In this way the research served as a metacognitive reflection tool

While some of the mentors suggested that formal opportunities for discussion were unnecessary, at least one, Peter, saw the potential benefit. "It would be really cool to have like a weekend exchange or something where we send two mentors up and have two mentors come down. Go through their program, sit down with the advisors and coordinators and just throw ideas off the wall. That'd be great."

Peter's suggestion in this final quote shows his dedication and sincere interest in the goals of the EnvironMentors program. Peter and Nate, who both participated for two years, were very focused on the broad aspects of the EnvironMentors program rather than the specifics. An important finding from this theme is that mentors would like to be more involved in the planning process and would also like to start meeting students earlier in the year.

Discussion

The bulk of data from this study reinforce existing scholarship on best practices of mentoring. Several key items are particularly relevant to the EnvironMentors program and provide useful justification for developing new strategies. Several recommendations are put forth based on findings, including the need for more interpersonal training and opportunities for informal time, especially early on in the program. These recommendations are consistent with previous research by Pfund which highlights the importance of proper training.

Several data provide insight which have potential implications in mentor recruitment, for example Clara who suggested that the program start early in the fall semester. Other data suggest the need for the development of communication skills because as Cassandra pointed out, few or none of the mentors were education majors. Another important concept was the opening of new professional paths reflected in the comments of Paul and Katness. An important theme, summarized by Nick, was the continuation of an existing pattern of service and a desire to “pay it forward’. These data reflect previous research which suggests mentors whose motivations for participating are met are more likely to continue to serve as mentors.

Based on the results, several practical steps are offered for EnvironMentors administrators. First, an abbreviated training module should be universally adopted by each chapter which emphasizes interpersonal communication skills. There currently exists a wealth of public and private resources to assist in development of a training regimen. The EnvironMentors Mentor Booklet provides a brief (15 pages) overview of basic information that mentors need to know including, "Tips for Good Communication and Listening Skills," as well as a helpful list of "Mentor Do's and Don'ts." Near the back of the booklet, additional resources are listed including the National Mentoring Partnership, National Mentoring Resources Center, MentorNet and SOAR (Significant Opportunities in Atmospheric Research and Science.) Unfortunately, many of the mentors I spoke with were unaware of these resources. To address this issue, EnvironMentors administrators should distribute this information from a centralized hub, rather than depend on individual chapters to do so.

Furthermore, a brief review of private sector options will reveal online mentor training modules such as mentoringcentral.net and mentoring advocacy websites such as mentoring.org. A document published by the National Mentoring Center in conjunction with Georg Washington University and the U.S. Department of Justice provides a helpful training outline for a two-part mentoring training. The agenda, featured in figure 4, includes two, three-hour sessions. This training is designed to provide mentors with an overview of the program they will be working with, realistic understanding of the mentor role, approaches for establishing trust with mentees and appropriate communication techniques.

Mentor Training Agenda—Part 1

1. Icebreaker—Introductions (30 minutes)
2. Roles of a Mentor (30 minutes)
3. Overview of Our Program (25 minutes)

Break (15 minutes)

4. The Youth We Serve (30 minutes)
5. What Supports Do Youth Need? (40 minutes)
6. Wrap-Up (10 minutes)

Mentor Training Agenda—Part 2

1. Icebreaker—Are You Listening? (20 minutes)
2. If You Want Easy Listening, Turn on the Radio (25 minutes)
3. Communication Role-Plays (40 minutes)

Break (15 minutes)

4. Trust Comes First (25 minutes)
5. Establishing and Maintaining Boundaries (45 minutes)

Optional activity—"What Should We Do?" (40 minutes)

6.Wrap-Up (10 minutes)

Figure 3.3
National Mentoring Center Mentor Training Agenda (Cannata et.al, 2008).

Second, chapter coordinators should consider involving the mentors themselves directly in the recruitment process. This recommendation comes from the finding that mentors consistently mentioned the importance of getting an early start and having ample opportunities to get to know participants in an informal way. Including mentors in student recruitment would facilitate early student/mentor interactions and allow mentors the opportunity to present themselves directly to participants in a relaxed setting. By supporting chapter coordinators in this way, mentors indicated that they believed student enthusiasm would increase.

Third, the finding that different mentors get different benefits from participating, supports the recommendation that the diverse and rich benefits of being a mentor should be emphasized throughout the duration of the program, from recruitment, until end of program follow-up. Mentors should be allowed an opportunity to reflect on the positive and negative aspects of their experience and mentors who complete the program should be encouraged to return the following year.

Finally, audience specific information, particularly in contexts where the mentors have a different sociological background than mentees is needed. This stems from the finding that the interpersonal relationship is important to mentors.

Limitations

While the theoretical and methodological foundation of this study is based on sound principles, there are a few limitations appropriate to mention. Most noticeable is the principal investigators role as a mentor. As a mentor I was able to experience the struggles and frustrations, as well as the rewards of being an EnvironMentors mentor. My mentee, one of the youngest in the group, required special attention and encouragement. My position as a Teachers Assistant and older peer leader for the institution B mentors was both a facilitating factor and a boundary to obtaining good, valid, reliable information. Furthermore, the physical distance between myself and the institution A mentors represented a potential source of misunderstanding. A personal visit during the initial segment (October) of the study period helped to allay this concern.

Conclusion

For the past 20 years EnvironMentors has engaged high school students underrepresented in the sciences in raising their interest level and preparedness for science and environmental college degree programs. Today, with the need for scientifically informed and active citizens greater than ever, EnvironMentors addresses a vital need, illustrated by this quote from Hill, "In the study of environmental science, academic mentors have been found to be effective in positively impacting student behavioral, attitudinal, health related, relational motivational and career outcomes." This study contributes to a greater understanding of the dynamics of EnvironMentors while informing the manner in which it is implemented. By focusing on the mentor experience rather than the student experience, this study addresses a key factor in overall program success (Dubois, 2002). Exploratory in nature, this research identifies issues specific to the EnvironMentors program which can be directly and immediately applied.

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SUMMARY AND RECOMMENDATIONS

Over the course of the past few years, research has revealed a substantial amount of information about the EnvironMentors program. The 2008 thesis of Shawn Davis for example outlined important guidelines for maximizing student outcomes. This study contributes to our understanding of the program in two key ways:

1. Statistical analysis of the EnvironMentors target audience and their attitudes toward careers in STEM fields

2. Interpretive analysis of the mentor experience through the eyes of the mentor

Taken together, these insights provide EnvironMentors staff with workable information which can support them as they strive to fulfill the program mission “to mentor and motivate high school students underrepresented in the sciences as they conduct scientific research and acquire skills that will allows them to build careers and become active stewards of their communities and the environment. “

Understanding the Audience

Chapter two of this study presents three key findings:

1. Females show less interest than boys in careers in technology and engineering.
2. Race has a marginal impact on interest in STEM professions.
3. Older students have stronger feelings about STEM careers than younger students.

The Mentor Experience

Chapter three of this study makes the following recommendations:

1. EnvironMentors should universally adopt an abbreviated mentor training module focused on interpersonal communication skills. Central administration should control distribution of the information.

2. Chapter coordinators should involve mentors directly in the recruitment process.

3. The diverse and rich personal and professional benefits of being a mentor should be stressed during the mentor recruitment process and emphasized throughout the duration of the program.

4. Background information on the lives of the students, particularly where the mentors have a different sociological background than mentees is needed.

Looking Forward

The findings of this study reflect the diverse and complex factors relevant to the EnvironMentors program. From student attitudes to mentor satisfaction, program success depends on a special combination of conditions.

In order to operationalize findings from chapter three, a mentor survey has been created as a measurement tool. This survey was built using existing surveys as a guide and was intended to cover the most important facets of the mentor experience in a concise, easy to complete manner. Each of the five, three-question sections represents one of the concepts discussed in chapter three such as training, satisfaction, mentor/mentee relationship, recommendations and retention. Results from this survey will measure mentor satisfaction, the underlying purpose of this research. Future research which connects mentor retention and satisfaction to student outcomes is recommended.

Table 4.1

The Mentor Survey

Mentor Survey 2013-2014

Dear Mentors,

Please take a few minutes to fill out both sides of the following survey. Your feedback helps us continually improve our programs and make EnvironMentors all that it can be!

Thank you,

EnvironMentors Staff

1. Please rate different aspects of your mentor training:

	Strongly Disagree			**Neutral**			**Strongly Agree**
Mentor training prepared me for being a mentor	1	2	3	4	5	6	7
I felt supported throughout the mentor process	1	2	3	4	5	6	7
I had adequate supplies to complete my project	1	2	3	4	5	6	7

2. Please describe your overall satisfaction with the EnvironMentors program:

	Strongly Disagree			Neutral			Strongly Agree
The EnvironMentors program met my expectations	1	2	3	4	5	6	7
I gained valuable professional skills through my participation in EnvironMentors	1	2	3	4	5	6	7
Being a mentor was personally fulfilling	1	2	3	4	5	6	7

3. Please describe your relationship with your mentee:

	Strongly Disagree			Neutral			Strongly Agree
My mentee and I were on the same page all year	1	2	3	4	5	6	7
My mentee was internally motivated to participate	1	2	3	4	5	6	7
I had a close relationship with my mentee	1	2	3	4	5	6	7

4. The following would help EnvironMentors improve:

	Strongly Disagree		Neutral			Strongly Agree
More extensive training for mentors, including online training modules	1	2	3 4	5	6	7
Financial incentives for mentors	1	2	3 4	5	6	7
Working with a mentoring partner	1	2	3 4	5	6	7
Creating an online EnvironMentors community	1	2	3 4	5	6	7
More field trips and group events	1	2	3 4	5	6	7

5. Please reflect on your EnvironMentors participation:

	Strongly Disagree			Neutra l			Strongl y Agree
I would repeat this season of EnvironMentors again	1	2	3	4	5	6	7
If possible, I would participate again next year	1	2	3	4	5	6	7
I would like to participate in a similar program in the future	1	2	3	4	5	6	7

6. Which EnvironMentors chapter are you affiliated with?
   _______LSU ______CSU ______DC _______Arkansas St. ______Nebraska______UC Davis
   ______North Carolina St. _________Alabama St. ________Alabama A&M ________WVU

Thank you very much for your time and participation!

My EnvironMentors Journey

To conclude, I would like to share some reflections on my own participation in this study. As a mentor I was able to participate fully in the EnvironMentors program. I went to meetings, I struggled with timelines, I shared my insights with my colleagues and I learned from the experience. My mentee, Javier was a young student, bright but reserved. In him I observed first-hand the promise and potential that EnvironMentors is designed to develop.

When Javier presented his project during the CSU chapter fair, I shared in his sense of accomplishment. When he informed me of his intention to repeat the program next year, my own efforts felt validated. This immersion in the day to day process of EnvironMentors enriched my knowledge and understanding of the program. As a researcher, I believe my role as a mentor ensured the authenticity of this report and increased the validity of the findings.

Throughout the evolution of the research process, my own growth and development has informed the creation of this document. My knowledge of the scope of the field of science education My education in the field of statistical analysis as well as survey design and implementation has refined how I look at and approach theoretical questions in the field of Human Dimensions research. Over the course of the past 12 months I learned much about how to answer questions in an accurate and precise manner. Likewise, I have made leaps and bounds in my understanding of qualitative research methods, from the theoretical foundations, to the practical applications of its use. I have learned how to collect data in a rigorous manner and analyze and present that data in a structured and formal way. As an environmental science educator, I am now better equipped to consider issues central to the field and produce new knowledge which others can consume with confidence.