AN INVESTIGATION INTO THE EFFECTS OF COLLEGE RESEARCH SHADOWING ON THE PERCEPTIONS OF HIGH SCHOOL SCIENCE STUDENTS

by

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Randy Arnold Metzger

July 2012

DEDICATION

I would like to dedicate this work first to my wife, who has made many sacrifices on her own behalf, to allow me the chance to fulfill my dreams and aspirations. Without her, none of this would have been possible. The late nights of coming to bed after she was already asleep, times of frustration, and hours “glued” to the computer screen would not have been manageable if it were not for her constant support and dedication to our relationship. Secondly, to my parents for setting a great example of how hard work, love, and commitment build the foundation for a strong family atmosphere. My upbringing and their guidance is something I will always cherish and use to “teach” my child strong family values.

TABLE OF CONTENTS

INTRODUCTION AND BACKGROUND 1

CONCEPTUAL FRAMEWORK 5

METHODOLOGY 12

DATA AND ANALYSIS 22

INTERPRETATION AND CONCLUSION 33

VALUE 36

REFERENCES CITED 39

APPENDICES 41
APPENDIX A: Graduation Rate, Areas of Study, Student Choices 42
APPENDIX B: PSSA Report Card, Blue Mountain High School 47
APPENDIX C: Pre/Post Student Survey 51
APPENDIX D: Pre/Post Parent Survey 76
APPENDIX E: Instructor Journaling 85
APPENDIX F: Student Interview Quotes 91
APPENDIX G: Environmental Science Simulation 93
APPENDIX H: Student Field Study Report 96

LIST OF TABLES

1. Programs of Study Selected by Post-Secondary Students at Blue Mountain 13

2. Data Triangulation Matrix 20

LIST OF FIGURES

1. Student Survey Results – *Me and the Environmental Challenges*……25

2. Student Survey Responses – *What Changed Your Perceptions of Science*……..27

ABSTRACT

The National Science Foundation and National Research Council have identified a sharp decline in positive attitudes toward science. These predispositions are becoming more commonplace in middle and high school classrooms for various reasons. The NSF has identified a decline in students pursuing post-secondary careers in science and engineering, predominantly due to the negative perceptions seen in high school science classes. This study focused on the implementation of project based learning as a method for changing students' perspectives toward science and possibly altering their post-secondary choices towards a science career. Projects involved the shadowing of college researchers and professors in field-based environmental activities. High school students worked alongside college researchers and professors, while collecting data and preparing documentation in an inquiry based setting.

INTRODUCTION AND BACKGROUND

Blue Mountain High School is located in south-central Pennsylvania, approximately 30 minutes north of Reading and 1.5 hours northwest of Philadelphia. The district covers approximately 100 square miles containing numerous small towns, boroughs, and a large portion of rural area. The student population (1566) is primarily Caucasian (1484), with some mixed nationalities including African American (13), Hispanic/Latino (35), Asian (15), and Multiracial (17). We are seeing an influx of differing nationalities due to our location just north of a large metropolitan area in Reading, Pennsylvania. Our student population contains 300 students who have an individualized education plan (IEP), a component of the special education department for students who have accommodations. There are 332 who are considered economically disadvantaged by the state of Pennsylvania. Blue Mountain School District has an excellent attendance rate (95%) which is just above the state average of 94%, and our graduation rate is also higher than the states (90%) at 95% for the general population, 86% for those having individualized education plans, and 93% for those designated as economically disadvantaged.

For the 2010 school year the district scored at or above the state average in all three areas of the state standardized tests (math, reading, science) given to the eleventh grade students. The district's curriculum indicates students are required to enroll in three science classes during their high school career. Normal student progression involves students enrolling in a freshman year of Physical Science, a sophomore year of Biology,

and dependent upon their future aspirations one or two more science classes. Students who are pursuing college will advance through a junior year of Chemistry. Their senior year does not mandate a science, however students pursuing college often enroll in an advanced placement science, Anatomy and Physiology, Environmental Science, or Physics. For students pursuing the vocational tract, they substitute their 11th grade Chemistry with an 11th or 12th grade Applications of Science class. For the past five years this district has dissolved the pedagogical ideology of providing students three educational tracts to choose from (college preparatory, general preparation, and vocational technical) during scheduling. The current theory is to allow students to choose the level of class based on their educational strengths. This methodology has been chosen in an effort to provide all students with the most challenging opportunities the district can afford them.

From 2005 through 2009, I taught Physical Science to a majority of the freshman class. I taught six periods of a non-lab physical science class (42 minute period). For the past two years, my position has changed and I now teach two sections of Physical Science (college prep), three sections of General Lab Science (environmental/workplace science for general students and vocational technical students), and this year I will also be teaching a vocational technical, half-year biology class. Over the past couple of years my position has changed quite dramatically. Some of this change was due to my ambition to diversify my teaching, and some is due to attrition of teachers who have not been replaced. Regardless, I see a broad range of student academic levels throughout the day. Some of those students have an easy time connecting with science, others seem to be very

challenged at times. Regardless, my goals are the same, to provide my students with the best possible science education I can offer them, in an inquiry based approach, with the ultimate goal of preparing them for the rigors of their future regardless of which path that might be.

The high school environment is one where students should broaden their horizons, enrolling in challenging classes and involving themselves in activities, which will provide them with educational experiences capable of preparing them for life beyond high school. As an institution, our goal should be to provide students with as many high-quality educational opportunities as possible. This research is focused on the importance of supplying students with these types of opportunities, specifically in science, and the responses of students to their involvement.

Research Question

Numerous students from Blue Mountain High School have excelled in various fields over the years. Many of them have progressed into college and beyond; others have chosen a vocation and have done very well. Regardless of their successes, research has indicated there is still a tremendous disconnect between the preparation high school students have upon graduation, and the expectation of their freshman post-secondary instructors. The objective of this study is to investigate this disconnect. Does the interaction of students from Blue Mountain High School with college researchers, and their professor from Kutztown University of Pennsylvania affect their perceptions of science.

Sub Questions

Many students come into my classroom blatantly discussing their hardships with understanding science. It is even evident during parent-teacher meetings, when parents indicate they always disliked science or always thought science was a "really hard" subject. That discontent is passed from parent to student and is continually brought into the classroom. Teachers often times must deal with predispositions that have been passed from parent to student generation after generation. Teachers will always have students who excel and those that need a helping hand. In an effort to bridge that gap and involve all students in hopes of changing their perspectives on science as a subject area, and possibly enlighten them into choosing science as a post-secondary major, I will be utilizing research students from Kutztown University who will be conducting field research at a 117-acre impoundment owned by Lehigh County in southeastern Pennsylvania (Leaser Lake). My high school students will be shadowing these college students in their time afield, and will also be involved with collecting and documenting their own field sampling. This will all be conducted in an effort to answer the following sub questions:

> What components of the field research provided the students with a different interpretation of the importance for science?
>
> Will interaction between high school and college researchers in a field-based environment, affect a students' post-secondary choices?
>
> Is there a greater chance of student cognition due to their involvement with shadowing of college researchers?

CONCEPTUAL FRAMEWORK

It is apparent there is a fundamental lack in preparation of high school students for a transition into college level research. This literature review guides readers through a myriad of research pertaining to the educational benefits of college shadowing. Literature has shown students are unprepared for the transition between high school and college and are lacking key skills to be successful. In an effort to address this concern, school districts must look at their curriculum, and make adjustments to their standards and classroom practices in an effort to closely align them with their collegiate counterparts. Professor David T. Conley of the University of Oregon stated,

> Each teacher tends to use his or her own personal college experience as a reference point. Most of them are unlikely to have ever talked with college instructors in their locale or vicinity. Most of them have never sat down and talked with a university professor about how each teaches their respective course how they're similar and different in their standards, and whether they're aligned in their expectation for what students need to know to succeed in college courses (Richardson, 2010, p. 30).

If there is such disconnect between secondary and post-secondary education, what are students missing? Ernst and Monroe (2007) indicated 84% of college seniors say their coursework emphasizes analysis of ideas, experiences, or theories. Seventy-three percent say it emphasizes synthesis, 70% say it emphasizes making judgments about the value of information, arguments, or methods, 79% say it emphasizes applying theories to

practical problems or new situations, and 52% have written at least one paper of twenty pages or more in length.

A 2009 TIMSS study found that in addition to having a positive attitude toward science, students' may be more attracted to science and more motivated to learn it if they perceive science achievement as advantageous to their future education and the world of work (TIMSS, 2009). Students strive to learn, and want to be provided with challenging situations. The National Science Education Standards state that all students need the ability to do scientific inquiry and gain the skills of science practitioners (National Research Council, 1996). We as teachers need to provide them with opportunities, which will help them meet these needs, and ultimately, succeed. Documentation shows middle and high school science students have been expressing a declining interest and negative attitudes toward science. George (2003) suggests science teachers need to find more creative ways to present science subjects in the classroom in order to maintain interest for science subjects. The California Partnership Academies (CPA's) have provided an interesting model of transition from high school to post-secondary commitments. The following is a list of five elements that are critical characteristics of high-performing CPA's that prepare students for post-secondary options (DeArcos, 2009):

- Develop integrated and relevant coursework, engaging students in their learning.
- Structuring planned access between students and caring adults.
    - Connections with practitioners and community adults in the outside world.
- Create a collaborative leadership team to provided meaningful experiences for the students.

- Establish pre-college expectations and experiences for students creating a mindset that college plays a key role in each student's future.
    - Align core subject area curriculum and assessments so that students can enroll seamlessly from high school into college courses.
- Implementation of rigorous curriculum and exploratory instruction is critical to preparing students for college-level coursework and employment.
    - A California School Board Association survey indicated students want "experiences that will be useful when they leave school for college or work," (California School Board Association, 2006).

In order to create an environment where students are going to succeed in the field of science, teachers and professors are going to need to work together, providing an environment, which fosters a positive outlook on the sciences. Professor Conley reiterated the idea, "Helping students understand what it means to think like an expert in one of those disciplines teaches them what it takes to become expert in any area. You do that the same time that you prepare all students to learn beyond high school," (Richardson, 2010, p.32).

Lastly the review shows support that involvement of high school students in scientific field studies promotes higher order learning which ultimately equates to a higher level of student success. With the ultimate goal of providing students with opportunities to further their education to a level of that comparable to college, high school teachers need to provide students with lessons similar to what they will be experiencing in their entry level collegiate courses. The literature in this review invokes

the perception that shadowing of college students conducting research is an exceptional method for providing educational benefits to students; preferably those benefits associated with providing for higher order thinking skills and college preparation. Stratford and Finkel (1996) stated project-based science promoted positive change in students' ideas about science classes, attitudes about science, and motivation for studying science. Toolin (2004) identified that researchers have learned that project-based classrooms increased student motivation and learning. In her study she investigated two project-based assessments, which are comparable to this study. The first involved students working alongside a botanist from the NY Museum of Natural History. The activity involved students meeting two to three afternoons a week with the botanist and identifying indigenous plants in Central Park. The meetings culminated in the students creating a "Naturalist Notebook," where they diagramed and documented their findings. The second activity involved student initiated research projects, where students were engaged in "original" independent research. Students developed research questions, submitted a proposal, conducted the experiment, gathered data, analyzed their findings and presented their findings in a poster session. Findings from this type of project-based learning identified a very high level of the students involved passing their New York Reagents test (95%). This was much higher than any of the other studied projects, with the closest being the "Naturalist Notebook" at 73%.

Pedagogically speaking, the main goal of a teacher is to provide students with a strong background of fundamental knowledge, sound skills in application, and from that, a thorough understanding of subject matter; all in an effort to provide each and every

student the opportunity to succeed. The question is what does success mean? Each student has a different outlook on what the future holds. According to the U.S. Department of Labor (2010), of the 2.9 million youths who graduated high school in 2009, 2.1 million or 70.1 % were enrolled in college in the fall of 2009. With an enormous percentage of current high school seniors pursuing college it is imperative that school districts focus on preparing students for college level studies. Ernst and Monroe (2007) indicated 36 percent of college faculty agree that students are well prepared for college upon arrival. Forty-one percent of faculty at all types of institutions, say that most of their students lack the basic skills needed for college level work. In the college readiness report distributed by ACT Inc., 27 % of students pursuing a college level Biology degree were ready to attend college (Earnst & Monroe, 2007). As a high school teacher, these numbers should sound very alarming.

Mackenzie (2009) found that, "Merely memorizing information does not adequately prepare students for the rigors of college life where deciphering, interpreting, and reasoning of biological information is critical to success in science courses." High school students need to be provided with activities, which will prepare them for college and eventual movement into a professional field. Through involvement with college students and professors such as in this study, and interactions with professionals in various fields of study, educators have options for providing students with opportunities, which closely resemble their next steps toward post-secondary careers. Earnst and Monroe (2004) recognized students who participated in environment-based programs were more skilled in critical thinking than their peers, and were comparable or exceeded

those of college students. Their findings revealed it was important to include students of all achievement levels because the activities created opportunities for lower achieving students to have role models and a challenging situation, while providing the high achieving students with peer teaching opportunities. Students engaged in inquiry experiences are more likely to be drawn to careers in science (Gibson & Chase, 2002). In an effort to provide students with a more cognitive approach to education, there needs to be a change from a teacher-centered classroom, to a more student-centered approach at the high school level. A key component of environment-based programs, as described by Ernst and Monroe, included project-based or issue-based instruction, a learner-centered setting, and constructivist approaches (Earnst & Monroe, 2004). Students have become accustomed to relying on teachers to feed them information and regurgitate what they have heard. In order to be successful, students need to be presented with challenging activities and immerse themselves in the problem, investigate possibilities, design experiments, and draw conclusions forming their own opinions. "Through inquiry, appropriate study skills, rigor, time management, and fostering independence, students are better apt to succeed in science courses and to approach science careers as possibilities," (Mackenzie, 2009, p. 7). This study looked to invoke these ideas in students through the implementation of student field research. By immersing the students in field activities alongside college researchers, students' cognitive levels were observed and outcomes were documented.

It has been challenging at times to create a classroom where all the students have a positive outlook on science. Many times they equate science class with extensive

amounts of work; lab reports, crunching numbers, and rigorous information, much of which they feel needs to be memorized. There are too many occasions in the classroom where students disconnect between the information presented to them and application to the real world. I believe a lot of these negatively focused opinions are a direct result of not providing the students with activities for which they can take ownership. The method I chose to use in this project involved the shadowing of college students conducting field research. The intent of this project focused on students immersing themselves in the research being conducted and collecting data, in an effort to mirror research conducted by college students. Research has shown that when students are given opportunities to work alongside scientists and participate in original scholarship, the experience may lead to improved understanding and increased motivation for studying science (Cox, Lafferty, & Abraham, 1998). Through pre and post-expedition questionnaires using a Likert scale and open-ended responses, students attending the Earthwatch Institute travelled to university laboratories, remote field stations, and observatories and revealed three common themes as a result of their involvement: an increased interest in pursuing a science-related major in college or a career in science, with over 45 percent stating the shadowing influenced their plans, a positive change in their views of scientists, and a positive attitude shift in the students perception of science (Abraham, 2002).

One underlying theme, which has a subtle implication to this research project, is the student's involvement within their community and eventual creation or distribution of the findings of their research. The idea of "citizen science" is a concept, which is strongly overlooked by high school aged students (Bonney et al., 2009). Students are

often involved in many after school activities, but few are environmentally focused. Cornell's Ornithology Lab conducts many "citizen science" activities including the Project Feeder Watch and the Great Backyard Bird Count. Their protocols have been designed for use with school groups and through pre and post-project surveys, focus-groups and in-depth interviews, found participants had an increased interest in pursuing science as a career (Bonney et al., 2009). Citizen science, like shadowing can involve complex designs and experiments, which provide excellent teaching opportunities (Bonney et al., 2009), and provide for tremendous amounts of data which can be used for measuring water quality across watersheds (EPA, 2006), or trends in population interactions over time (Cooper et al., 2007). Field research opportunities have been shown to have a positive impact on student learning. Student motivation is higher when they are engaged in field research opportunities (Holloway, Rofuth, Todd, Gruner, & Mimo, 1998). Prior research indicates there is a positive correlation between field activities and an increased perception of science. Utilizing field research, this action research investigated the effects of shadowing college level students conducting research, in an effort to create better opportunities for my students while looking to increase their appreciation of science as a subject and as a possible career choice.

METHODOLOGY

In an effort to understand how the interaction between high school students and college researchers affect a high school student's perceptions of science, researchers must first understand a student's cognizance and level of appreciation for the sciences. Once

these observances are documented, it is important to investigate what factors play key roles in molding these perceptions and the effects on a student's post-secondary choice.

Participants

The students in Blue Mountain School District have historically proven that college is a viable option after high school, with 53% of seniors over the past six years choosing to pursue a four-year degree, 16.9% deciding upon a two-year school or junior college and 13% immediately entering the workforce. Of those students, 32% chose some type of science career as a major (Appendix A). A breakdown of the different areas of study and the number of students pursuing various science fields is documented below:

Table 1
Program of Study Selections by Students at Blue Mountain High School, 2007-2011

Major Areas of Study	**2007**	**2008**	**2009**	**2010**	**2011**
Biology	***18***	***12***	***17***	***9***	***4***
Architecture	2	2	1	3	0
Languages	1	0	3	3	2
Undeclared	13	26	30	20	18
Environmental Science	***3***	***2***	***2***	***1***	***2***
Business/Information	13	19	7	9	20
Nursing	***11***	***13***	***13***	***8***	***16***
Criminal Justice	10	10	7	10	7
Media/Communications	7	8	8	7	2
Pharmaceuticals	***2***	***2***	***1***	***3***	***1***
Education	28	24	28	23	16
Political Science	7	3	4	0	1
Engineering	***8***	***9***	***16***	***4***	***12***
Chemistry	***3***	***5***	***1***	***1***	***4***
Trades	16	15	8	15	18
Medical Field	***7***	***12***	***5***	***11***	***6***
Marketing/Finance	9	0	1	3	6
Arts/Humanities	15	5	10	1	4
Physics	***1***	***0***	***0***	***1***	***0***
Psychology	6	3	6	7	2
Computers	10	4	3	7	7
Attorney/Legal	1	0	0	0	0

Therapy	***8***	***6***	***6***	***6***	***10***
Interior Design	1	0	0	1	0
Hotel Management	1	0	1	0	0
Aviation	0	2	0	0	0
Fashion	0	2	3	1	1
Sports Management	0	2	1	0	0
Ministry	0	1	1	1	1
Mathematics	0	3	2	2	0

The students of the Blue Mountain School District have shown their science prowess, as is seen in the district report card provided by the Pennsylvania Department of Education (Appendix B). This report card is based on state standardized testing (PSSA) results, which are given in grades 4, 8 and 11. Currently the science assessment is still in its infancy, and does not count towards a students' graduation requirement. At the fourth grade level, 95% of students scored proficient or above in the 08-09 school year and 91% in the 09-10 school year. This was much higher than the state averages of 83 and 81%, as documented in the report. At the 8th grade level, 73% scored proficient or above in 08-09, and 69% in the 09-10 school year. This is compared to 55% and 57% in the state respectively. At the 11th grade level 50% of students scored proficient or above in 08-09, and 46% in the 09-10 school year. This value like those in grades four and eight, were slightly higher than the recorded state average. The same held true for attendance and graduation requirements for adequate yearly progress. The states goal for attendance was set at 90%, and for graduation 85%. Blue Mountain School District's attendance was 95% compared to the state average of 94%, and the graduation rate was also 95% compared to the state average of 90%. It should be noted that our district is primarily Caucasian, and due to lack of a sizable number of other ethnicities, student groups were

only recorded for Caucasians. There was not a large enough student grouping for the other ethnicities to be counted separately. The district did however have a large enough population of special education (IEP) students and those that fell into the Economically Disadvantaged sub-grouping. With that said, both sub-groups performed above the state average on both the 08-09 and 09-10 Pennsylvania State Standardized Assessment of science.

The students I chose to study during this research were selected based on their selected academic path within the school setting. In our district prior to the 2007 school year, there were four labeled categories of students based on their course selections; Honors, College Preparatory, General, and Vocational-Technical. Since 2008 those designations have dissolved, and students now have a certain number of credits they must obtain in each subject area. Based on performance, they have the option to choose any academic level, as long as they meet the prerequisites. To select students for this study, and to provide for a representative sample of the student population, the subject group was composed of equal representation of male and female students, with some of the subjects focusing on a college preparatory tract, some from a general education tract, and some from the vocational-technical tract. When selection was made, students were chosen based on differing learning abilities (based on the levels of classes in which they were enrolled). It was important to this researcher that the study group represented students with varying academic levels, which hypothetically represented different perceptions of science and career choices. I chose five males and four females to take part in this research (N=7). Two seniors, two juniors, two sophomores, and three freshman. Of those students five are currently enrolled in college prep or advanced

placement science, and four are enrolled in general science classes. Three of the students receive supplementary assistance from a learning support teacher and have individualized education plans.

Intervention

In my current assignment I teach 9th grade Physical Science and 11th and 12th grade General Lab Science. There is no current class specifically offered to provide the students with environmental science experiences. Blue Mountain School District does provide for an advanced placement environmental science class, but due to low enrollment numbers it is not taught very often. Due to funding cuts and large class sizes, trips into the field have become very taxing and obsolete. Because of this dilemma, which is happening in a number of districts in Pennsylvania and abroad, students are finding themselves spending more time in the classroom and lacking those real-world experiences, which could be offered otherwise.

Many times there are numerous resources throughout a school district, which could provide meaningful experiences for students. During this investigation, students were given three different opportunities to interact with college researchers and professionals. Two of the activities involved a visit to a county owned park (Leaser Lake), where there has been an ongoing dam reconstruction project. Due to the nature of the project, and the subsequent draining of the lake, there were numerous opportunities for scientific research. During the first activity, students interacted with a professional engineer and college students while conducting a riparian buffer planting. One of my students worked with me to design the riparian corridor, order plants, and conduct training for his fellow students. On the day of the planting my students met with two

members of the non-profit lake organization, an environmental engineer and college students. The engineer gave an informative talk on the importance of riparian zones, native plants, and dealing with community issues and politicians regarding environmental issues. At the conclusion of the talk, there was a question and answer session, and then students proceeded to plant some 500 trees and shrubs as designed. For the second activity, students took a trip to Kutztown University where they helped evaluate different schooling characteristics of fish. They first interacted with the professor in charge and then helped the research students set up their observation equipment. While the videotaping was taking place, students reviewed past footage and deciphered results alongside the college researchers. For the third installment, students worked alongside a college researcher conducting macroinvertebrate sampling and electrofishing, in an attempt to determine population dynamics and impacts of land use in the area. There was no specific time set aside for my students to ask the college students about college issues. Rather, students were prompted ahead of time to take advantage of the opportunities put before them, and interact with the students. My intuition tells me the interactions of students with college researchers will come natural after a "warming up" period. As they work together on the different projects, they will naturally interact with one another easing the barriers and opening communications. As the researcher, I am looking to determine the effects of utilizing these types of interactions between high school students and college level researchers in an effort to build students perceptions of high school science while providing them with an experience of what post-secondary life is like, and what might be expected of them as a professional. It is these types of activities that

students will often remember long after high school. Will it persuade them into choosing a post-secondary career in science? I don't believe that was the goal of this research, but if it does change their perception of science in a positive direction, and provides them with a great experience, which is worthy of documentation in their portfolio, then I have created an important opportunity for these students.

Data Collection

With the primary goal of understanding how interactions with college students affect a high school students' perception of science, it was imperative to first understand the students' appreciation for, and possible apprehensions toward science. To accomplish this task, students were asked to complete a survey through www.surveymonkey.com. The survey (Appendix C) included components of the ROSE Survey (http://roseproject.no./), with additional questions added for this research. The ROSE Survey was designed as a cooperative research project of international proportions focused on how young learners relate to science and technology. "The purpose of ROSE is to gather and analyze information from the learners about several factors that have a bearing on their attitudes to science and technology and their motivation to learn (Sjoberg, 2010). One underlying premise of the survey was to shed light on how to stimulate interest in choosing a career in science or technology. Research conducted in 2008 by Jari Lavonen indicates certain factors contributing to a student's science and technology related career and occupational choices. Two of the most relevant findings which relate to this study, include student role models (family, friends, the community) and the quality of science teaching and learning, which includes teachers as role models, visits to research institutions, companies, museums and science centers.

Lavonen indicated both of these factors played key roles in influencing a student's interests and occupational choice (Lavonen et al., 2008). This survey was given prior to the student conducting any of the activities associated with this research project. The same survey was administered again at the end of the research period and statistical analysis was conducted on the results of the surveys to identify any changes. A pre and post survey was administered to parents as well, which asked them to privately answer the survey (APPENDIX D). It included questions focused on what gets talked about at home, students' perceptions, likes and dislikes in school, troubles, successes, and the involvement level of the parents in their students school lives. This survey was not statistically analyzed, but was used to understand interactions at home, which helped validate the students survey answers through triangulation (Table 2).

Table 2
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: 1. How does the interaction between high school students and college researchers change a high school students perceptions of science as a subject?	Pre-assessment survey of students and parents	Instructor journaling of students interactions and attitudes during the activities afield	Post-assessment survey and interviews of students Post-assessment survey of parents
Secondary Questions: 2. What components of the field research provided the students with a different interpretation for the importance of science?	Pre-assessment survey	Instructor journaling of students interactions and attitudes during the activities afield	Post-assessment survey Student Interviews
3. How will interactions between high school students and college researchers affect a students post-secondary choices?	Pre-assessment survey Identification of students post-secondary choices	Guidance councilor student reports	Post-assessment survey and interview Identification of students post-secondary choices
4. Is there a greater chance of student cognition due to their involvement with college researchers?	Student completion of a research proposal given a simulated environmental situation.	Instructor journaling documenting student understanding and ability to complete tasks.	Student generated reports created from data collected.

As the students conducted field activities, observations were documented regarding their attitudes toward the activities, and the interactions between students, specifically between high school students and the college researcher and professor. During the journaling, it was important to take note how the high school students interacted, their comfort levels, attitudes, and how cognition of the subject matter changed, as the activity progressed. It was important to indicate the presence of positive improvement, or frustration and

dislike. The journal was not defined by a rubric, but was designed as documentation by the researcher as to trends seen in students' attitudes and possible changes associated with the activities.

Students were interviewed in an effort to better understand how they perceive science, and why they have certain feelings. Students were asked numerous questions about the effect of the field activities and the interactions with college students and their professors. How did it affect their views and understandings of the subject and materials? Did it change their views of attending college? Did their involvement change their outlook on the importance of science? Due to the small group of students who were involved with this activity, all of the students were interviewed upon completion. A post assessment survey was also given with the results being compared to the pre survey. Based on the findings in the surveys, and through comparison to interviewing, I will address their thoughts about science and what a scientist actually does. This will also allow for identification of any changes in a student's perception of science as a subject. It was important to remember there were students of varying learning abilities taking part in this research. One of my personal reasons for conducting this project was the idea that all students should have the opportunity to see what college research entails, prior to getting there. It would be naïve to believe every student will attend college, nor do I believe that every student needs to attend college. But what I do believe is every student should be provided with ample opportunities in high school over a wealth of subject areas so they have the ability to make important life choices by the time they graduate.

Along with pre and post survey data, guidance councilor student reports helped determine how the interactions the high school students were involved with, and affected

their post-secondary choices.

Finally, to understand if students' cognitive levels increased due to the activity, they were first given a scenario similar to the fieldwork they conducted along with maps, aerial photos, and pictures (Appendix G). Conducted in the classroom, students were asked to design a study based on the situation and the information provided. Through journaling (Appendix E) I documented the students' level of understanding and ability to formulate and execute the stream study. Upon completion of data collection, students were to generate a report of their findings (Appendix H). The ability of the students to generate a report of their findings helps to define their level of understanding.

DATA AND ANALYSIS

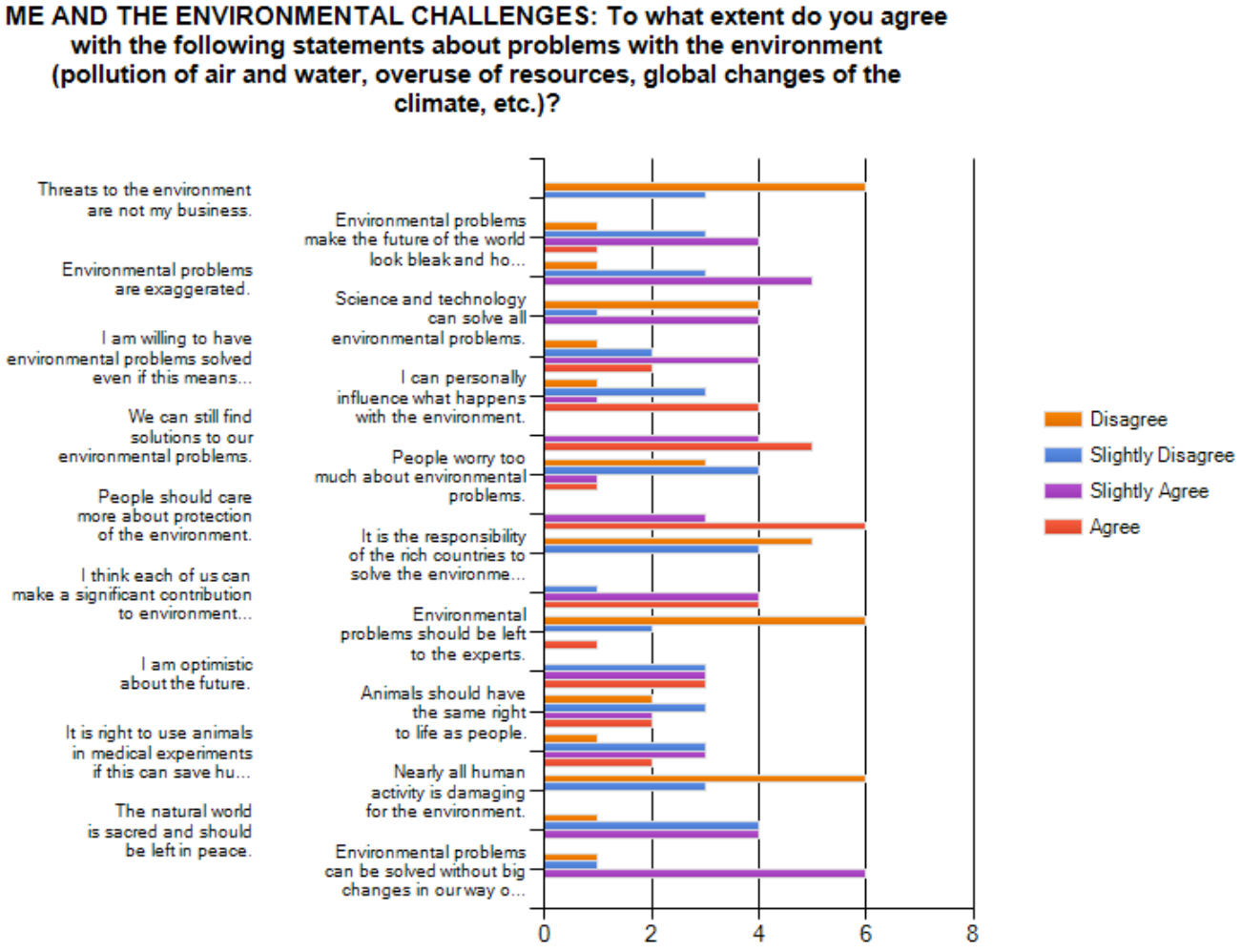
In an effort to understand the perceptions of todays' high school students, I utilized various different quantitative and qualitative methods. From those sources I accumulated numerous data sets, providing revealing insight into the questions posed by this research.

Field research does have a lasting impression on a students' interpretation of science

My first inquisition dealt with trying to understand the mentality of high school students and their predispositions toward science. I felt I could change those perceptions and positively influence a students perspectives of science by altering my methods of teaching and incorporating field studies and interactions with college researchers into my lessons. Because my methodology involved incorporating environmental science based activities into my lessons, my surveys reflected these methods, and therefore a measure of perceptions dealt with assessing their perspectives on environmental issues.

In an effort to gain a grasp on the students' current perceptions of science, they were given a Likert survey where they were asked numerous situations entitled *Me and the Environmental Challenges*. There was overwhelming support showing their positive perceptions of science, as seen in Figure 1. When asked if they agreed or disagreed with the statement, "Threats to the environment are not my business," students overwhelming responded they disagreed (pre-survey mean = 1.33, SD = .50) both on the pre-survey and post- survey. (mean = 1.13, SD = .35, $t(7) = 0.943$, P = 0.360) When asked if people should care more about protection of the environment students strongly agreed (pre-mean = 3.67, SD = .50) and those feeling did not change post assessment (mean = 3.75, SD = .46, $t(7) = 0.3418$, P = .7373). Students were also asked if they think each of us can make a significant contribution to environmental protection. Considering these students were involved in determining the quality of tributaries draining into Leaser Lake, a stream study that determined environmental stability in the area around the lake, it was no surprise the pre-survey indicated students strongly agreed (pre-mean = 3.33, SD = .71), with no significant change post-survey (post-mean = 3.63, SD = .74, $t(7) = 0.8526$, P = 0.4073).

Student Pre-Survey Results – *Me and the Environmental Challenges*



Student Post Survey Results – *Me and the Environmental Challenges*

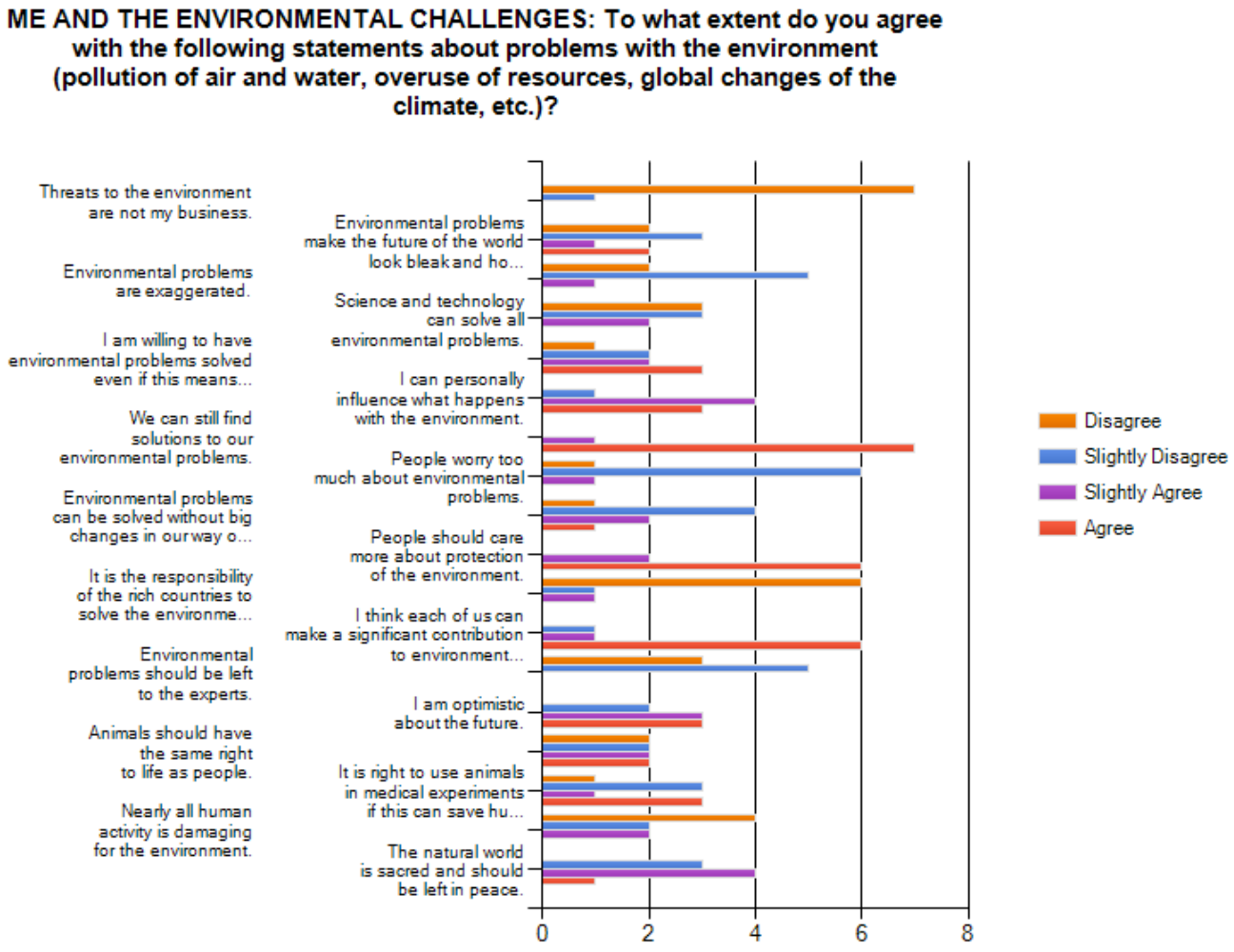


Figure 1. Pre and post assessment Likert survey results as taken by students, (*N*=9).

Through the course of this study students showed their determination towards environmental protection, and solidified the Likert data. The day we planted our riparian zone was hot and humid. Interestingly enough students who traditionally complain of the same conditions inside our non-air conditioned school managed to plant 500 trees that day. They were sweaty and dirty, but all had smiles on their faces. Comments like, “It’s

cool to know we are making a difference," and "I'm really excited that in a couple of years I will be able to come back here and see this place and it will look like a forest," fortify my original assumption that students are very knowledgeable when it comes to the importance of science. It was no more evident then when we revisited the lake three weeks later and "had to" take a walk over to the riparian zone because the students were that adamant about seeing how it changed! I really do hope they get to visit the lake in five or ten years and see the fruits of their labor!

Finally, students were questioned whether environmental problems should be left to the experts. Again, no significant difference was found between pre and post results (pre-mean = 1.56, post-mean = 1.63, $t(7) = 0.1760$, $P = 0.8627$). It is evident to this researcher that based on these findings, there was not a significant difference in the pre-assessment and post-assessment surveys. It did show that the students were very understanding of the importance of environmental science, that people do have the ability to make a difference, and it shows that they understand they can be involved, not just the experts.

Based on pre and post survey results, all respondents but one indicated on either survey that they feel science will play a large part in their lives after high school. The one student who determined science would not play a large role after high school did indicate that science is important, however they were "not going to need it." This strong support for science was reinforced through exit interviews where I made an interesting discovery. Students had varying reasons behind what changed their feelings about scientists throughout this field research activity (Figure 2). Numerous students (44%) of those interviewed mentioned when they think of scientists they think of them working in

a lab. Many of them who indicated the stream study was their favorite activity, which was responsible for their changing feelings about scientists, also indicated they thought scientists worked in labs, not in the field. They realized that scientists work in a "broad area" not just in a lab.

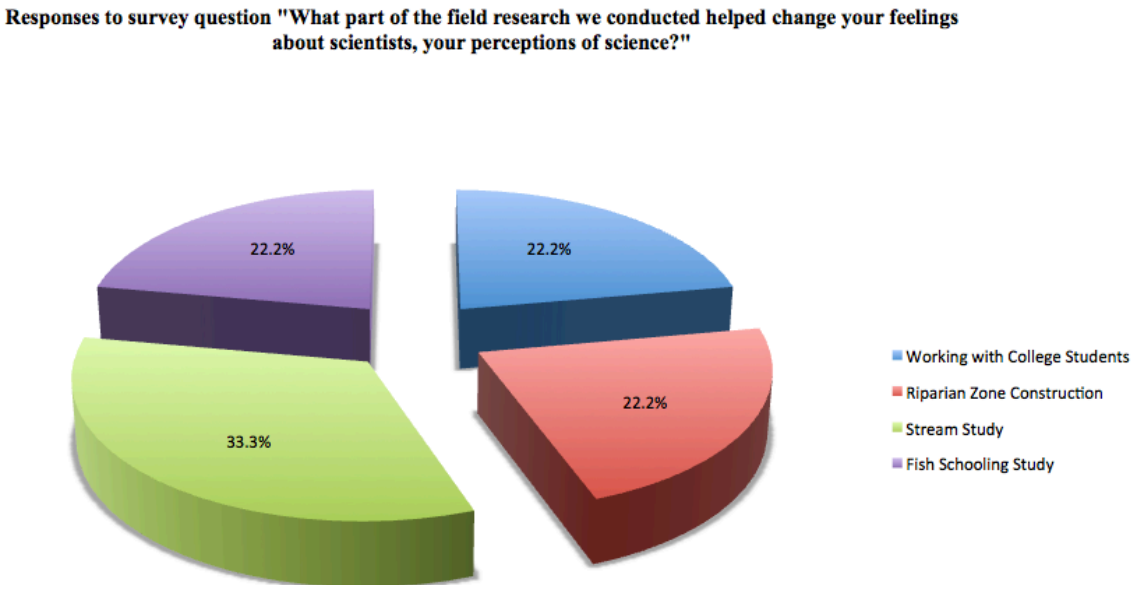


Figure 2. Student responses to post-assessment survey question, "What part of field research we conducted helped change your feelings about scientists, your perceptions of science?" (N = 9).

<u>Did interactions between high school students and college researchers affect post-secondary choices?</u>

After examining surveys, interviews, and journal entries, there is no indication that interactions between high school students and college researchers have any influence on a high school students post-secondary career choices. I knew it was highly unlikely we were going to find favorable results. Favorable, meaning this study would have influenced students into choosing a career in the sciences, specifically environmental

science due to the nature of this study. Being influential was not the purpose of this study. In fact, I did not want to influence students into a science career but rather investigate if field studies had any affect on this. I wanted to offer students increased opportunities afield and let them make their own decisions.

Students in the Blue Mountain School District during their 8th grade year meet with their guidance councilor and take a survey called the COIN Career Guidance System. The survey is designed as three different Likert style surveys, which students take during their 8th grade year. The surveys include a career cluster, where students answer questions regarding careers they might be interested in pursuing, a skills assessment, which has them arrange their answers based on their likeness of a certain skill, and a self-assessment, which focuses on a students values. From these three surveys, the computer database of 429 possible job descriptions chooses the top three jobs that fit the students survey results. I was able to enter the system and extract the results of four of my study students from their 8th grade survey. Of those four students three of them had career clusters listed that matched the results of question four on their post-assessment survey. The remaining students did not have data in the districts system regarding career clusters, and two of the students were seniors and are now graduated. Regardless, when asked their intentions prior to and after the field studies, there was no change in the students' choices. This could lead to further study in the future following these students through their high school careers and beyond to see if students pursue those sights set during their 8th grade COIN surveys. Students do revisit these results with their guidance councilors during their 11th grade year, as the program is very

thorough and includes a portfolio area, with links between those careers chosen and college websites of those, which may specialize in the choices of the students.

A number of the students in this study (8 of 9, 89%) indicated they planned to pursue college in the future. Not all students have the same goals, and it is arguable that college is not the right fit for every student, nor am I making that assumption. Students were asked during interviews if they felt interacting with college students in high school would influence choices after high school. Students felt there were, "a lot of students that don't know what they want to do." "Shadowing would let you know if you really want to do that job." In my district, many of the vocational technical students complete job shadowing as a component of their education. Those who eventually attend college often times do not have that opportunity, as this is one of the underlying goals of this study, to determine the importance of such an opportunity. Interviews revealed students have nervousness about attending college. Of the students in this study, none of them had any college interactions to date. The only results I found during interviews were, "I visited my sister or brother, helped them move in," and three of the students mentioned the activity from last year, (2011) a dry run for this research project where we worked along side a Kutztown researcher conducting her senior graduation project which involved assessing different methods for determining fish population dynamics including trap netting, seining, and electrofishing. Students helped the researcher run samples and collect data using different methods as well as water quality parameters.

Even if the results show there was no correlation between the interactions with college students and a high school students post-secondary choices, there is extensive

evidence which supports the study was well received by students and parents alike, and created encouraging opportunities for my students. One of the students in the study who is one of my general science students in the classroom has every intention of going into the military upon graduation, but when asked if she now has a different understanding of science and if she thought interactions with college students were beneficial, she answered both with, "I feel more open about science, about learning new things!" When another student was asked if the field trips affected their decisions to go to college, she answered, "Yes, it has further ensured my opinions on joining college," obviously showing that these activities eased nervousness regarding the transition to college.

Some of the most intriguing data came compliments of the parent survey. When asked how the activities I involved their student with affected their students' attitudes toward school 60% of respondents stated their involvement did have a positive influence on their perceptions of science, while 40% stated it has affected their post secondary choices. Although this seems very reassuring, I only received five returns on my post-assessment parent survey. The surveys I was missing were from parents of students who are currently enrolled in lower level science classes in our district. It could be possible these numbers would be different if I received those results. Regardless, it was still supportive of these types of activities. I was reassured in the follow-up question regarding the parents' feelings about the importance of activities such as those in this study. A reassuring 100% of parents affirmed they should have as many of these experiences as possible. When asked if they have discussed anything about their child's future endeavors and if their involvement in this activity had any impact on future decision my assumptions were confirmed. Replies ranged from "this activity provided

her insight into what fieldwork is all about," to "I believe this activity has given him confidence as he enters the next part of his life," to "I do attribute his renewed interest in this topic to the activity, and his participation has definitely contributed to the post-secondary options he has considered," to finally and most uplifting,

> He has wanted to pursue a future in science/biology and possibly in a fisheries program, but now he is very excited in the program since this research project. Now he is sure that is what he would like to do. So YES this research project had a huge impact on his future decision! Thank you so much!

As a researcher, I could not think of a more positive result to the activities. I will be the first to admit that the activities I incorporated into this study could not have been a better fit for this student, but in return I found the result I would have expected, a strong correlation that these activities do influence students perceptions.

<u>There was a greater level of cognition due to their work with college researchers</u>

It is important to realize the college researchers my students worked with during this activity were only two years older than some of the high school students. Regardless, students found it very rewarding working along side these researchers. The intent was to introduce my high school students to college level work ethic, and allow them to compare for themselves the level of commitment needed in college compared to what they are experiencing in high school.

Interviews determined students have apprehensions about attending college. All of us college graduates remember the first day our parents dropped us off at college and

we were alone in this new world! My students realize “there is a lot to think about when going off to college.” How to “get around the school,” coping with other people, financial challenges, harder curriculum, how difficult the classes are, what are professors expectations, how are the courses designed, are all discussions my students had with researchers. Many of their questions were answered, but I wanted to know if they gained any greater scientific knowledge through the process. My approach to test this parameter was to offer the students an environmental science scenario where I gave them maps, pictures, and an open-ended scenario to construct an experimental design of the exact location we were going to sample. Students were graded using a 16-point rubric (Appendix G). The average score for the completed scenarios was a 9.2. Students were graded on three categories: Use of the Scientific Method, Level of Student Understanding, and Level of Professionalism. When given to the students, it was my expectation that they would create a document that was professional-looking, typed, and strongly covered the scientific method, considering some of the students have been afield with me before. To my surprise, all of the students submitted hand written, basic designs. Their strong point was the procedure and equipment needed. Many students had a grasp on the methodology of conducting a stream sampling, and others were “off the wall!” The students had very basic reports, which were well below what I was expecting. Some of this could be attributable to the study being conducted relatively close to the end of the school year. Students have a lot of requirements placed upon them at the end of the school year and although they were held accountable to turn in the scenario in order to take part in the field trip, their reports were below my expectations.

It was evident during the stream study that students did pay particular attention to the guidance given to them by myself, and Chad Delar from Mansfield University. Students were very effective at sampling the stream and paid particular attention to proper methods of assessment. Many students made reference to how this was so much better than sitting in a classroom. As an observer, not once did I see a student frustrated with what they were trying to accomplish, even if their scenarios told me they were naive to the methods used. Even if the students really didn't know how to do something, they were more apt to ask than become frustrated which is a different response from what I see at times in my classroom conducting bench labs. Students' comments during the activities were also positive. "It's really neat to see all these different techniques and that all this means something." I think cognition can be measured more by the students' responses to the activities themselves rather than creating a report. However, upon completion of our field activities we conducted further bench identification of aquatic insects together we worked on compiling a final professional report (Appendix H), which is much more detailed than any of my students thought they were capable of constructing. It is evident through the process that these students were introduced to material they were previously unaccustomed to. That alone provides for a higher level of cognition, one that could not have been accomplished without the help of college researchers' insight.

INTERPRETATION AND CONCLUSION

Indisputably through this process my students visited a university, interacted with college students and professors, and professionals, increased their levels of collaboration,

conducted undergraduate level research and left this school year with a better understanding of what college was about, what would be expected of them, and hopefully experiences they can look forward to in the future. With the objective of determining if interactions between high school students and college researchers have the ability to change a high school students perceptions of science, I would conclude more research must be done. It is evident from the findings in this study that my students, contrary to the National Science Foundations findings had a positive perception of science prior to the activity and held those same feelings post activity. Interestingly, six of the nine students (67%) in this study indicated in their post survey, signs of post-secondary careers in a science related field. The only true determinant of whether these collegiate interactions do have an effect on high school students would be to follow these students through their entire college careers and into their professional lives to see if they actually do follow their career goals.

What was determined through this research is that the interactions between students, college researchers, and professionals, created positive results. We know there are many different types of students in our classrooms, all of whom have varying levels of cognition, learning styles, and goals. As educators it is our responsibility to provide them with an education, which is exciting, rewarding, and in todays educational philosophy, comparable to a state or national standard. My goal as an educator is to use science as a tool to provide students with opportunity. Opportunity to make their own decisions, draw their own conclusion, and challenge them to push themselves to think beyond the simple, why things happen, what makes them happen, and how we can make a difference. I feel this action research took an extensive look at the importance of

interactions between undergraduate and high school students and its effectiveness. The students in this study along with their parents were vocal in discerning the importance of field activities, interactions with professionals, professors, and college researchers. Interviews, surveys, and interactions observed in the field were overtly reassuring. When you see your students as I did, working hand-in-hand alongside college students talking about the classes they are taking, how hard college is, what expectations are placed upon students in college, it is hard to believe the interactions were not beneficial. The science was secondary, the interactions could have been in any subject area, the key is to find those opportunities and incorporate them into your lesson planning. My favorite observation was when my students were in the lab at Kutztown University, the researchers were telling them about the trials and tribulations of their experimental setup. One of their biggest problems was the light glare off the tanks and being able to identify the location of schooling fish. My students immediately began to troubleshoot giving the researchers "their ideas" of ways to alleviate the situation. They were very adamant in their responses, the researchers were very receptive, and the conversation was rekindled by one of the students as we stopped for lunch on the way back to school.

Students' levels of cognition in relation to environmental science issues were raised by the activities created during this assessment. Indications show the students were very receptive to the tasks given to them, and interactions among students in school reassured the inquisitiveness of others. There was a "buzz" amongst others in my classes as to why some students were allowed to go on the trip and why everyone couldn't. It was hard to explain to students that I needed to pick students from all genders, ages, and educational backgrounds. Based on the premise of the study, I could only take so many.

As a researcher, this is an encouraging but heart-wrenching paradox.

VALUE

Students are always looking for opportunity, sometimes they show it sometimes they do not, but they are always looking. It doesn't matter if they are high school students, productive college students, or professionals, those who are successful make themselves successful by putting themselves in opportunistic positions. Every individual from outside the Blue Mountain School District who was involved with this study including a professional engineer, college professor, non-profit board members, and college students made some very distinctive comments to my students about how they wish they had opportunities like the ones these students were partaking in when they were in school, how they need to take advantage of every opportunity given to them, and how they are taking the initiative to make a difference. They are all lessons learned. Not exactly science lessons, but taught utilizing environmental science. Lessons these students will use to improve their cognition of the sciences, reduce their apprehension towards college, by preparing them ahead of time, and even though data acquired during this action research didn't support the determination, all indications show a positive effect on the perceptions of science among high school students due to their interactions afield.

When beginning this research, I did not want to be narcissistic in believing I was going to change every student's perceptions of science, especially in a positive direction. I did have a strong feeling however, that fieldwork does and would provide my students

with opportunities they would find interesting, rewarding, and informative. These qualities I feel lead to positive perceptions of any subject area, not only science.

My intentions for the future are to continue to utilize Leaser Lake and the surrounding park area as a research site where my students can interact with college students while conducting various types of scientific studies. There are countless opportunities with the only setbacks stemming from the current financial situations of educational institutions, the availability of transportation, and time constraints. One other slightly troublesome component of this type of activity is aligning the schedules of college researchers and the high school students. After running this activity last year and this year, it is evident college classes only take place during certain semesters, and sometimes alternating years. This could pose a challenge, one that could be overcome with good communications between teachers and professors. This was previously discussed in the conceptual framework of this paper and held true during this research.

Regardless, I am looking to continue incorporation of these types of activities into my classes as much as possible in the coming years. With my current classes, it will take some alteration of the curriculum to incorporate these types of environmental projects I am so familiar with, but as I have previously suggested, these types of activities should not be bound to one subject alone.

Two key components of successfully changing some of the activities in my classes to include more of these opportunities for my students would involve looking at colleges and their outreach programs. I have two very good contacts right now at the colleges I used during this research, but it would be juvenile not to expand my horizons. Secondly, interviews showed there was a disconnection between those who have

graduated from Blue Mountain and those currently enrolled. The findings of this study were forwarded to the guidance department in an effort to boost opportunities for interaction between current students and those who have graduated. Could guidance conduct some type of "graduate roundtable," where past students' return to discuss with current students the trials and tribulations of college life in an effort to ease nervousness? Could I keep contact with some of my now professional ex-students to possibly have them come back into my classroom and discuss what they now do? Or better yet, although a long shot, could we create a position or class, which focuses specifically on creating these "interaction type" activities for our students. For my classroom, I cannot think of a better way to provide students with a positive outlook on science as a subject, giving them opportunities to become involved, create memories, while fostering rewarding experiences. If you do this in your classroom, with your students, cognition levels will ultimately follow.

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APPENDICES

APPENDIX A

YEARLY GRADUATION RATE, AREAS OF STUDY, AND COLLEGE SELECTION OF STUDENTS IN THE BLUE MOUNTIAN SCHOOL DISTRICT

BLUE MOUNTAIN HIGH SCHOOL CLASS OF 2012 SUMMARY

Seventy-two percent (72 %) of the Blue Mountain High School graduating class of 2012 intend to pursue post-secondary education including four-year degrees and additional graduate programs, two-year degrees, certificate/specialty programs, and diploma programs. There are 126 graduates pursuing four-year degree programs or higher, and 44 graduates pursuing two-year degrees, certificate/specialty programs, or diploma programs. The 170 total graduates plan to attend the following post-secondary institutions:

Alvernia	5
American College of Bldg. Arts	1
Arizona State	1
Art Institute of Philadelphia	1
Art Institute of Washington	1
Asbury	1
Automotive Training Center	1
Berks Tech.	1
Binghampton	1
Bloomsburg	4
Centenary	1
Central Michigan	1
Columbia/Barnard	1
Dean	1
Delaware Valley	1
DeSales University	2
DeVry	1
Dickinson	1
Drexel	1
Elizabethtown College	3
Empire Beauty School	3
Gwynedd Mercy College	1
Hank Haney Golf Academy	1
Indiana University of Pa	2
Kutztown University	9
Lafayette	1
Lebanon Valley	1
Lehigh Carbon Community College	8
Lehigh University	1
Lock Haven	1
McCann School of Business	6
Mansfield	2
Messiah	1
Marywood	1
Millersville	4
Misericordia	5
Monmouth	1
Northampton Co. Comm. College	3
Penn State University	33
Penn Tech	7
Reading Area Community College	1

Reading Hosp. School of Health Sci.	1
Rosemont	1
Rutgers	1
Saint Joseph's	1
Schuylkill Health School of Nursing	3
Schuylkill Tech. Center	1
Shippensburg	10
Slippery Rock	1
Syracuse	2
Temple	3
Thaddeus Stevens	1
Universal Technical Institute	5
University of Delaware	1
University of Pittsburgh	6
University of Virginia	1
Ursinus	1
Welder Training Tech. Inst.	1
West Chester	2
West Virginia	1
Widener	1
Wyotech	1
York Tech Institute	2
School choice undecided to date	1

PROGRAMS OF STUDY

Accounting	6
Actuarial Science	1
Ag. Science	1
Architecture	1
Architectural Metalworking	1
Autobody	1
Auto Tech./Mech.	4
Biology	9
Business/ Admin./Mngt.	9
Chemistry	2
Collision Repair/Refinishing	1
Communications	1
Cosmetology	3
Criminal Justice	5
Culinary Arts	5
Dental Hygiene	1
Dietetics/Nutrition	2
Early Childhood Education	3
Early Childhood Ed./Vis. Impaired	1
Education-History	1
Education – Math	2
Education – Soc. St.	1
Electrical Engineering	1
Electromech. Engineering tech.	1
Elementary Education	4

Energy Engineering	1
Engineering	6
English	1
Fashion Merchandising	1
Finance/Mngt./Econ	3
Forensic Science	2
Game Simulation/Programming	1
Golf Mngt.	1
Golf Pro.	1
Graphic Design	4
Graphic Design/Art Educ.	1
Health Sciences	1
Heavy Equipment Operator	1
Horticulture	1
Hospitality Mngt.	2
Human Dev. & Family Studies	1
HVAC	1
Info. Sci. and Tech.	4
Interior Design/Architecture	1
Marketing	1
Mathematics	1
Mechanical Engineering	2
Medical Asst.	1
Medical Tech.	1
Medical Transcription	1
Music Education	1
NASCAR Tech.	1
Nursing	11
Pharmacy	2
Phlebotomy	1
Photography	1
Physician Asst.	4
Physical Fitness Training	1
Physical Therapy	5
Physical Therapy Asst.	2
Pre-med	3
Pre- Physical Therapy	2
Psychology	5
Res. Construction Tech. Mngt.	1
Residential Electricity	1
Secondary Educ.	1
Small Animal Sciences	1
Social Work/Psych	1
Spec.Educ.	1
Sports Mngt.	1
Studio Arts	1
Ultrasound tech.	1
Welding	2
Wildlife and Fisheries	1
Undeclared	11

MILITARY
There are 13 graduates planning to enter the military:

WORKFORCE
There are 37 graduates planning on entering the workforce as follows:

OTHER:
There are 7 students returning for a fifth year to graduate, continuing for a 5th year in the S.T.C. program, or life skills program.

UNDECIDED:
There are 7 students indicating that they are undecided about joining the military or workforce or pursuing post-secondary education at this point.

CLASS SUMMARY

Four-year degree	126	(53%)
Two-year degree, Certificate, or Diploma	44	(19%)
Military	13	(5.5 %)
Workforce	37	(16%)
Future Plans Undecided	7	(3%)
5th yr, (incl. STC and Life Skills)	7	(3%)
Foreign Exchange	1	(.5%)
TOTAL	235	

Reported as of 5/5/12

APPENDIX B

PENNSYLVANIA STATE STANDARDIZED ASSESSMENT REPORT CARD FOR THE BLUE MOUNTAIN SCHOOL DISTRICT

Assessment Report

District **BLUE MOUNTAIN SD**

District PSSA Results in Grade 4 Science

Student Group[1]	Academic Year	Participation Rate	Percentage of students in each Performance Level				Percentage of students Proficient and above	
			Below Basic	Basic	Proficient	Advanced	District	State
All Students	**2009–2010**	**100%**	**4%**	**4%**	**30%**	**61%**	**91%**	**81%**
	2008–2009	100%	2%	3%	41%	54%	95%	83%
Male	**2009–2010**	**100%**	**6%**	**3%**	**28%**	**63%**	**91%**	**81%**
	2008–2009	100%	1%	3%	48%	48%	96%	83%
Female	**2009–2010**	**100%**	**2%**	**6%**	**33%**	**60%**	**93%**	**82%**
	2008–2009	100%	3%	4%	32%	60%	92%	84%
White	**2009–2010**	**100%**	**4%**	**4%**	**30%**	**62%**	**92%**	**89%**
	2008–2009	100%	2%	3%	41%	54%	95%	91%
Black	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Latino/Hispanic	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Asian	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Native American	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Multiracial	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
IEP	**2009–2010**	**100%**	**14%**	**14%**	**46%**	**26%**	**72%**	**61%**
	2008–2009	100%	9%	9%	59%	23%	82%	65%
English Language Learners	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Migrant	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Economically Disadvantaged	**2009–2010**	**100%**	**8%**	**12%**	**40%**	**40%**	**80%**	**68%**
	2008–2009	100%	0%	9%	57%	35%	91%	70%

NOTE:
This is the first year the PSSA-M assessment was administered.
Percentages may not total 100 due to rounding.
This table reflects all students enrolled for any portion of the academic year, meaning that these numbers may not match the results reported for Accountability purposes.
— Indicates fewer than 10 students in a group. To provide meaningful results and to protect the privacy of individual students, data are printed only when the total number of students in a group is at least 10.
[1] There can be overlap among the groups since a student may belong to more than one of these groups.

Assessment Report

District **BLUE MOUNTAIN SD**

District PSSA Results in Grade 8 Science

Student Group[1]	Academic Year	Participation Rate	Percentage of students in each Performance Level				Percentage of students Proficient and above	
			Below Basic	Basic	Proficient	Advanced	District	State
All Students	**2009–2010**	**100%**	**15%**	**16%**	**39%**	**31%**	**69%**	**57%**
	2008–2009	100%	11%	16%	37%	35%	73%	55%
Male	**2009–2010**	**100%**	**13%**	**13%**	**40%**	**33%**	**74%**	**58%**
	2008–2009	100%	18%	13%	31%	39%	69%	56%
Female	**2009–2010**	**100%**	**16%**	**20%**	**37%**	**28%**	**65%**	**56%**
	2008–2009	100%	5%	19%	44%	32%	76%	53%
White	**2009–2010**	**100%**	**14%**	**16%**	**39%**	**31%**	**70%**	**66%**
	2008–2009	100%	12%	14%	37%	37%	74%	64%
Black	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Latino/Hispanic	**2009–2010**	**100%**	**10%**	**10%**	**60%**	**20%**	**80%**	**28%**
	2008–2009	—	—	—	—	—		—
Asian	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Native American	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Multiracial	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
IEP	**2009–2010**	**100%**	**49%**	**24%**	**19%**	**8%**	**27%**	**20%**
	2008–2009	100%	43%	37%	11%	9%	20%	19%
English Language Learners	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Migrant	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Economically Disadvantaged	**2009–2010**	**100%**	**31%**	**13%**	**42%**	**15%**	**56%**	**36%**
	2008–2009	100%	11%	27%	45%	16%	61%	32%

NOTE:
This is the first year the PSSA-M assessment was administered.
Percentages may not total 100 due to rounding.
This table reflects all students enrolled for any portion of the academic year, meaning that these numbers may not match the results reported for Accountability purposes.
— Indicates fewer than 10 students in a group. To provide meaningful results and to protect the privacy of individual students, data are printed only when the total number of students in a group is at least 10.
[1] There can be overlap among the groups since a student may belong to more than one of these groups.

Assessment Report

District **BLUE MOUNTAIN SD**

District PSSA Results in Grade 11 Science

Student Group[1]	Academic Year	Participation Rate	Percentage of students in each Performance Level				Percentage of students Proficient and above	
			Below Basic	Basic	Proficient	Advanced	District	State
All Students	**2009–2010**	**100%**	**9%**	**44%**	**25%**	**22%**	**46%**	**39%**
	2008–2009	100%	11%	38%	25%	26%	50%	39%
Male	**2009–2010**	**100%**	**8%**	**43%**	**21%**	**28%**	**49%**	**41%**
	2008–2009	99%	15%	31%	27%	27%	54%	42%
Female	**2009–2010**	**99%**	**11%**	**46%**	**29%**	**15%**	**44%**	**38%**
	2008–2009	100%	8%	45%	22%	25%	47%	37%
White	**2009–2010**	**100%**	**8%**	**45%**	**25%**	**22%**	**47%**	**45%**
	2008–2009	100%	11%	38%	25%	26%	51%	46%
Black	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Latino/Hispanic	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Asian	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Native American	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Multiracial	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
IEP	**2009–2010**	**97%**	**43%**	**47%**	**7%**	**3%**	**10%**	**9%**
	2008–2009	100%	48%	38%	14%	0%	14%	9%
English Language Learners	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Migrant	**2009–2010**	—	—	—	—	—		—
	2008–2009	—	—	—	—	—		—
Economically Disadvantaged	**2009–2010**	**97%**	**30%**	**40%**	**20%**	**10%**	**30%**	**20%**
	2008–2009	100%	14%	57%	17%	11%	29%	19%

NOTE:
This is the first year the PSSA-M assessment was administered.
Percentages may not total 100 due to rounding.
This table reflects all students enrolled for any portion of the academic year, meaning that these numbers may not match the results reported for Accountability purposes.
— Indicates fewer than 10 students in a group. To provide meaningful results and to protect the privacy of individual students, data are printed only when the total number of students in a group is at least 10.
[1] There can be overlap among the groups since a student may belong to more than one of these groups.

APPENDIX C

PRE AND POST ASSESSMENT STUDENT SURVEY
WWW.SURVEYMONKEY.COM

Pre Assessment Student Survey

Exit this survey

This survey is about you! In an effort to understand students ideas about high school and how it prepares you for your future I would ask that you answer all the questions below and answer them as honestly as possible. This information is going to be used for a scientific study so its very important that you take your time complete the survey to the best of your ability. If you have any questions please ask your teacher for clarification.

Participation in this survey is voluntary, and you can choose to not answer any questions that you do not want to answer. You can stop at any time. Your participation or non-participation will not affect your grade or class standing.

1. What is your gender?

- Male
- Female

2. How old are you and in what grade are you currently enrolled?

Age

Grade Level

3. Where do you see yourself immediately after graduation, 5 years, 10 years?

4. What profession are you planning on pursuing upon graduation from high school?

5. WHAT ROLES WILL DIFFERENT SUBJECTS PLAY IN YOUR FUTURE?

To what extent will the following concepts help prepare you for your choices after high school?

	Not Important	Slightly Important	Important	Very Important
Knowledge of computer software - I'm not talking about how to use a computer, I'm talking about the different programs and how to use them.				
The "ins and outs" of basic business software like microsoft word, excel, and PowerPoint.				
Basic math concepts - add, subtract, multiply, divide and knowing how to calculate percentages.				
Simple business math concepts like balancing a checkbook and keeping financial records like budgets and company expense reports.				
Knowlege of how business operates - management, marketing, and communications.				
Proper writing and research skills - grammar, spelling, organization, content				

Proper

communication skills - public speaking				
Proper reading skills - being able to analyze what you read.				
Critical thinking skills.				
Expanded vocabulary/word choice				

6. After you graduate high school, do you feel science will play a large part in your life? Will you take any science courses(college), will your job require it, why or why not?

7. MY FUTURE JOB:
How important are the following issues for your potential future occupation or job?

	Not Important	Slightly Important	Important	Very Important
Working with people rather than things.				
Helping other people.				
Working with animals.				
Working in the area of environmental protection.				
Working with something easy and simple.				
Building or repairing objects using my hands.				
Working with				

machines or tools.	○	○	○	○
Working artistically and creatively in art.	○	○	○	○
Using my talents and abilities.	○	○	○	○
Making, designing or inventing something.	○	○	○	○
Coming up with new ideas.	○	○	○	○
Having lots of time for my friends.	○	○	○	○
Making my own decisions.	○	○	○	○
Working independently of other people.	○	○	○	○
Working with something I find important and meaningful.	○	○	○	○
Working with something that fits my attitudes and values.	○	○	○	○
Having lots of time for my family.	○	○	○	○
Working with something that involves a lot of traveling.	○	○	○	○
Working at a place where something new and exciting happens frequently.	○	○	○	○
Earning lots of money.	○	○	○	○
Controlling other people.	○	○	○	○
Becoming famous.	○	○	○	○

Having lots of time for my interests, hobbies and activities.				
Becoming "the boss" at my job.				
Developing or improving my knowledge and abilities.				
Working as part of a team with many people around me.				

8. What are your current opinions of high school science, what do you like, dislike, and how do you think it relates to your everyday life?

9. ME AND THE ENVIRONMENTAL CHALLENGES:
To what extent do you agree with the following statements about problems with the environment (pollution of air and water, overuse of resources, global changes of the climate, etc.)?

	Disagree	Slightly Disagree	Slightly Agree	Agree
Threats to the environment are not my business.				
Environmental problems make the future of the world look bleak and hopeless.				
Environmental problems are exaggerated.				
Science and technology can solve all environmental problems.				

I am willing to have environmental problems solved even if this means sacrificing many goods.				
I can personally influence what happens with the environment.				
We can still find solutions to our environmental problems.				
People worry too much about environmental problems.				
Environmental problems can be solved without big changes in our way of living.				
People should care more about protection of the environment.				
It is the responsibility of the rich countries to solve the environmental problems of the world.				
I think each of us can make a significant contribution to environmental protection.				
Environmental problems should be				

left to the experts.

I am optimistic about the future.

Animals should have the same right to life as people.

It is right to use animals in medical experiments if this can save human lives.

Nearly all human activity is damaging for the environment.

The natural world is sacred and should be left in peace.

10. In what ways do you think you will use the information you learned in your high school science classes in your post-high school lives?

11. MY SCIENCE CLASSES:
To what extent do you agree with the following statements about the science that you may have had at school?

	Disagree	Slightly Disagree	Slightly Agree	Agree
School science is a difficult subject.				
School science is interesting.				
School science is rather easy for me to learn.				
School science has opened my eyes to new and exciting jobs.				

I like school science

better than most other subjects.	○	○	○	○
I think everybody should learn science at school.	○	○	○	○
The things that I learn in science at school will be helpful in my everyday life.	○	○	○	○
I think that the science I learn at school will improve my career chances.	○	○	○	○
School science has made me more critical and skeptical.	○	○	○	○
School science has increased my curiosity about tings we cannot yet explain.	○	○	○	○
School science has increased my appreciation of nature.	○	○	○	○
School science has shown me the importance of science for our way of living.	○	○	○	○
School science has taught me how to take better care of my health.	○	○	○	○
I would like to become a scientist.	○	○	○	○
I would like to have as much science as possible at school.	○	○	○	○
I would like to get a				

job in technology.				

12. By the time you leave high school, do you think you will be prepared for your next step in life, what makes you feel prepared, what makes you feel unprepared?

13. WHAT ROLES WILL DIFFERENT SUBJECTS PLAY IN YOUR FUTURE? To what extent will the following concepts help prepare you for your choices after high school?

	Not Important	Slightly Important	Important	Very Important
Being able to calculate mathematical equations				
Understanding different biological processes				
The ability to work with different computer programs				
The ability to balance a checkbook				
Practicing art and creative design				
Being part of the chorus or band				
Calculating forces during a Physics lab				
Understanding why its important to protect the environment				
Studying English vocabulary				
Giving speeches				

Preparing

presentations				
Conducting Chemistry experiments and documenting results				
Learning about our coutries history				
Learning about other countries histories				
Understanding genetics and how it affects our lives				
Studying geometric shapes and understanding calculations				

14. How do you think your high school science classes are preparing you for your future choices (after high school)?

15. MY OPINIONS ABOUT SCIENCE AND TECHNOLOGY:
To what extent do you agree with the following statements?

	Disagree	Slightly Disagree	Slightly Agree	Agree
Science and technology are important for society.				
Science and technology will find cures to disease such as HIV/AIDS, cancer, etc.				
Thanks to science and technology, there will be greater opportunities for				

future generations.				
Science and technology make our lives healthier, easier and more comfortable.	○	○	○	○
New technologies will make work more interesting.	○	○	○	○
The benefits of science are greater than the harmful effects it could have.	○	○	○	○
Science and technology will help to eradicate poverty and famine in the world.	○	○	○	○
Science and technology can solve nearly all problems.	○	○	○	○
Science and technology are helping the poor.	○	○	○	○
Science and technology are the cause of the environmental problems.	○	○	○	○
A country needs science and technology to become developed.	○	○	○	○
Science and technology benefit mainly the developed countries.	○	○	○	○
Scientists follow the scientific method				

that always leads them to correct answers.				
We should always trust what scientists have to say.				
Scientists are neutral and objective.				
Scientific theories develop and change all the time.				

16. Assume that you are grown up and work as a scientist. You are free to conduct research that you find important and interesting. Write some sentences about what you would like to do as a researcher and why.

Done

Powered by **SurveyMonkey**
Create your own free online survey now!

It has been great working with you during this research project. I hope you had a lot of fun, learned a bunch about the environment and how we can protect it, and got a taste of what is expected of college students and professionals. Thanks again it was great working with you!

I would ask that you answer all the questions below and answer them as honestly as possible. This information is going to be used for a scientific study so its very important that you take your time complete the survey to the best of your ability. If you have any questions please ask your teacher for clarification.

Participation in this survey is voluntary, and you can choose to not answer any questions that you do not want to answer. You can stop at any time. Your participation or non-participation will not affect your grade or class standing.

1. What is your name?

2. How old are you and in what grade are you currently enrolled?

Age

Grade Level

3. Where do you see yourself immediately after graduation, 5 years, 10 years?

4. What profession are you planning on pursuing upon graduation from high school?

5. By the time you leave high school, do you think you will be prepared for your next step in life, what makes you feel prepared, what makes you feel unprepared?

6. WHAT ROLES WILL DIFFERENT SUBJECTS PLAY IN YOUR FUTURE? To what extent will the following concepts help prepare you for your choices after high school?

	Not Important	Slightly Important	Important	Very Important
Being able to calculate mathematical equations	○	○	○	○
Understanding different biological processes	○	○	○	○
The ability to work with different computer programs	○	○	○	○
The ability to balance a checkbook	○	○	○	○
Practicing art and creative design	○	○	○	○
Being part of the chorus or band	○	○	○	○
Calculating forces during a Physics lab	○	○	○	○
Understanding why its important to protect the environment	○	○	○	○
Studying English vocabulary	○	○	○	○
Giving speeches	○	○	○	○
Preparing presentations	○	○	○	○
Conducting Chemistry experiments and documenting results	○	○	○	○
Learning about our coutries history	○	○	○	○
Learning about other countries histories	○	○	○	○
Understanding genetics and how it affects our lives	○	○	○	○
Studying geometric shapes and understanding calculations	○	○	○	○

7. How do you think your high school science classes are preparing you for your future choices (after high school)?

8. Assume that you are grown up and work as a scientist. You are free to conduct research that you find important and interesting. Write some sentences about what you would like to do as a researcher and why.

9. What are your current opinions of high school science, what do you like, dislike, and how do you think it relates to your everyday life?

10. ME AND THE ENVIRONMENTAL CHALLENGES:

To what extent do you agree with the following statements about problems with the environment (pollution of air and water, overuse of resources, global changes of the climate, etc.)?

	Disagree	Slightly Disagree	Slightly Agree	Agree
Threats to the environment are not my business.	○	○	○	○
Environmental problems make the future of the world look bleak and hopeless.	○	○	○	○
Environmental problems are exaggerated.	○	○	○	○
Science and technology can solve all environmental problems.	○	○	○	○
I am willing to have environmental problems solved even if this means sacrificing many goods.	○	○	○	○
I can personally influence what happens with the environment.	○	○	○	○
We can still find solutions to our environmental problems.	○	○	○	○
People worry too much about environmental problems.	○	○	○	○
Environmental problems can be solved without big changes in our way of living.	○	○	○	○
People should care more about protection of the environment.	○	○	○	○
It is the responsibility of the rich countries to solve the environmental problems of the world.	○	○	○	○
I think each of us can make a significant contribution to environmental protection.	○	○	○	○

Environmental problems should be left to the experts.	○	○	○	○
I am optimistic about the future.	○	○	○	○
Animals should have the same right to life as people.	○	○	○	○
It is right to use animals in medical experiments if this can save human lives.	○	○	○	○
Nearly all human activity is damaging for the environment.	○	○	○	○
The natural world is sacred and should be left in peace.	○	○	○	○

11. In what ways do you think you will use the information you learned in your high school science classes in your post-high school lives?

12. MY SCIENCE CLASSES:

To what extent do you agree with the following statements about the science that you may have had at school?

	Disagree	Slightly Disagree	Slightly Agree	Agree
School science is a difficult subject.	○	○	○	○
School science is interesting.	○	○	○	○
School science is rather easy for me to learn.	○	○	○	○
School science has opened my eyes to new and exciting jobs.	○	○	○	○
I like school science better than most other subjects.	○	○	○	○
I think everybody should learn science at school.	○	○	○	○
The things that I learn in science at school will be helpful in my everyday life.	○	○	○	○
I think that the science I learn at school will improve my career chances.	○	○	○	○
School science has made me more critical and skeptical.	○	○	○	○
School science has increased my curiosity about tings we cannot yet explain.	○	○	○	○
School science has increased my appreciation of nature.	○	○	○	○
School science has shown me the importance of science for our way of living.	○	○	○	○
School science has taught me how to take better care of my health.	○	○	○	○
I would like to become a scientist.	○	○	○	○
I would like to have as much science as possible at school.	○	○	○	○
I would like to get a job in technology.	○	○	○	○

13. WHAT ROLES WILL DIFFERENT SUBJECTS PLAY IN YOUR FUTURE?

To what extent will the following concepts help prepare you for your choices after high school?

	Not Important	Slightly Important	Important	Very Important
Knowledge of computer software - I'm not talking about how to use a computer, I'm talking about the different programs and how to use them.	○	○	○	○
The "ins and outs" of basic business software like microsoft word, excel, and PowerPoint.	○	○	○	○
Basic math concepts - add, subtract, multiply, divide and knowing how to calculate percentages.	○	○	○	○
Simple business math concepts like balancing a checkbook and keeping financial records like budgets and company expense reports.	○	○	○	○
Knowlege of how business operates - management, marketing, and communications.	○	○	○	○
Proper writing and research skills - grammar, spelling, organization, content	○	○	○	○
Proper communication skills - public speaking	○	○	○	○
Proper reading skills - being able to analyze what you read.	○	○	○	○
Critical thinking skills.	○	○	○	○
Expanded vocabulary/word choice	○	○	○	○

14. After you graduate high school, do you feel science will play a large part in your life? Will you take any science courses(college), will your job require it, why or why not?

15. MY FUTURE JOB:

How important are the following issues for your potential future occupation or job?

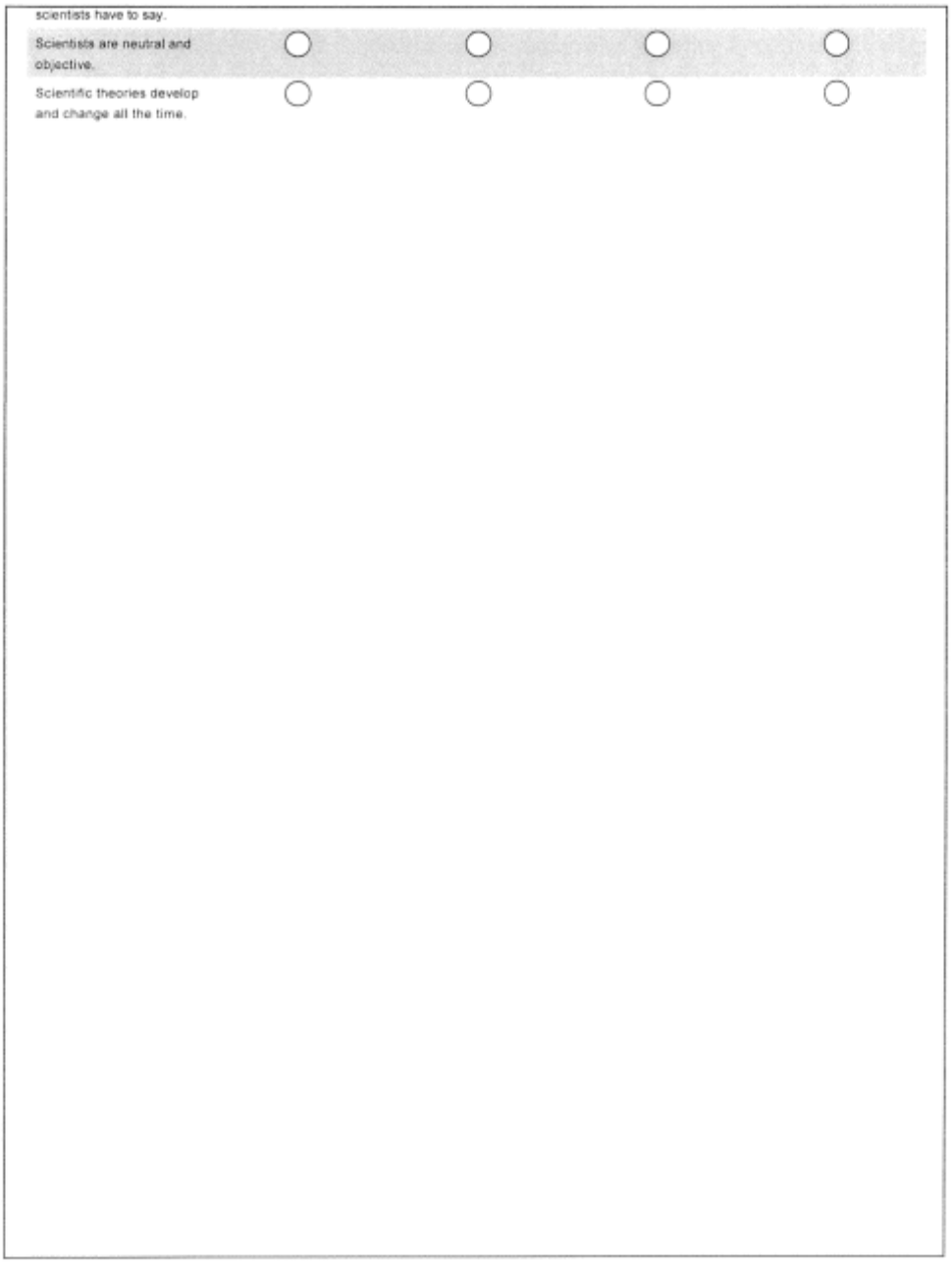
	Not Important	Slightly Important	Important	Very Important
Working with people rather than things.	○	○	○	○
Helping other people.	○	○	○	○
Working with animals.	○	○	○	○
Working in the area of environmental protection.	○	○	○	○
Working with something easy and simple.	○	○	○	○
Building or repairing objects using my hands.	○	○	○	○
Working with machines or tools.	○	○	○	○
Working artistically and creatively in art.	○	○	○	○
Using my talents and abilities.	○	○	○	○
Making, designing or inventing something.	○	○	○	○
Coming up with new ideas.	○	○	○	○
Having lots of time for my friends.	○	○	○	○
Making my own decisions.	○	○	○	○
Working independently of other people.	○	○	○	○
Working with something I find important and meaningful.	○	○	○	○
Working with something that fits my attitudes and values.	○	○	○	○
Having lots of time for my family.	○	○	○	○
Working with something that involves a lot of traveling.	○	○	○	○
Working at a place where something new and exciting happens frequently.	○	○	○	○
Earning lots of money.	○	○	○	○
Controlling other people.	○	○	○	○
Becoming famous.	○	○	○	○
Having lots of time for my interests, hobbies and activities.	○	○	○	○
Becoming "the boss" at my	○	○	○	○

job.	○	○	○	○
Developing or improving my knowledge and abilities.	○	○	○	○
Working as part of a team with many people around me.	○	○	○	○

16. MY OPINIONS ABOUT SCIENCE AND TECHNOLOGY:

To what extent do you agree with the following statements?

	Disagree	Slightly Disagree	Slightly Agree	Agree
Science and technology are important for society.	○	○	○	○
Science and technology will find cures to disease such as HIV/AIDS, cancer, etc.	○	○	○	○
Thanks to science and technology, there will be greater opportunities for future generations.	○	○	○	○
Science and technology make our lives healthier, easier and more comfortable.	○	○	○	○
New technologies will make work more interesting.	○	○	○	○
The benefits of science are greater than the harmful effects it could have.	○	○	○	○
Science and technology will help to eradicate poverty and famine in the world.	○	○	○	○
Science and technology can solve nearly all problems.	○	○	○	○
Science and technology are helping the poor.	○	○	○	○
Science and technology are the cause of the environmental problems.	○	○	○	○
A country needs science and technology to become developed.	○	○	○	○
Science and technology benefit mainly the developed countries.	○	○	○	○
Scientists follow the scientific method that always leads them to correct answers.	○	○	○	○
We should always trust what	○	○	○	○



scientists have to say.

Scientists are neutral and objective.	○	○	○	○
Scientific theories develop and change all the time.	○	○	○	○

APPENDIX D

PRE AND POST ASSESSMENT PARENT SURVEY
WWW.SURVEYMONKEY.COM

Parent Survey - Pre Assessment

Exit this survey

The intent of this survey is for the researcher to understand how interactions outside of the school are affecting a students perceptions of science. This research is being conducted in an effort to determine how interactions in field based activities alongside college researchers will provide your student with a positive experience, helping to shape their future. I would ask that you please try to answer all the questions, and answer them as honestly as possible. It will be included as part of my research and is very important to the results of the study.

Your participation in this survey is voluntary, and you can choose to not answer any questions that you do not want to answer. You can stop at any time. Your participation or non-participation will not affect your students grades or class standings in any way.

1. What is your students name?

2. What is your age?

- <30
- 30-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- >60

3. Which of the following best describes your involvement with your students education?

- I am constantly watching to make sure they are completing their assignments and helping them when they have trouble understanding concepts.
- I will help them occasionally when I see them struggling with their work.
- I would only help if my student comes and asks me for assistance.
- I do not get involved with my son/daughters education.

4. Which of the following would describe your feelings about the importance of

science in todays society?

	Agree	Slightly Agree	Slightly Disagree	Disagree
Science plays a key role in most decisions in our society				
I guess science is important but it really does not relate to me				
Our world would be a very different place if it was not for science				
I disliked science in school and still find it to be a difficult subject				
Science is important if you want to be a doctor or chemist but isn't necessary for everyday life				
I loved science when I was in high school it was really interesting				
I don't really know why anyone would want to study science, it is boring				
Science has had a direct impact on my life				

5. After school, at the dinner table, at night sitting in the living room watching television, what types of school related subjects are talked about?

6. Based on the conversations at home, please indicate your students level of interest/excitement with the following subject areas.

	My student is really excited and talks about this at home often	My student shows interest and does occasionally mention it at home	I have heard some ramblings here and there	Never discuss it at all
Playing a new game in gym class				
Learning how to solve mathematical problems				
Singing or playing music in music class				
Conducting a lab exercise in science class				
Building something or learning a new computer program in technology class				
Learning about the history of our country and others around the world				
Studying grammar and reading novels in English class				

7. If you were asked to describe your student's favorite activity in school, what would it be?

8. If you were asked to describe what your student dislikes most about school what would your answer be?

9. Of the following scenarios please rate each based on your students successes and troubles when completing work at home.

	My student has a very easy time completing assignments and understanding the materials	Assignments challenge my student but over time he/she manages to complete the work	My student struggles through the activities and sometimes I wonder if they really understand	My student becomes very frustrated and hates homework	N/A
Solving algebraic equations	○	○	○	○	○
Completing a drawing for art class	○	○	○	○	○
Balancing a checkbook for business class	○	○	○	○	○
Writing a report on a historical figure for history class	○	○	○	○	○
Reading a fiction novel for English	○	○	○	○	○
Writing a lab report about the lab they conducted in science class that day	○	○	○	○	○

10. How would you describe your involvement as parents in your son/daughters education?

11. Since your student was asked to be part of this research has there been any communications at home about their involvment?

- ○ Yes
- ○ No

12. Pertaining to the last question, what was discussed? What was their level of

excitement? Have you seen an increase in the amount of school based discussion since being asked to participate?

13. Have you discussed anything about your students future endevours? What are their plans beyond high school? What do you feel are your students strengths and weaknesses heading into the future?

14. How do you feel the involvment of your student in this field research will affect their attitudes toward school?

- I don't think it will have any affect on my students perceptions toward school.
- I think my student will like being involved but it will not affect how they feel about their schooling.
- I think their involvement will have a positive affect on their perceptions of science and school.
- I think their involvment has affected their post secondary choices to pursue a career in science.

Done

Parent Survey - Post Assessment

Exit this survey

You should be proud, your student has worked hard completing this field research and has hopefully gained great knowledge and understanding of how important our environment is and ways we can protect it. It was great to work with the kids, and I hope it provided them with a great opportunity to further their education and most importantly have a lot of fun doing it! In an effort to assess any changes in your students perceptions or attitudes toward science I would ask that you answer the following follow-up questionaire.

Please try to answer all the questions, and answer them as honestly as possible. It will be included as part of my research and is very important to the results of the study.

Your participation in this survey is voluntary, and you can choose to not answer any questions that you do not want to answer. You can stop at any time. Your participation or non-participation will not affect your students grades or class standings in any way.

Thanks for your involvement
Mr. Metzger

1. What is your students name?

2. During the time when your student was involved in the research study, did you notice any changes in their discussions at home regarding schoolwork?

- There were no changes, our student does not talk much about what goes on at school.
- I heard some ramblings about what they were doing in school.
- My student showed an increased interest in the activity you involved them with.
- All my student talked about was the research project they conducted, and they are still talking about it.

3. If your student did discuss the scientific study they were involved with at home, how often did they discuss it and what did they talk about?

4. Which of the following would describe your feelings about the importance of science in todays society?

	Agree	Slightly Agree	Slightly Disagree	Disagree

Science plays a key role in most decisions in our society				
I guess science is important but it really does not relate to me				
Our world would be a very different place if it was not for science				
I disliked science in school and still find it to be a difficult subject				
Science is important if you want to be a doctor or chemist but isn't necessary for everyday life				
I loved science when I was in high school it was really interesting				
I don't really know why anyone would want to study science, it is boring				
Science has had a direct impact on my life				

5. What do you feel are the most important components of a students education? What do you feel are important concepts they need to know to be successful?

6. Based on the conversations at home, please indicate your students level of

interest/excitement with the following subject areas.

	My student is really excited and talks about this at home often	My student shows interest and does occasionally mention it at home	I have heard some ramblings here and there	Never discuss it at all
Playing a new game in gym class				
Learning how to solve mathematical problems				
Singing or playing music in music class				
Conducting a lab exercise in science class				
Building something or learning a new computer program in technology class				
Learning about the history of our country and others around the world				
Studying grammar and reading novels in English class				

7. If you were asked to describe your student's favorite activity in school, what would it be?

8. If you were asked to describe what your student dislikes most about school what would your answer be?

9. Of the following scenarios please rate each based on your students successes

and troubles when completing work at home.

	My student has a very easy time completing assignments and understanding the materials	Assignments challenge my student but over time he/she manages to complete the work	My student struggles through the activities and sometimes I wonder if they really understand	My student becomes very frustrated and hates homework	N/A
Solving algebraic equations	○	○	○	○	○
Completing a drawing for art class	○	○	○	○	○
Balancing a checkbook for business class	○	○	○	○	○
Writing a report on a historical figure for history class	○	○	○	○	○
Reading a fiction novel for English	○	○	○	○	○
Writing a lab report about the lab they conducted in science class that day	○	○	○	○	○

10. Over the past few months have you seen a change in the amount of time your spending with your son/daughter involving schoolwork? What has changed?

11. Since your student was asked to be part of this research has there been any communications at home about their involvment?

- ○ Yes
- ○ No

12. Pertaining to the last question, what was discussed? What was their level of excitement? Have you seen an increase in the amount of school based discussion

since being asked to participate?

13. Have you discussed anything about your students future endevours? What are their plans beyond high school? Do you think their involvement in this activity had any impact on their future decisions?

14. How do you feel the involvment of your student in this field research will affect their attitudes toward school?

- I don't think it will have any affect on my students perceptions toward school.
- I think my student will like being involved but it will not affect how they feel about their schooling.
- I think their involvement will have a positive affect on their perceptions of science and school.
- I think their involvment has affected their post secondary choices to pursue a career in science.

15. Regarding the study they were just involved in, how important do you feel activities like this are in your students educational experience?

- Very Important (they should have as many of these experiences as possible)
- Important (its great they get out and about, but they could learn the same in school)
- Not So Important (doesn't really make a difference)
- Not Needed At All !!! (what a waste of taxpayer money!)

Done

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APPENDIX E

INSTRUCTOR JOURNALING

Instructor Journaling 4/20/12 Riparian Zone Planting

Students were excited to take part in the activity. There was a lot of buzz in school regarding the project. Jeremy Faust, a senior at the high school was initially involved with me designing the riparian zone. He completed a bunch of the work deciding which

native species to use in the planting, proper site selection, spacing, and informing the other students helping with the planting on proper planting techniques. Students were very excited on the trip down to the property. They were meeting Jason Smith of Hanover engineering, an environmental engineer who was going to discuss with them the importance of riparian zone planting, why you should select native species, and the importance on planning ahead, and working with local municipalities concerning land-use planning. During Jason's informative discussion, students were very quiet and interested in what Jason had to say. All the students were paying close attention to what Jason had to say. This is not what I typically see in my classroom when I am lecturing. There are always some students who are dosing off or not paying attention. Jason's discussion lasted about 15 minutes with him telling the students "*how fortunate you guys are to have an opportunity like this to make a difference. When I was in high school we would go on field trips but never had an opportunity like this. Your really working on something here that is going to make a difference, something you can revisit in the future and know you had a part in.*" Students then helped two board members of the lakes non-profit group plant all 500 tree/shrub seedlings. It was hot and humid but the students continued to work hard, obviously showing their interest. There were a lot of great conversations throughout the day, not only between the students and I but between the students and the adults at the site helping that day. There were many questions for Jason before he left to return to work about what exactly environmental engineers do? How does he spend many of his days? Do you like being outside working in the environment like this? Students also found how important it is to get involved in a volunteer aspect by interaction with the board members of the lake association. The lake association could not thank the students enough for their hard work and determination. It was evident when they surprised the students with certificates of appreciation for their efforts. Students asked these volunteers questions like why your involved with a project like this? How do you get involved with things like this? It was evident to me they really liked what they were doing that day. Even though they were dirty and sweaty, they all had smiles on their faces, and were excited in the work they had accomplished. Some of the comments made by the students included:

"I'm really excited that in a couple years I will be able to come back here and see this place and it will look like a forest!"
"We worked hard today, but it's still better than sitting in a classroom."
"How long do you think it will take this area to grow into adult trees?"
"It's cool to know we are making a difference for this lake."
"When this is full, I want to come down here with my family, can you camp here?"

We were back at the lake three weeks later to conduct our stream sampling, and we almost didn't make it back to school in time for dismissal because the students said we "had to" go see what the riparian zone looks like. We took the hike over to the site, and

came in from the opposite direction but the kids were really interested in seeing what the site looked like since they planted it three weeks ago. The best comment came from Kayla, "*Wow, this is really the place where we planted all those plants! I didn't even recognize it! That's funny.*" As the grasses in the area grew up a little higher and it was harder to see all the tree and shrub species.

5/3/12 Kutztown University Trip – Fish Schooling Study
Took the students today to Kutztown University to interact with researchers Mike Simmonds and Anthony Pallus, along with their professor Dr. Nancy Butler. While waiting in the science center at Kutztown University, students were excited looking at all the fish tanks they had within the science center, different collections of bird species, and reptile mounts caught their eye as some of are preparing for the state envirothon competition later in May. On the walls were posters of different research projects undergraduates were undertaking. Students seemed interested in what was taking place around the university. Upon Dr. Butler's arrival with her research students, she took my students into her office area and the research office and talked with the students regarding the basis for their study. She informed my students that Mike and Tony are undergraduates and that this is the beginning of a deeper study into fish schooling. She talked about how these guys got involved, and the premise of their study, (a) how stress affects schooling behavior of fish, (b) whether the number of fish affects school cohesion, and (c) whether having cover (i.e. vegetation) in the tank will alter a & b. She then had to leave for a meeting and left the discussion to Mike and Tony who talked with the kids about their project.
They showed them the experimental design, talked about different problems they ran into along the way, how they trouble-shooted these problems, and talked about why they got involved with this study. Mike was adamant about his involvement. As a sophomore he returned to college at an older age and discussed the importance of "*setting yourself apart from the rest.*" He stated how college was "*an important part of his life, his future, and he wanted to take advantage of every opportunity given to him*", and the importance "*as a college student to take advantage of those opportunities given to you, get involved with your professors.*" The researchers then showed my students how they set up their experiment, videotaping the fish in different aquariums, and then we needed to leave the room as part of their experimental design was to have no movement in the test area. We moved to a lab where the researchers provided my students with laptops and prior video from their experiment. Mike and Tony had my students figure out how they were going to decipher the video, what types of data tables they were going to need and what they thought was going to happen. Much like the two of them did in the infancy of their experiment. My students watched the video of the fish in the tank, learned the hardships of deciphering data, but managed to accumulate a good sampling which was evident by both groups having similar findings. It was rewarding to see my students huddled around a laptop almost "fighting" over if you counted one fish over another depending on where they were located. Student argued a bit at first on how to set up their data collection. Nate who is a student that is more independent at first broke away from his group and wanted to design his own data table, but warmed up to what the group was accomplishing and

did eventually phase in with the rest of his group. The groups included students of varying ability levels from high school seniors that are well versed in the sciences to general students who had never been involved with something so in depth before. The interesting thing was when it was time to collect data they were all working together, and as an observer if you had just walked into the room, you would never know the differences. Students asked the researchers many questions. When we first met them,

students were very quiet and as we were in a little room filled with science equipment may have felt very uncomfortable. Dr. Butler and I tried to ease their timidness and I believe the lost crayfish in the room broke the silence. As we looked for the escapee students seemed to start interacting with Professor Butler and her students. As we migrated to the other lab, which was a very nice science lab, students had no problems asking the researchers what they thought about something in the videos, how their data compared to the researchers (which ended up being very close) and even told the researchers how they thought they could alter the experiment to make it easier to identify fish within the tank which was one of the researchers problems. Below are some of the comments I observed:

Mike Simmonds (Junior Biology Major): "I wish when I was in high school they would have given us opportunities like this."

Cathy Mannon (Junior High School Student): "I really enjoyed this activity, are we going to go down there next year and work on that project again?" "How can we keep up to date on that research?"

Cathy Mannon: We need to do more stuff like this in high school. How come you don't do labs like this in school? Mr. Metzger, did you see me, I didn't fall asleep, I really liked this!"

One thing I am noticing is there must have been some talk back at school every time these students return, I have students coming and asking me how they can get involved. I'm pretty sure this is a good thing.

5/14/12 Macroinvertebrate Study – Leaser Lake

Today I took the students to Leaser Lake again, this time conducting a macroinvertebrate study on one of the tributaries. Have a researcher from Mansfield University making the trip down today to interact with the students while conducting the stream assessment and also to teach them about a sampling technique known as electrofishing.

Students again very excited to make the trip, this one involved a bit more on the planning side, students needed to familiarize themselves ahead of time with macroinvertebrate identification and the sampling techniques. Once we reached the stream, which was a bit of a hike, we set up our base of operations and I informed them on experimental design, how to set up their sampling sites, proper kick-netting techniques, and how to collect samples and preserve them. Student then broke into three groups of three and each selected sampling sites. They were excited to put on waders and get in the stream. Many of them made reference to how this was so much better than sitting in a classroom. Chad Delar, the Mansfield University sophomore who made the trip to work with the students, helped students with proper site selection, and worked through the trials of beginner stream samplers. During all three activities, not once did I see a student frustrated with what they were trying to accomplish. Even if they didn't really know how to do something, they were more apt to ask than become frustrated which seems different from in a classroom. One reason that may be is the smaller size group I am working with compared to in a full classroom. Students collected their samples and began to pick trough them and preserve the samples. It is great to see the looks on the students' faces; especially those that never conducted anything like this before. They are so excited and intrigued that all this stuff lives in a stream.

Quotes:

Maddie: "I cannot believe all this stuff lives in the bottom of a stream!"
Chad Delar: "You guys are really lucky that your school has a program like this where you can come out here and get involved in the outdoors."
Sam: "Mr. Metzger, what exactly does all this tell us about the stream? Is this stream in good or bad condition?"
Eric: "Mr. Metzger thanks for taking me along on these trips, It's really neat to see all these different techniques and that all this means something."
Chad then gathered the students and gave them an overview of what electrofishing is all about, why it is done, what the results mean. He gave them a safety briefing because they were working in the water along side him and the electrofishing unit.
Protocol is a 300-meter section. We conducted our stream sampling on three 100-yard sections so the determination was made to electrofish our entire sampling area. Students rotated through with Chad working the backpack electrofishing unit and the students working along side him netting fish and another manning the collection bucket immediately behind. As they progressed up the stream, students rotated through the different positions, with one student who was really interested in pursuing a career in fisheries being asked by Chad to help by using the electrodes.
Students were focused on the safety parameters that needed to be followed, and were very excited when they started to see fish and other aquatic organisms "roll up" when shocked. You can sense the excitement when they are yelling at the net minders in the water that they are missing some, or that they see some coming toward them. It was contagious, the excitement that the students showed. Some might have been timid in the beginning but still wanted to get in the stream and help net. The best comment I heard the entire day was "the really cool part about this is you walk up to the stream and have no idea what you're going to find, then you start electrofishing and see all that stuff!" So many of the students commented to me about how they could not believe all those minnows lived in the small stream we were studying. Many of them had a hard time grasping that they could stand along the stream and see very few if any minnows, but when we electrofished, we found numerous minnows.
After the sampling run was completed students identified and measured the species acquired back at our staging area. Chad helped them with the identification of the fish species, and then answered any questions the students had. Chad expressed to the students about how important it is and was for him to get involved in different activities and become well rounded. He was excited to be involved, answered some of the students questions regarding college life at Mansfield, what the classes were like, how hard they were, and what the professors expected from you. He told them that there is a definite

change in the expectation level, it is much higher in college, and that students need to seek their instructors out at times, especially if they need assistance. Teachers in college assume that your understanding everything if you don't make it a point to ask about something, unlike in high school where many teachers, at least his, would make sure you knew the information before moving on.
He said, "It takes some adjusting, but make sure you don't get caught up in all that there is to do at college. It is very competitive and you need to have great grades right from the beginning!" He wanted to stay longer but had to get back to Mansfield, so he wished the students luck with the rest of their project, expressed his excitement for being involved,

and offered the students his assistance in future years. He even exchanged information with one of my students who is looking to visit the college to pursue fisheries biology. Joe is looking to make a trip up to Mansfield sometime in the near future to see what the program has to offer.

APPENDIX F

QUOTES FROM STUDENT INTERVIEWS

When Kayla was asked about having a different understanding of science after conducting the different research activities:

> *"I have learned to conduct experiments differently, looking at all the factors of that experiment, or the outcome of the experiment"*

Joe was asked about the interactions with college students and its effects on choices beyond high school:

> "*I think a lot of students don't know what they want to do. Shadowing would let you know if you really want to do that job."*

Maddie thoughts about scientists were similar to many others.

> "*I liked the bug part of the study, because when I think of scientists, I think of them in a lab, not in a stream."*

Tyler discussing his thoughts of college life:

> "*I believe in college you have more freedom, responsibility, high school teachers care more about students, in college professors don't have as much time for each student."*

Joe added:

> *"I heard there is so much time in between classes where you need to be responsible. Professors don't say when something is due the just give a date and it is up to you to get it done."*

APPENDIX G

ENVIRONMENTAL STUDY SIMULATION

Environmental Science Scenario





The Pennsylvania Fish and Boat Commission is in dire need of help! Their resources are limited and they need to figure out what is going on at Leaser Lake. They have hired your group of professional scientists to conduct a study to determine if there are any impacts to the lake from the surrounding community. Currently the lake is drained for dam repairs, so it is important that we get in to the bottom of the lake and conduct some sampling of macroinvertebrates and water quality. We want to make sure we identify and address local impacts, which will affect the lake when the lake is ready to be refilled.

Your preliminary assignment is to create a proposal for the PA Fish and Boat Commission which outlines how you are going to conduct your study including the following key points:

(I included some maps and photos to help you design your plan)

- **What are we trying to determine (why are we studying the bugs and water at the lake)?**
- **Where is your study going to be done?**
- **How are you going to design the experiment?**
- **What equipment are we going to need?**
- **How are you and your fellow scientists going to conduct the experiment?**
- **Did you use the scientific method?**
- **How are you going to record results?**

When your finished with this assignment, you should have a completed document which looks professional, ready to hand over to the PA Fish and Boat Commission. You should try to do your best work because this could be a big job for your business, which most likely will mean $$$$$$$$$$!

Environmental Science Scenario Grading Rubric (16 Points Maximum)

Use of Scientific Method (Each component is worth 1 point)

Purpose	_____	(What is the group trying to determine)
Hypothesis	_____	(Based on observations of the area, what do they believe they will find?)
Procedure	_____	(How was the study conducted, methods, equipment, researched technique)
Data	_____	(Information is given regarding what data will be collected, data table?)
Results	_____	(Was there an indication that students discussed the data)
Conclusion	_____	(Students should indicate what their study was looking to find)

Level of Student Understanding

5 Student showed EXTENSIVE knowledge and understanding of concepts including what is expected during a field study, proper field methods, and adherence to the scientific method.
4 Student showed STRONG knowledge and understanding
3 Student showed BASIC knowledge and understanding
2 Student showed MIMIMAL knowledge and understanding
1 Students knowledge and understanding is MISSING

Level of Professionalism

5 Students design was clean, well thought out, and precise
4 Students design was clean, covered some concepts, missing steps
3 Students design was average, missing components, jumbled
2 Students design was messy, missing numerous steps, not organized
1 Students design was unprepared, lacked organization, showed lack of understanding.

APPENDIX H

STUDENT FIELD STUDY REPORT

Leaser Lake Tributary Stream Study
May 4th, 2012

The purpose of doing this study was to figure out what the quality of the water is in the stream flowing into Leaser Lake on its northwest corner. The lake has been drained for dam repairs for several years and is almost ready to be refilled. Last year we sampled the other main tributary in hopes of understanding what kinds of macroinvertebrates and fish are living in those streams. We want to see if there is going to be any change after the lake is filled. As far as we know nobody has ever done any kind of scientific study on these two streams. We sampled the stream based on the EPA's Rapid Bioassessment Protocol. It will determine stream health based on the kinds of macroinvertebrates that we found. We also electrofished the area and recorded the different types of fish we found.





What we believe is, the stream will have good water quality because it is at the bottom of a mountain and the stream runs through the woods. It should be colder water and there should not be a lot of pollutants, except maybe from farming. We will probably find a lot of different insects and a bunch of fish.

First we got all our equipment together and had to take a walk through the woods to get to the stream. When we got there, we found a nice bridge that was built where we could put all of our equipment. We had 1-meter kick nets, buckets, a tape measure, flags, aluminum pans, and waders. The first thing we had to do was select our areas. Mr. Metzger said we needed to have three areas each being 300 ft.
We pulled the tape measure out and walked it through the woods along the stream. We put a flag at the beginning and end. Mr. Metzger informed us there would be one area below the bridge and two above. We were shown the right way to kick for bugs. Mr. Metzger called it the bug shuffle! We put our net in the bottom of the stream, stretched it out tight, and used our hands to clean the bottoms of any big rocks into the net. Then we kicked the bottom of the stream so all the bugs got loose and the water carried them into

the net. We lifted the net out and collected all the living stuff into a bucket. We did this three times at different areas.

We then took our bucket back to the bridge and slowly dumped it into the pans. We picked the insects out of the pan with tweezers or our hands and put them in alcohol in a jar. Mr. Metzger said this kills the bugs so we can look at them later back at school. When we returned to school we identified the bugs using a microscope and petri dish. We recorded the number and family of our bugs on the data table included.

The other part of our study had us using an electrofishing backpack. We sampled our same 300ft. sections with the help of Chad Delar from Mansfield University. The backpack put an electric shock in the water, which stunned the fish so we could net them. We had one person with the backpack, two people netting, and one person carrying a bucket for us to dump our fish in. You needed to wear waders so you would not get zapped and could not put your hands in the water. All the fish we caught were identified and measured. Then we let them go again in the stream. We recorded all the measurements on the data sheet.





RBP III Stream Assessment Data

	Site 1	Biosurvey Score	Site 2	Biosurvey Score	Site 3	Biosurvey Score
Taxa Richness	18	6	22	6	13	6
EPT Richness	13	6	15	6	8	3
% Dominance	31	6	22	6	33	6
Sensitive Taxa Index	10.9	0	11.3	0	21.5	0
% Scrapers	33.8	6	22	6	11	3
% Shredders	1.6	0	8	3	14	6
TOTAL SCORE		24		27		24
SITE SCORE		Good		Good		Good

Macroinvertebrate Score Sheets at end of report.

Looking at the data above, the taxa richness tells us the total number of taxa. Site 2 had the most. EPT taxa includes stoneflies, mayflies, and caddisflies which don't like pollution. Site 2 was the best again. % shredders and scrapers calculate the percent based on how the macroinvertebrates eat. More shredders and scrapers are good for the stream. Depending on the numbers we got we were given a certain biosurvey score. When totaled it will tell us the quality of our stream.

Our stream was of good quality which is what we figured was going to be the case. The stream did have some sediment in it especially site 3, which was the closest to the farm fields. We found a bunch of dipteran larvae in that site, much more than anywhere else. When we electrofished we were hoping to find some native brook trout, but the only fish we found were blacknose dace and creek chubs. They were small. Overall, the stream had good quality as we determined. It had a lot of different insects, a bunch of crayfish, some salamanders (we think we saw a hellbender but didn't catch it), but not many fish. This could be because the stream is not very deep.