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By Robbie Ray Ortega

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MOTIVATION AND CAREER OUTCOMES OF A PRECOLLEGE LIFE SCIENCE EXPERIENCEFOR UNDERREPRESENTED MINORITIES

For the degree of Doctor of Philosophy

Is approved by the final examining committee:

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MOTIVATION AND CAREER OUTCOMES OF A PRECOLLEGE LIFE SCIENCE EXPERIENCE FOR UNDERREPRESENTED MINORITIES

A Dissertation

Submitted to the Faculty

of

Purdue University

by

Robbie Ray Ortega

In Partial Fulfillment of the

Requirements for the Degree

of

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ABSTRACT

Ortega, Robbie Ray. Ph.D., Purdue University, August 2011. Motivation and Career Outcomes of a Precollege Life Science Experience for Underrepresented Minorities. Major Professors: Neil A. Knobloch and Roger L. Tormoehlen.

Minorities continue to be underrepresented in professional science careers. In order to make Science, Technology, Engineering, and Mathematics (STEM) careers more accessible for underrepresented minorities, informal science programs must be utilized to assist in developing interest in STEM for minority youth. In addition to developing interest in science, informal programs must help develop interpersonal skills and leadership skills of youth, which allow youth to develop discrete social behaviors while creating positive and supportive communities thus making science more practical in their lives. This study was based on the premise that introducing underrepresented youth to the agricultural and life sciences through an integrated precollege experience of leadership development with university faculty, scientist, and staff would help increase youths' interest in science, while also increasing their interest to pursue a STEM-related career.

Utilizing a precollege life science experience for underrepresented minorities, known as the Ag Discovery Camp, 33 middle school aged youth were brought to the Purdue University campus to participate in an experience that integrated a leadership development program with an informal science education program in the context of agriculture. The week-long program introduced youth to fields of agriculture in engineering, plant sciences, food sciences, and entomology. The purpose of the study was to describe short-term and intermediate student outcomes in regards to participants' interests in career activies, science self-efficacy, and career intentions.

Youth were not interested in agricultural activities immediately following the precollege experience. However, one year after the precollege experience, youth expressed they were more aware of agriculture and would consider agricultural careers if their first career choice did not work out for them. Results also showed that the youth who participated in the precollege experience were self-efficacious to learn science, and they were self-efficacious to learn science one year after the precollege experience. Youth reported they did not develop interpersonal and leadership skills during the precollege experience, yet they said the interpersonal and leadership skills were useful throughout the following year after the precollege experience. Participants were interested in science careers, and their career plans did not change after the precollege experience.

I. INTRODUCTION

A. Background of the Study

Ethnic minorities in the United States remain under-represented in a number of occupations, including those in the sciences (Lam, Doverspike, & Mawasha, 1997; Landenfeld, 2009). Why this is so has to do, in no small part, with minority youths' lack of interest in and accessibility to Science, Technology, Engineering, and Mathematics (STEM)-based education and job opportunities.

Up to this point, STEM-related careers have been occupied predominately by white, Caucasian males – a segment of the U.S. population that, according to the Census Bureau, will likely decline 10% by the middle of this century. This decline will leave a significant gap in the American workforce. The nation, however, has an untapped reservoir of talent that can be developed to fill that gap, minority youth, provided they are encouraged and given the opportunity to pursue meaningful STEM education from high school on up through doctoral level (George, Neal, Van Horne, & Malcolm, 2001).

In an attempt to spur interest among under-represented minority (URM) youth in the sciences, its relevance to their lives and as a career option, the focus of science education has been shifting away for the traditional memorization of fact and concepts and towards more informal inquiry-based learning, in which students seek out answers to their own questions (Gibson & Chase, 2002). Although informal educational programming is being offered, a number of studies have identified barriers that tend to hinder the participation of URMs in STEM-related activities.

Among those barriers are the following: (a) negative attitudes regarding science and mathematics, (b) negative perceptions of themselves as science and mathematics learners, (c) limited exposure to extracurricular activities in STEM, (d) lack of information about STEM, (e) few STEM-involved acquaintances and role models, (f)

varied but often negative influences of significant adults, (g) low self-perceptions of their ability to be successful in STEM classes, and (h) little interest or aspirations towards STEM careers (Davie-Lowe, 2006; George et al., 2001, Payton, 2004).

Reforms in science education often propose fulfillment of life skills that interconnect the sciences and technology (Hurd, 1997). By integrating leadership skill development with science education, students would learn metacognitive skills as well as discrete social behaviors. This would establish appropriate social behaviors and help create positive and supportive communities for students, thus making science and related fields more practical to their lives (Hurd, 1997; Ricks, 2006; Williams & Reisberg, 2003). These leadership skills are those that facilitate interaction between individuals or in group settings. Such interaction requires that the students have an awareness of the respective positions or the persons involved, the relationships among persons, and the task at hand (Sleigh & Ritzer, 2004). Possessing such leadership skills would provide students the ability to pursue solutions to ambiguous problems, to generate predictions, to collect and analyze evidence, and to communicate ideas to one another (Palincsar, Anderson, & David, 1993).

B. Statement of the Problem

Educational diversity programs have attempted, with some success, to make a difference in bringing URMs into STEM disciplines (George et al., 2001). However, despite these long-standing educational efforts, there remains reluctance on the part of URMs to purse higher education in STEM-related disciplines, due mainly to science education taking an impersonal approach to engaging students (George et al., 2001; Mervis, 2006). It seems clear that effective precollege science and mathematics education is needed to enlarge the pool of students available and prepared for courses and career options in STEM (Davis-Lowe, 2006).

That in mind, the study undertaken and reported here was based on the premise that introducing under-represented youth to informal life sciences education through an integrated precollege experience in leadership development with university faculty,

scientists, and staff would increase the youths' interest in science and their interest in pursing STEM-related careers.

C. Purpose of Study and Focus of the Study

The purpose of this study was to explore and describe the outcomes of a precollege agricultural life science program, known as the Ag Discovery Camp, on minority youth's agricultural interests in career activities, science self-efficacy, career awareness, and application of leadership development.

The Ag Discovery Camp (ADC) is a week-long summer enrichment program, conducted by the Office of Multicultural Programs in the College of Agriculture at Purdue University that exposes urban middle school aged youth to various fields of agriculture, while also introducing them to various aspects of leadership development. Examination of the program was expected to reveal some of the fundamental elements found in effective informal science education efforts, specifically those elements most apt to impact URM youth. Informal learning experiences, such as the ADC, are seen as valuable resources for fostering a positive attitude towards sciences, stimulating a positive self-image in performing science and building self-confidence to participate in science (Crane, Nicholson, Chen, & Bitgood, 1994).

Primary focuses of study were: (a) to add to the research related to URM youth programs in informal agricultural and life science education; (b) to assess the informal science-learning environment's ability to enhance STEM interests and career options among URMs; and (c) to better understand the relationship between leadership skill development and URM youths' interest in science, their science self-efficacy, and their 'personal agency.'

D. Significance of the Study

This study is deemed important because it focused on how URM youth can be motivated to learn science outside of formal educational settings. Even with added emphases on science inquiry, research shows that students typically do not develop a full understanding of science through participation in 'school science' alone (Bell, Blair, Crawford, & Lederman, 2003; Lederman, 1992; Mackay, 1971). Under this structure, science is usually presented as a rigid body of facts, theories, and rules to be memorized and practiced, rather than a way of knowing about natural phenomena. Therefore, traditional science education is becoming outmoded in that it does not adequately prepare youth to understand science- and technology-related issues in a rapidly evolving society (Driel, Beijaard, & Verloop, 2001; Millar & Osborne, 1998).

Students often report that what they learn in school has little relevance to their lives outside the classroom or to their futures. Thus, there is a need to build a 'science practice' with youth that they can relate to and that fits their own worldview and culture (Fusco, 2001; Nieto, 1994; Rahm, Moore, & Martel-Reny, 2005; Richmond & Kurth, 1999; Sleeter and Grant, 1991). Recommendations for addressing this shortfall have been for educators to provide students with opportunities to 'do science' through in-class projects, extracurricular activities, or informal educational experiences (Bell et al., 2003; Ricks, 2006).

Today's society looks to educators to provide 'hands-on' and 'minds-on' instruction, with the aim of reinforcing or increasing students' knowledge and learning potential (National Research Council, 1996; Ricks, 2006), thus the importance of moving instruction outside the formal classroom. Various studies tend to confirm that informal inquiry-based science activities have positive effects on students' science achievement, cognitive development, laboratory skills, science-process skills, and general understanding of the sciences (Chang & Mao, 1998; Gerber, Cavallo, & Marek, 2001; Gibson & Chase, 2002; Padilla, Okey, & Garrard, 1984).

Informal science learning environments, such as the Ag Discovery Camp, are seen as potentially providing the following advantages: (a) allowing for concentrated science investigations with few time constraints; (b) offering students opportunities to

perform science in comfortable ways, especially for those who struggle with the social incongruity of the educational system; (c) better facilitating students' understanding an transformation of science processes and concepts (Lee, Fradd, & Sutman, 1995; National Academy of Sciences, 2007; Ricks, 2006); (d) advancing science interest and learning (Hofstein & Rosenfeld, 1996); (e) breaking down barriers to reach minority and urban youth with science education (Bell et al., 2003; Bouillion & Gomez, 2001; Rahm et al., 2005); (f) providing students with positive role models; (g) introducing students to a variety of STEM career options; and (h) encouraging and inspiring students to do well in school and initiate STEM educational and career interests (Jordan & Nettles, 1999; Packard & Nguyen, 2003; Ricks, 2006).

E. Research Questions for the Study

The purpose of this study was to explore and describe the outcomes of a precollege agricultural life science program, known as the Ag Discovery Camp, on minority youth's agricultural science interests, science self-efficacy, career awareness, and application of leadership development.

The following nine questions guided this study:

1. What were interests in career activities of the students immediately following the 12 months after participating in the Ag Discovery Camp?
2. What was the perceived self-efficacy of the participants immediately following and 12 months after the ADC?
3. What STEM courses were the participants taking and/or intending to take while in high school?
4. What were the college intentions of the participants immediately following and 12 months after the ADC?
5. What were the career intentions of the participants immediately following and 12 months after the ADC?
6. Was the development of leadership skills positively related to higher perceived science self-efficacy of the ADC participants?

7. Was the development of leadership skills positively related to science interests of the ADC participants?
8. Were any negative experiences (e.g., social exclusion, negative group dynamics) related to perceived science self-efficacy of the ADC participants?
9. Were any negative experiences (e.g., social exclusion, negative group dynamics) related to the science interests of the ADC participants?

F. Basic Assumptions

The following assumptions were made for the conduct of this study:

1. That the participants were interested in science, due to their enrollment in the Ag Discovery Camp.
2. That the participants were all from urban populations.
3. That the presented material was age-appropriate for middle school-aged participants.
4. That the self-reported data collected from the questionnaire instruments were true and accurately reflected the participants' beliefs.
5. That in the collection of the interview data, the participants responded to questions openly and honestly.
6. That all data were collected with reliable and valid instruments.
7. That the study was conducted in an objective manner, with the influences of researcher bias minimized.
8. That the participants had an accurate recall of their experiences in the 12-month follow-up phase of the study.

G. Limitations of the Study

Enunciated here are potential limitations of this study that the researcher acknowledges may impact its internal validity.

1. Researcher Bias Limitations

The researcher served as an instructor for the weeklong Ag Discovery Camp experience. This may have influenced the responses given by the participants as well as endangered a researcher bias resulting from relationships formed with them. Also, the researcher is an URM in agriculture, which could have influenced interpretation of the findings because of 'ethnic minority empathy.'

2. Participant Selection/Numbers Limitations

Selection of the participants for the ADC (thus, the study subjects) was made by the Office of Multicultural Programs in Purdue's College of Agriculture. Although the researcher assumed that these youth would be from lower socio-economic status (SES) areas, as it turned out, many were students in charter or private schools and whose parents were college educated. Therefore, those who participated likely cannot be generalized to the larger URM population. In addition, the rather small number of participants limited the statistical power of the study for quantitative analyses.

3. Follow-Up Phase Limitations

The researcher recognizes that, over the 12 months following their ADC experience, the study participants may have been exposed to other activities, influences, and/or interventions that would affect their attitudes about or interests in STEM (negatively or positively). Also, he was not able to complete the 12-month follow-up aspects of the study with some of the students because they had moved with no forwarding address available, had changed cell phone numbers and/or e-mail addresses, or chose not the respond to follow-up requests.

H. Definition of Terms

Ag Discovery Camp - a weeklong precollege summer enrichment program offered on the Purdue University campus, which exposes urban middle school youth to

various fields of agriculture while also introducing them to various topics in leadership development.

Agriculture – encompasses the production of agricultural commodities, including food, fiber, wood products, horticulture crops, and other plant and animal products. The terms also include the financing processing, marketing, and distribution of agricultural products, farm production supply and service industries; health, nutrition, and food consumption; the use and conservation of land and water resources; development and maintenance of recreational resources; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system (National Research Council, 1998).

Agricultural Education – agricultural education is the scientific study of the principles and methods of teaching and learning as they pertain to agriculture (Barrick, 1989).

Informal Science Education - informal science education complements, supplements, deepens, and enhances classroom science studies. It increases the amount of time participants can be engaged in a project or topic. It can be the proving ground for curriculum materials (National Science Teachers Association, 1999).

Inquiry-Based Learning – a student centered, active learning approach focusing on questioning, critical thinking, and problem solving. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science; it involves the thinking, reading, writing, or research that gives meaning to hands-on (Ricks, 2006).

Life Science – includes plants, animals, food, and natural resources within science, technology, engineering, agriculture, and math (STEAM) (LSESA, 2010).

Leadership – an influence relationship among leaders and followers who intend real changes that reflect their mutual purposes (Rost, 1991).

PASW – Predictive Analytics Software, formerly SPSS (Statistical Package for the Social Sciences).

Precollege Outreach Programs – a program designed for students in grades eight through twelve. Precollege interventions provide academic foundation skills, counseling,

self-concept building and career planning, which are needed to adequately plan for college. Interventions are offered after school and during the summer break on many college/university campuses (Adams, 1997).

Self-Efficacy – one's self-percept belief about his or her ability to perform a specific task in a specific context. "Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3).

SES – Socioeconomic Status, an individual's or group's position within a hierarchical social structure. Socioeconomic status depends on a combination of variables, including occupation, education, income, wealth, and place of residence (American Heritage Dictionary, 2009).

STEM – Science, Technology, Engineering, and Mathematics.

URM – Underrepresented Minorities currently includes African Americans, Mexican-Americans, Native Americans (American Indians, Alaska Natives, and Native Hawaiians), Pacific Islanders, and mainland Puerto Ricans (John Hopkins Medicine, 2010).

Youth – the period of life between childhood and maturity (Mish, 1997), typically considered as K-12 students.

II. STUDY FRAMEWORKS AND LITERATURE REVIEW

The intent of this chapter is to discuss research that has been previously conducted in the areas related to this study. The review of literature included professional journals and magazines, books, research articles and reports, and electronic media.

A. The Conceptual Framework

As stated previously this study focused on the premise that introducing URM youth to informal life sciences education through an integrated precollege experience in leadership development with university faculty, scientist and staff would increase the youths' interest in science, while also increasing their interest to pursue a STEM-related career. From this premise, a conceptual framework was developed for the study, based on Bandura's social cognitive and self-efficacy theories (1986; 1997).

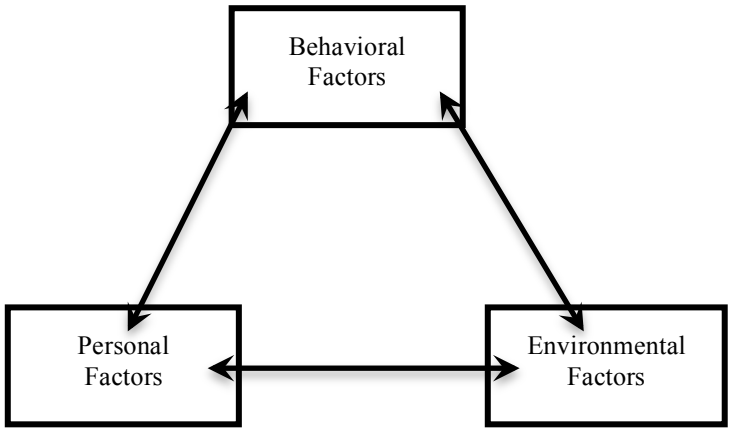

Figure 1. Bandura's social cognitive theory triadic reciprocality model.

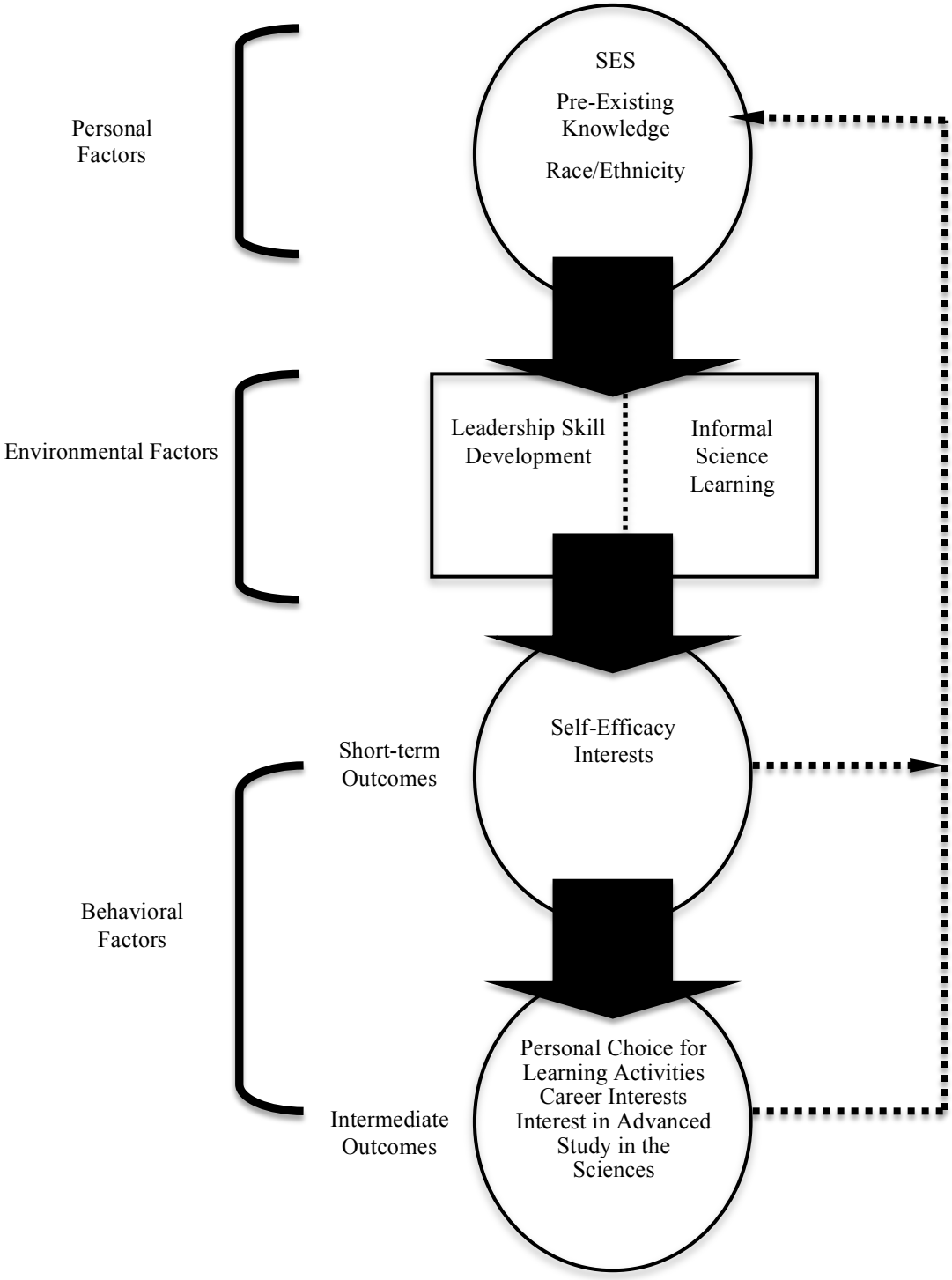

Figure 2. Researcher's conceptual framework for this study.

For this investigation, it was postulated that personal factors (i.e., socio-economic status, race, ethnicity, and previous knowledge) would influence the participants' reactions towards the informal learning environment (i.e., a leadership skills development workshop and an informal science experience), which would then influence the behavioral factors (i.e., immediate outcomes and longer-term outcomes, as measures of a participant's perceived self-efficacy, interests in agricultural science activities, and career interests/awareness).

Self-efficacy (i.e., one's perceived abilities for success in a given task) acts as a filter between the person's prior achievement or ability and his/her subsequent behavior (Bandura, 1986). Research supports the self-efficacy to academic motivation and achievement relationship, having an effect on anticipatory cognitive simulation, which is the scenario of a situation based on self-efficacy. Self-efficacy apparently serves as a 'mediator' between the students' abilities and the their subsequent academic performance, causing them to avoid those academic tasks in which they lack confidence and choose those in which they feel they will succeed (Knowles, Holton, & Swanson, 1998; Schunk, 1985).

1. Personal Factors

Personal factors in the conceptual framework as applied here include the following categories, each of which will be defined, discussed and the relevant literature- socio-economic status, race/ethnicity, and previous knowledge/experience.

a. Socio-Economic Status

The family characteristic most powerful in predicting school performance is socio-economic status (SES). The higher the SES of the student's family, the higher his/her academic achievement. SES 'predicts' grades, achievement, intelligence test scores, retention level, course failures, truancy, suspensions, and likely college attendance for high school students (Boocock, 1972; Charters, 1963; Rigsby & McDill, 1972).

The 1966 Coleman Report stated that family background accounted for most of the variation in student achievement (Coleman et al., 1966). In 2002, the United States Department of Education identified achievement gaps between students from low SES backgrounds versus those who are not academically disadvantaged (U.S. Department of Education, 2002b). Studies continue to confirm that students from the bottom SES quartile consistently perform below those from the top quartile (Lavin-Loucks, 2006; Currie & Thomas, 2001; Dills, 2006; Hoxby, 2001). Also, low SES students tend to be slower in language acquisition, literacy development, reading comprehension, and consequently, are less successful in academics (Barton, 2003).

In contrast, students from middle and upper SES families have an added advantage in that their parents can afford extracurricular activities and programs. These extracurricular activities, such as athletics, music, drama, dance, museum visits, recreational reading, etc., tend to bolster self-confidence, increase exposure to the 'outside world,' and instill/develop inquisitiveness, creativity, self-discipline, and organizational skills (Rothstein, 2004).

Minority students, primarily Hispanic and African American, comprise the majority of those youth in poverty. A discrepancy in performance between minority and white students correlated directly with low SES found in the nation's poorest urban schools (The Education Trust, 2005). In the core academic subjects, those achieving the highest scores on tests were white students who had no financial lunch assistance, while the lowest test-score group was African-American students who received free or reduced lunch (Thompson & O'Quinn, 2001).

b. Race and Ethnicity

According to the 2010 Census, African Americans constitute the largest racial minority group in the U.S., comprising 12.6% of the total population. Prior to 1970, they were largely invisible in the STEM community (Babco, 2003). Although progress has been made, the 'playing field' is still far from level in terms of the opportunities for high school preparation for STEM careers. African-American students do not enroll nearly as

often as do white and Asian students in advanced mathematics and science courses, which are seen as the entry point to careers in science and engineering (Babco, 2003).

URM students with high grade-point averages and SAT scores above 600 typically do not pursue STEM college majors. Among the reasons identified were: poor teaching in STEM courses, lack of encouragement from teachers or parents, and self-perception of their inability to be successful in those majors (George et al., 2001; Prabhu, 2010). Regardless of race and/or ethnicity, interest in science begins in early childhood; however, URMs are often not encouraged to study STEM fields in the early grades (Prabhu, 2010).

c. Previous Knowledge and Experience

Prior knowledge and/or experience can assist new learning. Those with greater pre-existing knowledge of a topic understand and remember more regarding that topic than do those with limited prior knowledge (National Research Council, 1999; W. Schneider & Pressley, 1997). Previous knowledge within specific domains benefits students' learning and achievement. However, in inaccurate, incomplete, or missing, it can hinder the understanding or learning of new information (Alexander & Judy, 1988; Dochy, Segers, & Buehl, 1999; National Research Council, 1999). Although prior knowledge/experience can facilitate students' comprehension of concepts, it can impair student understanding when misleading or incomplete (Thompson & Zamboanga, 2004).

Thompson and Zamboanga also found that prior content knowledge (measured by a pre-test) was a positive and significant predictor of subsequent exam performance, even with other influences on student achievement controlled. It was also an important predictor of academic success. This suggests that even modest prior understanding has a facilitating, rather than a hindering, effect on new learning, despite the diverse sources on which prior understanding may be based (Thompson & Zamboanga, 2003, 2004).

2. Environmental Factors

Environmental factors of the conceptual framework followed here include leadership skills development and informal science learning, both to be defined, discussed, and the relevant literature referenced.

a. Leadership Skills Development

Effective social interactions are necessary for a youth's emotional and behavioral adjustment and successful functioning at home school, work, and in social settings (Hansen, Giacoletti, & Nangle, 1995; Hansen, Nangle, & Meyer, 1998; Hartup, 1989; Kelly & Hansen, 1987; Peterson & Hamburg, 1986). These experiences during early adolescence provide the foundation on which young people form their personalities and life skills (Leffert, Saito, Blyth, & Kroenke, 1996). Youth organizations, such as 4-H, have proven effective in helping develop decision-making, interpersonal and social skills, as well as responsibility and a service ethic (Astroth, 1996).

In response to the changing world of work and industry, a report from the Labor Secretary's Commission on Achieving Necessary Skills (SCANS) stated that "a well-developed mind, a passion to learn, and the ability to put knowledge to work are the new keys to the future of our young people, the success of business, and the well-being of the nation" (Secretary's Commission on Achieving Necessary Skills, 1991, p. 2). SCANS then identified the following competencies that rest on a three-part foundation of basic skills, thinking skills, and personal qualities – the ability listen, the ability to speak, sociability, problem-solving, responsibility, self management, and integrity/honesty. These social skills have complementing competencies, namely, being a member of a team, exercising leadership negotiation, and working with diverse others. By integrating these competencies into current curriculum, students should be able to leave high school possessing the know-how needed to make their way in the world.

In addition to the SCANS report, Ferber, Pittman, and Marshall (2002) stated that youth need to grow within five developmental areas to become fully prepared and engaged adults – learning, thriving, connecting, working, and leading. Outcomes for the

area of connecting include developing quality relationships with adults and peers and developing the ability to empathize with others. Increased social skill calls for the ability to build trust, handle conflict, value differences, listen effectively, and communicate effectively. These skills in young people are enhanced through structured extracurricular activities (Edelman, Gill, Comerford, Larson, & Hare, 2004; Wehman, 1996).

By introducing students to leadership skills along with the traditional cognitive skills, they are able to think of more and better alternatives to problematic situations (Sarason & Sarason, 1981). Integration of leadership skills with science technical skills helps student to become more useful and well-rounded citizens, able to confront others with the required scientific knowledge plus understanding of the enterprise of science (Palincsar et al., 1993; Sleigh & Ritzer, 2004).

b. Informal Science Learning

Globally, science education is currently going through a process of change, due, in no small part, to the dissatisfaction with how science is traditionally taught. Although studies like "Trends in International Mathematics and Science" (TIMSS) reveal significant differences in science education across countries, in general, the emphasis still seems to be on lectures for conveying content and on technical training for acquiring practical skills (Driel et al., 2001; Stigler, Gallimore, & Hiebert, 2000).

In an attempt to address reform science education, the American Association for the Advancement of Science and the National Research Council, through a series of publications in the 1990s, urged less emphasis on memorization of scientific facts and more emphasis on understanding the nature of science and the process of science inquiry. Their thesis was that science education needed to focus on inquiry as a central element of the curriculum so that students would develop and understanding of scientific concepts, along with reasoning and thinking skills (American Association for the Advancement of Science, 1993; Driel et al., 2001; National Research Council, 1996). In response to this call for reform, a current trend in is to provide students the opportunities to 'do science' through either in-class science projects or extracurricular work with scientists.

After-school and community science programs have become recognized as important sanctuaries for science learning for low-income urban youth (Bell et al., 2003; National Research Council, 1996; Rahm et al., 2005; Rock & Lauten, 1996). Research on such outreach programs consistently demonstrates a positive impact in terms of students' understanding of the nature of science and scientific industry (Atwater, Colson, & Simpson, 1999; Bell et al., 2003; Bouillion & Gomez, 2001; Rahm et al., 2005).

According to some researchers, informal science learning differs from formal because of not only its physical location, but also its social context and "the underlying motivation of the learner" to seek out such educational context (Rahm et al., 2005, p. 284). Informal learning environments complement reform initiatives in the following ways – (a) offer many of the recommended resources aimed at achieving scientific literacy; (b) structure the curriculum so participants cognitively and socially engage in atypical instructional actions that represent accurate detail, thus allowing them to communicate and apply learned principles (Ricks, 2006); (c) allow ample time and opportunity for learners to make observations and predictions, to construct accurate representations of the concepts, and to apply those concepts to real-life issues; (d) endorse hands-on engagement in the instructional activities presented; (e) provide authentic locales and equipment for participants to process skill development (Ricks, 2006); and (f) place emphasis on learner-centered settings that allow participants to play a lead role in knowledge construction (National Research Council, 1999).

Students in informal settings are frequently involved in inquiry-based active learning situations that focus on critical thinking and problem solving tasks. Such settings pay attention to development of the knowledge, skills, attitudes, and beliefs that the learners bring to the environment (National Research Council, 1999; Voss & Ellis, 2002). Settings that concentrate on the students' academic and individual growth also promote establishment of learning communities that foster dialogue, cooperative learning skills, and cognitive development (Ricks, 2006).

In informal science learning, the students construct their knowledge by anchoring new information to pre-existing knowledge or building meaningful schemas in their minds (Strommen & Lincoln, 1992). Britner (2002) found that problem-solving and

hands-on inquiry-based science laboratory process skills and procedural demonstrations were effective in challenging participants' thinking, reflection, and application of concepts, and in restructuring cognitive schemas. This approach was used to enrich the participants' active involvement and construction of science knowledge (Britner, 2002).

c. Agriculture as a Context in Informal Science Learning

In 1988, the National Research Council (NRC) recommended that all students need an understanding of basic science concepts. This published recommendation led to development and implementation of 'agriscience,' which included curricula in plant and animal sciences, biotechnology, and engineering systems (National Research Council 1988). Agricultural educators and scientist, both natural and social, are wedded to the belief that the building blocks of knowledge in chemistry, physics, economics, and biology must be laid first before students can grasp the complexities of a science such as agriculture (Ison, 1990). Therefore, agriculture is an excellent context for teaching scientific knowledge, specifically within STEM careers.

In 2009, the NRC further recommended that colleges and universities expose elementary/secondary school students and teachers to agriculture and generate interest in agricultural careers. The NRC also suggested that formal partnerships be explored with youth-focused entities, such as 4-H, National FFA, and scouting (National Research Council, 2009).

Due to the already-existing infrastructure of youth organizations, agricultural education is capable of teaching science in informal learning venues whereby the participants improve their understanding of science while experiencing agriculture, food, fiber, and natural resource systems (Ramsey & Edwards, 2004). Agricultural education is also prepared to provide youth with the life skills needed to help them be successful in living productive, and satisfying lives. Such skills serve as the foundation of programs like 4-H (Boyd, Herring, & Briers, 1992).

Youth-focused programs, both formal and non-formal, are capable of preparing students for STEM careers. For example, 4-H, which has been in place for over 100 years, has a focus on agricultural science education, family and consumer sciences, food

sciences, and natural resources. Providing out-of-school opportunities in areas such as rocketry, robotics, bio-fuels, renewable energy, and computer science, 4-H's STEM programs currently reach more than 5 million youth nationwide, with hands-on learning experiences that encourages them to be leaders who are also proficient in science (4-H, 2009).

3. Behavioral Factors

Behavioral factors of the conceptual framework followed here include perceived self-efficacy, career interest, and interest in science. These factors will be defined and discussed, and the relevant literature referenced.

a. Impact of Self-Efficacy on Academic Performance

Self-efficacy beliefs are related to and predictive of academic performance, both in a global academic sense and in terms of specific subject areas. Among students of different ages, there is found significant and positive correlations between self-efficacy for learning and subsequent motivation during learning (Schunk, 1995; Schunk & Meece, 2006). Self-efficacy mediates cyclically between a student's ability and his/her academic performance (Schunk, 1985).

Self-efficacy has an effect on cognitive simulation, which is a student's anticipatory scenario of a situation. When encountering difficulty in performing a task, students with high self-efficacy will likely exert more effort, visualize success, and mentally rehearse their performance and positive solutions; whereas those with low self-efficacy will tend to project failure scenarios and the possible ways a situation could go wrong (Bouffard-Bouchard, Parent, & Larivee, 1991; Knowles et al., 1998; Schunk, 1985).

Most self-efficacy research in academic contexts has focused on mathematics. Findings consistently suggest that mathematics self-efficacy predicts math performance among middle school, high school, and college students (Parajes & Graham, 1999; Parajes & Miller, 1994). Mathematics grade self-efficacy reflects the students' belief that

their ability to achieve a certain grade in a math class. Because it is domain- and context-specific, the strength of self-efficacy as a predictive variable is linked to its use to forecast specific outcomes in specific settings. Thus, a measure of mathematics grade self-efficacy in a particular math course would have more predictive value than a general measure of self-efficacy (Zimmerman, 2000).

Few studies regarding confidence in science, as predictors of science achievement are available, and those that have been performed are conceptually or methodologically problematic (Britner, 2002). For example, some researchers have used self-reports by students of their previous science grades as achievement measures, which is less reliable than grades obtained from teachers or form school records (Cassady, 2001; Jinks & Morgan, 1996).

Kupermintz and Roeser (2001) found that, when students were shown multiple-choice and constructed response items from standardized tests and asked to rate their confidence, self-efficacy ratings correlated their responses to subsequent items. The researchers also found that the students' grades in science class correlated with their science self-efficacy. One flaw in Kupermintz and Roeser's study, however, was the time lag between the data collection for the two measures, which may not have met Bandura's criterion of close temporal proximity between self-efficacy and achievement measures (Bandura, 1997; Kupermintz & Roeser, 2002).

Pintrich, Marx, and Boyle (1993) suggested that science self-efficacy is related to the confidence of students who use research methods in a way that changes their own ideas and conceptions, thus acting as a mediator in the process of conceptual change. Science self-efficacy does appear to represent confidence that students can engage new ideas, evaluate them, and arrive at new conceptions (Britner 2002; Pintrich, Marx, & Boyle, 1993).

4. Summary of the Conceptual Framework

The three conceptual framework components applied to this study – personal factors, environmental factors, and behavioral factors – are based on Bandura's (1986) social cognitive theory. However, rather than each component influencing the other

through triadic reciprocality (*see Figure 1*), each affects the others in linear fashion (*see Figure 2*). For example, the environmental factors, which, in this case, included a leadership workshop and an informal science experience, influenced the behavioral factors of the students' interest and self-efficacy.

B. The Theoretical Framework

The Conceptual Framework for this study was under-pinned by a theoretical framework consisting of the social cognitive theory, the self-efficacy theory, and then the social cognitive career theory. Following is a review of literature regarding these three theories as they applied to the present research.

1. Social Cognitive Theory

In his book, "Social Foundations of Thought and Action," Albert Bandura (1986) explained human functioning in terms of a mode of triadic reciprocality in which behavior, cognitive, and other personal factors, and environmental events influence each other (*see Figure 1*). This allows individuals to have beliefs that enable them to exercise a measure of control over their thoughts, feelings, and actions so that, "What people think, believe, and feel affects how they behave" (p. 25).

Because of the bi-directionality of influence between behavior and environmental circumstances, people are both products and producers of their environment; thus, they affect the nature of their experienced environment through selection and creation situations, however the conceptual framework did not assume this. The three factors – personal, environmental, and behavioral – interact as determinants in a reciprocal nature of human functioning (Bandura, 1986, 1989). Reciprocity does not mean the three are of equal strength, for their relative influence will vary under varying circumstances (Bandura, 1997).

Personal/Behavioral Factors Reciprocality. The personal-behavioral reciprocal causation reflects the interaction between thought, affect, and action. Expectations,

beliefs, self-perceptions, goals, and intentions give shape and direction to behavior. What people think, believe, and feel affects how they behave (Bandura, 1986, 1989; Bower, 1975; Neisser, 1976). Physical structure and the sensory and neutral systems affect behavior and impose constraints and capabilities (Bandura, 1989; Greenough, Black, & Wallace, 1987).

Environmental/Personal Factors Reciprocality. The environmental-personal reciprocal causation is concerned with the interactive relationship between personal characteristics and environmental influences. People evoke different reactions from social environments by their physical characteristics, quite apart from what they say and do (Bandura, 1989; Lerner, 1982). People similarly activate different social interactions depending on their socially conferred roles and status (Bandura, 1989).

Behavioral/Environmental Factors Reciprocality. The behavioral-environmental causation represents the two-way influence between behavior and the environment. Behavior alters the environmental conditions and is, in turn, altered by the very conditions it creates. The environment is not a fixed entity that inevitably impinges on individuals; rather most aspects of the environment operate as influences only when activated by behavior (Bandura, 1989).

a. Personal Agency

'Agency' refers to acts done intentionally. People can exercise influence over what they do. Based upon their understanding of their power as humans plus their beliefs about their own capabilities, people try to generate a course of action to suit given purposes without knowing how their choices orchestrate the neurophysiological events sub-serving the endeavor. In evaluating the role of intentionality in human agency, one must distinguish between the personal production of action for an intended outcome and the effect that carrying out such action actually produced (Bandura, 1997).

'Agency' embodies the endowments, belief systems, self-regulatory capabilities, and distributed structures and functions through which personal influence is exercised. Personal agency enables people to play a part in their self-development, adaptation, and self-renewal in response to changing times (Bandura, 1986, 2001). To be an 'agent' is to

influence intentionally one's functioning and the course of environmental events. People are contributors to their life circumstances, not just products of them. Thus, personal influence is part of the determining conditions governing self-development, adaptation, and change (Bandura, 2008).

There are four core properties of personal agency – intentionality, forethought, self-reactiveness, and self-reflectiveness. Regarding the first property (intentionality), people form intentions that include action plans and the strategies for realizing them. Most human pursuits involve other participating agents, so there is no absolute agency. They have to negotiate and accommodate their self-interests to achieve unity of effort within diversity. This requires committing to shared intentions and coordination of interdependent plans of action. Effective group performance is guided by collective intentionality (Bandura, 1986, 2001, 2008).

Regarding the second and third properties (forethought and self-reactiveness), an agent has to be not only a planner and fore-thinker, but also a motivator and self-regulator. One cannot sit back and wait for the appropriate performances to appear. Thus, 'agency' involves the deliberate ability to make choices and action plans, to give shape to appropriate courses of action, and to motivate and regulate their execution. This multifaceted self-directedness operates through self-regulatory processes in the explanatory gap to link thought to action (Bandura, 2001, 2008).

Regarding the fourth agentic property (self-reflectiveness), people are not only agents of action, but also self-examiners of their own functioning. Through functional self-awareness, they reflect on their personal efficacy, the soundness of their thoughts and actions, and the meaning of their pursuits; and they make corrective adjustments if necessary. Through reflective self-consciousness, people evaluate their motivation, their values, and the meaning of their life pursuits. In this meta-cognitive activity, they judge the correctness of the predictive and operative thinking against the outcomes of their actions, the effects that other people's actions produce, what others believe, deductions from established knowledge, and what necessarily follows from it (Bandura, 2001, 2008). Bandura believed that a strong sense of personal agency requires development of

competencies, self-perceptions of efficacy, and self-regulatory capabilities for exercising self-directedness (Bandura, 1986).

b. Fundamental Human Capabilities

Bandura (1986) also described human functioning as being characterized by five capabilities – symbolizing, forethought, vicarious learning, self-regulation, and self-reflection – and identified the role of each as follows.

The ability to *symbolize* allows people to create meaning from the events they experience and transform what was experienced into behavioral models from which they generate multiple courses of action. From these courses of action, after consideration of possible consequences, comes *forethought*, which allows them to adapt their behavior to accommodate event they anticipate in the future (Bandura, 1986).

With an ability to *learn vicariously*, in observing the actions of others, people learn behaviors without experiencing them first hand and learn how to perform tasks without direct participation. Also, people regulate their behavior by developing standards by which they evaluate their own actions and carry out the plan of action they have chosen through *self-regulation*, continuously determining their own courses of behavior.

Not only do they regulate themselves and their actions, they also *reflect* upon their experiences and thought process. By doing so, individuals' gain an understanding of their environment and develop a set of beliefs about themselves. These beliefs guide subsequent actions then foster the monitoring and regulation of future behavior. Bandura believed that one's perception of efficacy derived from self-reflection is the most powerful of the five fundamental human capabilities.

2. Self-Efficacy Theory

Self-efficacy, also called perceived ability, refers to the level of confidence people have in their own abilities to succeed at a given task. It is defined as, "The beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). These beliefs act as filters between one's prior

achievement or ability and his/her subsequent behavior, thus strongly influence choices made, efforts expended, perseverance in the face of challenge, and degree of confidence in addressing the task at hand (Bandura, 1986, 1997). Bandura argued that self-referent thought mediates between knowledge and action and that the capability to self-reflect is the most distinctively human characteristic because it permits evaluation of one's own experience and though process. A result of self-reflection and a source of self-regulation is the individual's self-efficacy.

According to Bandura (1997), four major sources contribute to the development of an individual's self-efficacy: authentic mastery experiences, vicarious experiences, verbal persuasions, and physiological indexes. Of these four, the first, *authentic mastery experiences*, exerts the strongest influence on self-efficacy beliefs. Past accomplishments can foster a strong sense of efficacy to succeed at similar tasks in the future, whereas failure can lower self-efficacy beliefs. When information gathered from these experiences is internalized, past successes raise self-efficacy while repeated failures lower it, indicating to individuals their levels of capability (Bandura, 1986, 1997).

The second source of self-efficacy beliefs, *vicarious experiences*, is when one person observes another person engaged in a task. Individuals compare themselves to peers whom they perceive are similar in ability and intelligence to themselves. Through observing another's success or failure, one may process this information to make judgments in their own abilities (Bandura, 1986, 1997).

In the case of the third sources of experiences, *verbal persuasions*, individuals who are verbally encouraged or told they have the ability to accomplish a task will likely have a greater sense of self-efficacy; likewise, if verbally discouraged or told of their shortcomings, one's self-efficacy is apt to be lowered. To be meaningful, positive verbal persuasion must be realistic, sincere, and from a credible source (Bandura, 1986, 1997; Spence, 2004).

Finally, physical and emotional states, or *physiological indexes*, also affect an individual's self-efficacy. Although two states, anxiety and tension, may indicate that one is vulnerable to failure; the individual's interpretation of the physiological indexes is key to the effects on their self-efficacy (Bandura, 1997).

A strong sense of self-efficacy enhances human accomplishment and the personal well being in many ways. People with high assurance of their capabilities tend to see difficult tasks as a challenge to be mastered rather than threats to be avoided. They approach threatening situations with the assurance they can exercise control over them. Efficacious outlooks such as these produce personal accomplishments reduce stress, and lower vulnerability to depression. In contrast, people who doubt their capabilities shy away from difficult tasks, which they view as personal threats. They have low aspirations and weak commitments to the goals they choose to pursue (Bandura, 1994).

A meta-analytic review of self-efficacy literature found that self-efficacy beliefs were positively related to student persistence and academic performance (Multon, Brown & Lent, 1991). Researchers have shown associations between students' self-efficacy and motivation, goal setting, problem solving, and academic achievement (Parajes, 1997, 2001; Parajes & Graham, 1999).

3. Social Cognitive Career Theory

The social cognitive career theory (SCCT) is anchored within the social cognitive theory, which emphasizes the role of the self-referent thinking in guiding human motivation and behavior. It focuses on several cognitive-person variables (e.g., self-efficacy, outcome expectations, goals) and on how these variables interact with other aspects of the person and his/her environment. SCCT seeks to understand the processes through which people form interests, make choices, and varying levels of success in the arena of educational and occupational pursuits (Lent, Brown, & Hackett, 1994, 2000).

As stated previously, self-efficacy refers to people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances (Bandura, 1986). Introduced into the career literature by Hackett and Betz (1981), self-efficacy has been found to be predictive of academic- and career-related choice and performance indices (Hackett & Betz, 1981; Hackett & Lent, 1992; Lent et al., 1994; Multon et al., 1991).

Personal beliefs about probable response outcomes (termed 'outcome expectations') constitute another important component in social cognitive career theory.

Outcome expectations involve the imagined consequences of performing behaviors (Lent et al., 1994). Bandura (1986) distinguishes between several classes of expectations, such as the anticipation of physical, social, and self-evaluative outcomes, which may, importantly, affect career behavior. Whether self-efficacy and outcome expectations uniquely affect behavior likely depends on the nature of a particular activity. Where outcomes are only loosely tied to quality of performance, outcome expectations may make an independent contribution to motivation and behavior (Bandura, 1989). This would be particularly relevant to career development, in that the vagaries of academic and career environments often produce only imperfect linkages between quality of performance and outcomes (Lent et al., 1994).

Social cognitive theory presumes that goals play an important role in the self-regulation of behavior. A goal may be defined as the determination to engage a particular activity (Bandura, 1986). Goals operate principally through people's capacity to symbolically represent desired future outcomes and to react self-evaluative to their own behavior based on internal standards for performance. Social cognitive theory posits important reciprocal relationships among self-efficacy, outcome expectations, and goal systems (Bandura, 1986). Goals are a ubiquitous, if generally implicit, element of career choice and decision making theories. Such concepts as career plans, decisions, aspirations, and expressed choices are all essentially goal mechanisms (Lent et al., 1994).

SCCT is concerned with two primary aspects of academic performance – the level of achieved success or proficiency and the degree of persistence despite encountering obstacles. SCCT proposes that the self-efficacy belief system is impacted by past performances, therefore directly or indirectly affecting performance. Past performance, self-efficacy, outcome expectations, and goals combine to influence performance (Lent et al., 1994; Lent, Brown, & Hackett, 1996; Smith, 2002).

4. Summary of the Theoretical Framework

Social cognitive theory is based on the premise that human functioning is explained by an individual's behavior, cognitive and other personal factors, and environmental events – all influencing each other interdependently. Embedded in

Bandura's social cognitive view is the assumption that human functioning is characterized by capabilities to symbolize, to plan future and alternative strategies, to learn vicariously through others, to self-regulate, and to self-reflect. These five capabilities provide the means by which people influence their own destiny. This influence assists in establishing their personal agency (i.e., that individuals are proactively engaged in their own development and can make things happen by their own actions). At the core of social cognitive theory are self-efficacy beliefs, which define one's level of confidence in his/her abilities to succeed at a given task. These beliefs are filters between prior achievement and future behaviors, and they strongly influence the choices that the person will make (Pajares, 2002).

C. The Precollege Experiences Framework

Opportunities for students to participate in university life, programs, and resources are very important to college preparation. Youth-serving entities partnering with universities or colleges can offer summer enrichment experiences that let students live and study on campus. The college classrooms can also be the site of an after-school program or enrichment course (Fenske, Geranios, Keller & Moore, 1997). On-campus experiences provide youth a first-hand 'taste' of higher education, can help them plan future coursework and careers, and instruct them on how to use basic study skills to increase academic performance – a all of which increase their chances for success and positive self-esteem (Adams, 1997).

Precollege preparation programs for low SES minority youth encourages development of the skills, knowledge, confidence, and aspirations they need to participate in higher education (Oesterreich, 2000). The most effective such programs focus on 'readiness' (Fenske et al. 1997), and provide services and information about college early enough to influence educational outcomes for students (Oesterreich, 2000).

Although precollege intervention can do little to change environmental and economic conditions, many of the negatives URM youth would face in planning can be countered by precollege counseling programs that develop aspiration, sustain motivation,

promote effective study skills, differentiate between programs and courses, and utilize guidance resources (Adams, 1997; Oesterreich, 2000).

1. Precollege Experiences and Career Development

Raynor (1978) stated that pursuing a career requires what is known as 'career striving.' One must learn the 'rules of the game' (i.e., acquisition of general step-path schema), which will relate to achieving large rewards and skills through a sequence of interrelated activities over time. One must develop a plan that uses activity-outcome structures and successful experiences to build self-confidence and to continue achievement toward long-term career goals as a means of obtaining self-esteem (Raynor, 1978; Raynor & Entin, 1982).

Precollege experiences have a strong influence on students' continued interest in science and can be a key motivating factor regarding both their attitudes towards science and their perceived ability to succeed in advanced science course, as well as increasing their enthusiasm toward pursing careers in science (Gibson & Chase, 2002; Knox, Moynihan, & Markowitz, 2003; Markowitz, 2004). Markowitz (2004) found that those who participated in a Summer Science Academy indicated that it contributed significantly to their interest in pursing a career in science and were more likely to major in college science.

It is the intention of precollege programs to improve the learning opportunities for high school students, interest them in STEM careers and majors, and inspire them to explore job opportunities in STEM fields. Successful programs have proven to be a pipeline for studies in more advanced science programs (Horan, 2001; Knox et al., 2003; Lam, Srivatsan, Doverspike, Vesalo, & Mawasha, 2005).

Career readiness and awareness are critical to college planning. Adams (1997) stated that, to develop aspiration for a career, one needs to have some understanding of occupational information, because it fosters broad career possibilities and opportunities, the purpose of school, and the development of a career plan. Precollege experiences aid in providing such understating and in the maturation process towards college and career aspiration (Adams, 1997).

2. Precollege Experiences and College Preparation

Nora and Cabrera (1993) stated that precollege interventions are worth the expense and time. If they have no interaction with institutions of higher learning, middle-school students will likely not take college-preparatory courses, which are so critical to aspiration for college (Hossler, 1985; Nora & Cabrera, 1993). Precollege outreach programs help to develop that aspiration by providing information on educational and career planning (Mau, 1995) and by countering negative school or community influences – e.g., lack of rigorous curriculum, poorly trained teachers, lack of inspiring role models (Gullatt & Jan, 2003). Also, these programs create partnerships with local school districts to help meet the challenges of science education reform. However, the overall intent of such efforts is to increase the number of students entering into STEM degree programs by encouraging their interest in science (Gibson & Chase, 2002; Knox et al., 2003; Markowitz, 2004; Nichandowicz, 2004; Wallace & Pendersen, 2005).

Effective precollege experiences provide role models for the students, many of whom lack academic motivation and confidence, due to inadequate social support. These role models are the scientists, university faculty and staff, and individuals from local industry who serve as mentors, counselors, and academic coaches. Through their knowledge, actions, and caring, they lay the groundwork for increasing the students' self efficacy (Freedman, 1993; Gullatt & Jan, 2003; Yelamarthi & Mawasha, 2008).

Precollege outreach programs have been proven valuable in the retention of students in the sciences. One key way is by facilitating peer support. Numerous programs believe that supportive peer groups contribute to the effectiveness of the program on student achievement. A major factor in retention among URM students is interaction with like-minded peers in science who often face isolation because of race or socio-economic status and the sometimes open aversion of fellow students to science (Gandara, Larson, Mehan, & Rumberger, 1998; Gullatt & Jan, 2003; Treisman, 1992; Knox et al., 2003).

3. Impact of Precollege Experiences and Teaching Science

Knox, Moynihan, and Markowitz (2003) looked at the *short-term* impact of a high school summer science academy on students' knowledge or laboratory skills and interest in pursing science careers. Conducted over a four-year period with a cumulative sample of 112 participants, the study's key findings are as follows: (1) there were significant differences on six of the ten statements from the pre- to the post survey, which measured laboratory knowledge and skills; (2) 75% of participants indicated the academy heightened their interest in pursing a career in science; (3) the participants felt confident in their ability to apply laboratory skills; and (4) exposure to sophisticated equipment and a professional scientist increased the participants' enthusiasm towards a career in science (Knox et al., 2003).

A follow up study evaluated the *long-term* impact of the summer science academy on students' perceived abilities in higher-level science courses, on their involvement in extracurricular science programs, and on their interest in pursuing a science-related career. A total 216 former academy participants were surveyed over a 7-year span, utilizing a Likert-type instrument. The findings were as follows: (1) 90% of participants said the program improved performance in their AP Biology courses, (2) 82% said it improved their performance in science, (3) 67% said it influenced their decision to enroll in more advanced science courses, (4) 49% said it led them to take advantage of additional science programs outside the school, and (5) 80% said it contributed to their interests in a career in science (Markowitz, 2004).

Gibson and Chase (2002) examined the *long-term* impact of a two-week inquiry-based science camp designed to stimulate interest in science and scientific careers among middle-school students. Longitudinal results showed that the control group lost more interest in science than did the experimental group, 77% of that reporting the camp experience increased their interest in science. Qualitative findings indicated that the participants most enjoyed the hands-on laboratory activities, but also found the content covered during the camp was interesting to them. The researchers concluded that the camp's inquiry-based approach likely affected the middle-school students continued interest in science during their years in high school (Gibson & Chase, 2002).

McKendall et al. (2000) evaluated the impact of a health and science technology academy on the progress of URM youth through high school, college, and professional school. This academy utilized inquiry-based theory that encompassed problem solving and persuasion, both considered important to student understanding of science concepts and processes. The effect of the program on academic success was measured using both quantitative and qualitative methods. Participants reported that the academy exposed them to health-field occupations of which they would otherwise have had no knowledge. The study also found that the program's graduates had significantly high GPAs than those that did not participate (McKendall, Simoyi, Chester, & Rye, 2000).

In summary, precollege experiences play a significant role in shaping youth interests and career intentions (Markowitz, 2004). Although the above sampling of studies varied in contexts, each was successful in influencing students' on-going interest – and even retention – in science. Precollege experiences likely will continue to serve as a pipeline supplying the next generation of workers, both traditional and URMs (L.S. Jones, 1997).

4. Precollege Experience and Minority Youth

a. Purpose for the African-American Audience

African Americans have been and continue to be under-represented in most areas of the agricultural sciences. Many link this situation to perceptions of the low salaries and unpleasant working conditions that most African Americans faced in the past (Foster & Henson, 1992; Jones & Bowen, 1998). Consequently, African Americans have, by and large, turned away from farming as an occupation, as well as many other agriculture-related career options now (Moon, 2007).

Perceptual concerns regarding the agricultural industry keep many African-American youth from participating in agricultural programs. Their academic interests and idea of a desirable lifestyle, in terms of location and social activity, are likely to be very different than anything they associate with agriculture (Alston & Crutchfield, 2009; Jones, 1997). Thus, in order to achieve and maintain the critical mass of minorities in

agriculture, introduction to agricultural-related career options must be made at an early age – in fact, as early as middle school (Foster & Henson, 1992; Gottfredson, 1996). Educational interventions are needed to instill an understanding of agriculture and a positive view of educational and career opportunities in this area (Steward & Sutphin, 1994).

b. Purpose for Middle-School Audience

A college education is generally accepted as both a goal and a value among many youth today. Most educational organizations and the U.S. Department of Education recommend that students planning for college begin as early as the sixth grade. The middle-school years are often viewed as a period of disclosure in human development; this is commonly when youth are seeking to identify their own interests an abilities (Reynolds, 1991). By the eighth grade, over 80% of students said they wanted to earn a college degree, with nearly half of them also interested in earning a graduate or professional degree (Csikszentmihalyi & Schneider, 2000; Neith & Wimberly, 2002; Schneider & Stevenson, 1999; U.S. Department of Education, 2002a; Wimberly & Noeth, 2005).

Introducing middle-school student students to the college planning process through after-school and precollege programs has unique benefits. The more informal, interactive activities these programs offer can get youth more engaged and motivated, including those who already have a high interest in science (Friedman, 2006). Attitudes toward science are developed early in a child's education and are difficult to change once they reach middle school. Thus, precollege programming for middle school students are best suited to help support and sustain that interest (Gibson & Chase, 2002). Singh, Granville, and Ditka (2002) suggested that critical examination of the factors that affect mathematics and science achievement in the middle school grades are needed because those years, when students begin considering future and academic pathways, have been identified as experiencing the highest drop in STEM interests (Singh, Granville, & Ditka 2002).

c. Importance of Interpersonal/Leadership Skills Development

Research shows that youths' learning-related interpersonal and work-related social skills contribute to school performance (McClelland, Morrison, & Holmes, 2000). Interpersonal skills include behaviors, such as interacting positively with peers, playing cooperatively, sharing and respecting others; whereas work-related social skills encompass behaviors like listening and following directions, participating appropriately in groups, staying on tasks, and organizing work materials (Cooper & Farran, 1988; McClelland et al. 2000).

Interpersonal experiences with peers are not a luxury to be enjoyed during lunch and after school; peers have a great deal of influence on students' educational aspirations and actual achievement. Thus, interaction with academically motivated peers can significantly increase achievement (Johnson, 1981). Students learn more when they work together cooperatively, talking through the material with one another and making sure that they all understand (Johnson & Johnson, 2010). Interpersonal skills are important for developing relationships with and better understanding peers from diverse ethnic and social class groups (Holland & Andre, 1987; National Research Council, 2000; Patrick et al., 1999).

Youth at the secondary level are apt to increase their interpersonal and leadership skills in communicating, making decisions, getting along with others, learning management of self, understanding self, and working with groups when they participate in leadership organizations and/or community activities (Wingenbach & Kahler, 1997). In fact, these organization/activities are often promoted as providing youth with opportunities to develop interpersonal skills (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 1999; Dubias & Snider, 1993).

d. Programs that Teach Interpersonal/Leadership Skills

Considerable youth learning occurs through collaborative participation in activities of shared interest; thus, learning cooperation and teamwork has been described as part of the 'hidden curriculum' in youth activities (Dworking, Larson, & Hansen,

2003; Jarrett, 1998; Rogoff, Turkanis, & Bartlett, 2001). Much of leadership development is a result of participation in youth organizations. Through coming together in these organizations, youth learn to work with one another, handle each other's emotions, divide responsibilities, and give and take feedback, thus gaining social skills and confidence in relating to peers (Dworkin et al., 2003; Patrick et al., 1999; Ricketts & Rudd, 2002).

Youth programs, such as 4-H, focus on development of leadership skills and life skills. Boyd (1992) found that 4-H Club participants' perceptions of their life skills development were significantly higher than the perceptions of non-4-H youth. These 4-H members rated their skill development high in the areas of working with groups, understanding self, communication, and making decisions. Boyd's (1992) research indicated that participating in the 4-H program is positively related to perceived leadership development.

National FFA Organization also teaches interpersonal skills and leadership to youth. Wingenbach and Kahler (1997) found a positive relationship between interpersonal and leadership skills and FFA membership and involvement. High school students increased their leadership skills in communications, decision-making, getting along with others, learning management of self, understanding of self, and working with groups by participating (Wingenbach & Kahler, 1997). A youth's leadership ability is positively correlated with their involvement within their FFA chapters (Ricketts & Newcomb, 1984; Rutherford, Townsend, Briers, Cummins, & Conrad, 2002).

5. Summary of the Precollege Experiences Framework

Precollege programs play a significant role in shaping youths' interests in the sciences, while also exposing them to the career options and pathways that can be obtained through higher education. Introducing URM youth to precollege science experiences, specifically in agriculture, contributes significantly to changing their perspective of job opportunities in the agricultural and life sciences. In addition to broadening their career interests, it is also important to develop youths' interpersonal and

leadership skills so that they can effectively work with others once they reach the professional workforce.

While a number of youth organizations already focus on interpersonal and leadership skills, there are few that seek to develop youths' leadership skills while developing their interest in science. The basic premise of the study conducted and reported here is that exposing youth to a precollege agricultural science experience integrated with a leadership development program would increase their interest in science while also increasing their interest in pursing a STEM-related career.

III. STUDY METHODOLOGY

As previously stated at the outset, the study sought to answers to nine questions related to the ability of informal science education – in this case, a two-week agricultural and life sciences educational experience known as the Ag Discovery Camp – to create greater interest in agricultural science, improve science self-efficacy, and generate STEM and agricultural career interests, and develop leadership skills among URM youth (*Those questions are seen on page 5*). The immediate outcomes of the camp were measured by the participants' responses to a questionnaire administered at the conclusion of the camp. The longer-term outcomes were measured in the study's 12-month follow-up phase through questionnaire responses and interview data. This follow-up phase provided valuable qualitative information as to the programs influences, STEM course selection and/or intentions, and career intentions.

In June 2009, Purdue University's Institutional Review Board (IRB) gave approval for the use of the Ag Discovery Camp Questionnaire Parts and II and the Ag Discovery Experience Questionnaire – Protocol #05202000935A002 (*Appendix A*). In March 2010, IRB approved use of the 12-month follow-up questionnaire and interview procedure/questions – Protocol #1002008985 (*Appendix B*).

A. Design of the Study

The researcher utilized a mixed-methods approach of collecting data to identify and describe those factors that improve students' interests in science, science self-efficacy, and STEM career interests. Mixed-methods research is defined as the class of research where the investigator mixes or combines quantitative and qualitative research

techniques, methods, approaches, concepts, or languages into a single study. It yields richer, more valid and reliable findings and a more comprehensive understanding about the study that would data from either quantitative or qualitative studies alone (Berkowitz, 1996; Johnson & Onwuegbuzie, 2004). Mixed-methods research is an expansive and creative, not a limiting, form of research. It is inclusive, pluralistic, and complementary, and suggests that researchers take an eclectic approach to method selection and thinking about its conduct (Johnson & Onwuegbuzie, 2004).

As such, a mixed-methods approach was chosen for this study in order to gain a greater understanding of the experience of the participants that the questionnaire data could describe on its own. This researcher felt it necessary to collect qualitative data to provide a more thorough understanding of the questionnaire responses and statistical analyses. Both quantitative and qualitative data were collected and triangulated in an attempt to describe the participants' experiences with more meaning from their individual perspectives.

The study's mixed-method design was quantitatively driven. The qualitative data collected were used to inform the quantitative phase, with data collected sequentially. *Sequential mixed designs* are those in which there are at least two strands that occur chronologically (QUAN → QUAL or QUAL → QUAN; Teddlie & Tashakkori, 2006). The final inferences of this design are based upon the results of both the quantitative and qualitative components of the study. The second component is conducted either to confirm or disconfirm the inferences of the first component to provide further explanation for findings from the first strand (Teddlie & Tashakkori, 2003). *Sequential explanatory designs* do not use an explicit advocacy lens. In these designs, qualitative data were used primarily to augment quantitative data. As the name suggests, these designs are particularly useful for explaining relationship and/or study findings, especially when they are unexpected (Hanson, Creswell, Plano Clark, Petska, & Creswell, 2005). Figure 3 depicts the design of the study and the priority levels of the quantitative and qualitative components.

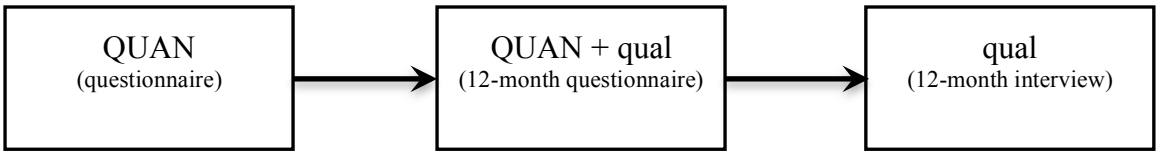

Figure 3. Graphic Presentation of Mixed-Methods Design

1. Epistemological Stance

The researcher took a pragmatic epistemological stance. "This is a deconstructive paradigm that debunks concepts such as 'truth' and 'reality' and focuses instead on 'what works," (Tashakkori & Teddlie, 2003, p. 713) using diverse approaches and valuing both objective and subjective knowledge (Cherryholmes, 1992). Pragmatism supports the use of both qualitative and quantitative research methods in the same study and within multi-stage research programs, and acknowledges that the researcher's values play a larger role in interpreting the results (Tashakkori & Teddlie, 2003).

Pragmatism rejects both the forced choice between post-positivism and constructivism. It also rejects the either/or of the 'incompatibility thesis,' which states that compatibility between quantitative and qualitative methods is impossible due to the incompatibility of the paradigms that underlie the methods, and embraces both points of view. Pragmatism suggests studying what interests, is of value to, and in the ways the researcher deems appropriate, utilizing the results such that can bring about positive consequences within his/her value system (Tashakkori & Teddlie, 2003).

2. Quantitative Perspective

The purpose of the quantitative component of this study was to assess the participants' science interests, science self-efficacy, and STEM career intentions. Two quantitative data collection instruments were utilized. The first included a pre-questionnaire/post-questionnaire design (*see Appendix C*) to determine the immediate

outcomes of the Ag Discovery Camp experience regarding the participants' perceptions of self-efficacy, interests, and intentions

The second instrument was a questionnaire (*see Appendix F*), administered via the Internet 12 months later, to asses the strength of the same three perceptions by asking the participants to reflect upon their experiences at the camp. At that time, they were also asked to think back and answer the retrospective pre-questionnaire accordingly. Although the retrospective pre-/post-questionnaire design controls for response shift bias effects, it is susceptible to validity threats, such as social desirability responding and effort justification (Sprangers, 1987). A basic assumption for the validity of self-reporting in pre-/post-questionnaires is that the underlying metric a respondent employs when completing both the pre-questionnaire and post-questionnaire remains the same for both points in time (Cronbach, 1970; Sprangers, 1987).

3. Qualitative Perspective

The study's qualitative component sought to gain greater understanding of the participants' experiences approximately one year after the camp. Descriptive data were gathered from the 12-month follow-up questionnaire (*see Appendix F*), which provided a longitudinal perspective of information. An analysis of the returned questionnaires' open-ended questions allowed the researcher to determine which participants to choose for interviewing. Those selected were the ones who had provided the most thorough responses, which the researcher felt they could expand upon, thus providing greater understanding amd explanations of their precollege experiences.

Triangulation of both the qualitative and quantitative components of the study increased authenticity and validity of the data. The questionnaires and personal interviews were used to ascertain data that addressed research question 1, 2, 3, 4, 6, 7, and 9 stated previously (*see page 5*). Appendix G is the protocol for the 12-month follow-up personal interviews.

B. Selection of the Participants

The study's 33 participants had been recruited for the Ag Discovery Camp through the Office of Multicultural Programs in Purdue's College of Agriculture and selected by the Program's staff, based on their submitted applications. Although urban African-American youth were the camp's (and study's) target audience, other minorities and non-minorities were not discouraged from applying to the program.

The participants were middle school-aged students from varied socio-economic backgrounds in Indianapolis, a majority of who were already enrolled in school enrichment programs and were scheduled to enroll in a college preparatory high school with an emphasis on STEM.

C. Background of the Participants

The following characteristics described the 33 study participants, as reported by the students themselves.

Gender (*Table 1*). Twenty-five were female and 8 were male.

Table 1.

Gender of Participating Students

Gender	Frequency (*N* = 33)
Male	8 (24.2%)
Female	25 (75.8%)

Race (*Table 2*). Thirty were African-American, one was White or Caucasian, and two were Multiracial.

Table 2

Race of Participating Students

Race	Frequency (*N* = 33)
Black or African American	30 (90.9%)
White or Caucasian	1 (3.0%)
Multiracial	2 (6.1%)

Age (*Table 3*). Two were 12 years old, 11 were 13 years old, 11 were 14 years old, and 9 were 15 years old.

Table 3

Age of the Participating Students

Age	Frequency (*N* = 33)
12 years old	2 (6.1%)
13 years old	11 (33.3%)
14 years old	11 (33.3%)
15 years old	9 (27.3%)

Grade in school entering 2009-2010 school year (*Table 4*). One entering the 7th grade, 14 entering the 8th grade, and 16 entering 9th grade, with two did not report their entering grade.

Table 4

Grade Classification of the 2009-2010 School Year of the Participants

2009-2010 Grade Classification	Frequency (*N* = 33)
7th Grade	1 (3.0%)
8th Grade	14 (42.4%)
9th Grade	16 (48.5%)
Did Not Report	2 (6.1%)

Previous year's performance in science, mathematics, language arts/reading, and social studies (*Table 5*). Eighty-eight percent of the students self-reported they earned A's or B's in these courses, 86% self-reported earning those grades in science and mathematics.

Table 5

Self-Reported School Performance of the Participants

Reported Grade	Science (*N* = 33)	Mathematics (*N* = 33)	L.A./Reading (*N* = 33)	Social Studies (*N* = 31)
A	16 (48.5%)	15 (45.5%)	21 (63.6%)	18 (58.1%)
B	13 (3.4%)	13 (39.4%)	8 (24.2%)	10 (32.3%)
C	4 (25.2%)	5 (15.2%)	3 (9.1%)	3 (9.7%)
D	0 (0.0%)	0 (0.0%)	1 (3.0%)	0 (0.0%)

Parents'/guardians' education level (*Table 6*). Where educational level was known, 81% of the female parents/guardians and 69% of the male parents/guardians had earned two-year, four-year, post-graduate, or professional degrees. Only one female and one male guardian had not graduate from high school.

Table 6

Self-Reported Data on Participant Parents' Education

Level of Education	Mother/Female Guardian (*N* = 33)	Father/Male Guardian (*N* = 33)
Don't Know	2 (6.1%)	3 (9.1%)
8th Grade or Less	1 (3.0%)	1 (3.0%)
Completed High School	3 (9.1%)	4 (12.1%)
Some College, No Degree	2 (6.1%)	4 (12.1%)
Complete 2-year Degree	3 (9.1%)	1 (3.0%)
Complete 4-year Degree	13 (39.4%)	10 (30.3%)
Graduate or Professional School	9 (27.3%)	9 (27.3%)
Did Not Report	0 (0.0%)	1 (3.0%)

D. Researcher Roles and Potential for Bias

Through the duration of the Ag Discovery Camp, the researcher served as both coordinator and instructor. As coordinator, he was responsible for design and development of the camp's Engineering Science Workshop portion. As instructor, he was responsible for all of the camp's leadership skill development sessions.

Admittedly, the potential for bias existed due to the researcher's camp coordinator/instructor roles and his relationship with the participants. However, rather than being viewed as a bias, this relationship could actually have had the following benefits: (a) securing a level of comfort and trust that increased the amount and accuracy of information shared; (b) enhancing the researcher's ability to gather information from family members; and (c) allowing for more sensitivity and adaptability in conducting the personal interviews (Maynard, 1994; Ricks, 2006). In an attempt to minimize the chances of bias, the researcher used direct quotes given by the participants and conducted

peer debriefing sessions with research experts not directly involved in collecting and analyzing the data.

E. Data Collection Instruments

The study's data collection strategies included use of three student questionnaire questionnaires, a semi-structured student interview instrument, and a parent questionnaire.

1. Ag Discovery Camp, Part I and Part II

The Ag Discovery Camp Questionnaire, Parts I and II (*see Appendix C*) were created by modifying the current Indiana 4-H Science Workshops for Youth questionnaire (Knobloch et al., 2009). That instrument, originally created as a summative workshop evaluation (Rusk & Machtmes, 2002), was used to gain a greater understanding of the youth's experiences immediately after participating in those annual workshops. In 2008, the Life Science Education Signature Area in Purdue's Youth Development and Agricultural Education Department revised the questionnaire to measure science interests, career intentions, and science self-efficacy by utilizing items from the Agri-science Education Self-Efficacy Scale (Esters & Lusters, 2004). Those items were adjusted for an informal education setting and a precollege experience.

Validity of the ADC questionnaire instrument was established as follows: Seven Purdue faculty members (Drs. Knobloch, Brady, Carroll, Dotterer, Esters, Rusk, and Tormoehlen), who were content experts, reviewed the 4-H Science Workshop questionnaire. From their comments, the content and structure of the questions were edited to improve readability and consistency. The resulting questionnaire, based on social cognitive career theory (SCCT), was then utilized and validated as a field- and pilot-test at the 2008 Science Workshops for Youth, which involved 433 participants. Cronbach's alpha reliability coefficients verified that the scales were reliable with this dataset: interests = 0.79, self-efficacy = 0.81, outcome expectations = 0.85, agricultural

career intentions = 0.96, and science career intentions = 0.93 (Snyder et al., 2009; Adedokun, 2008).

New items were subsequently added to improve the questionnaire instrument's validity and reliability for the 2009 4-H Science Workshops for Youth. Also, a confirmatory factor analysis was conducted for the questionnaire variables. The 2009 Ag Discovery Questionnaire was aligned with the 2009 Science Workshop Questionnaire.

The modified 2009 questionnaire consisted of various summated rating scales, which measured career and college choices, science interests, expected outcomes, career intentions, perceptions of the workshop, and science self-efficacy. It consisted of the following seven sections, containing a total of 78 items:

1. Demographics – 19 items.
2. Career and college choices – 7 items. (e.g., "How likely will you attend a technical or vocational school after high school?" Scale: 1 = very unlikely; 2 = unlikely; 3 = likely; 4 = very likely.)
3. Career interests – 16 items. (e.g., "How much interest do you have in working with animals?" Scale: 1 = very low interest; 2 = low interest; 3 = high interest; 4 = very high interest.)
4. Expected outcomes – 10 items. (e.g., "By participating in the Ag Discovery Camp, I will be more successful in college." Scale: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree.)
5. Career intentions – 10 items. (e.g., "I plan on entering a career in agriculture." Scale: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree.)
6. Workshop evaluation – 11 items. (e.g., "Before attending the Ag Discovery Camp, I though science was boring." Scale: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree.)
7. Science self-efficacy – 5 items. (e.g., "I'm confident I can do well in science at school." Scale: 1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree.)

2. Ag Discovery Camp Experience Questionnaire

To evaluate the experiences that youth have when participating in informal educational programming, Hansen and Larson (2005) developed the Youth Experience Survey (YES) 2.0. The YES 2.0 assesses self-reported data about high school-aged youths' developmental experiences in organized youth activities. The items in YES 2.0 focus primarily on positive experiences within three domains of positive interpersonal development – Teamwork and Social Skills, Positive Relationships, and Adult Networks and Social Capital (Hansen & Larson, 2005).

A modified version of the YES 2.0 Survey called the Ag Discovery Camp Experience Questionnaire (*see Appendix D*) served as the second instrument utilized for this present study. Although none of the constructs from the YES 2.0 were changed, a number were removed, including all those that referred to adult/student interaction. The purpose of using YES 2.0 was to obtain data from the ADC participants on the types of developmental experiences they encountered during the camp. It focused primarily on the experiences within three domains of *positive* personal development – Identity Work, Initiative, and Basic Skills – plus three domains of positive *interpersonal* development – Teamwork and Social Skills, Relationships, and Adult Networks and Social Capital – *plus* one domain of negative experiences.

The Ag Discovery Camp Experience Questionnaire consisted of a total of 33 items within the seven domains as follow:

1. Identity Experiences – 6 items. (e.g., "Tried doing new things." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)
2. Initiative Experiences – 3 items. (e.g., "Started thinking more about my future because of this activity." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)
3. Basic Skills – 4 items. (e.g., "Observed how others solved problems and learned from them." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)

4. Interpersonal Relationships – 4 items. (e.g., "Made friends with someone of the opposite gender." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)
5. Teamwork and Social Skills – 8 items. (e.g., "Learned that working together requires some compromising." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)
6. Social Capital – 3 items. (e.g., "This activity opened up job or career opportunities for me." Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)
7. Negative Experiences – 5 items. (e.g., "Felt like I didn't belong in this activity. Scale: 1 = not at all; 2 = a little; 3 = quite a bit; and 4 = yes, definitely.)

3. Twelve-Month Follow-Up Questionnaire

Developed at the same time as the original Ag Discovery Camp Questionnaire, the 12-Month Follow-Up Questionnaire (including retrospective pre-/post-questions) contained the identical items to collect data on career and college choices, interests, career intentions, and science self-efficacy as did the ADC Questionnaire *plus* five open-ended questions to glean additional data. The 12-Month Follow-Up Questionnaire was distributed via e-mail using Qualtrics® (*see Appendix E*) to all the participants that the researcher was able to contact 12-months later.

The open-ended questions were added: (a) to obtain more detail about the participants' workshop experiences, and (b) to gain a better description of the perceived influences the workshop had on shaping the interests in science, career choices, and science self-efficacy. Those five questions were as follows:

1. How has your confidence changed regarding science as a result of the Ag Discovery Camp?
2. What effect did the Ag Discovery Camp have on how well you do in science at school?
3. Did the leadership skills you were presented at the Ag Discovery Camp make an impact on how you work with others in the classroom?

4. Did the Ag Discovery Camp change your opinion of agriculture as science?
5. Did the Ag Discovery Camp influence your future plans on going into a science related career?

4. Twelve-Month Follow-Up Interview Protocol

The researcher conducted telephone interviews with 10 of the 33 ADC (and study) participants from his office at Purdue's Youth Development and Agricultural Education Department on the Purdue Campus or from his private residence. Each interview, which was 20-30 minutes in length, consisted of semi-structured items in a guide that was audiotaped with a sub-sample of the participants. This format was chosen to give the interviewees some leeway in how to reply, while allowing the researcher to ask additional questions to clarify any of the interviewee's statements (Bryman, 2004). The interview protocol included 19 open-ended questions including 5 questions from the 12-month follow-up questionnaire (*see Appendix E*).

Parental consent was obtained verbally prior to the interviews due to the age of the participants. Parents were told of the study's purpose and benefits and were given a statement regarding participant confidentiality. The interview questions were prepared in a manner that would both ensure the responses related to the study's research questions of the study and allow the participants to contribute their perspectives and suggestions about the ADC.

5. Twelve-Month Follow-Up Parent Questionnaire

Developed in conjunction with the participants' 12-month follow-up questionnaire, the 12-Month Follow-Up Parent Questionnaire consisted of items that corresponded with those in the participant questionnaire regarding science interests, self-efficacy, and career interests (*see Appendix I*). Five open-ended questions were also included to gain a greater understanding of parent's perceptions of their child's experience at the ADC. The parent follow-up questionnaire was distributed via e-mail utilizing the software Qualtrics® (*see Appendix H*). Although all parents were contacted ($N = 33$), only four responded to the questionnaire.

F. Instrument Validity and Reliability

Cronbach's alpha post-hoc reliability coefficients verified that the questionnaire questions were reliable within the data set. The coefficients in Table 7 are for those factors associated with the Ag Discovery Camp Questionnaire Parts I and II and the Ag Discovery Camp Experience Questionnaire.

Table 7

Reliability Coefficients for Post Questionnaires

Questionnaire Section	Cronbach's Alpha
Career Interest	$\alpha = 0.84$
Career Intentions	$\alpha = 0.91$
Science Self-Efficacy	$\alpha = 0.64$
Ag Discovery Experience	$\alpha = 0.82$

Post hoc reliability coefficients were also computed for the 12-Month Follow-Up Questionnaire to verify the questions' reliability within the data set. The coefficients in Table 8 are reported for those factors associated with that 12-month questionnaire.

Table 8

Reliability Coefficients for 12-Month Follow-Up Questionnaire

Questionnaire Section	Cronbach's Alpha
Career Interest	$\alpha = 0.88$
Career Interest Retrospective	$\alpha = 0.84$
Career Intentions	$\alpha = 0.90$
Career Intentions Retrospective	$\alpha = 0.86$
Science Self-Efficacy	$\alpha = 0.71$

G. Research Setting and Description of Treatment

The Ag Discovery Camp was started in the summer of 2008 by the Office of Multicultural Programs in Purdue's College of Agriculture as a two-week summer residential agricultural careers precollege experience for urban high school students. The next summer it was offered as a one-week residential experiences for middle school students (Purdue University, 2010b), its goals being to provide scientific information, to develop leadership skills, and to enhance knowledge, attitudes, and perceptions regarding STEM-related careers, particularly in the agricultural sciences. The ADC participants were chaperoned by minority undergraduate and graduate students recruited by the Office of Multicultural Programs. The camp was organized into two portions – a leadership skill development workshop and a science workshop.

Arriving Sunday evening of June 7, the participants were checked into their dormitories then attended the camp orientation, which included introduction of their counselors and coordinators followed by ice-breaking activities that allowed them to meet. The next two days consisted of the leadership skills development workshop plus social events. The workshop's four sessions dealt with self-awareness, appreciating differences in others, communication skills, and team building. The topics were specifically chosen to instill in the youth the importance of working with each other and the importance of positive interpersonal skills in today's professional world.

The lessons were adapted from Leadership in Action (LIA) training material (*see Appendix J*), which was developed by Purdue, the University of Wisconsin-Madison, and the University of Illinois, Champaign-Urbana for use by those who conducted leadership programs for college student organizations (Ayres et al., 2009). The major adaptations included: (a) incorporation of activities and games that taught leadership skills, (b) conversations adjusted to fit the lifestyles and issues of relevance to middle school-age youth, and (c) use of simpler personality assessment (i.e., True Colors®) in the self-awareness session, instead of the more complex Kiersey Temperament Sorter®.

For the remainder of the camp, the 33 participants were integrated into the 4-H Science Workshops for Youth, which is an annual three-day science-based career development/awareness program. Held on the campus and attended by some 400

primarily rural Indiana 4-H members, the program gives middle and early high school students opportunity to learn about a science field through hands-on involvement in science-related activities and interaction with Purdue professors and staff from various departments in the Colleges of Agriculture and Engineering.

The ADC participants were enrolled in one of five workshops (to the extent possible, each one's first choice): engineering sciences, plant sciences, food sciences, entomology, and integrated lunar plant sciences (aka, "Mission to Mars"; *Table 9*). To address a potential concern regarding their 'comfort level' in this new environment, there were at least five ADC students in each workshop. Also, to further enhance their sense of inclusion, they participated in all Science Workshops activities, including the meals and social events.

Table 9

Number of Participants per Science Workshop

Workshop	Ag Discovery Participants	Science Workshop Participants	Total Participants
Engineering	$n = 5$	$n = 42$	$N = 47$
Plant	$n = 9$	$n = 25$	$N = 34$
Food	$n = 7$	$n = 22$	$N = 29$
Entomology	$n = 5$	$n = 7$	$N = 12$
Mission to Mars	$n = 7$	$n = 6$	$N = 13$

At the end of the workshops, the ADC participants came back together to conclude the week's events, which included a talk with Virgil Madden from the Indiana Lieutenant Governor's office and presentation of certificates of recognition. Table 10 outlines the first two days of the 6-day process of the Ag Discovery Camp, while Appendix K outlines a sample of activities the students participated in the last three days of the Ag Discovery Camp.

Table 10

Schedule of Events of the Ag Discovery Camp Leadership Development Sessions

Date	Session Description
Monday, June 8, 2009 9:00 am – 12 noon	• Understanding Differences – Mr. Robbie Ortega • Listening and Speaking Clearly – Mr. Robbie Ortega
Tuesday, June 8, 2009 9:00 am – 12 noon	• Understanding Our Values and Character and True Colors® - Mr. Robbie Ortega & Mr. David Caldwell • Building Teams – Mr. Robbie Ortega

H. Collection of the Data

1. Collection During the Camp

Data from Ag Discovery Camp Questionnaire Parts 1 and II were collected at the camp's beginning and conclusion. Questionnaire Part I was administered by the researcher prior to the leadership skills development session on the first day (Monday, June 8, 2009). Part II was administered at the end of the science workshop (Friday, June 12) by the workshop chaperones, which handed out the questionnaires only to the ADC participants, collected them upon completion, and returned them to the researcher. The Ag Discovery Experience Questionnaire was both administered and collected at the camp's wrap-up session, prior to the presentation of the certificates of completion.

2. Collection During the 12-Month Follow-Up

The 12-Month Follow-Up Questionnaire was distributed to 32 of the 33 ADC participants 12 months later, utilizing the on-line questionnaire software Qualtrics® licensed to Purdue (*see Appendix E*). One student was not included due to the inability to locate her from the phone number and address that was on the student's original application from the previous year. The purpose of this questionnaire was to determine the outcomes of the camp on the participants' interest in science, science self-efficacy, and career intentions.

Of the 23 who responded, 10 were chosen for personal interviews, based on the 'quality' of their responses to the instrument's open-ended questions. What, in the researcher's judgment, defined 'quality' were responses that indicated careful forethought and that contained more than just a minimum of words. Conducted via telephone by the researcher between May 31 and June 11, 2010, the interviews lasted 20-30 minutes and followed a semi-structured format in order to elicit the most content-worthy responses as to the participants' camp experience and its influences on their interest in science, science self-efficacy, and subsequent decisions concerning course and/or careers (*see Appendix F*).

All of the 32 students' parents were also contacted and sent the Ag Discovery Parent Questionnaire. If the mother and father's e-mail was listed, the questionnaire was sent to both guardians with the potential of 64 questionnaires to be returned. However, the parents were effective at getting their child to return their electronic questionnaire, but were not as responsive at returning the parent questionnaires. Of the 32 sets of parents, only 4 responded to the email. The items for the parent questionnaire corresponded with the items from the participant questionnaire in areas of science interests, self-efficacy, and career interests. Open-ended questions were also included in the questionnaire to gain a greater understanding of parents' perceptions of their children's experience at the Ag Discovery Camp (*see Appendix H*).

In order to strengthen the study, the data collected from the 12-month follow-up participant questionnaire and the subsequent participant interviews plus parent questionnaire were triangulated to provide a cumulative view of that which was drawn form each of these three contexts (Patton, 2000; Silverman, 2000). Table 11 shows the dates on which each of the five data-collection instruments were administered.

Table 11

Data Collection Timeline

Date	Component
Monday, June 8th, 2009	Ag Discovery Camp Questionnaire Part I
Friday, June 12th, 2009	Ag Discovery Camp Questionnaire Part II
Friday, June 12th, 2009	Ag Discovery Camp Experience Questionnaire
April 30th, 2010 – June 5th, 2010	12-Month Follow-Up Questionnaire
June 1st, 2010 – June 10th, 2010	12-Month Follow-Up Interviews
June 1st, 2010 – June 5th, 2010	Parent Questionnaire

I. Analysis of the Data

1. Quantitative Analysis

All responses to the four questionnaires carried out in this study were entered and analyzed using the Predictive Analytics Software (PASW), Version 18 (formerly the Statistical Package for Social Sciences [SPSS]). Descriptive statistics were used to analyze the data, inferential statistics were not used because the assumption of normality was not met.

Means, standard deviations, frequencies, and percentages were calculated and reported for career interests, career intentions, science self-efficacy, and perceptions of experiences (both participants' and parents'). Table 12 identifies the level of measurement of sub-scales used to measure the dependent and independent variables. Practical significance was determined by using effect sizes, which were calculated by Cohen's *d* (1988) and described by Cohen's descriptors, which are present in Table 13 (Cohen, 1988).

Table 12

Level of Measurement, Central Tendency, and Variance Related to Each Dependent and Independent Variable

Variable	Level of Measurement	Central Tendency	Variance
Four student interest in activities variables • Production agriculture • Plant sciences • Food sciences & nutrition • Engineering & science	Item: Ordinal Scale: Interval	Mean	Standard Deviation
Parent's perceptions of child's interest	Nominal	Frequency	
Student's perceived self-efficacy	Item: Ordinal Scale: Interval	Mean	Standard Deviation
Parent's perceptions of child's confidence in science	Nominal	Frequency	
Post high school plans of participants	Nominal	Frequency	
Intended college majors of participants	Nominal	Frequency	
Student career interest (agricultural career & science career)	Item: Ordinal Scale: Interval	Mean	Standard Deviation
Parent's perception of child's college and career intentions	Nominal	Frequency	
Negative experiences of participants of Ag Discovery Camp	Nominal	Frequency	

Table 13

Conventions for Effect Sizes for Mean Differences (Cohen, 1988)

Effect Size Coefficient (*d*)	**Convention**
≥ 0.8	Strong Effect Size
0.50 – 0.79	Moderate Effect Size
0.20 – 0.49	Small Effect Size
0.0– 0.19	Trivial Effect Size

Pearson's Product Moment Correlations were computed to determine the relationship between the leadership skills component of the Ag Discovery Camp and the perceived science self-efficacy and science career interest. Pearson's Correlation was also used to determine if any negative experiences at the ADC were related to perceived self-efficacy and science career interest. Table 14 identifies the statistical tests utilized to describe the relationship between dependent and independent variables. Relationships were described using conventions by Hopkins (2000), which are presented in Table 15. Effect sizes for relationships were calculated using Cohen's R^2 (1988) and described by Cohen's conventions, which are presented in Table 16 (Cohen, 1988).

Table 14

Statistical Tests Used to Describe Each Relationship

Dependent and Independent Variable Relationships	Statistical Test	Measure of Association
Self-Efficacy/Interpersonal Skills	Pearson's Correlation	Linear
Self Efficacy/Team & Social Skills	Pearson's Correlation	Linear
Production Agriculture Activities/Interpersonal Skills	Pearson's Correlation	Linear
Production Agriculture Activities/Team & Social Skills	Pearson's Correlation	Linear
Plant Science Activities/Interpersonal Skills	Pearson's Correlation	Linear
Plant Science Activities/ Team & Social Skills	Pearson's Correlation	Linear
Food Science Activities/Interpersonal Skills	Pearson's Correlation	Linear
Food Science Activities/Team & Social Skills	Pearson's Correlation	Linear
STEM Activities/Interpersonal Skills	Pearson's Correlation	Linear
STEM Activities/Team & Social Skills	Pearson's Correlation	Linear
Self-Efficacy/Negative Experiences	Pearson's Correlation	Linear
Production Agriculture Activities/Negative Experiences	Pearson's Correlation	Linear
Plant Science Activities/Negative Experiences	Pearson's Correlation	Linear
Food Science Activities/Negative Experiences	Pearson's Correlation	Linear
STEM Activities/Negative Experiences	Pearson's Correlation	Linear

Table 15

Conventions for Relationships (Hopkins, 2000)

Effect Size Coefficient (*r*)	**Convention**
0.9 – 1.0	Nearly Perfect
0.7 – 0.89	Very Large
0.5 – 0.69	High
0.3 – 0.49	Moderate
0.1 – 0.29	Low
0.0 – 0.09	Trivial

Table 16

Conventions for Effect Sizes of Relationships (Cohen, 1988)

Effect Size Coefficient (r^2)	**Convention**
$\geq$ 0.25	Large
0.09 – 0.24	Medium
0.01 – 0.08	Small

2. Open-Ended Questions and Personal Interviews

The qualitative component of the study included both open-ended questions presented in the 12-month follow-up questionnaire and the 12-month follow-up interview. The open-ended questions were designed to gather information of how the students utilized the interpersonal and leadership skills taught to them after leaving the camp, the students' interest in science, their science self-efficacy (confidence in learning science), and also asked the participants' of their future career plans. Ten participants were chosen from their responses to the open-ended questions and were asked to participate in short 20 – 30 minute interviews that attempted to get more in depth

responses to participants open-ended responses, as well as additional information in regards to the camp.

The open-ended questions and interviews were transcribed and analyzed. Attempts were made to develop themes from the qualitative responses, however the responses and interview transcriptions were limited in the amount of information provided by the participants. Participants' responses to both the open-ended questions and the interviews were often short and concise. Therefore the researcher identified specific quotes, which were similar in context and redundancy, given by the respondents from both the open-ended questions and the participant interviews and corroborarted them with the corresponding data from the quantitative portion of the study. Hammond (2005) states that quotes are given when they describe an experience with more sentiment, flavor, and eloquence. The participants' quotes were utilized to add meaning and to add a greater understanding of the experience of the Ag Discovery Camp.

Not all of the qualitative data were complementary to the corresponding quantitative findings. Some of the open-ended and interview responses were different than the findings of the quantitative data, which caused the researcher to interpret reasons for the discrepancies. Though some of the qualitative data were different, they were included to try to provide additional meaning to the experience the participants had at the Ag Discovery Camp. In addition to the open-ended questions for the participants and the interviews, parents of the participants were also asked open-ended questions. Similar to the participant findings, specific quotes were pulled from the parent open-ended questionnaire data and corroborated with corresponding quantitative data to provide a more rich description of the outcomes of the Ag Discovery Camp. A summary of the participants and parents is available in Table 17.

Table 17

Summary of Interview Particpants

Student	**Sex**	**Grade**	**Corresponding Parent**
Student 1	Female	8th	
Student 2	Female	8th	
Student 3	Female	7th	Mother #1
Student 4	Female	6th	
Student 5	Female	7th	Father #2
Student 6	Male	7th	
Student 7	Female	7th	
Student 8	Female	7th	
Student 9	Female	8th	Mother #2
Student 10	Male	8th	
N/A	N/A	N/A	Father #1*

* Father #1 was the parent of a Ag Discovery Camp participant, however not an interview participant.

IV. STUDY RESULTS

To reiterate, (a) the purpose of this study was to explore and describe the outcomes of the Ag Discovery Camp on minority youth's agricultural science interests, science self-efficacy, career awareness, and application of leadership development (*page 3*); and (b) the 'answers' to the nine research questions posed would be the basis of that assessment (*page 5*). Following are the 'answers' to each of those nine questions that analysis of the collected data revealed.

A. Question Results: Interest in Science

Research question 1: *What were the career interest of the students immediately following and 12 months after participating in the Ag Discovery Camp?*

Research question 1 was answered utilizing both the quantitative data from the Ag Discovery Camp Questionnaire and the 12-month follow-up questionnaire. This data was then corroborated with supportive quotations from 12-month follow-up personal interviews of the selected 10 participants. Finally, supportive data and quotes were then added from the 12-month follow-up parent questionnaire. The following sections are the results corresponding to research question 1.

1. Question #1: Results from Participants Questionnaires

Participants were asked if they were interested in various career activities immediately following the Ag Discovery Camp. Findings of interests in career activities

are presented in four different career domains for each workshop (Table 18). Overall, participants were not interested in career activities in agricultural production ($\mu = 2.22$; $\sigma = 0.67$; $N = 33$), plant sciences ($\mu = 2.20$; $\sigma = 0.90$; $N = 33$), and food sciences ($\mu = 2.27$; $\sigma = 0.80$; $N = 33$); however, participants were slightly interested in career activities in engineering and science ($\mu = 2.51$; $\sigma = 0.71$; $N = 32$). Specifically, participants in the Food Science Workshop ($\mu = 2.50$; $\sigma = 0.58$; $n = 7$) and Mission to Mars Workshop ($\mu = 2.50$; $\sigma = 1.04$; $n = 7$) were slightly interested in career activities in the career domain of food science. Moreover, participants in the Engineering Workshop ($\mu = 2.88$; $\sigma = 0.61$; $n = 5$) and Mission to Mars Workshop ($\mu = 2.80$; $\sigma = 0.89$; $n = 7$) were interested in career activities related to engineering and science.

Table 18

Participants' Interest in Career Activities Immediately Following the Agricultural Discovery Camp

Workshop	Interest in Production Agriculture Mean (SD) *n*	Interest in Plant Sciences Mean (SD) *n*	Interest in Food Science & Nutrition Mean (SD) *n*	Interest in Engineering & Science Mean (SD) *n*
Engineering	2.08 (0.41) *n* = 5	1.87 (0.65) *n* = 5	2.10 (0.96) *n* = 5	**2.88** (0.61) *n* = 5
Food Science	2.39 (0.75) *n* = 7	2.24 (1.13) *n* = 7	**2.50** (0.58) *n* = 7	2.34 (0.65) *n* = 7
Plant Science	2.20 (0.82) *n* = 9	2.37 (0.86) *n* = 9	2.33 (0.71) *n* = 9	2.25 (0.64) *n* = 8
Entomology	1.80 (0.73) *n* = 5	2.13 (0.80) *n* = 5	1.70 (0.67) *n* = 5	2.44 (0.74) *n* = 5
Mission to Mars	2.49 (0.47) *n* = 7	2.23 (1.08) *n* = 7	**2.50** (1.04) *n* = 7	**2.80** (0.89) *n* = 7
Grand Mean	2.22 (0.67) *N* = 33	2.20 (0.90) *N* = 33	2.27 (0.80) *N* = 33	**2.51** (0.71) *N* = 32

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

Twelve months following the Ag Discovery Camp, the participants were asked of their interests in the same various career activities asked immediately after the camp. Findings of interest in career activities 12 months following the ADC are presented in four different career domains for each workshop (Table 19). Findings showed that the participants were less interested in career activities 12 months following the camp, overall, participants were not interested in career activities in agricultural production (μ = 1.95; σ = 0.66; *N* = 23), plant sciences (μ = 1.99; σ = 0.76; *N* = 23), food sciences (μ =

2.26; σ = 0.81; *N* = 23), and engineering and science (μ = 2.27; σ = 0.71; *N* = 23). Specifically, participants in the Mission to Mars Workshop (μ = 3.33; σ = 0.58; *n* = 3) were interested in career activities in food science and nutrition. In addition, participants in the Entomology Workshop (μ = 2.73; σ = 1.10; *n* = 3) were slightly interested in doing career activities in the area of engineering and science. Moreover, participants in the Mission to Mars Workshop were interested in career activities in the areas of food science (μ = 3.33; σ = 0.58; *n* = 3) and engineering and science (μ = 3.00; σ = 0.60; *n* = 3). These findings should be interpreted cautiously due to the low number of participants.

Table 19

Participants' Interest in Career Activities 12-month Following the Agricultural Discovery Camp

	Interest in Production Agriculture	**Interest in Plant Sciences**	**Interest in Food Science & Nutrition**	**Interest in Engineering & Science**
Workshop	**Mean (SD)** ***n***	**Mean (SD)** ***n***	**Mean (SD)** ***n***	**Mean (SD)** ***n***
Engineering	1.88 (0.97) *n* = 3	1.67 (0.67) *n* = 3	1.83 (1.04) *n* = 3	2.20 (0.53) *n* = 3
Food Science	1.94 (0.55) *n* = 7	1.81 (0.79) *n* = 7	2.36 (0.75) *n* = 7	2.09 (0.63) *n* = 7
Plant Science	1.80 (0.72) *n* = 7	2.14 (0.74) *n* = 7	1.86 (0.69) *n* = 7	2.00 (0.58) *n* = 7
Entomology	1.93 (0.75) *n* = 3	1.89 (1.01) *n* = 3	2.33 (0.29) *n* = 3	**2.73** (1.10) *n* = 3
Mission to Mars	2.40 (0.69) *n* = 3	2.44 (0.77) *n* = 3	**3.33** (0.58) *n* = 3	**3.00** (0.60) *n* = 3
Grand Mean	1.95 (0.66) *N* = 23	1.99 (0.76) *N* = 23	2.26 (0.81) *N* = 23	2.27 (0.71) *N* = 23

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean ≥ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

During the 12-month follow-up, participants of the Ag Discovery Camp were asked to think back retrospectively about their career interests prior to the camp. These retrospective findings were an attempt to determine the participants' career interests prior to the ADC, and the findings are presented in four different domains for each workshop (Table 20). Findings showed that the participants were not interested in career activities prior to attending the Ag Discovery Camp. Participants were not interested in career activities in production agriculture ($\mu = 1.85$; $\sigma = 0.67$; $N = 23$), plant sciences ($\mu = 1.98$; $\sigma = 0.92$; $N = 23$), food science and nutrition ($\mu = 2.14$; $\sigma = .67$; $N = 23$), and engineering and sciences ($\mu = 2.33$; $\sigma = 0.59$; $N = 23$). Specifically, participants in the Engineering Workshop were slightly interested in career activities in the area of engineering and science ($\mu = 2.67$; $\sigma = 0.46$; $n = 3$) prior to participating in the ADC. Moreover, participants in the Mission to Mars Workshop were slightly interested in career activities in food science and nutrition ($\mu = 2.50$; $\sigma = 0.71$; $n = 3$) and were interested in career activities in engineering and sciences ($\mu = 2.80$; $\sigma = 1.13$; $n = 3$) prior to the ADC.

Table 20

Participants' Retrospective Interest in Career Activities Prior to Ag Discovery Camp

Workshop	**Interest in Production Agriculture** **Mean (SD)** ***n***	**Interest in Plant Sciences** **Mean (SD)** ***n***	**Interest in Food Science & Nutrition** **Mean (SD)** ***n***	**Interest in Engineering & Science** **Mean (SD)** ***n***
Engineering	1.93 (0.61) $n = 3$	2.00 (0.88) $n = 3$	2.00 (0.87) $n = 3$	**2.67** (0.46) $n = 3$
Food Science	2.11 (0.67) $n = 7$	1.90 (1.05) $n = 7$	2.42 (0.79) $n = 7$	2.40 (0.61) $n = 7$
Plant Science	1.70 (0.63) $n = 7$	2.22 (0.78) $n = 7$	1.83 (0.52) $n = 7$	2.07 (0.41) $n = 7$
Entomology	1.40 (0.35) $n = 3$	1.56 (0.96) $n = 3$	2.00 (0.50) $n = 3$	2.07 (0.58) $n = 3$
Mission to Mars	2.00 (1.41) $n = 3$	2.17 (1.65) $n = 3$	**2.50** (0.71) $n = 3$	**2.80** (1.13) $n = 3$
Grand Mean	1.85 (0.67) $N = 23$	1.98 (0.92) $N = 23$	2.14 (0.67) $N = 23$	2.33 (0.59) $N = 23$

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and N = sample size.

The grand means of participants' interests in career activities between the three data points (retrospective means, post-camp means, 12-month follow-up means) were compared (Table 21). Upon completion of the ADC, participants were more interested in career activities in production agriculture ($d = 0.53$, moderate effect size). Participants had similar interests in career actitities in the domains of and engineering and science ($d = 0.27$, small effect size), plant science ($d = 0.24$, small effect size), and food science and nutrition ($d = 0.17$, trivial effect size) upon completion of the ADC compared to what they remembered their career interests were before the camp. In comparison from

immediately after the ADC to one year after the ADC, participants had similar interests in career activities in the domains of production agriculture (d = 0.40, small effect size), plant science (d = 0.25, small effect size), food science and nutrition (d = 0.01, trivial effect size), and engineering and science (d = 0.32, small effect size).

In summary, participants in the ADC were not interested in career activities in the areas of production agriculture, plant science, and food science and nutrition. Participants were not interested in Engineering and Science career activities before or one-year after the ADC; however, they were interested in Engineering and Science career activities immediately following the ADC.

Table 21

Comparison of Grand Means of Participants' Interest in Career Activities

	Production Agriculture	**Plant Sciences**	**Food Science and Nutrition**	**STEM Sciences**
Retrospective (I^R)	1.86 (.67) N = 21	1.98 (.92) N = 21	2.14 (.67) N = 21	2.33 (.59) N = 21
Effect Size ($I-I^R/SD_{weighted}$)	d = .53 Moderate	d = .24 Small	d = .17 Trivial	d = .27 Small
Immediate (I)	2.22 (.68) N = 33	2.20 (.90) N = 33	2.27 (.80) N = 33	2.51 (.71) N = 32
Effect Size ($I^F-I/SD_{weighted}$)	d = .40 Small	d = .25 Small	d = .01 Trivial	d = .32 Small
12-Month (I^F)	1.95 (.66) N = 23	1.99 (.76) N = 23	2.26 (.81) N = 23	2.28 (.71) N = 23

Note. Means were calculated on a 4-point scale (1=strongly disagree, 2=disagree, 3=agree, and 4=strongly agree). Standard deviations are in parentheses following means and N = sample size.

2. Question #1: Results from Participant Interviews

Interviews were conducted with 10 participants 12 months after the ADC to gain more insight to their career interests. As such participants were asked, *"Have you found yourself learning more about the topics that you were presented at the Ag Discovery*

Camp?" Most of the 10 participants answered to the question affirmatively by mentioning various topics they were exposed to during the workshop segment of the ADC. Although the interviews revealed relatively low interest in the agricultural sciences, five of the 10 participants expressed a measure of interest in specific agricultural science-related topics through the following quotes.

- *I decided that I wanted to learn more about the topic of entomology. I never really knew that it had anything to do with agriculture. I decided to look further into it. ~ Student #1*

- *I was ahead on some of the plant knowledge at my school because of the camp and we covered that in school this year. I was able to do more and look up more information while the other kids in my class had to learn it from the beginning. ~ Student #4*

- *I found myself looking up more information about food. Like when I help my mom cook dinner, I explained to her why some things taste the way they do. I really looked into smells and how they affect our taste and also nutrition. ~ Student #5*

- *After the camp that I decided that I wanted to explore my backyard and see what kind of insects and bugs that we had back there because I was still tuned into what we did at the entomology camp. I looked up insects on the Internet and learned of how some are good for certain things and how some are not so good. ~ Student #7*

- *I didn't learn it at my camp, but through one of the other kids at camp they mentioned forensic science. So I did a report on forensic science at school. I talked about how you can use things like insects to solve crimes. It was cool and my teacher liked it. ~ Student #10*

Although quantitative data showed that participants had low interests in agricultural career activities (i.e., production agriculture, plant science, food science), the interview data revealed that half of the participants had continued interest in agricultural-related career activities presented during the Ag Discovery Camp. These statements do not lay claim to the participants having increased interest in agricultural-related career activities, however, they did indicate that the participants had more awareness of agriculture and agricultural career activities by relating to agriculture in new ways,

becoming more familiar with an agricultural related topic, or connecting what they learned in school to agriculture.

3. Question #1: Results from Parent Questionnaire

Results from a parent questionnaire that was conducted 12-months after the ADC showed the parents were positive in their perspectives of their children's interest in science (Table 22). Overall, the four parents who responded agreed their children were interested in science, engineering, and mathematics, and that the ADC increased their child's interest in learning science. These results need to be interpreted cautiously due to the small number of respondents.

Table 22

Parent responses to Childrens' Interests

Question	Very Unlikely/ Unlikely	Likely/ Very Likely
Your child is interested in science laboratories.	1 (25.0%)	3 (75.0%)
You child is interested in performing math calculations to solve problems.	0 (0.0%)	4 (100.0%)
You child is interested in designing machinery, roadways, or electronics as an engineer.	1 (25.0%)	3 (75.0%)
Attending the Ag Discovery Camp has increased your child's interest in learning science.	0 (0.0%)	4 (100.0%)
Your child is determined to use their knowledge learned from science classes.	0 (0.0%)	4 (100.0%)

A single open-ended question was also presented to the parents to gain greater insight on their children's interests in science and science activities. The parents were asked the question, *"Do you feel that your child's interest in science has increased as a*

result of the Ag Discovery Camp?" Parent responses (see quotes below) indicated several outcomes they observed after their children attended the ADC, such as an increase in science and agriculture, a broader view of agriculture, and a better understanding of doing well academically.

- *I feel that my son's interests in science have increased. It is hard to determine whether these interests influenced by his involvement in the Ag Discovery Camp. ~ Father #1*
- *My child is so excited about agriculture as a science. It has truly opened her eyes to something new and exciting. ~ Mother #1*
- *This experience has changed both my daughter and my views about agriculture. I didn't know of the different areas that were related to agriculture. She and I are both interested in learning more about this field. ~ Mother #2*
- *The Ag Discovery Camp has taught my child of the importance of having good grades so that she has the opportunity to attend other camps (like the Ag Discovery Camp) for additional exposure to science. ~Father #2*

The parents' responses indicated that they believed that their children had an increase in both science and agriculture, yet these statements were interpreted cautiously because extraneous variables were not controlled. For example, one parent stated that though his child's interest in science had increased, he couldn't determine how much the Ag Discovery Camp influenced his child. This parent's statement was considered by the researcher due to unknown factors (i.e., new topics brought up in school, enthusiastic science teachers, having friends that were interested in science) that may have influenced the youth during the 12 months following the camp.

4. Summary of Finding of Research Question #1

Quantitatively, participants of the ADC had low interest in agricultural career activities throughout three points in time (retrospectively prior to camp, immediately following, 12-months after ADC). Participants who were enrolled in the Mission to Mars Workshop were the most consistent of all the participants showing interest in career

activities in the categories of food science and nutrition and engineering at all three data points in time. Participants who were enrolled in the Engineering Science Workshop showed interest career interests in engineering and science both prior to the ADC retrospectively and immediately following the ADC. Participants in the Entomology Workshop only expressed interest career activities in engineering and sciences 12 months following the workshop, while the Food Science Workshop participants only expressed interest career activities in food science and nutrition immediately following the workshop.

Qualitatively, participants had low interests in agricultural careers, but half of the participants who were interviewed expressed interest in specific topics and hands-on agricultural activities presented at the ADC. Moreover, participants of shared the information they learned at the ADC helped them in school, and one student provided an example that she learned about a topic through a peer who participated in a different workshop at the ADC.

Parents agreed that they felt that their child's interest in science had increased and that their exposure to agriculture increased as well. In summary, though the participants of the Ag Discovery Camp showed low interest in agricultural career activities specifically, the ADC exposed the participants to a field of study they had not previously considered the outcome from the ADC was more exploratory interest. As such, the students were more aware of new topics from the field of agriculture and provided examples of continued learning in specific activities that were related to agriculture.

B. Question Results: Perceived Science Self-Efficacy

Research Question 2: *What was the perceived self-efficacy of the participants immediately following and 12 months after the Ag Discovery Camp?*

The participants of the Ag Discovery Camp were asked of their perceived self-efficacy at two points during the study. First the participants were asked to respond to 6 statements to rate their self-efficacy in both the Ag Discovery Questionnaire Part II and

in the 12-month follow-up survey. In addition to the quantitative data statements from the 12-month follow-up and quotes from the personal interviews were utilized to strengthen the data presented. The parents were also asked to rate their children's self-efficacy in the questionnaire presented to them 12 months after the camp. Note that self-confidence and self-efficacy were viewed as the same construct due to self-confidence being a term that both the participants of study and the parents understood. The following sections are the results corresponding to research question two.

1. Question #2: Results from Participant Questionnaires and Interviews

Overall, participants were self-efficacious immediately following ($\mu = 3.20$; $\sigma = 0.36$; $N = 33$) and 12 months following ($\mu = 3.47$; $\sigma = 0.41$; $N = 24$) the Ag Discovery Camp with a moderate effect size ($d = 0.71$; Table 23). The participants of the Engineering Science Workshop, the Food Science Workshop, and the Entomology Workshop were self-efficacious to learn science and all had an increase in self-efficacy from the post-camp questionnaire to the 12-month follow-up, all with strong effect sizes ($d = 0.90$, $d = 0.82$, and $d = 1.14$, respectively). The participants of the Plant Science Workshop were self-efficacious to learn science and had an increase in self-efficacy between post-camp and 12-month follow-up questionnaires with a moderate effect size ($d = 0.70$). Participants in the Mission to Mars Workshop were self-efficacious to learn science, and they were the only group that had a slight decrease in self-efficacy. However, this difference was so small that the effect size was trivial ($d = 0.03$). It is important to note that the overall increase in self-efficacy cannot be attributed to the Ag Discovery Camp, as a number of confounding variables were not controlled. However, there is a consistent pattern that participants reported self-efficacy was higher one year later than the Ag Discovery Camp regardless which science workshop in which they participated.

Table 23

Participants Perceived Self-Efficacy Immediately Following and 12-Months Following the Ag Discovery Camp

Workshop	Immediately Following Mean (SD) *n*	12-Months Following Mean (SD) *n*	Effect Size *d* Cohen's Index
Engineering	**3.20** (0.34) *n* = 5	**3.54** (0.42) *n* = 4	*d* = 0.90 Strong
Food Science	**3.21** (0.42) *n* = 7	**3.50** (0.27) *n* = 7	*d* = 0.82 Strong
Plant Science	**3.04** (0.47) *n* = 9	**3.38** (0.51) *n* = 7	*d* = 0.70 Moderate
Entomology	**3.37** (0.25) *n* = 5	**3.67** (0.29) *n* = 3	*d* = 1.14 Strong
Mission to Mars	**3.29** (0.19) n = 7	**3.28** (0.63) n = 3	*d* = 0.03 Trivial
Grand Mean	**3.20** (0.36) *N* = 33	**3.47** (0.41) *N* = 24	*d* = 0.71 Moderate

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

Comments of the ADC participants from both the 12-month instruments open-ended questions and the 12-month interview revealed that many of the participants reported they experienced an increase in confidence when it came to 'learning science.' For instance, responding to open-ended questions in the 12-month follow-up questionnaire regarding their confidence to learn science in school, the following statements from six of the participants (kept anonymous due to the web-based collection of Qualtrics®) are representative of all who commented:

- *It's changed quite a lot (confidence in science). I believe, because of the camp, I understand science better and I am not as confused with the subject. The camp helped me learn to ask more questions when I didn't understand.*
- *I am not nervous to try an experiment for class.*
- *I do feel better about my science skills.*
- *Now I am not scared to ask questions.*
- *At first I was scared and now I feel like I can do anything.*
- *My confidence to learn science in my science class has gone up because what we learned to do in the Ag Discovery Camp we eventually did in my science class.*

Also, five of the 10 selected to be interviewed during the 12-month follow-up, when asked, "Do you feel that you are more confident to do well in science at school?" and "are you more confident that you can understand science topics taught in school?" responded as follows:

- *I feel like I have a better understanding of science. So I am not scared to ask questions anymore, because science is about asking questions. I used to be afraid to get it wrong. ~ Student #5*
- *Yes (I feel more confident), because I question things more now and you have to do that in science. ~ Student #4*
- *I just had a better feeling about going to science class. ~ Student #9*
- *I don't know why, but I've always liked to get things right the first time and I feel like in science I can do that now. ~ Student #7*
- *I just think I have a better understanding of it (science). ~Student #6*

In summary of the qualitative responses from both the 12-month follow-up and the interviews, participants attributed their newfound confidence in science to their ability to question science. Questionning science gave participants a better feeling of their understanding of science and reduced their anxiety of their science skills.

2. Question #2: Results from Parent Questionnaire

Parents were asked about their children's confidence to learn science via the 12-month follow-up questionnaire. Their agreement with two items and an open-ended question follow.

Table 24

Parent's Perspective of Child's Confidence in Science

Question	Frequency (%)
Your child is confident that he/she can do well in science at school.	4 (100%)
Your child is confident that he/she can understand the topics taught in science at school	4 (100%)

Note. 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree).

Although the number of parent questionnaire response was low, all four parents strongly agreed that their children had the ability to understand science topics at school and that their children were confident in their abilities to do well in science at school (Table 24). In addition, the parents were asked to respond to one open-ended question in regards to their children's confidence in science, "Do you feel that your child's confidence to learn science has changed as a result of participating in the Ag Discovery Camp?" among the parents' responses were these:

- *I believe my son has advanced in his approach to science based on his being around other students who perform well in science. I am waiting on his report card to confirm my beliefs. ~ Father #1*
- *It [camp] helped her for school science class this year. She brought back information similar to that presented to her at the workshop. ~ Mother #1*
- *My child is very interested in science after attending the Ag Discovery Camp. ~ Mother #2*

- *Yes, I believe she is interested more in science and has more confidence. ~ Father #2*

From the responses to both the questionnaire and its open-ended questions, parents believed that the Ag Discovery Camp helped increase their children's ability to perform in and understand science. Parents attributed this increase in confidence to learn science because of positive peer influence, learning new information, and an increased interest. One stated that he believed that his child learned vicariously through other high-performing children, while the other believed that the camp attributed measurably to a greater interest in science. Overall the parents' responses showed that they felt that their children had a greater interest in science, which they attributed to greater confidence in science.

3. Summary of Findings of Research Question #2

Participants of the Ag Discovery Camp were self-efficacious (self-confident) both immediately following and 12 months after the camp. Although no claims can be made that the ADC had a positive effect on participants' science self-efficacy, the participants and their parents attributed their increased confidence to learn science to the ADC. Although this maybe the case, the researcher did not establish cause-effect due to the descriptive nature of the study and suggests that this be explored in further studies. Interestingly, many of the participants associated the ability to question science to their new confidence in learning and understanding science.

Moreover, a few participants of the Ag Discovery Camp attributed their confidence their advanced knowledge of science topics that were presented both at camp and at school. They felt that topics presented at the ADC kept them ahead of their classmates. In addition many of the participants attributed their confidence from developing the ability to question science more, which allowed them to have a greater understanding of the science as it was presented to them.

C. Question Results: STEM-Related Coursework

Research Question 3: *What Science, Technology, Engineering, and Mathematics (STEM) courses were the ADC participants taking and/or intending to take while in high school?*

Research question 3 was answered utilizing quotes from the 12-month follow-up interview. The follow section includes the results corresponding to research question 3.

1. Question #3: Results from Participant Interviews

In the 12-month follow-up interviews, the 10 selected ADC participants were asked about potential science-related career plans, the courses that such careers would require, their intentions to take those courses, and what, if any, aspects of the Ag Discovery Camp encouraged them to pursue more STEM-related courses. Also, most of the 10 participants interviewed acknowledged the importance of taking advanced STEM courses in high school, especially chemistry biology, and physics, and their intentions to pursue STEM-related studies in college. Some even expressed aspirations of earning college credit while still in high school. The following were among the responses regarding plans to take future science courses:

- *I'm taking honors biology now and I will take honors chemistry next and I will try to take more advanced math classes. At my school we don't have required science for four years and I want to take more than we have to. I plan on taking all the math classes my school has, I think it will help me with a career in or a career that deals with math. ~ Student #2*

  I plan on taking AP (advanced placement) courses like chemistry and biology when I get into high school. I want to be able to get college credit near the end of high school. ~ Student #3

- *Yes (I plan on taking more science courses), I am going to take chemistry, biology, and physics. Even though I really don't know what physics is. Maybe something like biochemistry. ~ Student #7*

- *Yes, I am going to try to take all the classes at my high school that I can that are related to science and math. ~ Student #5*

- *I already took biology and chemistry my freshman year. I'm taking physics next year. When I get to college I'll probably take as many science courses as I can that relate to me becoming a doctor. ~ Student #1*

- *I already plan on taking all the science classes that I can and also taking them in college. ~ Student #6*

- *I guess I will have to take more science classes in high school like chemistry and biology and physics. But in college, if I end up being a veterinarian, I'll take classes that deal with animals. ~ Student #10*

Four of the interviewees expressed a desire to participate in STEM-related extracurricular activities, including advanced science programs like the Ag Discovery Camp. Although such extracurricular activities were not available in their high school curricula, those four participants wanted to study advanced science courses in non-formal camp settings. The following statements indicated the interviewed participants' intentions of seeking additional academic programs:

- *I decided that I wanted to participate in another science camp. So my mom and I signed me up for a camp at IU (Indiana University). There is a summer science program that I am going to take in biology. ~ Student #1*

- *I didn't think science was that exciting. But when I came to the Ag Discovery Camp it taught me that there is so much more than what I just saw on the surface. So I decided that I wanted to go to the Ag Discovery Camp again, but I wish that I could go to the high school camp. ~ Student # 10*

- *I plan on doing more stuff (attending extracurricular activities) like the Ag Discovery Camp. Maybe ones that looks into being a doctor, because I want to be a doctor. ~ Student #7*

- *I was excited about last year's camp. I knew that I wanted to go again to learn more so I signed up for it again this year (in reference to the Ag Discovery Camp). ~ Student #9*

2. Summary of Findings of Research Question #3

The participants of the Ag Discovery Camp understood the importance of enrolling in advanced science courses and extracurricular activities. Many attributed their plans to participate in extracurricular science activities to the Ag Discovery Camp, however, none mentioned the Ag Discovery Camp in regards to taking advanced science courses in school. The participants' plans to take advanced science courses in school appeared to be already determined by their choice of careers.

D. Question Results: College Intentions

Research Question 4: *What are the college intentions of the participants immediately following and 12 months after the Ag Discovery Camp?*

Research question 4 was answered utilizing quantitative data regarding post-high school plans and intended college majors. The following section includes the results corresponding to research question 4.

1. Question #4: Results from Participant Questionnaires

To gain a greater understand of the post-high school plans of the participants, two sections of the Ag Discovery Camp Questionnaire and the 12-month follow-up questionnaire asked of their post-high school plans and of their intended college majors. Table 25 presents the results from the questionnaire immediately following camp and the one taken 12 months later regarding the ADC participants' post-high school intentions. Both questionnaires signified the respondents' high motivation to attend a four-year college/university. All 32 participants (100%) indicated 'likely' or 'very likely' on the after-camp questionnaire, and 95.8% (23 or 24) indicating in the same in the 12-month questionnaire. Also, most of the participants aspired to attend either professional or graduate school after high school/college, 84.4% so indicating in the after-camp questionnaire, and 74.0% in the 12-month questionnaire. Concerning attending a two-

year junior or community college, the likelihood of doing so dropped to 40.6% and 39.1% in the after-camp and 12-month questionnaires, respectively.

As to the other post-high school plan options listed on the questionnaires, participants chose 'enlist in the military' as the least popular, with only 2 of the after-camp questionnaire respondents and none of the 12-month questionnaire respondents marked this option as having any likelihood. Neither was "vocational/technical school' in the post-high school plans of the respondents to he after-camp and 12-months questionnaires, 13.0% and 22.7%, respectively. The 'get a full-time job' options showed a change between the after-camp and 12-month questionnaires. While 60.6% of the after-camp questionnaire respondent indicated that option as 'likely' or 'very likely,' only 47.8% of the 12-month questionnaire respondents indicated the same. This difference was perhaps caused, in part, by a wording change on the 12-month questionnaire to 'get a full-time job *immediately* out of high school,' which was made to clarify intention of the questions.

Table 25

Post High School Plans of the Participants

	Immediately Following		**12-Months Following**	
	Very Unlikely/ Unlikely	**Likely/ Very Likely**	**Very Unlikely/ Unlikely**	**Likely/ Very Likely**
Post High School Plans	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Get a full-time job	6 (19.4%)	25 (60.6%)	12 (52.2%)	11 (47.8%)
Enlist in the military	30 (93.8%)	2 (6.3%)	23 (100%)	0 (0.0%)
Vocational/Technical school	27 (87.0%)	4 (13.0%)	17 (77.3%)	5 (22.7%)
Attend 2-year college	19 (59.4%)	13 (40.6%)	14 (60.9%)	9 (39.1%)
Attend 4-year college or university	0 (0.0%)	32 (100%)	1 (4.2%)	23 (95.8%)
Attend graduate or professional school	5 (15.6%)	27 (84.4%)	6 (26.0%)	17 (74.0%)

Note. Frequency and percentages were calculated on a 4-point scale (1 = Very Unlikely, 2 = Unlikely, 3 = Likely, and 4 = Very Likely).

Participants' were asked their intended majors in college, both after the ADC and 12 months following the camp (Table 26). On the after-camp questionnaire, the largest percentage (37.5%) marked 'human medicine' as their desired major. This dropped to 20.8% in the 12-month questionnaire. None or only one respondent identified agriculture, education, sciences, and veterinary medicine as an intended major on either questionnaire, whereas two to four indicated arts/humanities/social sciences, engineering/technology, and business. The 'other' category, which had seven and nine respondents, respectively, in the two questionnaires included: pilot, entrepreneur, psychology, lawyer, physical education, pediatrician, forensic sciences, law, and marine biology.

Table 26

Intended College Majors of Participants

	Immediately Following	**12-Months Following**
Major	**Frequency (%)**	**Frequency (%)**
Agriculture	1 (3.1%)	0 (0.0%)
Education	0 (0.0%)	1 (4.2%)
Arts, Humanities, & Social Sciences	2 (6.3%)	4 (16.7%)
Engineering and Technology	4 (12.5%)	1 (4.2%)
Sciences	0 (0.0%)	1 (4.2%)
Business	2 (6.3%)	3 (12.5%)
Veterinary Medicine	1 (3.1%)	0 (0.0%)
Human Medicine	12 (37.5%)	5 (20.8%)
Other	7 (21.9%)	9 (37.5%)

2. Summary of Findings of Research Question #4

Participants of the Ag Discovery Camp had aspirations of attending college and attaining employment. The majority of the participants planned on attending a 4-year college or university, while over half of the participants aspired to attend graduate or

professional school. When asked of their intended college majors, the participants of the ADC showed greater interests in the field of human medicine while showing little or no interest in the field of agriculture at both immediately following and 12-months following the ADC. Other areas of interests included engineering and technology and the category of other, which included law, being a pilot, and being a pediatrician, which falls into human medicine. The participants tended to fall into categories, which corresponded with high paying careers.

An additional finding that should be noted is the shift in career intentions of the participants from the two time periods immediately following the ADC and 12 months after the ADC. Participants intended college majors moved from STEM-related careers to the topic of other, education, and to the social sciences. This could be attributed to the participants being more knowledgeable to the requirements for careers in STEM.

E. Question Results: Career Intentions

Research Question 5: *What were the career intentions of the participants immediately following and 12 months after the Ag Discovery Camp?*

Research question 5 was answered utilizing both the quantitative data from the Ag Discovery Camp Questionnaire and the 12-month follow questionnaire regarding careers interests/intentions. This data was corroborated with supportive quotes from 12-month follow-up interviews regarding career intentions. In addition to the participant data, supportive data and quotes from the 12-month follow-up parent questionnaire were added to strengthen the data. The following sections are the results corresponding the research question #5

1. Question #5: Results from Participant Questionnaires

Participants were asked of their career intentions in regards to agricultural and science careers immediately following the Ag Discovery Camp. Findings of career

intentions are presented in two different career intention domains for each workshop (Table 27). Overall participants did not have career intentions in agricultural ($\mu = 2.09$; $\sigma = 0.77$; $N = 33$), however, they did have intentions to pursue careers in science ($\mu = 2.98$; $\sigma = 0.76$; $N = 33$). Specifically, participants in the Engineering Science Workshop ($\mu = 2.86$; $\sigma = 0.59$; $n = 5$), Food Science Workshop ($\mu = 3.26$; $\sigma = 0.28$; $n = 7$), Entomology Workshop ($\mu = 3.50$; $\sigma = 0.46$; $n = 5$), and Mission to Mars Workshop ($\mu = 3.26$; $\sigma = 0.82$; $n = 7$) agreed to having science career intentions immediately following the Ag Discovery Camp.

Table 27

Career Intentions of the Participants Immediately Following the Ag Discovery Camp

	Ag Career Intention	Science Career Intention
Workshop	Mean (SD) *n*	Mean (SD) *n*
Engineering	1.60 (0.84) *n* = 5	**2.86** (0.59) *n* = 5
Food Science	2.40 (0.62) *n* = 7	**3.26** (0.28) *n* = 7
Plant Science	2.00 (0.70) *n* = 9	2.34 (0.86) *n* = 9
Entomology	2.25 (0.94) *n* = 5	**3.50** (0.46) *n* = 5
Mission to Mars	2.14 (0.82) *n* = 7	**3.26** (0.82) *n* = 7
Grand Mean	2.09 (0.77) *N* = 33	**2.98** (0.76) *N* = 33

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

Twelve months following the Ag Discovery Camp, participants were asked of their career intentions in agriculture and science (Table 28). Overall, participants were did not plan to pursue careers in agriculture ($\mu = 2.03$; $\sigma = 0.74$; $N = 22$), however, they did plan to pursue science careers ($\mu = 3.13$; $\sigma = 0.75$; $N = 22$). Specifically, participants in the Engineering Science Workshop ($\mu = 3.61$; $\sigma = 0.42$; $n = 3$), Food Science Workshop ($\mu = 3.19$; $\sigma = 0.75$; $n = 7$), and Entomology Workshop ($\mu = 3.39$; $\sigma = 0.59$; $N = 5$) agreed to having career intentions in science. Participants of the Plant Science Workshop ($\mu = 2.83$; $\sigma = 1.07$; $n = 6$) and Mission to Mars ($\mu = 2.88$; $\sigma = 0.19$; $n = 3$) also agreed to having intentions of careers in science. Regardless of the workshop they participated in, none of science workshop groups planned to pursue careers in agriculture one year after the ADC.

Table 28

Career Intentions of the Participants 12-Months Following the Ag Discovery Camp

	Ag Career Intention	Science Career Intention
Workshop	Mean (SD) *n*	Mean (SD) *n*
Engineering	2.25 (0.90) *n* = 3	**3.61** (0.42) *n* = 3
Food Science	2.32 (0.53) *n* = 7	**3.19** (0.75) *n* = 7
Plant Science	1.63 (0.80) *n* = 6	**2.83** (1.07) *n* = 6
Entomology	1.92 (0.76) *n* = 3	**3.39** (0.59) *n* = 5
Mission to Mars	2.08 (1.01) *n* = 3	**2.88** (0.19) *n* = 3
Grand Mean	2.03 (0.74) *N* = 22	**3.13** (0.75) *N* = 22

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

During the 12-month follow-up participants of the Ag Discovery Camp were asked to think back retrospectively about their career intentions prior to the camp. Findings of career intentions prior to the Ag Discovery Camp are presented in two different career intention domains for each workshop (Table 29). Overall, participants did not have agricultural career intentions ($\mu = 1.67$; $\sigma = 0.70$; $N = 22$). However, they had intentions of careers in science ($\mu = 2.80$; $\sigma = 0.81$; $N = 22$). Specifically, participants in the Engineering Science Workshop ($\mu = 3.44$; $\sigma = 0.48$; $n = 3$), Food Science Workshop ($\mu = 2.88$; $\sigma = 0.66$; $n = 7$), and Plant Science Workshop ($\mu = 2.75$; $\sigma = 1.00$; $n = 6$) agreed to having science career intentions. Regardless of which science workshop they participated in, none of the groups of students planned to pursue a career in agriculture prior to the ADC.

Table 29

Career Intention of the Participants Prior to the Ag Discovery Camp

Workshop	Ag Career Intention	Science Career Intention
	Mean (SD) *n*	Mean (SD) *n*
Engineering	1.39 (0.35) *n* = 3	**3.44** (0.48) *n* = 3
Food Science	2.03 (0.82) *n* = 7	**2.88** (0.66) *n* = 7
Plant Science	1.50 (0.57) *n* = 6	**2.75** (1.00) *n* = 6
Entomology	1.42 (0.38) *n* = 3	2.44 (0.75) *n* = 3
Mission to Mars	1.67 (1.15) *n* = 3	2.39 (1.06) *n* = 3
Grand Mean	1.67 (0.70) *N* = 22	**2.80** (0.81) *N* = 22

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). **Bold face** items represent positive outcomes (mean $\geq$ 2.5). Standard deviations are in parentheses following means and *N* = sample size.

The grand means of the participants' career interest from the retrospective questionnaire, the post-camp questionnaire, and the year later questionnaire were compared (Table 30). Findings showed an increase in interest in agricultural careers from the retrospective questionnaire to the post-camp questionnaire ($d = 0.57$, moderate effect size) and an increase in interest in science careers from the retrospective questionnaire to the post-camp questionnaire ($d = 0.25$, small effect size). In addition there was a decrease in interest in agricultural careers from the post-camp questionnaire to the 12-month follow-up questionnaire ($d = 0.08$, trivial effect size). However, there was an increase in interests in science careers from the post-camp to the 12-month follow-up questionnaires ($d = 0.20$, small effect size).

Table 30

Comparison of Grand Means of Participants Career Interests

	Agricultural Career Interest	**Science Career Interest**
Retrospective (I^R)	1.67 (0.70) $N = 22$	2.79 (0.81) $N = 22$
Effect Size ($I-I^R/SD_{weighted}$)	$d = 0.57$ Moderate	$d = 0.25$ Small
Post-questionnaire 1 (I)	2.09 (0.77) N = 33	2.99 (0.77) N = 33
Effect Size ($I^F-I/SD_{weighted}$)	$d = 0.08$ Trivial	$d = 0.20$ Small
Post-questionnaire 2 (I^F)	2.03 (0.74) $N = 22$	3.14 (0.75) $N = 22$

Note. Means were calculated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree). Bold face items represent positive outcomes (mean ≥ 2.5). Standard deviations are in parentheses following means and N = sample size.

2. Question #5: Results from Participant Interviews

To gain a greater understanding of the ADC participants' career intentions, open-ended questions were posed to the 22 who completed the 12-month follow-up questionnaire and the 10 selected for the 12-month follow-up interviews. Their responses were consistent what they indicated in the questionnaire, again many affirming their interest in the field of human medicine. Here is a sampling of replies to the open-ended questions (kept anonymous due to the web-based collection of Qualtrics®).

- *The Ag Discovery Camp got me thinking if I was sure about my plans for the future. I have always wanted to be a doctor, but now agriculture seems like a promising field.*

- *I currently plan to pursue a career in medicine. I am still exploring careers. The Ag Discovery Camp opened my eyes to new career options. I plan to look further into careers dealing with nutrition.*

- *Currently I want to do something in the health sciences. I really want to be a neonatal nurse.*

- *I want to work with sick babies and children. What is that called a pediatrician? You know a children's doctor.*

- *It pushed me more (in response to the Ag Discovery Camp) to the Health Science/Medical field, so it helped me really know what I want to do with my future. It however opened more doors for me as far as if I wanted to find another career.*

In addition to the open-ended questions presented to the participants in the 12-month follow-up questionnaire, questions were asked to the 10 interviewees regarding their career plans in the 12-month follow-up interviews. One of the questions asked in the 12-month interview was whether any of the 10 interviewees would consider a career in agriculture. Five of the participants indicated they now would, as a result of participating in the Ag Discovery Camp, but only if their first choice of career did not work for them. In response to the question, "Would you consider a career in the agricultural sciences?" were these comments:

- *Yes, because at the Ag Discovery Camp I learned there are a variety of things to do in agriculture. ~Student #4*

- *I would consider it, but it isn't the career that I want to go in. The camp did make me aware of things that I can do (in agriculture). ~ Student #1*

- *Yes, maybe as a veterinarian. I have always considered that as a career option. Is that in agriculture? ~Student #5*

- *Yes, I would (consider a career in agriculture). It seems like there are plenty of options to choose from. The Ag Discovery Camp changed my opinion drastically. Before the camp I thought agriculture was all about farming but now I could see there is a lot more to agriculture than farming. They have food, plant and even engineering courses. ~ Student #6*

- *I would consider it more than I did before (the Ag Discovery Camp) because I am more familiar with more fields of agriculture. But I am more interested in a career in engineering and mathematics, because I think I would be a lot better at math. ~ Student #2*

Results revealed that the participants continued to have interests in jobs in medicine, engineering, and law. However, after the Ag Discovery Camp, the participants were more aware of careers in agriculture. Many of the participants stated that they would consider a career in agriculture although they still intended to pursue their original career plans.

3. Question #5: Results from Parent Questionnaire

Parents of the participants were also asked to respond to questions regarding their children's college and career plans 12 months after the ADC (Table 31). All four parents who responded to the questionnaire agreed that, because of the Ag Discovery Camp, their children had become more motivated to get a college education, would be more successful in college, and were not better able to make informed career decisions. Also, three of the four felt it 'likely' or 'very likely' their children would pursue a science-related career.

Table 31

Parent Responses to College and Career Intentions

Question	Very Unlikely Unlikely	Likely Very Likely
By attending the Ag Discovery Camp, your child has increased their desire to pursue a college education	0 (0.0%)	4 (100.0%)
By participating in the Ag Discovery Camp, your child will be more successful in college	0 (0.0%)	4 (100.0%)
Participating in the Ag Discovery Camp will help your child make a more informed career decision	0 (0.0%)	4 (100.0%)
Your child's career aspirations are in an area involving science	1 (25.0%)	3 (75.0%)

The 12-month follow-up parents' questionnaire also provided opportunity to respond to open-ended questions regarding their children's college and career intentions. The following are a couple responses from the parents:

- *I feel that this camp has influenced my child to go into a science career. It would be nice, however, to have them shadow someone in the field of science and/or agriculture so they can see the true benefits. ~Mother #1*
- *She changes her mind about what field she wishes to go into. But her eyes were opened when she attended the Ag Discovery Camp to a lot more options. ~Father #2*

Although the participants continued to have higher interest in science careers over agricultural careers, the results showed that the participants were not interested in agricultural careers. However, several participants mentioned they would consider agriculture as a career, if their original career plans did not work. This consideration of agricultural careers could be attributed to increased awareness of possible careers in agriculture

4. Summary of Finding of Research Question #5

Participants of the ADC had high intentions to enter science-related careers, but they did not plan to pursue careers in agriculture when as across three points in time (retrospectively prior to the camp, immediately following, and 12 months post camp). The overall means of the participants' intentions to enter a career in science slightly increased at each interval, with the highest intentions of pursuing a career in science being 12 months following the Ag Discovery Camp.

Though the participants of the Ag Discovery Camp did not plan to pursuea career in agriculture, they did say they would consider a career in agriculture if their existing career plan did not work out. The exposure of agricultural sciences could be attributed to the consideration of agricultural careers due to ADC.

Parents felt that the camp influenced their children to go into a science career and that the Ag Discovery Camp helped their children make informed career decisions. One of the parents stated that the Ag Discovery Camp opened their child's eyes to career options. In summary, the participants of the Agricultural Discovery Camp had intentions of entering careers in science rather than careers in agriculture; however, their exposure to agriculture may lead to their consideration of careers in the field of agriculture if they change their existing career plans.

E. Question Results: Leadership Skills/Self-Efficacy

Research Question 6: *Was the development of leadership skills positively related to higher perceived science self-efficacy of the Ag Discovery Camp participants?*

Research question 6 was answered utilizing quantitative data from the Ag Discovery Camp. Correlations were run between leadership skills and perceived science self-efficacy. The follow sections include the results corresponding to research question 6.

1. Question 6: Results of Leadership Skills/Self-Efficacy Relationship

A Pearson's Product Moment correlation (*r*) was used to determine whether a positive linear relationship existed between perceived leadership and social skills presented at the Ag Discovery Camp and the perceived science self-efficacy of the participants ($\mu = 3.20$; $\sigma = 0.36$). Correlations were run on two factors of leadership that were assessed using Hansen and Larson's (2005) Youth Experience Survey (YES 2.0) – perception of developed interpersonal skills and perceptions of developed teamwork and social skills (Table 32).

For the teamwork and social skills factor, there was a negative moderate relationship ($r = -0.35$, $r^2 = 0.12$, medium effect size), while for interpersonal skills there was a positive trivial relationship ($r = 0.04$, $r^2 < 0.01$, trivial effect size). These coefficients showed that the camp's leadership development activities, specifically the teamwork and social skills-related ones, had a negative moderate relationship to the participants' perceived science self-efficacy, thus did not support the researcher's predicted relationship. The negative correlation showed that as self-efficacy increased, the perception of the participants' development of teamwork and social skills decreased.

Table 32

Correlation Between Science Self-Efficacy and Leadership Skills

		Interpersonal Skill	**Team & Social Skills**
Self-Efficacy	*r*	.04	-.35
	r^2	< .01 Trivial effect size	.12 Medium effect size
	N	31	31

2. Reported Benefits of the Leadership Skills Training Received

Although the perceptions of the participants' development of interpersonal skills and teamwork and social skills presented at the Ag Discovery Camp was not related to

perceived self-efficacy (*discussed above*) or their interest in agricultural science (*discussed in Section H below*), the participants expressed they valued the training. Both the 12-month follow-up questionnaire ($N = 24$) and personal interviews ($N = 10$) asked how the leadership skills training received at camp was utilized throughout the next school year. The responses focused on two areas that were deemed especially beneficial, working with others and developing their communication abilities. The following statements are representative of the respondents' experiences in ***working with others*** in both the classroom and extracurricular activities. (Note: Statements kept anonymous due to Qualtrics® web-based collection method.)

- *The leadership skills that were presented at the Ag Discovery Camp changed how I work with others in the classroom. I learned to listen more to the ideas of others. I learned to respect the viewpoints of others and not want everything to go in my direction.*

- *I worked better with them (classmates) because we were taught, at the camp, that people learn at different levels; henceforth, I was able to understand their learning patterns and how they understood things differently and sometimes better. I got less aggravated when they didn't understand something I did and it eventually helped me socially in my life at school.*

- *I learned to work with others in the classroom because we learned how we should engage with others.*

- *The leadership skills changed the way I worked with others in the classroom. It taught me how to respect others opinions in a way that I haven't been introduced to me before.*

- *I ran track this year and you have to be a leader. I earned the team spirit stick and had to lead my teammates. But you have to do it in a way that is not bossy. You have to do it in a nice way, which I had never used to do.*

- *I used my leadership skills that I learned at the camp and joined student council at my school. I got elected.*

- *I had to use my leadership skills in cheerleading because we had a competition and we had to make a good half-time cheer. None of the girls were paying attention so I had to get their attention without being bossy. With the skills that I learned I think I helped get things done and learn the cheer and dance. I learned how to control them without being crazy and controlling!*

- *I am in band, and there are some things that are voluntary, like we could play at graduation, I took the initiative to do the extra things for my school.*

The respondents felt that the camp's leadership skills training also increased their abilities to communicatwith others, not only their willingness and ability to speak up and ask questions, but also the ability to listen, as the following statements illustrate. (Note: Statements kept anonymous due to Qualtrics® web-based collection method.)

- *The skills taught during the program helped me to communicate more with my peers in groups instead of staying to myself. It helped me to ask more questions in the classroom, which has helped me in answering more questions in the right way.*
- *It helped me communicate better.*
- *It helped me take charge in anything I am given to do in a group activity. I also can talk and interact with people more.*
- *I also listen with intent to what is being said and I feel that engage more in conversations.*

3. Summary of Finding of Research Question #6

The findings corresponding with research question 6 found that there was a positive trivial correlation between self-efficacy and the perception of the development interpersonal skills. Self-efficacy and the perception of the development of team and social skills had negative correlation with a medium effect size. This finding went against the assumption of the researcher that presenting youth a precollege workshop, which combined agricultural science and leadership would increase science self-efficacy.

Qualitative findings found that though self-efficacy did not increase with the addition of leadership skills, the leadership skills presented at the Ag Discovery Camp were found valuable to the participants in their school and extracurricular activities 12-months following the camp. The perceived value of leadership and social skills 12-months following the camp could be attributed to the participants having opportunities to apply what they had learned in the ADC in their school activities throughout the

following year. In summary, though not valued immediately following the Ag Discovery Camp, leardership and social skills were valued a year following the camp through the application of the skills presented at the ADC in the participants school and extracurricular activities.

F. Question Results: Leadership Skills/Science Interest

Research Question 7: *Was the development of leadership skills positively related to the science interests of the Ag Discovery Camp participants?*

Research question 7 was answered utilizing quantitative data from the Ag Discovery Camp Questionnaire. Correlations were run to determine whether leadership skills were positively related to interest in career activities in agricultural science. The following sections are the results corresponding to research question 7.

1. Question #7: Results of Leadership Skills/Science Interest Relationship

Pearson's Product Moment Correlations (*r*) were computed to correlate the linear relationships between the ADC participants' interest in career activities in agricultural sciences and their perceived development of leadership and social skills. Activities in four agricultural science-related areas: production agriculture, plant sciences, food science and nutrition, and engineering and science, were used to determine the relationships between agricultural career activities and two leadership skills factors, the perception of developed interpersonal skills and perception of developed team and social skills. Results of the correlations run to determine the relationship between the ADC participants' perceived developed interpersonal skills and perceived developed team and social skills and their interest in career activities in production agriculture ($\mu = 2.22$; $\sigma = 0.68$), plant sciences ($\mu = 2.02$; $\sigma = 0.90$), food science and nutrition ($\mu = 2.27$; $\sigma = 0.80$), and engineering and science ($\mu = 2.51$; $\sigma = 0.71$) are reported in Tables 33 through 36.

Perceptions of developed interpersonal skills had a negative trivial relationship to interest in career activities in production agriculture ($r = -0.07$), but it was not practically

significant (r^2 = 0.01, small effect size; Table 32); and the perception of developed team and social skills had a positive trivial relationship (r = 0.05), but was not practically significant (r^2 < 0.01, trivial effect size). The participants' perceptions of developed interpersonal skills had a negative low relationship to interest in plant science career activities (r = -0.12), but it was not practically significant (r^2 = 0.04, small effect size; Table 33); and the development of perceived team and social skills had a positive low relationship (r = 0.26), but was not practically significant (r^2 = 0.07, small effect size). Perceptions of developed interpersonal skills had a negative low relationship to interest in food science and nutrition (r = -0.29), but was not practically significant (r^2 = 0.08, small effect size; Table 34); and the perception of developed team and social skills had a negative trivial relationship (r = -0.08), but again, it was not practically significant (r^2 = 0.01, small effect size). Table 35 shows that the perception of developed interpersonal skills had a trivial positive relationship to interest in engineering and science (r = 0.07), but it was not practically significant (r^2 < 0.01, trivial effect size); and the perception of developed team and social skills had a trivial positive relationship (r = 0.05), but again, it was not practically significant (r^2 = 0.05, small effect size).

Table 33

Correlation Between Production Agriculture Activities and Leadership Skills

		Interpersonal Skill	**Team & Social Skills**
Production Ag Activities	*r*	-.07	.05
	r^2	.01 Small effect size	< .01 Trivial effect size
	N	31	31

Table 34

Correlation Between Plant Science Activities and Leadership Skills

		Interpersonal Skill	Team & Social Skills
Plant Science Activities	*r*	-.12	.26
	r^2	.04	.07
		Small effect size	Small effect size
	N	31	31

Table 35

Correlation Between Food Science Activities and Leadership Skill.

		Interpersonal Skill	Team & Social Skills
Food Science Activities	*r*	-.29	-.08
	r^2	.08	.01
		Small effect size	Small effect size
	N	31	31

Table 36

Correlation Between Engineering and Science Activities and Leadership Skills

		Interpersonal Skill	Team & Social Skills
Eng. & Science Activities	*r*	.07	.22
	r^2	< .01	.05
		Trivial Effect Size	Small Effect Size
	N	31	31

2. Reported Benefits of the Leadership Skills Training Received

See discussion and participant responses concerning this topic in Section F.2 above.

3. Summary of Finding of Research Question #7

The correlations found that the leadership skills presented at the Ag Discovery Camp had were not related to increasing the participants' interest in agricultural science activities. As answered by the results of research question 1, the participants had low interests in agricultural activities. Therefore, it was unlikely that there would be a positive correlation between leadership skills and interest in agricultural science career activities. As discussed previously, the leadership skills presented at the ADC were valued by the participants and utilized in their academic and extracurricular activities.

G. Question Results: Negative Experiences/Self-Efficacy

Research Question 8: *Were there any negative experiences (e.g., social exclusion, negative group dynamics) related to perceived science self-efficacy?*

Research question 8 was answered utilizing both quantitative and qualitative data from the Ag Discovery Camp Experience Questionnaire and the 12-month follow-up interviews. The following sections are the results corresponding with research question 8.

1. Question #8: Results of Negative Experiences/Self-Efficacy Relationship

A Pearson's Product Moment correlation coeffient (r) was used to determine whether there was a negative linear relationship between the perception of negative experiences (being discriminated against, being left out, feeling of not belonging at the ADC) while at the Ag Discovery Camp ($\mu = 2.09$; $\sigma = 0.76$) and the participants'

perceived science self-efficacy ($\mu = 3.30$; $\sigma = 0.36$). A negative low relationship was identified ($r = -0.27$), but was not practically significant ($r^2 = 0.07$; small effect size; Table 37).

Table 37

Correlation Between Self-Efficacy and Negative Experiences

		Negative Experiences
Self-Efficacy	*r*	-.27
	r^2	.07 Small Effect Size
	N	31

2. Presence/Absence of Negative Experiences During Camp

Negative experiences are important to understand because they can interfere with positive youth engagement. A youth who is upset, distressed, or angered by an event in a program is less likely to be psychologically engaged and devote attention to learning (Dworkin & Larson, 2006). Negative experiences can also lead a youth to drop out of organized activities and totally disengage from learning. The Ag Discovery Experience Questionnaire (adapted from Hansen and Larson's YES 2.0 Survey) measured the frequency of any negative experiences that could have occurred during the weeklong Ag Discovery Camp.

a. Post-ADC Questionnaire Results: Perceived Negative Experiences

Results from the Ag Discovery Experience Questionnaire, which reports the participants' frequency-of-occurrence responses (i.e., 'Not at all,' 'A little,' 'Quite a bit,' 'Yes, definitely') regarding five potential negative experiences they could have had at the

camp (Table 38). 'Not at all' was the response of 22 (71%) of the participants when asked if they felt like they didn't belong at the camp. Twenty-four (77.4%) of the participants responded 'Not at all' when asked if they felt left out, while 16 (53.4%) of the participants responded 'Not at all' when they asked if they felt they were being 'stuck' doing all the work. 'Yes definitely' was the response of 16 (51.6%) of the participants when asked if they felt discriminated against due to gender, race, ethnicity, disability, or sexual orientation, while 13 (41.9%) of the participants responded 'Yes, definitely' when asked if there were cliques in any of the activities in which they were involved.

Table 38

Negative Experiences of Ag Discovery Camp Participants

Negative Experiences	**Not at all**	**A little**	**Quite a bit**	**Yes, Definitely**
I felt like I didn't belong in this activity.	22 (71.0%)	5 (16.0%)	2 (6.5%)	2 (6.5%)
I felt left out.	24 (77.4%)	3 (9.6%)	2 (6.5%)	2 (6.5%)
There were cliques in this activity.	6 (19.4%)	8 (25.8%)	4 (12.9%)	13 (41.9%)
I get stuck doing more than my fair share.	16 (53.4%)	6 (20.0%)	4 (13.3%)	4 (13.3%)
I was discriminated against because of my gender, race, ethnicity, disability, or sexual orientation.	9 (29.0%)	2 (.5%)	4 (12.9%)	16 (51.6%)

b. 12-Month Follow-Up Interviews Results: Perceived Negative Experiences

Of the 10 students who participated in the 12-month follow-up interviews, none gave indication of any negative aspects of their Ag Discovery Camp experience. This leads the researcher to believe that the negative comments expressed in the post-camp questionnaire had perhaps been experienced during the 4-H Science Workshops for Youth portion of the camp, in which the 33 ADC students were integrated with over 400 predominantly Caucasian youth. Moreover, the ADC students were given fluorescent yellow shirts to wear, and the student in the 4-H Science Workshops were not wearing these shirts. Because of the heightened sensitivity at the time of the camp, students likely expressed they felt singled out because of their race, but it did not appear to have etched their long-term memory of the event.

The following statements from the 12-month interviews expressed general satisfaction with the Ag Discovery Camp.

- *I don't know of anything that I disliked about the camp. ~ Student #1*
- *Nothing (in regards to things she didn't like), everything was okay. I can't think of anything. ~ Student #3*
- *I liked it all. I didn't like all the walking; things are far on a college campus. ~ Student #2*
- *I can't think of anything, it was all fun to me. ~ Student #5*
- *No, I can't think of anything that I didn't like. I liked it all ~ Student #6*
- *Nothing really, it was all good ~ Student #8*

3. Summary of Findings of Research Question #8

Data showed that over half of the participants of the Ag Discovery Camp felt discriminated against when presented the Ag Discovery Camp Experiences Questionnaire immediately following the camp. However, when asked if they felt discriminated against in the 12-month follow-up interview, the participants stated that they didn't feel

discriminated against. Negative experiences that occurred may have resulted during the integration of the participants with the 430 youth who participated in the 4-H Science Workshops, which may have been the reason why some of the students reported they felt discriminated against. This however, does not correspond with the qualitative data, which reported that the participants did not feel discriminated against, which likely explains that the participants felt awkward at the camp, but did not have a lasting memory when they were asked about the camp one-year after the event.

H. Question Results: Negative Experiences/Science Interest

Research Question 9: *Were there any negative experiences (e.g., social exclusion, negative group dynamics) related to the science interests of the ADC participants?*

Research question 9 was answered utilizing quantitative data from both the Ag Discovery Camp Experience Questionnaire and the Ag Discovery Camp Questionnaire. The follow sections are the results corresponding to question 9.

1. Question #9: Results from Negative Experiences/Science Interests Relationship

Pearson's Product Moment correlation coefficients (*r*) were also computed to determine whether there were negative linear relationships between any negative experiences at Ag Discovery Camp ($\mu = 2.09$; $\sigma = 0.76$) and the participants' interest in the agricultural sciences. The four agricultural science career-related activities—production agriculture, plant sciences, food science and nutrition, and engineering and science—were used to determine the relationships between perceived negative experiences and interest in agricultural science career activities. Results of the correlations run to determine the relationship between the ADC participants' negative experiences and their interest in the camp activities in production agriculture ($\mu = 2.22$; $\sigma = 0.68$), plant sciences ($\mu = 2.03$; $\sigma = 0.90$), food science and nutrition ($\mu = 2.27$; $\sigma =$

0.80), and engineering and science ($\mu = 2.51$; $\sigma = 0.71$) are presented in Tables 39 through 42.

Perceived negative experiences had positive relationships to interest in each of the four agricultural science-related career activities, but were not practically significant (Tables 38 through 41). Results showed, production agriculture had a positive low relationship ($r = 0.17$, $r^2 = 0.03$, small effect size), plant sciences had a positive low relationship ($r = 0.22$, $r^2 = 0.05$, small effect size), food science and nutrition had a positive low relationship ($r = 0.19$, $r^2 = 0.04$, small effect size), and engineering and science positive low relationship ($r = 0.28$, $r^2 = 0.03$, small effect size). In summary, negative experiences were not related to the ADC participants' interests in agricultural science career activities.

Table 39

Correlation Between Production Agriculture and Negative Experiences

		Negative Experiences
Interests	*r*	.17
	r^2	.03 Small Effect Size
	N	31

Table 40

Correlation Between Plant Sciences and Negative Experiences

		Negative Experiences
Interests	*r*	.22
	r^2	.05 Small Effect Size
	N	31

Table 41

Correlation Between Food Sciences and Negative Experiences

		Negative Experiences
Interests	*r*	.19
	r^2	.04 Small Effect Size
	N	31

Table 42

Correlation Between Engineering and Science Activities and Negative Experiences

		Negative Experiences
Interests	*r*	.28
	r^2	.08 Small Effect Size
	N	31

V. STUDY CONCLUSIONS, IMPLICATIONS, RECOMMENDATION, AND CONTRIBUTIONS

The purpose of this study was to explore and describe the outcomes of a precollege agricultural life science program, known as the Ag Discovery Camp, on minority youth's interest in career activities, science self-efficacy, career awareness, and application of leadership development. Following are the conclusions, implications, and recommendations of the study, as well as the study's contributions to the body of knowledge.

A. Conclusions and Discussions

1. Conclusion Results: Participant Academic Interests

The Ag Discovery Camp participants, being urban minority students, showed little interest in the agricultural science career activities upon completion of the camp; however, their involvement in the camp provided them with opportunities to become more aware of and informed about the agricultural sciences as potential college study options and career areas.

Participants were not interested in agricultural science-related career activities immediately following or one year after the camp experience. This conclusion supported Gibson and Chase's (2002) findings that increasing student interest in science from an informal science-based experience (e.g., Ag Discover Camp) and through follow-up is difficult and may be an unrealistic goal. They suggested that attitudes and interests

towards science are developed early in a child's education and are hard to change once that child reaches middle school (Gibson & Chase, 2002).

It is likely that the ADC participants' low interest in agriculture can be attributed to their preconceived ideas about agriculture being closely associated with farming. For example, participants were not interested in agricultural production and plant science career activities, whereas they were interested in engineering and science career activities. Jones (1997) stated that African-American students had impressions that a career in agriculture meant going 'back to the fields.' These preconceived ideas and impressions about agriculture lead to the perception that agriculture is nothing more than farming, which ignores the tremendously productive science research and other technical opportunities available in this rapidly changing arena (L. S. Jones, 1997). Leising found that students, in general, perceived agricultural careers as being underpaid, of low prestige, and male-oriented while also perceiving agricultural careers as boring and laborious work, which involves more muscle than brain (Leising, 1991). Such a stereotypical view has the ability to shape youth's interests. Moreover, Holz-Clause and Jost found that urban youth had little interest in agricultural careers, largely because they thought agriculture was farming rather than it being a broader-based industry (Holz-Clause, & Jost, 1995).

Though the data from this study showed low interests in agricultural science activities, students who participated in the Ag Discovery Camp continued to explore activities and topics that were presented during the camp. In the study's 12-month follow-up interviews, some of the participants said they continued to learn about and explore the hands-on topics they were exposed to at camp. Also, in the 12-month follow-up parent questionnaire, half of the parents had observed an increase in their children's interest in agricultural science and science activities, in general. Again, these results supported another of Gibson and Chase's findings that, when science is taught using a hands-on approach, students remain interested in science. They then suggested that the pedagogical approach utilizing hands-on learning is what makes science not only enjoyable, but also interesting for students. This conclusion further supports studies by Markowitz and Knox, both of which found that student's exposure to advanced science

techniques and interaction with professional scientists provides a very positive hands-on experience, which can be a key motivating factor in their attitudes towards science (Markowitz, 2004; Knox, Moynihan, & Markowitz, 2003). In addition, Jones found that, by inviting URM students to a college/university for casual but deliberate exposure to agricultural science, it is possible to challenge their existing notions and change their perceptions about the field (L. S. Jones, 1997).

The intention of the Ag Discovery Camp was to expose the urban students to various scientific aspects of the field of agriculture to broaden their perceptions of agriculture and to expose the youth to the scientific side of agriculture. The intention of precollege programs is to improve the learning opportunities for high school students, to interest them in careers and majors, and inspire them to explore job opportunities. Though the students continued to have low interest in agriculture as a career, the Ag Discovery Camp seemed to have broadened their view about agriculture as a career option by making them more aware about the diverse possibilities of careers available in agriculture. The participants of the camp stated that they were still committed to their initial choice of career, however, they would consider agriculture as an option for a career by chance their career of choice does not work out. This finding supports Adams statement that to develop career aspirations, that one needs to have some understanding of occupational information, because it fosters broad career possibilities and opportunities (Adams, 1997).

In summary, although the questionnaire data showed the ADC students had a low interest in agricultural science activities presented at the camp, their awareness of agriculture had, nonetheless, been stimulated by those activities as evidenced by continuing to pursue them plus related new interests. In their Social Cognitive Career Theory (SCCT), Lent, Brown, and Hackett contended that awareness and exploration can develop interest, stating:

> *Over the course of childhood and adolescence, people's environments expose them to a wide array of potential career relevance. They also observe or hear about others performing various occupational tasks. Not only are they exposed (directly and vicariously) to diverse activities from among those that are possible and for achieving satisfactory performances in chosen activities. Through repeated activity engagement, modeling and feedback from important others, children and*

> *adolescents refine their skills, develop personal performance standards, form a sense of their efficacy in particular tasks, and acquire certain expectations about the outcomes of their performance. These perceptions of self-efficacy and outcome likelihood figure prominently in the formation of interest* (Lent et al., 1994, pg. 88).

The present study supports SCCT by exposing youth directly to career options in agriculture. Youth have the ability to explore possibilities and new careers through hands-on activities provided in precollege agricultural experiences like the Ag Discovery Camp. In addition, the Ag Discovery Camp gave the youth the opportunity to perform occupational tasks, in a controlled environment, allowing them to be exposed, directly and vicariously, to professionals in the field of agriculture. The value of early and extensive exposure to careers in science has well been documented as a way of influencing decisions that African-American students make about science professions, sufficient to cause some of them to pursue academic study and consider careers in these fields (L.S. Jones, 1997; Rowe, 1977).

2. Conclusion Results. Participant Science Self-Efficacy

The Ag Discovery Camp participants were self-efficacious to 'learn science,' and their self-efficacy had increased a year after their camp experience.

The study found a measureable change in the ADC participants' self-efficacy between the post-camp questionnaire and the 12-month follow-up questionnaire. This increase in self-efficacy could be linked to increased confidence to learn and understand science. However, a quasi-experimental design or grounded theory was not utilized to establish causality. For this study, self-confidence and self-efficacy were viewed as the same constructs of belief in one's capabilities to organize and execute the course of action required to produce given attainments. Self-confidence and self-efficacy were viewed as the same construct due to self-confidence being a term that the participants of the study understood. The collected data were corroborated utilizing the participants' answers to the open-ended questions about confidence to learn and understand science asked in the post-camp questionnaire, the 12-month follow-up questionnaire, and the 12-month follow-up interviews.

The increase in confidence reported by the participants supported Pintrich et al.'s (1993) assertion that science self-efficacy represents confidence that students can engage new ideas, evaluate them, and arrive at new conceptions. The participants stated that by taking initiative and overcoming fears, their ability to question increased their confidence in learning and understanding science. The ADC participants expressed their confidence to learn science, with many attributing the camp experience to this newfound confidence. Qualitative statements suggested that the confidence was gained through the activities performed at camp being presented in their science classes at school. Such statements support the notion that students had an authentic 'mastery experience,' which exerts the strongest influence on self-efficacy beliefs (Bandura, 1997). These past accomplishments can foster a strong sense of efficacy to succeed at similar tasks in the future, thus creating an increase in self-efficacy (Bandura, 1997). However, even though the positive results were consistent with the reactions and qualitative reports of the 12-month interviews, this conclusion should be interpreted with caution, due to the small sample size and unique nature of the sample.

The findings from the study also showed that being more self-efficacious about science may have assisted in the participants' interest to pursue further studies in science. Further studies in science included advanced science courses in high school and the intention of pursuing STEM-related studies in college. The participants stressed the importance of taking advanced STEM courses while in high school, specifically chemistry, biology and physics, with the knowledge that it would assist them with their college aspirations. The intentions of pursing more advanced studies in science in both high school and college can be attributed to the participants increase in science self-efficacy between the Ag Discovery Camp and the 12-month follow-up questionnaire. This finding supported Lent, Brown, & Hackett's (1994) Social Cognitive Career Theory, which states academic and career interests developed during the school years ideally become translated into career selections.

As stated previously, the participants' ability to overcome fears increased their ability to question science by seeking clarification, which in turn increased their understanding of science. In exercising the ability to question, they acquired a sense of personal agency,

recognizing that, as 'doers,' they can make things happen. Personal agency thus involves the ability to make choices and action plans, but also to shape appropriate courses of action and to motivate and regulate their execution (Bandura, 2001; 2008). A strong sense of personal agency requires development of competence, self-regulator capabilities for exercising self-directedness, and self-percepts of efficacy (Bandura, 1986). The ability to question may have a connection to the leadership skills taught during the Ag Discovery Camp. Participants were taught communication skills, which may have aided them in their ability to ask questions. Participants were taught not only to listen properly, but also to express their ideas clearly as well. By questioning science (e.g., clarifying oneself and seeking clarification, as well as identifying shared and unique perspectives), students employ concepts that are useful to taking science into their own hands and useful for scientific problem solving (Palincsar, Anderson, & David, 1993).

3. Conclusion Results: Participant Leadership Skills Development

The Ag Discovery Camp participants with high self-efficacy reported they did not develop social and interpersonal leadership skills during the camp, yet students reported they applied these skills in a variety of context throughout the following year.

The study data indicated a negative relationship between the participants' team and social skills and their perceived self-efficacy. Although negative in relationship to self-efficacy, the participants acknowledged value in the leadership skills training received at the camp. Participants reported applying these skills later both in the classroom and in their extracurricular activities. The inverse relationship of leadership skills to self-efficacy might be related to students' feelings of already possessing such skills and from the fact that information regarding those skills was self-reported. Another plausible explanation could be that the timing of the immediate assessment occurred too quickly after the training and students did not have enough time to reflect on the leadership skills they were taught in the ADC.

Two findings came forth from the study related to the perceived benefits of the leadership skills training received. One was the high sense of self-efficacy participants' acknowledgement of a gain in ability to 'work with others' both in the classroom and

within their extracurricular activities. Although they felt they already possessed the ability to (a) respect others' viewpoints, (b) empathize with others, and (c) engage meaningfully with others, the camp experience appeared to enhance these abilities. This finding may be explained by Rohs' study, which reported students that were pre-tested on their leadership abilities tended to over-estimate their level of leadership skills (Rohs, 1999; 2002). Such over-estimation could explain why the high self-efficacy ADC students felt they did not learn leadership skills, but then eventually utilized these skills in a variety of contexts throughout the school year. This could also be attributed to not realizing the application of leadership skills until months after the camp.

A second finding with regard to the benefit of the camp's leadership skills training was development of the participants' interpersonal skills, including listening and communication. Many of the ADC students reported a gain in communication skills, especially the ability to ask questions, talk and interact with people, and engage in conversation. This finding supported O'Connell and Pascoe's study on the integration of an interpersonal skills/leadership training program with traditional medical curricula for physicians in training. These participants reported an increase in communications and sharing of and generation of ideas with peers (O'Connell & Pascoe, 2004).

Sarason and Sarason (1981) found that introducing students to leadership skills with their traditional cognitive skills enabled them to analyze and think of better alternatives to problematic situations. The increased levels of communication also supported development of the basic skills that are important to employability of the U.S. workforce, which include the ability to listen, ability to speak, and sociability (Secretary's Commission on Achieving Necessary Skills, 1991). Moreover, Gardner (1987) emphasized the importance of communication. As a result of his work in leadership development, communication was named the one 'all-purpose instrument of leadership.'

The leadership skills training in the Ag Discovery Camp helped the participants to develop their social and interpersonal skills. After the training, participants reported they integrated these skills into their daily lives allowing them to exercise influence over themselves and others at their schools and in their extracurricular activities, thus being

agents of their environment. Personal agency refers to one's capability to originate and direct actions for given purposes. It is influenced by the belief in one's effectiveness in performing specific tasks, which is termed self-efficacy, as well as by one's actual skill. Agency embodies the endowments, belief systems, self-regulatory capabilities, and distributed structures and functions through which personal influence is exercised. Personal agency enables people to play a part in their self-development, adaptation, and self-renewal in response to changing times (Bandura, 1986, 2001).

The development and teaching of leadership skills can contribute to increased school performance. The participants of the Ag Discovery Camp expressed the use of the skills presented at the camp in various forms from classroom applications to extracurricular activities. McClelland et al. (2000) stated that when youth learn leadership skills, those leadership skills contributed to increase school performance. The participants of the Ag Discovery Camp mentioned their increased ability to communicate with their peers. Johnson (1981) stated that communication and interaction with academically motivated peers could increase academic achievement.

4. Conclusion Results: Participant Career Interests

The Ag Discovery Camp participants, being urban minority students, were interested in science careers but not in agricultural careers; however, they became much aware of agricultural career opportunities as a result of attending the camp and willing to consider them as potential options.

Both the pre- and post-camp participant questionnaires revealed high interest in science careers but not in agriculture. However, one year after the precollege experience, urban high school students said they would consider agricultural careers as a secondary choice if their original career choice did not materialize. Such willingness to consider agriculture can be attributed to the exposure to agriculture sciences received during the camp, and the value of exposing urban students to agricultural careers was to help them broaden their thinking about a field of STEM-related careers, in which they were not familiar.

Interests are formed early in a child's education and difficult to change in adolescence (Gibson & Chase, 2002), therefore, it is not surprising that the ADC participants were consistent with their initial chosen career path. Participants were interested in pursuing careers that are perceived as high-paying professions, such as medicine and engineering. Nevertheless, exposure to agriculture through the camp experience opened their eyes to new possibilities for future careers – including those in agriculture (Wiley, Bowen, Bowen, & Heinsohn, 1997).

Precollege experiences, such as the Ag Discovery Camp, have a strong influence both on students' continued interest in science and on their enthusiasm toward pursuing a career in science (Gibson & Chase, 2002; Knox et al., 2003; Markowitz, 2004). This interest and enthusiasm could be attributed to numerous reasons, two of them being humanitarian and monetary. Analysis of this study's qualitative data revealed many students' interest in careers in human medicine, being both humanitarian in nature and monetarily rewarding. This is supported Byler and Shipp's studies, which found that salary was listed as a very important consideration among individuals selecting a career (Byler, 1987; Shipp, 1992).

The 12-month follow-up parent questionnaire also supported that the camp experience increased awareness in pursuing a science-based career. Although limited in the number who responded, those that did respond observed that their children's horizons as to career opportunities in the sciences hasd been broadened.

This conclusion supported SCCT by exposing youth directly to career options in agriculture by giving youth the ability to explore possibilities and new careers through hands-on activities provided in precollege agricultural experiences like the Ag Discovery Camp. Social cognitive theory presumes that goals play an important role in the self-regulation of behavior and a goal may be defined as the determination to engage in a particular activity (Bandura, 1986). Goals operate principally through people's capacity to symbolically represent desired future outcomes and to react self-evaluative to their own behaviors and are ubiquitous of career choice. The Ag Discovery Camp gave the youth the opportunity to perform occupational tasks, in a controlled environment, allowing them to be exposed, directly and vicariously, to professionals in the field of

agriculture, challenging the goals they have set for themselves and allowing them to consider agriculture as a possible career choice. As stated previously, the value of early and extensive exposure to careers in science has well been documented as a way of influencing decisions that African-American students make about science professions (L.S. Jones, 1997; Rowe, 1977).

B. Implications of the Findings for Practice

Researchers, educators, and coordinators of precollege educational programs in informal settings, such as the Ag Discovery Camp, seeking to improve student interest in agricultural science activities and careers may wish to consider the following implications of the study.

1. Implications for Career Awareness and Interests

The present study and past studies have found that URM youth from urban areas have very limited knowledge of the field of agriculture, many associating agriculture with only the occupation of farming (L. S. Jones, 1997). URM youth also have a very limited knowledge of the career opportunities in agriculture and need to be exposed to the wide range of careers in a diverse field such as agriculture (Holz-Clause, & Jost, 1995). The focus of researchers, educators and coordinators of precollege educational programs should be on providing students opportunity to explore agriculture-related activities and helping them develop awareness of the agricultural sciences.

Findings from the present study found that Ag Discovery Camp participants who were enrolled in the engineering-related workshops (i.e., Engineering Science & Mission to Mars) had higher interest in science-based activities than did those who were in agriculture related workshops (i.e., Plant Science, Food & Nutrition Science, and Entomology). Therefore programming should be more focused on a contemporary scientific agriculture rather than traditional agriculture. For, example, precollege agricultural experiences should address high technology and science intensive areas of

agriculture such as agricultural engineering, biotechnology, biochemistry, genetics, and forensic sciences.

The study's results revealed that students had low interest in agricultural activities while at the camp and 12-months after the camp, however, many of the participants continued to explore informally the topics that were presented at the camp. With a different approach to presenting agriculture, the topics explored have the potential to be future career options for the URM youth. Though ADC participants were determined to pursue a career of their first choice, they were however willing to consider agriculture as a career if their first choice "didn't work out." Once again precollege experiences should focus on science-based agriculture to help develop greater interests in agricultural careers.

The youth who participated in the Ag Discovery Camp were more interested in high-paying and prestigious careers (e.g., medicine, engineering, and law). In addition to addressing the science of agriculture and careers in agriculture, future studies need to address the career interest of the participants prior to entering a precollege experience. Although participants were interested in high-paying careers, students may be unaware of how to enter those careers. Agricultural precollege experiences, like the ADC, should inform participants of the potential pathways that agriculture has to offer into their desired high paying careers as well as alternative careers, in case they decide not to pursue their original career choice.

2. Implications of Cultural Relevance

In addition to addressing scientific agriculture, researchers, educators, and coordinators of precollege expereinces need to consider culturally relevant teaching and practices, specifically when working with URM youth. Culturally relevant teaching must develop students academically, nurture and support cultural competence, and foster a social political or critical competence (Hefflin, 2002; Ladson-Billings, 1995). Culturally relevant practices include acknowledging and respecting cultural differences and values, should be made a part of precollege educational experiences. Training materials need to

be provided that consciously reflect the best elements of a cultural group's identify and practice.

Creating a culturally relevant teaching experience can be as simple as changing the topic slightly so that youth see relevance in a career field from their point of view. Traditional agricultural precollege experiences (e.g., 4-H Science Workshops for Youth) focus on agriculture in a traditional context. Future studies need to focus on topics of scientific agriculture such as biotechnology and biofuels, which will more likely create a context for URM youth to learn and make connections.

An additional method of making precollege experiences culturally relevant is by involving parents and additional family members. This study found that parents had positive feelings towards the Ag Discovery Camp precollege agricultural experience and were supportive of their children's involvement. However, they too often lack knowledge of agriculture and careers in agriculture. Adding a parent component to the experience would likely increase parental support thus recruitment of future participants.

3. Implications of Program Evaluation

The timing of the program evaluation needs to be considered by future researchers. The 12-month follow-up component of the study assisted with the participants' reflection upon the experience and revealed interesting results, however one year did make it difficult for some students to reflect upon the experience and also made it difficult to contact many of the participants. Future studies need to consider multiple post-camp follow-ups, possibly every 4 to 6 months to keep the experience fresh in the minds of the participants and to obtain more data from the participants.

In addition to the timing of the timing of the evaluation, parents of the participants also need to be contacted multiple times during the study. This will allow for greater insight to the support structure of the participants and of the influence that the parents have on the students. Multiple points of contact with the parents will also allow for easier contact with the participants. The parents were the gateway (aka, access) to the participants, many being supportive of the research, specifically knowing that it could benefit future programming with additional URM youth. Having contact with the parents

ensured that the youth who participated in the Ag Discovery Camp responded to the study's follow-ups.

Finally, future coordinators of precollege experiences need to ensure ample time to collect data while with the participants. Without an adequate amount of time to respond to questionnaires and survey, participants feel rushed to and often do not complete surveys accurately. In addition it is pre-questionniares need to be added to gain more insight of the participants prior to receiving instruction or an intervention.

C. Recommendations for Future Study

Minority youth are an untapped reservoir of talent, which needs to be utilized to fill the shortcomings of individuals entering STEM-related careers. The findings of this study revealed many issues that call for further research related to precollege experiences in informal settings dealing with agricultural sciences, specifically when working with minority youth. Following are suggested topics for such investigations.

1. Addressing the Science of Agriculture and Careers in Agriculture

The researcher stated in the implications that future precollege agricultural experiences needed to focus on scientific agriculture rather than traditional agriculture. With this being stated, future studies need to focus on whether these high technology and science intensive areas of agriculture can increase students' interests more than traditional agricultural sciences. Research has been conducted on the outcomes and effectiveness of agricultural precollege experiences, however little research has been conducted on precollege experiences that move beyond traditional agricultural practices and therefore should be addressed. It is important to measure the impact of scientific agriculturally based precollege experiences on students' interest. In addition, future studies need to determin whether culturally relevant settings increase participant interests in the agricultural sciences.

2. Addressing the Logistics of Precollege Experiences

Future studies should be conducted on the effectiveness of the length of precollege experiences. Shepard and Speelman (1985) state that the length of time of a program affects the degree to which students can develop positive attitudes. Dresner and Gill (1994) suggested that a period of acclimatization to a setting is necessary. These future studies need to focus on what the appropriate length of a precollege summer experience should be to increase participants' interests in agricultural science.

Precollege experiences are typically offered on a campus of a college or university. However, when presented on a college/university campus, the numbers of students that can attend are limited. Future studies need to focus on different venues of the precollege experience. A change in venue could possibly increase the number of URM that can participate in the precollege experience. A combination of outreach and precollege experiences, where university faculty travel to the students' urban environments can increase the number of students that are involved in future studies, thus making studies more generalizable to larger populations.

In addition to time and venue, future studies need to focus on the instructors of the precollege experiences. Instructors need time to develop relationships with the youth and be "models" to the participants, being minorities and if possible from the same background as the participants. A major source of an individual's self-efficacy beliefs is vicarious experiences. Individuals compare themselves to peers whom they perceive are similar to in ability and intelligence to themselves. With instructors of similar backgrounds, race, and ethnicity students will have the ability to live vicariously through the success of their "peers," thus making judgments on their own abilities. In addition, URM faculty and staff are often encouraging to those like themselves, thus giving students verbal persuasions and encouragement. Two sources of self-efficacy, according to Bandura (1997), included vicarious experiences and verbal persuasions future studies need to determine whether cultural ties such as environment and minority instructors increase participants' science self-efficacy.

3. Addressing the Addition of Leadership Skills in a Science Precollege Experience

Future studies are needed regarding the integration of leadership skills training with informal science-based programming. Findings from the study showed a negative correlation between teamwork and social skills and perceived self-efficacy; the most likely explanation being that the camp's leadership component and science experience were presented at two different times and were not truly integrated. One potential solution is providing science experiences that involve leadership skills such as teamwork and communication. The future studies need to focus on whether a true integration of leadership skills with a science-based precollege experience lead to a positive correlation between leadership skills and perceived science self-efficacy.

In addition to determining whether the integration of leadership skills and science programming lead to a greater sense of science self-efficacy, future studies need to address the concept of personal agency. Personal agency refers to one's capability to originate and direct actions for given purposes. The current study found that students utilized the leadership skill presented in the Ag Discovery Camp in their daily lives and at school. Future studies need to look at the integration of leadership skills and science programming in developing personal agency; both in an academic content and in a social context of the participants.

4. Addressing Experimental Design

Lastly, future research should replicate this study in its context but should consider a different experimental design. The study was limited in both its quantitative and qualitative stances due to the small number of students and the lack of a quasi-experimental design. Studies are needed on utilizing a quasi-experimental design to assess impact of a precollege agricultural experience on middle school URM students. In addition to utilizing quasi-experimental design, a pre-test/post-test design needs to be utilized to measure increased interests and career interests of the participants of the precollege experience.

Future studies are needed that focus on the qualitative means of data collection as a means of gaining greater understanding of student interests in both activities and careers. Qualitative data collected in this study yielded information that the questionnaire data missed. For example, when measuring participants' interests in agricultural science activities, the questionnaire was unable to collect actual interests to the extent that the qualitative data did. Studies need to utilize qualitative methods to strengthen and to tell a story of the quantitative data.

D. Potential Contributions of the Study

This study adds to science education research regarding the role of informal learning settings as effective contributors to interests in science activities and science careers specifically for URM youth. The study's results strengthen the argument for a need to provide effective tools that assist with improving students' science knowledge, attitudes, interests, and career choices. They provide insight into how informal programming offers students opportunity to learn new concepts and to gain awareness of topics little known to them. Given the outcomes of this study, it is likely that informal educational settings used to teach agriculture science to middle school URM students may be an untapped area of human capital development in agricultural education.

Further, the study underscores the importance of mixed-methods research to focus on short-term, informal educational settings. While much of the results showed that the students had low interest in science, especially the agricultural sciences, the qualitative data collected revealed they did have some interest in the science related activities presented to them during the Ag Discovery Camp. The study also provided insight into what types of programs would be effective in influencing urban youth to study agriculture. Those programs that focused on scientific agriculture interested the youth more than traditional sciences.

Finally, although the study did not show a positive relationship between leadership skills and self-efficacy and/or interests in science, it did show that it is important to introduce leadership activities to urban middle school students. They

expressed in their interviews how the leadership skills taught helped shape their interactions with their peers in both the classroom and in their extracurricular activities. Although this study was very preliminary, perhaps the leadership development component provides the greatest potential for enhancing human capital development for STEM learning and career development.

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APPENDICES

Appendix A. IRB Protocol #502000935A002

PURDUE
UNIVERSITY

HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To:	CLINTON RUSK AGAD 225
From:	RICHARD MATTES, Chair Social Science IRB
Date:	06/04/2009
Committee Action:	**Exemption Granted** – Amendment
IRB Action Date:	06/04/2009
IRB Protocol #:	0502000935A002
Study Title:	Sciences Workshop for Youth

The Institutional Review Board (IRB), pursuant to Federal regulations, 45 CFR 46.101(b), has determined that the above-referenced protocol is exempt category (1) .

If you wish to revise or amend the protocol, please submit a new exemption request to the IRB for consideration. Please contact our office if you have any questions.

We wish you good luck with your work. Please retain a copy of this letter for your records.

Ernest C. Young Hall, 10th Floor ▪ 155 S. Grant St. ▪ West Lafayette, IN 47907-2114 ▪ Phone: (765) 494-5942 ▪ Fax: (765) 494-9911

Appendix B. IRB Protocol #1002008985

Monday, July 5, 2010 10:34 PM

Subject: IRB Approval 1002008985 "Exploratory Research on an Introductory Informal..."
Date: Tuesday, March 23, 2010 1:50 PM
From: Berry, Erica L <elberry@purdue.edu>
To: "Knobloch, Neil A" <nknobloc@purdue.edu>
Cc: Robbie Ortega <ortegar@purdue.edu>

The IRB has reviewed your Research Exemption Request titled, "Exploratory Research on an Introductory Informal...", Ref. #1002008985 and deem it to be exempt. A copy of the approved letter will be forthcoming via campus mail. Good luck on your research.

Erica L. Berry
Human Research Protection Program
Purdue University
Ernest C. Young Hall
10th Floor, Room 1032
155 S. Grant Street
West Lafayette, IN 47907-2114
PH: 765/494-7090
FAX: 765/494-9911
http://www.irb.purdue.edu <http://www.irb.purdue.edu/>

Appendix C. Ag Discovery Camp Questionnaire Part I and II

PARTICIPANT SURVEY

PART I

2009 AGRICULTURAL DISCOVERY CAMP

ID #: _____ (This is the number on your name tag)

Section 1: **Demographics**

Instructions: Please **CHECK** the answer that best applies to you.

1. How do you describe yourself? *(Check All That Apply)*

☐ White or Caucasian
☐ Hispanic or Latino/Latina
☐ Multiracial
☐ Black or African-American
☐ Asian American
☐ other (please specify)_____

2. Gender: ☐ Male ☐ Female

3. What year were you born? _____

Section 2: **School Performance**

Instructions: Please **CHECK** the answer that best applies to you.

1. Over the past year, have your grades in the following subjects mostly been....

Science (CHECK ONE)	Mathematics (CHECK ONE)	Language Arts/Reading (CHECK ONE)	Social Studies (CHECK ONE)
☐ A's	☐ A's	☐ A's	☐ A's
☐ B's	☐ B's	☐ B's	☐ B's
☐ C's	☐ C's	☐ C's	☐ C's
☐ D's	☐ D's	☐ D's	☐ D's
☐ F's	☐ F's	☐ F's	☐ F's

2. What grade will you be in the 2009-10 school year? ☐ 9th ☐ 10th ☐ 11th ☐ 12th

Section 3: **Extra Curricular Activities Part 1**

Instructions: Please **CHECK** the answer that best applies to you.

1. During the past semester, did you do any music, dance, drama, or art activities after school or on weekends? (Examples are piano lessons, church choir, singing lessons, dance class, arts & crafts)

☐ No (SKIP TO SECTION 4) ☐ Yes

2. When you were doing these activities in the past semester, how many days did you take part in them a typical week?

☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ Less than 1 (i.e. 1 day every other week)

Answer the next set of questions about the MUSIC, DANCE, DRAMA, or ART ACIVITY you did in the Fall. If you did more than one of these activities, think about our FAVORITE one.

3. How much did you like doing this activity during the past semester?
   - ☐ Very much
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

4. Is the coach or leader for this activity someone you can trust, who listens to you and cares about you, and thinks that you are important?
   - ☐ No, not at all
   - ☐ Somewhat
   - ☐ Yes, very much

5. Did the coach or leader help you learn new skills or things you didn't know about before?
   - ☐ Very much
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

6. How well did you get along with other kids at this activity?
   - ☐ Very well
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

7. Was this club, class, or group organized by your school?

☐ No ☐ Yes ☐ Don't know

Section 4: **Extra Curricular Activities Part 2**

Instructions: Please **CHECK** the answer that best applies to you.

1. During the past semester, did you take part in clubs, classes, or interest groups after school or on weekends? (i.e. Scouts, 4-H, Computer class, Spanish class, Science or Reading club, Science Olympiad, Odyssey of the Mnd)

   ☐ No (SKIP TO SECTION 5) ☐ Yes

2. When you were doing these activities in the past semester, how many days did you take part in them a typical week?

☐ 7 ☐ 6 ☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ Less than 1 (i.e. 1 day every other week)

Answer the next set of questions about the CLUB, CLASS, or INEREST GROUP you did in the Fall. If you did more than one of these activities, think about your FAVORITE one.

3. How much did you like doing this activity during the past semester?
   - ☐ Very much
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

4. Is the coach or leader for this activity someone you can trust, who listens to you and cares about you, and thinks that you are important?
   - ☐ No, not at all
   - ☐ Somewhat
   - ☐ Yes, very much

5. Did the coach or leader help you learn new skills or things you didn't know about before?
   - ☐ Very much
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

6. How well did you get along with other kids at this activity?
   - ☐ Very well
   - ☐ Somewhat
   - ☐ Only a little
   - ☐ Not at all

7. Was this club, class, or group organized by your school?

   ☐ No ☐ Yes ☐ Don't know

Section 5: **Career and College Choices**

Instructions: Please **CIRCLE** the most appropriate answer for each statement.

1. How Likely will you do EACH of the following after high school?	**Very Unlikely**	**Unlikely**	**Likely**	**Very Likely**
1. Get a full-time job	1	2	3	4
2. Enlist in the military	1	2	3	4
3. Attend a technical or vocational school	1	2	3	4
4. Graduate from a two-year college program	1	2	3	4
5. Graduate from a college/university (four-year program)	1	2	3	4
6. Attend graduate school or professional school (medical school, law school, veterinary school) after 4-year college degree	1	2	3	4

2. If you plan to attend college, which of the following best describes what you would like to study in college? ***(Chose only one)***

- ☐ **Agriculture** (i.e. Horticulture, Food Science, Agronomy, Animal Science)
- ☐ **Education** (i.e. Elementary Education, Secondary Education)
- ☐ **Arts, Humanities & Social Sciences** (i.e. Psychology, Sociology, Economics, History, Fine Arts)
- ☐ **Engineering and Technology** (i.e. Mechanical Engineering, Chemical Engineering, Agricultural Engineering, Computer Science)
- ☐ **Sciences** (i.e. Chemistry, Biology, Physics, Mathematics)
- ☐ **Business** (i.e. Accounting, Marketing, Management)
- ☐ **Veterinary Medicine**
- ☐ **Human Medicine**
- ☐ **Pharmacy**
- ☐ **Other** (Please Specify) _____

Section 6: **Interests**

Instructions: Please indicate your degree of interest in doing each of the following activities. Use the 1-4 scale and **CIRCLE** how much interest you have in each activity.

How much interest do you have in……	**Very Low Interest**	**Low Interest**	**High Interest**	**Very High Interest**
1. working with animals.	1	2	3	4
2. working with nature.	1	2	3	4
3. working with plants.	1	2	3	4
4. working with food products and food processing.	1	2	3	4
5. working in a science laboratory setting.	1	2	3	4
6. working in a greenhouse.	1	2	3	4
7. working on a farm.	1	2	3	4
8. working in shop.	1	2	3	4
9. working in an agricultural business.	1	2	3	4
10. working with computers.	1	2	3	4
11. teaching others about agriculture.	1	2	3	4
12. working as a dietician or nutritionist.	1	2	3	4
13. working a geneticist or breeder.	1	2	3	4
14. designing machinery, roadways, or electronics as an engineer.	1	2	3	4
15. creating new energy sources such as biofuels.	1	2	3	4
16. performing math calculations to solve problems.	1	2	3	4

Section 7: **Perceptions**

1. Why did you attend the 2009-2010 Agricultural Discovery Camp?

- ☐ To learn something new
- ☐ Career exploration and career interest
- ☐ Because it is fun
- ☐ To learn more about Purdue University
- ☐ To meet new people and to socialize
- ☐ Other: _____

2. What do you think of when you hear the word *"agriculture?"*

- ☐ Farming
- ☐ Science and Technology
- ☐ Opportunities
- ☐ Agricultural Industry (food & fiber system, animal processing)
- ☐ 4-H/FFA
- ☐ Other: _____

3. What do you think of when you hear the word *"science?"*

- ☐ Physics, Chemistry, Biology
- ☐ Laboratory Experiments
- ☐ Learning, studying, knowledge of the natural world
- ☐ Animals, Plants, Agriculture
- ☐ Secondary science courses (Medicine, Anatomy)
- ☐ Other: _____

4. What do you think of when you hear or see the words *"Purdue University?"*

- ☐ Future college, where I would like to go to school
- ☐ The agriculture program
- ☐ The veterinary program
- ☐ The engineering program
- ☐ Sports (Football, Basketball, Purdue Pete)
- ☐ Other: _____

Section 8: **Parent's Education**

Instructions: The next questions ask about your parents. If you were raised mostly by foster parents, stepparents, or others, answer for them. For example, if you have both a stepfather and a birth father, answer for the one that was most involved in raising you.

1. What is the highest level of schooling your father/male guardian completed? ***(Circle one)***

   - ☐ Completed 8th grade or less
   - ☐ Some high school
   - ☐ Completed high school
   - ☐ Some college, but did not complete a degree
   - ☐ Completed a 2-year college degree
   - ☐ Completed a 4-year college degree
   - ☐ Graduate or professional school after college
   - ☐ Don't know

2. What is your father's/male guardian's primary job? ***(Please be specific)***

3. What is the highest level of schooling your mother/female guardian completed? ***(Circle one)***

   - ☐ Completed 8th grade or less
   - ☐ Some high school
   - ☐ Completed high school
   - ☐ Some college, but did not complete a degree
   - ☐ Completed a 2-year college degree
   - ☐ Completed a 4-year college degree
   - ☐ Graduate or professional school after college
   - ☐ Don't know

4. What is your mother's/female guardian's primary job? ***(Please be specific)***

PARTICIPANT SURVEY

PART II

2009 AGRICULTURAL DISCOVERY CAMP

ID #: _____ (This is the number on your name tag)

Section 1: **Expected Outcomes**

Instructions: Please indicate the degree to which you agree or disagree with the statement below by **CIRCLING** the appropriate number to the right of each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. By participating in the Ag Discovery Camp, I will be more successful in college.	1	2	3	4
2. If I do well in my high school science classes, I will have more career opportunities.	1	2	3	4
3. If I take science classes in high school, I will be better prepared for an agricultural major in college.	1	2	3	4
4. Participating in the Ag Discovery Camp will help me make an informed career decision.	1	2	3	4
5. If I put a lot of work into my projects, I will feel that I have accomplished something worthwhile.	1	2	3	4
6. If I get good grades in my science classes in high school, then my parents will be pleased.	1	2	3	4
7. By participating in the Ag Discovery Camp, I will be better able to achieve my future goals.	1	2	3	4
8. Taking science classes in high school will be beneficial to my career.	1	2	3	4
9. Engaging in the Ag Discovery Camp is rewarding.	1	2	3	4
10. I get a sense of self-satisfaction when engaging in the Ag Discovery Camp.	1	2	3	4

Section 2: **Career Intentions**

Instructions: Please indicate the degree to which you agree or disagree with the statements below by **CIRCLING** the appropriate number to the right of each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I plan to enter a career in agriculture.	1	2	3	4
2. I plan to take agriculture classes in college.	1	2	3	4
3. I plan to major in an area of agriculture in college.	1	2	3	4
4. My career aspirations are in an area involving agriculture.	1	2	3	4
5. I plan to take as many science classes as possible.	1	2	3	4
6. I intend to enter a career, which will use science skills and knowledge.	1	2	3	4
7. I am determined to use my knowledge from my science classes.	1	2	3	4
8. I am committed to study hard in my science classes.	1	2	3	4
9. I intend to use many of the things I learn in science classes in my future career.	1	2	3	4
10. My career aspirations are in an area involving science.	1	2	3	4

Section 3: **Workshop Evaluation**

Instructions: Please indicate the degree to which you agree or disagree with the statement below by **CIRCLING** the appropriate number to the right of each statement.

Please CIRCLE the appropriate number to the right of each statement.	Strongly Disagree	Disagree	Agree	Strongly Agree
1. Before attending the Ag Discovery Camp, I thought science was boring.	1	2	3	4
2. My impression of Purdue University has improved as a result of attending the Ag Discovery Camp.	1	2	3	4
3. Attending the Ag Discovery Camp has increased my desire to pursue a college education.	1	2	3	4
4. Attending the Ag Discovery Camp has increased my desire to study a science-related major in college.	1	2	3	4
5. Attending the Ag Discovery Camp has improved my interest in learning about science.	1	2	3	4
6. Attending the Ag Discovery Camp has improved my understanding of science.	1	2	3	4
7. As a result of attending the Ag Discovery Camp, I am more likely to attend Purdue University than I was previously.	1	2	3	4
8. My awareness of the various career opportunities has increased as a result of attending the Ag Discovery Camp.	1	2	3	4
9. I am interested in doing a project related to the topics I learned in the Ag Discovery Camp.	1	2	3	4
10. I found the Ag Discovery Camp to be a positive learning experience.	1	2	3	4
11. I would encourage others to attend the Ag Discovery Camp.	1	2	3	4

Section 4: **Science Self-efficacy**

Instructions: To what extent do you agree with or disagree that attending the Science Workshops has helped you in the following ways? *(Circle the most appropriate answer for each statement)*

Please CIRCLE the appropriate number to the right of each statement.	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am confident in my ability to learn the content taught in the Ag Discovery Camp.	1	2	3	4
2. I am confident I can do well in science at school.	1	2	3	4
3. I don't think I will be successful in science at school.	1	2	3	4
4. I am confident that I can understand the topics taught in science at school.	1	2	3	4
5. I believe that if I exert enough effort, I will be successful in my science classes at school.	1	2	3	4
6. I am confident that I can explain something I learn in this science workshop to my parents.	1	2	3	4

Section 5: **Open Ended Response Questions**

1. **Name one thing you have learned at the Ag Discovery Camp that you plan to use within the next six weeks.**

2. **How will you use the information you learned at Ag Discovery Camp?**

3. **Who do you plan to share the information you learned at the Ag Discovery Camp with?** ***(Check all that apply)***

☐ Parent/family	☐ Teachers
☐ Friends	☐ Public, Newspapers, Media
☐ 4-H Club members	☐ Other (please specify)_____
☐ 4-H Leader	

4. **What knowledge or skill did you expect to learn at the Ag Discovery Camp, but did not?**

Appendix D. Ag Discovery Camp Experience Questionnaire

The Agricultural Discovery Camp Experience Survey

ID#: _____ (This is the number on your name tag)

Instructions: Based on your ***current*** or ***recent*** involvement please rate whether you have had the following experiences in Ag Discovery Camp

	Not At All	A Little	Quite a Bit	Yes, Definitely
IDENTITY EXPERIENCES				
Identity Exploration				
1. Tried doing new things	1	2	3	4
2. Tried a new way of acting around people	1	2	3	4
3. I do things here I don't get to do anywhere else	1	2	3	4
Identity Reflection				
4. Started thinking more about my future because of this activity	1	2	3	4
5. This activity got me thinking about who I am	1	2	3	4
6. This activity has been a positive turning point in my life	1	2	3	4
INITIATIVE EXPERIENCES				
Problem Solving				
7. Observed how others solved problems and learned from them	1	2	3	4
8. Learned about developing plans for solving a problem	1	2	3	4
9. Used my imagination to solve a problem	1	2	3	4
BASIC SKILL				
Cognitive Skills				
In this activity I have improved:	1	2	3	4
10. Academic skills (reading, writing, math, etc.)	1	2	3	4
11. Skills for finding information	1	2	3	4
12. Computer/internet skills	1	2	3	4
13. Communication skills	1	2	3	4
INTERPERSONAL RELATIONSHIPS				
Diverse Peer Relationships				
14. Made friends with someone of the opposite gender	1	2	3	4
15. Learned I had a lot in common with people from different backgrounds	1	2	3	4
16. Got to know someone from a different ethnic group	1	2	3	4
17. Made friends with someone from a different social class (someone richer or poorer)	1	2	3	4

	Not At All	A Little	Quite a Bit	Yes, Definitely
TEAM WORK AND SOCIAL SKILLS				
Group Process Skills				
18. Learned that working together requires some compromising	1	2	3	4
19. Became better at sharing responsibility	1	2	3	4
20. Learned to be patient with other group members	1	2	3	4
21. Learned how my emotions and attitude affect others in the group	1	2	3	4
22. Learned that it is not necessary to like people in order to work with them	1	2	3	4
Leadership and Responsibility				
23. Learned about the challenges of being a leader	1	2	3	4
24. Others in this activity counted on me	1	2	3	4
25. Had an opportunity to be in charge of a group of peers	1	2	3	4
SOCIAL CAPITAL				
Linkages to Work and College				
26. This activity opened up job or career opportunities for me	1	2	3	4
27. This activity helped prepare me for college	1	2	3	4
28. This activity increased my desire to stay in school	1	2	3	4
NEGATIVE EXPERIENCES				
Social Exclusion				
29. Felt like I didn't belong in this activity	1	2	3	4
30. I felt left out	1	2	3	4
31. There were cliques in this activity	1	2	3	4
Negative Group Dynamics				
32. I get stuck doing more than my fair share	1	2	3	4
33. Was discriminated against because of my gender, race, ethnicity, disability, or sexual orientation	1	2	3	4

Appendix E. 12-Month Follow-Up Email to Students

Monday, July 5, 2010 10:59 PM

Subject: Ag Discovery Camp 12-month Follow-Up
Date: Monday, July 5, 2010 10:59 PM
From: Robbie Ortega <ortegar@exchange.purdue.edu>

Hello, my name is Robbie Ortega, and I am a graduate student in the Department of Youth Development & Agricultural Education. I had the opportunity to work with you this past summer in the Ag Discovery Camp on the campus of Purdue University. I am requesting your participation in a research study about your learning experiences at this event. The purpose of the study is to determine how the Ag Discovery Camp influenced your ideas and interests in science.

Your continuing participation in this study is voluntary. If you choose to participate your commitment will be to:

- Complete one 20-minute question about your experiences at the Ag Discovery Camp.

- If selected, participate in a 45-minute to 1-hour interview about the Ag Discovery Camp.

I believe that you will directly benefit from this study by reflecting on your experiences at the Ag Discovery Camp. Future participants of the camp will also benefit from the insights gained from your experiences. The results from this study will be used in reports and journal articles as a means to help other educators, such as myself, improving the teaching and learning experiences for youth much like you.
The information collected from your survey responses are completely confidential and will be released only as summaries in which no individual's answers can be identified. You will be assigned a number code that will be used to protect your identity. Once again, your participation is completely voluntary to for this study. Your participation can be ended at any time by a confirmed e-mail message sent to me, Robbie Ortega, requesting to end your participation

Participation in this study does not involve risks beyond those that your experience in everyday life. If you have any questions please feel free to contact me at any time. You may email me at ortegar@purdue.edu <mailto:ortegar@purdue.edu> or call me at (765) 532-2055.

You may retain this consent form for your records. Your consent will be indicated by your completion of the questionnaire. To continue with the study, please click the link at the bottom of this message to continue on with the survey.

Thank you so much for helping with this important study.

Sincerely,
Robbie R. Ortega

HOT LINK TO QUALTRICS SURVEY

Appendix F. 12-Month Follow-Up Questionnaire Qualtrics®

Thank you for taking the time to respond to this survey. This survey asks you to reflect upon your experiences at the Ag Discovery Camp at Purdue University in the Summer of 2009. Please take time to read each question carefully and respond to each question as accurately as possible. The survey should only take 10-15 minutes to complete. Once again, thank you for taking the time to take this survey.

Expected Outcomes

Instructions: Please indicate the degree to which you agree or disagree with the statement below by CLICKING the appropriate response to the right of each statement.

	Strongly Disagree	Disagree	Agree	Strongly Agree
By participating in the Ag Discovery Camp, I will be more successful in college.	○	○	○	○
Participating in the Ag Discovery Camp will help me make informed career decisions.	○	○	○	○
By participating in the Ag Discovery Camp, I will be better able to achieve my future goals.	○	○	○	○
Taking science classes in high school will be beneficial to my career.	○	○	○	○
Engaging in the Ag Discovery Camp was rewarding.	○	○	○	○
I got a sense of self-satisfaction when engaging in the Ag Discovery Camp.	○	○	○	○

Instructions: Please read the following question and type your response in the box below.

To what extent did the leadership skills you were presented at the Ag Discovery Camp change how you work with others in the classroom? Why?

>>

Self-Efficacy

Instructions: To what extent do you agree with or disagree that attending the Ag Discovery Camp has helped you in the following ways? Please CLICK the most appropriate answer for each statement

	Strongly Disagree	Disagree	Agree	Strongly Agree
I am confident in my ability to learn the content taught in the Ag Discovery Camp.	○	○	○	○
I am confident I can do well in science at school.	○	○	○	○
I don't think I will be successful in science in school.	○	○	○	○
I am confident that I can understand the topics taught in science at school.	○	○	○	○
I believe that if I exert enough effort, I will be successful in my science classes at school.	○	○	○	○
I am confident that I can explain something I learned in the Ag Discovery Camp to my parents.	○	○	○	○

Instructions: Please read the following question and type your response in the box below.

To what extent has your confidence to learn science changed as a result of the Ag Discovery Camp?

Instructions: Please read the following question and type your response in the box below.

To what extent did the Ag Discovery Camp have on how well you learn science in school? Why?

>>

Career and College Choices

Instructions: The following statements are asking about your plans after high school. Please CLICK the most appropriate response for each statement.

	Very Unlikely	Unlikely	Likely	Very Likely
Get a full-time job immediately after high school	○	○	○	○
Enlist in the military immediately after high school	○	○	○	○
Attend a technical or vocational school	○	○	○	○
Graduate from a two-year college program	○	○	○	○
Graduate from a college/university (four-year program)	○	○	○	○
Attend graduate school or professional school after a 4-year college degree (medical school, law school, veterinary school)	○	○	○	○

If you plan to attend college, which of the following best describes what you would like to study in college? (Choose only one)

- ○ Agriculture (i.e. Plant Sciences, Food Sciences, Animal Sciences, Natural Resources)
- ○ Education (i.e. Elementary Education, Secondary Education)
- ○ Arts, Humanities, & Social Sciences (i.e. Psychology, Sociology, Economics, History, Fine Arts)
- ○ Engineering & Technology (i.e. Mechanical Engineering, Chemical Engineering, Agricultural Engineering, Computer Science)
- ○ Sciences (i.e. Biology, Chemistry, Physics, Mathematics)
- ○ Business (i.e. Management, Accounting, Marketing)
- ○ Veterinary Medicine
- ○ Human Medicine
- ○ Pharmacy
- ○ Other

>>

Career Interests

Instructions: Please think carefully about the following statements and respond as honestly as possible. Answer the following questions based upon your participation in the Ag Discovery Camp. You are being asked to respond to how you feel about the following statements both currently and prior to attending the Ag Discovery Camp. Your answers may or may not differ between the two time periods.

Using the very low interest to very high interest scale please indicate how much interest you have in each career-based activity by CLICKING the appropriate button.

	How I feel currently.				How I felt prior to attending the Ag Discovery Camp.			
	Very Low Interest	Low Interest	High Interest	Very High Interest	Very Low Interest	Low Interest	High Interest	Very High Interest
Working with animals.	○	○	○	○	○	○	○	○
Working with nature.	○	○	○	○	○	○	○	○
Working with plants.	○	○	○	○	○	○	○	○
Working with food products and food processing.	○	○	○	○	○	○	○	○
Working in a science laboratory setting.	○	○	○	○	○	○	○	○
Working in a greenhouse.	○	○	○	○	○	○	○	○
Working on a farm.	○	○	○	○	○	○	○	○
Working in a shop.	○	○	○	○	○	○	○	○
Working in an agricultural business.	○	○	○	○	○	○	○	○
Working with computers.	○	○	○	○	○	○	○	○
Teaching others about agriculture.	○	○	○	○	○	○	○	○
Working as a dietitian or nutritionist.	○	○	○	○	○	○	○	○
Working as a geneticist or breeder.	○	○	○	○	○	○	○	○
Designing machinery, roadways, or	○	○	○	○	○	○	○	○

electronics as an engineer.								
Creating new energy sources such as bio-fuels.	○	○	○	○	○	○	○	○
Performing math calculations to solve problems.	○	○	○	○	○	○	○	○

Instructions: Please read the following question and type your response in the box below.

To what extent did the Ag Discovery Camp change your opinion of agriculture as science? Why?

>>

Career Intentions

Please think carefully about the following statements and respond as honestly as possible. Answer the following questions based upon your participation in the Ag Discovery Camp. You are being asked to respond to how you feel about the following statements both currently and prior to attending the Ag Discovery Camp. Your answers may or may not differ between the two time periods.

Instructions: Please indicate the degree to which you agree or disagree with the following statements below by CLICKING the appropriate button to the right of each statement.

	How I feel currently.				How I felt prior to attending the Ag Discovery Camp.			
	Strongly Disagree	Disagree	Agree	Strongly Agree	Strongly Disagree	Disagree	Agree	Strongly Agree
I plan to enter a career in agriculture.	○	○	○	○	○	○	○	○
I plan to take agriculture classes in college.	○	○	○	○	○	○	○	○
I plan to major in an area of agriculture in college.	○	○	○	○	○	○	○	○
My career aspirations are in an area involving agriculture.	○	○	○	○	○	○	○	○
I plan to take as many science classes as possible.	○	○	○	○	○	○	○	○
I intend to enter a career, which will use science skills and knowledge.	○	○	○	○	○	○	○	○
I am determined to use my knowledge from my science classes.	○	○	○	○	○	○	○	○
I am committed to study hard in my science classes.	○	○	○	○	○	○	○	○
I intend to use many of the things I learn in science classes in my future career.	○	○	○	○	○	○	○	○
My career aspirations are in an area involving science.	○	○	○	○	○	○	○	○

Instructions: Please read the following question and type your response in the box below.

To what extent did the Ag Discovery Camp influence your future plans of going into a science related career? Why?

Appendix G. 12-Month Follow-Up Interview Protocol

Interview Protocol

Hello, my name is Robbie Ortega; I would like to take the time to thank you for participating in this interview. This interview is designed to give myself greater insight to your experience at the Ag Discovery Camp held on the Purdue University Campus from June 8th through June 12th of 2009. Please note that all information collected from this interview are completely confidential and will be released only as summaries in which you will not be identified. Please know that your participation in this interview is completely voluntary and you have the right to end the interview at anytime during its duration. Do you understand the purpose of the interview and your rights as the interviewee? *If yes, continue to the interview.*

The following questions will have you reflect about your past experience at the Ag Discovery Camp. Think about the activities both social and educational, the people who worked with you (camp counselors, the presenters, coordinators), and the experience as a whole.

1. What did you like most about the camp?

    - Why?

2. What did you like least about the camp?

    - Why?

3. What do you think of when you hear the word science?

    - Has this viewpoint changed since participating in the Ag Discovery Camp?

4. Have you found yourself learning more about the topics that you were presented at the Ag Discovery Camp?

5. Have your idea about science changed after participating in the Ag Discovery Camp?

    -Why? Why not?

6. How has the Ag Discovery Camp changed you idea about scientist?

The next set of questions will look at your school and out-of-school experiences after the Ag Discovery Camp. Please answer the questions to the best of your ability.

1. Since the Ag Discovery Camp, have you joined or looked into joining any type of extracurricular science program or club?

2. Have you pursued additional information about the topics learned at the Ag Discovery Camp?

3. Have you utilized the leadership skills that you learned at the Ag Discovery Camp in any of your extracurricular activities or while in the classroom at school?

4. Do you feel that you are more confident to do well in science at school?

5. Are you more confident that you can understand science topics taught in school?

The next series of questions look at you career interests and future goals. Though these are bound to change in the future, I would like to know about how you are thinking currently.

1. Currently, what is the career path that you would like to take in your future?

2. What do you need to prepare for that career?

3. Does this career require you to take more courses in science? Do you plan to take these courses in the future?

4. The Ag Discovery Camp focused on science, are there any particular aspects of the program that encouraged you to pursue a science related career?

5. Are there any aspects of the Ag Discovery Camp that have encouraged you to pursue taking more science related courses in high school and/or college?

6. Ag Discovery Camp focused on the agricultural sciences, what do you think of when you think of agriculture?

7. Has your viewpoint of agricultural sciences changed since participating in the Ag Discovery Camp?

8. Would you consider a career in the agricultural sciences?

-Why? Why not?

Appendix H. 12-Month Follow-Up Email to Parents

Monday, July 5, 2010 11:12 PM

Subject: Ag Discovery Camp 12-month Parent Follow-Up
Date: Monday, July 5, 2010 11:12 PM
From: Robbie Ortega <ortegar@exchange.purdue.edu>

Hello, my name is Robbie Ortega, and I am a graduate student in the Department of Youth Development & Agricultural Education. I had the opportunity to work with your child this past summer in the Ag Discovery Camp on the campus of Purdue University. I am requesting your participation in a research study about your child's and your perception of your child's learning experiences at this event. The purpose of the study is to determine how the Ag Discovery Camp influenced their ideas and interests in science.

Your continuing participation in this study is voluntary. If you choose to participate your commitment will be to:

- Complete one 10-minute questionnaire about your child's interest in science and agriculture

The results from this study will be used in reports and journal articles as a means to help other educators, such as myself, improving the teaching and learning experiences for youth like your children.
The information collected from your survey responses are completely confidential and will be released only as summaries in which no individual's answers can be identified. You will be assigned a number code that will be used to protect your identity. Once again, your participation is completely voluntary to for this study. Your participation can be ended at any time by a confirmed e-mail message sent to me, Robbie Ortega, requesting to end your participation
P
articipation in this study does not involve risks beyond those that your experience in everyday life. If you have any questions please feel free to contact me at any time. You may email me at ortegar@purdue.edu <mailto:ortegar@purdue.edu> or call me at (765) 532-2055, or you may contact Dr. Neil Knobloch at nknobloc@purdue.edu <mailto:nknobloc@purdue.edu> or at (765) 494-8439.

You may retain this consent form for your records. Your consent will be indicated by your completion of the questionnaire. To continue with the study, please click the link at the bottom of this message to continue on with the survey.

Thank you so much for helping with this important study.

Sincerely,
Robbie R. Ortega

HOT LINK TO QUALTRICS SURVEY

Appendix I. 12-Month Follow-Up Parent Questionnaire Qualtrics®

From your perspective, please use the scale to answer the question in regards to your child.

	Very Unlikely	Unlikely	Likely	Very Likely
Your child is confident that he/she can do will in science at school.	○	○	○	○
Your child is confident that he/she can understand the topics taught in science at school.	○	○	○	○

Do you feel that your child's confidence to learn science has changed as a result in participating in the Ag Discovery Camp? Explain.

>>

From your perspective, please use the following scale to answer the following questions.

	Very Unlikely	Unlikely	Likely	Very Likely
Your child is interested in working in a science laboratory.	○	○	○	○
Your child is interested in performing math calculations to solve problems.	○	○	○	○
Your child is interested in designing machinery, roadways, or electronics as an engineer.	○	○	○	○

Do you feel that your child's interest in Science has increased as a result of the Ag Discovery Camp? Explain.

>>

From your perspective, please use the following scale to answer the following questions.

	Very Unlikely	Unlikely	Likely	Very Likely
By attending the Ag Discovery Camp, your child has increased their desire to pursue a college education.	○	○	○	○
Attending the Ag Discovery Camp has increased your child's interest in learning science.	○	○	○	○
Your child found the Ag Discovery Camp a positive learning experience.	○	○	○	○

Do you feel that you child has demonstrated more leadership behaviors as a result of the Ag Discovery Camp? Explain.

>>

From your perspective, please use the following scale to answer the following statements.

	Very Unlikely	Unlikely	Likely	Very Likely
By participating in the Ag Discovery Camp, your child will be more successful in college.	○	○	○	○
Participating in the Ag Discovery Camp will help your child make a more informed career decision.	○	○	○	○
By participating in the Ag Discovery Camp, your child will be better able to achieve his/her goals.	○	○	○	○

How has the experience of the Ag Discovery Camp changed your child's views of AGRICULTURE AS SCIENCE? Has this changed your views?

>>

From your perspective, please use the following scale to determine your child's interest in science

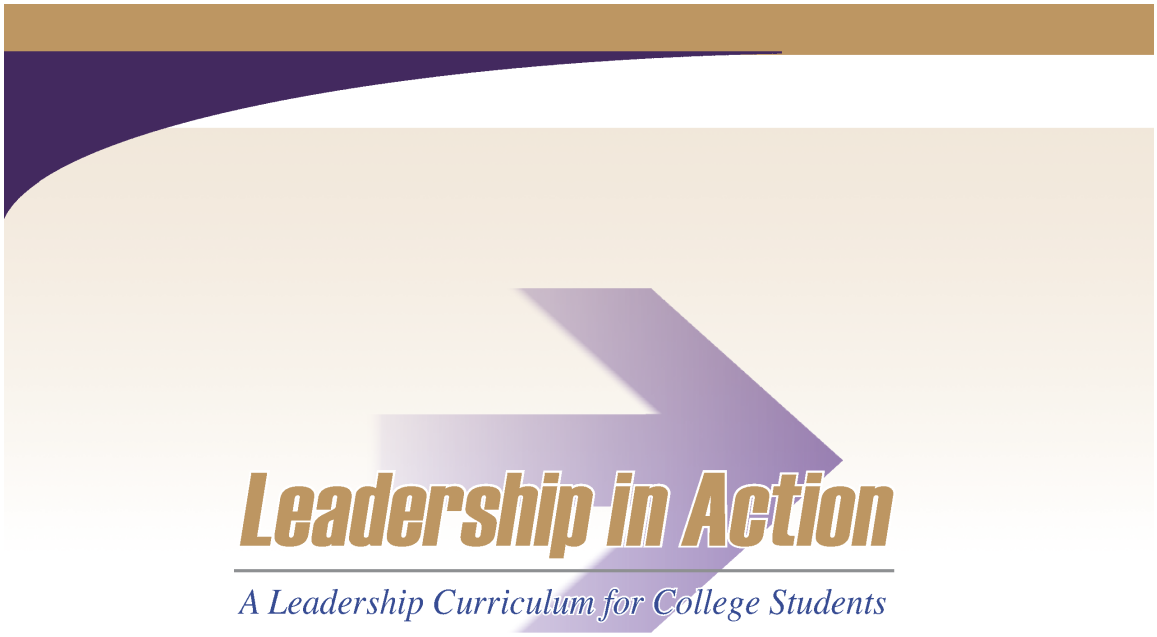
	Very Unlikely	Unlikely	Likely	Very Likely
Your child plans to enter a career which will use science skills and knowledge.	○	○	○	○
Your child is determined to use their knowledge for their science classes.	○	○	○	○
Your child's career aspirations are in an area involving science.	○	○	○	○

Do you feel that the Ag Discovery Camp has influenced your child into going into a science related career?

>>

Appendix J. Leadership in Action Curriculum

(Example)



Understanding Our Values & Character

Workshop Guide

Module 2

University of Wisconsin - Madison, Purdue University, & University of Illinois

Leadership in Action
A Leadership Curriculum for College Students
Purdue University, University of Illinois, & University of Wisconsin - Madison

Understanding Our Values & Character

Workshop Guide

Objectives

Participants will be able to
1. Identify personal values and character attributes that guide their lives and leadership behavior;
2. Understand how values and character become internalized and how one behaves congruently with one's values;
3. Consider how values and character affect leadership.

Materials Needed

- Flipchart
- Several color markers for each small group
- Rolls of scotch tape, enough for each small group
- Copies of the following materials for each participant:
  - — Blank sheets of paper
  - — "Clarifying Our Values"
  - — "Examining My Core Values"

Workshop Outline

Minutes	Activity
10	Icebreaker – "Wearing Your Values"
5	Introduction
20	Topic Discussion
20	Activity – Clarifying Values
10	Activity – Examining Core Values
10	Reflection, Application, & Summary
1 Hour 15 minutes	**Total Time**

Note: Instructions to conduct this workshop are given in italics print. The "script" for a workshop facilitator is given in regular type.

Icebreaker – 10 Minutes – "Wearing Your Values"

Distribute a blank sheet of paper to each participant, along with a color marker. Place a roll of scotch tape on each table.

Have you ever heard the phrase, "she wears her emotions on her sleeve" to indicate a person cares about what she is doing? If we want people to know what we value, what is important to us, sometimes we have to do or say things to make it really evident. Even though it is not really possible to wear our emotions or values on our sleeve, we are going to try it and see what it is like.

I'd like you to think about what values drive you. What values make you who you are? On the sheet of paper, write down the values you feel are at your core. Use the color markers, and write large enough that others can see the words clearly. Tape the piece of paper to your chest, or hold it so that others can see it. Now, mingle with others. Share your values, and ask others in the group to share stories about how they developed a value or why a particular value is important to them.

Introduction – 5 Minutes

The key question we will be considering in this workshop is how values and character are related to leadership.

The development of positive values and character attributes can have a large effect on the type of leader a person becomes. The legacy of a leader does not rest solely in his or her accomplishments. Leaders are also judged on what they value and how they conduct themselves as they confront difficult decisions brought on by trying to balance the interests of others and the practical demands of challenging issues. A person's values and character act as powerful guides for decision-making and behavior; therefore, the development of positive values and a strong character helps leaders use their skills and abilities to make positive contributions.

Understanding our own values and character is an important component of leadership development. Kouzes and Posner in *The Leadership Challenge* suggest that leaders need to know what they believe in and stand for if they are to have an influence. If leaders are unsure about their values and character, then others will also be unsure, and the leader will lose credibility.

In this section we will discuss the concepts of values and character, and we will consider some ideas regarding how values and character develop and become internalized. After the discussion, we will focus on how values and character relate to leadership.

Topic Discussion – 20 Minutes

Values

Ask participants how they define values. Allow a few participants to respond. Record their thoughts on the flipchart.

Values are principles or standards we believe are important or worthwhile. They form the underlying priorities that guide our decisions and behavior. Values we consistently rank higher than others are what we call "core values." These are what define our character and remain relatively stable across contexts.

Character

Ask participants how they define character. Allow a few participants to respond. Record their thoughts on the flipchart.

Character is the combination of attributes, traits, and values that defines us and differentiates one person from another. These qualities or attributes regulate our behavior. Character is relatively consistent across time and context.

Where do values and character come from? How do they develop, become internalized, and guide our actions?

Allow a few participants to respond. Record their thoughts on the flipchart.

Bandura's Social Cognitive Model of Development

Over the course of history, philosophers and psychologists have addressed different aspects of value and character development. There are many different perspectives on this issue. Albert Bandura's Social Cognitive Model of Development can give you a sense of how values and character might develop. Although Bandura's theory is only one set of ideas, it captures the complexity of value and character development and it has empirical support.

In this model, all development, including the development of values and character, is the result of three factors: a person's environment, a person's behavior, and personal/cognitive factors such as motivation or beliefs. For example, the family and community in which a person lives and grows (his or her environment) will emphasize some values more than others and will attempt to socialize people toward particular character traits.

At the same time, a person's own behavior elicits a response from his or her surroundings. For example, if a child exhibits prosocial behavior in the classroom, his or her teacher may reward the behavior, making it more likely the child will repeat the behavior. Over time, the prosocial behavior may become a character trait that is not contingent upon the behavior being rewarded.

The third factor, personal characteristics such as beliefs, also affects the development of values and character. Self-efficacy beliefs, for example, refer to our beliefs in our own ability. People are more likely to act according to their values when they have the ability to do so and expect to achieve positive outcomes. If leaders develop the confidence that, even during difficult situations, they are strong enough to act according to their guiding values, then they are more likely to achieve their desired standard of conduct.

An important component of Bandura's theory is vicarious learning, or modeling. Bandura proposed and tested the notion that people model the behaviors to which they are exposed. If people have peers, family members, and mentors who display particular values, they are likely to act in a similar manner.

These three factors contributing to development—environment, behavior, and personal/cognitive factors—interact with each other, making the development of values and character complex and dynamic. Bandura's theory suggests how values and character may develop; being aware of these processes can help us understand our own values and character, strive for desired changes, and learn to influence the values and character of others.

What does this have to do with leadership?

Richard L. Daft, who wrote the textbook on leadership development, *The Leadership Experience*, believes leadership is inseparable from our values and moral actions. He says, "Leadership is not merely a set of practices with no association with right or wrong" (Daft, p. 222).

Values act as filters when we are making decisions, and character provides a stable base or anchoring from which to act. In order to move people toward improvement, leaders must have a positive value

system and a strong character. There are a number of leadership models rooted in values and character. The following is a brief summary presenting a few popular ideas about character and leadership. You can find more information in the reference list.

Josephson's Six Pillars of Character

The Six Pillars of Character were developed by The Josephson Institute, a nonprofit organization "dedicated to improving the ethical quality of society by changing personal and organizational decision making and behavior."

The Six Pillars are:

1. Trustworthiness (honesty, integrity, reliability, loyalty)
2. Respect (civility, courtesy, decency, dignity, autonomy, tolerance, acceptance)
3. Responsibility (accountability, pursuit of excellence, self-restraint)
4. Fairness (process, impartiality, equity)
5. Caring (compassionate, forgiving, helpful)
6. Citizenship (cooperate, involvement, considerate of neighbors and community)

Covey's *Principle Centered Leadership*

Stephen Covey's model of Principle Centered Leadership has four dimensions that he calls "natural laws" or "principles": Wisdom, Guidance, Security, and Power. He argues that we need to focus on natural laws because they endure and hold everywhere; natural laws do not change or shift. They provide principles that act as a compass and can guide us.

He separates these principles from human values. He says these principles, unlike our values, are objective and external, and the more our values align with the natural laws, the more useful they will be. Covey writes that when we are guided by Wisdom, Guidance, Security, and Power, "we gain the strength to break with the past, to overcome old habits, to change our paradigms and to achieve primary greatness and interpersonal effectiveness (p.30)." The idea is that these four principles should guide our value system and our character development.

According to Covey (1991):

- Security represents our sense of worth, self-esteem, and personal strength.
- Guidance is the direction we receive, the standards and principles that govern how we make decisions and what we do.
- Wisdom is a sage perspective on life, balance, a deep understanding of how principles apply and relate to each other.
- Power is the capacity to act and the courage to accomplish a task.

Greenleaf's *Servant Leadership*

Robert Greenleaf developed the notion of Servant Leadership. Greenleaf believes true leadership emerges from people who are intrinsically motivated to help others. Servant Leaders transcend self-interest to serve the needs of others. They help others grow and provide opportunities for others to gain materially and emotionally. Servant leadership is a long-term, transformational approach to life and work.

Greenleaf wrote about the need for a different approach to leadership. He suggested that serving employees, customers, and the community should be a leader's first priority. Characteristics of Servant Leaders are that they listen, empathize, heal, persuade, and build community. They exhibit foresight, stewardship, and commitment to the group.

If time permits, lead the participants through a discussion of these ideas. Possible discussion questions include:

What do these ideas (Six Pillars of Character, Principle Centered Leadership, and Servant Leadership) have in common?

- How are they distinct from one another?
- How useful are they?
- What do they add to the knowledge base of leadership?

These three models are based on values and character. They are popular frameworks that provide important ideas regarding the nature of leadership and the personal characteristics of good leaders.

The Relationship Among Values, Character, & Leadership

Research helps us to better understand the relationship among values, character, and leadership. Gillespie and Mann (2004) investigated leadership practices and how they affect trust in the leader. They found values have a significant role in the development of trust; sharing common values was among the three variables that accounted for 67 percent of the team members' total trust in the project leader.

Character is popularly conceptualized as a group of constant and unchanging traits. Peterson and Seligman (2003) investigated the conditions under which character may change. Following the September 11 attacks on the World Trade Center, they found increases in seven character strengths: gratitude, hope, kindness, leadership, love, spirituality, and teamwork. This indicates there are conditions under which character can change. One questions with very large implications for leadership is whether or not people can intentionally change their own character without a life-changing event. Although research has not addressed this specific point, there is evidence that long-standing, habitual behavior can change when people are motivated to change.

In another study, Hogan and Kaiser (2005) reviewed a study by Peterson and Seligman (2004) regarding the characteristics people look for in their leaders. The top four characteristics in order of importance were integrity, decisiveness, competence, and vision. People tend to accept leadership from people with these attributes, and each of these involves values and character. This research supports the importance of values and character in leadership.

Activity – 20 Minutes – Clarifying Values

Break the participants into small groups for the Values Clarification activity. Pass out the "Clarifying Our Values" activity sheet to each participant. Read the instructions on the sheet.

After 15 minutes, ask the groups to discuss the following questions:

1. If your values conflicted with those of another group member, how did you resolve the decision?
2. Were there values you would concede and some you would not?
3. What did you think about some of your group members' values, especially if they seemed to conflict with your own?
4. How is this exercise like "real life" when you are faced with decisions in which values come into play?

Activity – 10 Minutes – Examining Core Values

Pass out the "Examining My Core Values" activity sheet. Read the instructions at the top of the page, and ask participants to think about their core values individually and respond to the questions. If time allows, ask if anyone would like to share their core values or what they learned in doing this activity. Ask if they identified the same values as in the Icebreaker activity, "Wearing Your Values," or if they were able to identify other core values.

Reflection, Application, & Summary – 10 Minutes

Have the participants apply the content of the workshop by discussing some or all of the following:

1. What do the people you consider to be leaders value? How do you know?
2. How would someone know what you value?
3. How did you make decisions in the value clarification exercise? What does this tell you about your values?
4. Does courage have a role in leadership based on values? If so, what is the role?
5. Why might it be important for leaders to understand their own values and character attributes?
6. How can you continue to develop positive values and build a strong character?
7. How can you help others develop positive values and a strong character?
8. When you are in situations that challenge your values, from where will your courage to act in accordance with your values come?

Values and character attributes are at the center of who we are and therefore affect all aspects of our lives, including our leadership capacity. Many people who write about leadership indicate values and character are central to creating a positive influence. We have discussed different views regarding leadership based on values and character, and you have had time to think about some of your values and character attributes. As you continue to develop your leadership style and ability, consider the role your values and character play.

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Clarifying Our Values

You are on a cruise ship off the coast of South Africa. A very bad storm damaged the vessel, and it is taking on so much water that it is going to sink. There are not enough life rafts for everyone; some will be left behind and likely drown or be eaten by the sharks circling the sinking ship. You are part of the rescue team and must decide which five or six of 10 people will be allowed into a small rescue boat. Five of the people can fit easily, and the small rescue boat should make it safely to the coast. Six people may fit, but that would exceed the boat's capacity and possibly jeopardize the ability to get to shore safely. The team has only 10 minutes to make the decision.

As you discuss which six people to allow into the rafts, be aware of the values that underlie your reasoning. For example, if the pregnant woman is to be saved, what is the underlying value guiding your decision? Here are your choices:

- A recent university male graduate who works in an accounting firm.
- The recent graduate's wife who is eight months pregnant.
- A second-year Latina medical student who is also a community advocate.
- A middle aged man who is an accomplished writer.
- A Hollywood actor who has played the lead in award-winning movies.
- A female geneticist who had an important role in mapping the genome.
- A middle-aged member of the clergy who has four young children.
- An Olympic athlete who is likely to bring her country a great deal of recognition.
- A college student who plans to become a civil rights attorney.
- A Supreme Court Justice who is writing the majority opinion on the use of stem cells for cloning animals.

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Examining My Core Values

The purpose of this activity is for you to think more deeply about core values that you hold. In the spaces below, write about your values.

1. Identify a value that governs your behavior or life.

2. Write about something or someone that supports your value.

3. Describe how the value protects you.

4. Describe a time when the value has been difficult to hold onto and it would have been easier to release it.

5. Write about how you came to that value, how or why it developed.

6. Describe what someone would see if they witnessed you behaving according to the value.

7. Describe a time you invited others to share your value, or describe how you could do that.

8. Describe a situation in which you hid or would have rather hidden your value. Or describe a situation that could make your value hard to live by.

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About *Leadership in Action*

Leadership in Action is a multi-state leadership development program for college-age students. It was funded in part by an USDA/CSREES HEP Challenge Grant, 2005-2009 to the University of Illinois, Purdue University, and the University of Wisconsin – Madison. Undergraduate students from those universities participated in a 21-month program during which the workshop modules were developed, used during the two cohort programs, reviewed, and revised.

We intend that students who have been trained in conducting effective workshops use these materials for leadership workshops with various student organizations. The materials can be used separately for individual workshop sessions, in any combination for a short-term program, or in their entirety for a long-term program.

Leadership in Action *Curriculum Team*

Janet Ayres, Professor, Department of Agricultural Economics, Purdue University
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John Klatt, Associate Student Services Coordinator, College of Agricultural & Life Sciences, University of Wisconsin-Madison
Marianne Lorensen, Visiting Leadership Program Coordinator, Human & Community Development, University of Illinois
Charles Olson, Assistant Dean of Academic Programs, Agricultural Consumer & Environmental Sciences, University of Illinois
Robbie Ortega, Graduate Student, Youth Development and Agricultural Education, Purdue University

Understanding Our Values & Character *Development Team*

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Editor: Laura Hoelscher, Purdue University
Designer: Russell Merzdorf, Purdue University

Purdue University

University of Illinois

University of Wisconsin - Madison

10/09

Appendix K. Sample of Activities for the Science Workshop Component

4-H Engineering Science Workshop

June 10th-June 12th
Workshop Schedule

Wednesday, June 10th

9:00am-11:00am	Registration *Earhart Hall*
11:00am-12:15pm	***LUNCH ON YOUR OWN***
12:30pm	Earhart Hall for General Orientation
1:30pm-2:15pm	WECOME – ABE 204 Dr. Bernard Engel, Head, ABE
2:30pm-5:30pm	**Engineering Session #1** *The Electronic Measurement Technique* Mr. Barrett Robinson, Electrical & Computer Engineering EE 163 *The Physics of Mousetrap Cars* Mr. Mike Kowalkowski, Aerospace and Aeronautical Engineering EE 117 *Wind Sail Testing Experiment* Ms. Wei Liu & Mr. Jose Duenas, Purdue INSPIRE Program EE 115
5:30pm-6:00pm	Free Time, Explore Purdue *(In small groups!!!)*
6:00pm	Dinner at Ross-Ade Stadium
8:30pm-10:30pm	Recreational Sports Center
10:45pm	Back to Earhart Hall, Doors Locked
11:00pm	Delegates meet with chaperones on each floor
11:30pm	In rooms for room check
Midnight	*LIGHTS OUT!*

Thursday, June 11th

6:30am-7:30am	Breakfast, Windsor Dining Hall
7:45am	Meet on lawn of Windsor Halls to walk to ABE
8:00am-11:00am	**Engineering Session #2** *Physical Properties of Biological Materials* Dr. Richard Stroshine, Agricultural & Biological Engineering ABE 111 *An Introduction to Biomedical Engineering* Dr. Marcia Pool & Dr. Allison Sieving, Biomedical Engineering MJIS 1087 *Hands-On Demonstration of Agricultural Machine Systems and Robotics* Dr. John Lumkes, Agricultural & Biological Engineering ABE 106C
11:15am-11:30am	Meet in ABE 204 for afternoon instructions
11:30am-12:30pm	**LUNCH ON YOUR OWN** *Purdue Memorial Union*
12:30pm-12:40pm	Load bus at Purdue Memorial Union, Grant Street Exit
12:4pm	Depart for Subaru of Indiana Automotive
1:00pm-2:30pm	**Engineering Session #3** Tour Subaru of Indiana Automotive Tom Elger, Tour Coordinator, Subaru of Indiana Automotive
2:30pm-2:45pm	Load bus at SIA
2:45pm	Depart for ABE
3:00pm-4:00pm	Work on Mousetrap Cars
4:00pm-5:00pm	Free Time – Explore Purdue University
5:00pm-7:00pm	Dinner at Windsor Dining Hall
8:00pm-10:30pm	Dance in the North Ballroom of the Purdue Memorial Union
10:45pm	Back to Earhart Hall
11:30pm	In rooms for room check
Midnight	*LIGHTS OUT!*

Friday, June 12th

6:30am-7:30am	Breakfast at Windsor Dining Hall
7:45am	Meet on lawn of Windsor Halls to walk to ABE
8:00am-8:50am	**Session #4** College Awareness Session Mr. Robbie Ortega, Youth Development & Agricultural Education ABE 204
9:00am-10::00am	Final preparations for the 4-H 500 Derby
10:15am-11:15am	4-H 500 Derby. Site TBA
11:30am-Noon	Presentation of Awards and Final Comments Dr. William Field, Professor, Agricultural & Biological Engineering Mr. Robbie Ortega, YDAE ABE 204
Noon	Have a safe trip home

VITA

VITA

Education

August 2011	Ph.D.	Purdue University, West Lafayette, Indiana Field of Study: Youth Development & Agricultural Education Specialty Areas: Extension & Non-formal Education Dissertation Title: *Motivation and Career Outcomes of a Precollege Agricultural Science Experience for Underrepresented Minorities*
June 2003	M.S.	Purdue University, West Lafayette, Indiana Field of Study: Curriculum & Instruction Specialty Areas: Agricultural & Extension Education Thesis Title: *Analysis and Evaluation of the Effectiveness of Gearing Up: Production Agricultural Safety Training for Youth, the Computer Assisted Instruction/Multimedia Farm Tractor and Machinery Safety Curriculum*
May 2000	B.S.	Texas A&M University, College Station, Texas Field of Study: Agricultural Leadership & Development Specialty Areas: Agricultural Education & Building Construction Management

Experience

August 2000-Present Graduate Assistant, Department of Youth Development & Agricultural Education, Purdue University

<u>Outreach and Engagement</u>

- Coordinate Annual Engineering Science Workshop for Youth
- Co-Coordinate Annual 4-H Electric Workshop
- Co-Coordinate Annual 4-H State Tractor Contest at the Indiana State Fair
- Co-Coordinate Annual 4-H Bicycle Rodeo Contest at the Indiana State Fair

- Co-Coordinate Annual 4-H Aerospace and Rocket Launch Contest at the Indiana State Fair
- Assistant Superintendant for the National 4-H Engineering Challenge
- Assist with the management and maintenance of 4-H Engineering Science Projects

Teaching

- Co-Instructor, YDAE 540, Program Development in Agriculture and Extension Education
- C0-Instructor, YDAE 644, YDAE Graduate Seminar
- Teaching Assistant, AGEC 435, Leadership in a Changing World

Leadership

- Purdue University College of Agriculture Leadership Certificate Steering Committee
- Purdue University College of Agriculture Diversity Action Team
- Advisor, Purdue Chapter of Leadership in Action

Refereed Publications

Kingman, D., Field, W., Hodge, N., Yoder, A., & **Ortega, R.** (2005). Utilizing Expert Panels in Agricultural Safety and Health Research. *Journal of Agricultural Safety and Health*, 11(1).

Ortega, R., Tormoehlen, R., Field, W., Balschweid, M. & Machtmes, K. (2003). Determining Critical Subject Matter Content for a Safety Certification Program for Youth Employed in Agricultural Production. *Journal of Agricultural Education*, 44(4).

Curricula, Works, & Publications

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National Paper & Poster Presentations

Esters, L., Knobloch, N., **Ortega, R.,** & Jones, A. (2010). *Human capacity development in science, technology, engineering, agriculture, and math (STEAM) disciplines through precollege science workshops for rural school students.* Poster presented at the Association of Public Land-Grant and Universities Summit, State College, PA.

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Invited Presentations

Ortega, R. (2009). *Getting Youth Engaged in Your Nonprofit Organization and Activities.* Presented at the 2009 Downstate Illinois Nonprofit Conference, Urbana-Champaign, IL.

Additional Publications

Tormoehlen, R., Field, W., & **Ortega, R.** (2004). *Gearing Up for Safety: A computer-based approach to teaching agricultural safety.* Resource: Engineering & Technology for a Sustainable World, September, 13-14.

Honors and Affiliations

Association of Leadership Educators	2004-present
Gamma Sigma Delta – Honors Society of Agriculture, Consumer Family Sciences & Veterinary Medicine	2004-present

President – Agricultural & Extension Education Graduate Student Association – Purdue University	2001 – 2004
American Association of Agricultural Educators	2000-present
National Association of Agricultural Educators	2000-2004
Indiana Association of Agricultural Educators	2000-2004

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