



Impact Planning, Evaluation & Audience Research

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Summative Evaluation:
The Whitten-Newman ExplorOlogy®
Program

Prepared for the
Sam Noble Museum
Norman, OK

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SUMMARY AND DISCUSSION

INTRODUCTION

This report presents the findings from a summative evaluation of the *Whitten-Newman ExplorOlogy*[®] Program conducted by Randi Korn & Associates, Inc. (RK&A) for the Sam Noble Museum. This study explored how 16 program participants experienced the program and how their sense of self and identity was affected during the year following the programs' completion. Data from participants were collected beginning with their participation in the program and continuing over the course of approximately one year. Below, first we present a summary of key findings to highlight significant outcomes of participants' experiences. Second, we discuss implications of the findings for the program, including successful program aspects, as well as those that might need to be revisited.

The findings presented here are among the most salient. Please read the body of the report for a more comprehensive presentation of findings.

SUMMARY OF KEY FINDINGS

STUDENT PARTICIPANTS

Interviews were conducted with student participants over the course of one year, and findings show that the program had a strong and enduring effect on their individual growth and development, particularly in the areas of social confidence, communication skills, and science identity.¹ Specific key findings include:

- ♦ All student participants were motivated to participate in the program because of a strong prior interest in science and/or exploring nature; these interests were primarily personal, having been mostly cultivated during out-of-school time activities (e.g., exploring backyard) as opposed to in-school coursework.
- ♦ Most students were interested in the *Whitten-Newman ExplorOlogy*[®] Program because they had a desire to “do” science (or specifically paleontology) in a real-world, hands-on setting and learn from and with those who are knowledgeable and share a common passion for science. A couple students, both of whom were repeat participants, also were motivated by a desire to build leadership skills.
- ♦ Not surprisingly, the authentic, interactive science opportunities (e.g., discovering and identifying fossils) and building meaningful relationships with others who share a passion for science (e.g., scientists, peers) created memorable experiences for most students.
- ♦ Many students gained social confidence as a result of the program, which was attributed to team-building activities, research projects, and working with others who share similar interests (e.g., a passion for learning science). As a result of their increased confidence, many students reported continually building relationships with peers and maintaining contact with other program participants over the course of the year.

¹ Science identity is defined by the National Research Council (2009) as “how learners view themselves with respect to science.”

- ◆ Many student participants gained communication skills as a result of the program; some became more confident vocalizing their opinions during collaborations, while others became more comfortable speaking in front of others (e.g., about science). Most students gave examples of ways these skills persisted since the program ended.
- ◆ As stated previously, nearly all students entered the program with a strong interest in science, and the program confirmed or enhanced their interests or views. Over the year, interviews indicate that students continued to see science as an enjoyable pursuit and sought additional ways to pursue it, such as in out-of-school activities and possible careers in science or medicine.
- ◆ As a result of the program, many students' understanding of what it means to be a scientist was deepened. Interviews showed that this enhanced understanding was maintained over the course of the year following the program. For instance, students continued to say things such as “being a scientist is challenging but worthwhile,” and “the scientific process requires trial and error.”
- ◆ Some students' understanding of what it means to “do” science was developed as a result of the program. For instance, some came to understand that doing science involves collaboration, and observation is an important aspect of science. Other students' understanding did not grow substantially; rather, they maintained the broad view of science they had when they entered the program, saying “everything involves science.” These understandings persisted throughout the year.
- ◆ Many students learned new practical applications of science skills and techniques, such as how to cast a fossil, decipher fossil evidence to make conjectures about the past, and journaling. In general, students did not have many opportunities to apply these skills after their program experience.
- ◆ Besides causing an increased awareness of the *Whitten-Newman ExplorOlogy® Program* and Museum, the program did not seem to indirectly affect members of participants' “community,” including family, friends, and peers. While some students shared their experiences with others, either formally through *ExplorOlogy in Motion®* or informally with family and friends, others were unable to do so due to logistical or scheduling constraints.

TEACHER PARTICIPANTS

Interviews were conducted with teacher participants over the course of one year, and findings show that the program had lasting effects on most, especially regarding their ability to use inquiry as a strategy to teach science and their understanding of what science and being a scientist entails. Overall, key findings include:

- ◆ All teachers entered the program with a strong prior interest in science and science education, citing in-school and out-of-school activities, such as a BioBlitz, as programs they participate in with students and/or family.
- ◆ All teachers were motivated to participate in the program by a desire to learn more about the inquiry method, a love of science, and/or a desire to network with scientists and other teachers.
- ◆ Most memorable for teachers were the science activities they could adapt for use with their students.
- ◆ All teachers gained increased confidence in their ability to use inquiry to teach science; however, the extent to which they gained confidence varied. For instance, a couple teachers felt confident enough to change their overall approach to teaching science during the course of the year, while the other two have considered but integrated just one or two isolated inquiry activities.

- ◆ Even though participating teachers reported that they did not maintain contact with each other, a couple said they had made efforts to collaborate with other teachers in their school by sharing program resources.
- ◆ All teachers gained an understanding of how to teach science using inquiry, and most also broadened their understanding of science; for instance, realizing that science involves creativity and risk-taking. This understanding persisted over the course of the year.
- ◆ Over the course of the year, the effect that teachers had on others who were not directly involved with the *Whitten-Newman ExplorOlogy® Program* varied. For instance, a couple said their students were significantly affected by the inquiry method; on the other hand, the other two could not articulate whether the program had affected their students due to lack of implementation.

SCIENTIST PARTICIPANTS

Fewer interviews were conducted with scientists, yet findings indicate that their past program involvement has affected how they relate to and facilitate science for non-scientists. Overall, key findings include:

- ◆ Both scientists had prior experience conducting informal science education programs and were motivated to participate in the program by a desire to teach science to middle- and high-school age youth.
- ◆ Scientists praised the following about the program's structure: total immersion in activities away from home, engagement in authentic scientific research with real scientists, and the opportunity to teach using open-ended exploration.
- ◆ Scientists cited a couple challenges they encountered during the program, including discovering participants' passions in order to effectively relate to them and preparing for the program given their other professional responsibilities.
- ◆ Both scientists gained confidence facilitating science experiences for non-scientists (i.e., students and teachers) and learned how to better relate to non-scientists. One scientist has even shared with his colleagues that demonstrating how science is relevant is important when teaching students science.
- ◆ Interviews with student and teacher participants revealed that the passion both scientists exuded for their work during the program had a lasting positive effect on participants' interest in science.

PROGRAM IMPLICATIONS

As evidenced by the year-long study, which captured how participants made meaning from their experiences and explored their individual and science identities, the *Whitten-Newman ExplorOlogy® Program* has had deep and long-lasting effects on most participants. For instance, as a result of the program, students view themselves as more socially confident, better communicators, and more effective collaborators. Further, the National Research Council (2009) posits that informal science programs can help participants develop science identities by “helping them to identify and solidify their interests, commitments, and social networks, thereby providing access to scientific communities and careers.” In this sense, the program contributed to students' science identities by confirming that they love science or can realistically pursue science as a career. Likewise, as a result of the program, teachers and scientists are better able to envision themselves as individuals who can effectively facilitate science experiences for others. It is also noteworthy that the outcomes of participants' program experiences

have persisted over time, as some informal science education programs often struggle to achieve deep, long-lasting effects on individuals.

In many ways, the program's purposeful structure has contributed to the successful achievement of these outcomes. First, participants undergo a rigorous selection process when applying for the program, which includes a detailed application submission, letters of recommendation, and an in-depth interview process. This selection process results in a group of students and teachers who have a strong interest in science and are highly motivated to participate in the program. As findings indicate, students and teachers greatly appreciated participating in a program with others who were equally passionate about science and learning. Thus, an ideal program environment persisted, allowing participants to become more socially confident and enhance their understanding of science. Previous research shows that motivation is a significant contributing factor to the success of informal science education experiences (National Research Council, 2009; Anderson, 2005; National Research Council, 2000) so the Museum's careful consideration of this factor when designing the program structure is worthy of note.

The real-world aspect of the program also proved successful. For example, the program emphasized authentic scientific research with scientists who are passionate about their work and allowed students to conduct field research, including excavating fossils and collecting samples of pond life. These kinds of experiences confirmed participants' view that science is interesting and fun. And, interacting with scientists who are passionate about their work was very effective, as it deepened participants' interest in science and science-related careers.

The program also taught participants relevant life and professional skills such as working in teams and, in the case of teachers, learning pedagogical strategies. Opportunities to work with a partner or group to conduct scientific investigations led participants to build collaborative and communication skills. And, for teachers, engaging in pedagogical sessions that integrated inquiry methods into existing curriculum bolstered their confidence as science educators. Similarly, the scientists gained confidence facilitating science experiences for non-scientists by immersing themselves in the program experience. Total immersion in the program also likely facilitated relationship building between participants and helped participants envision what real scientific field research requires.

While the program had significant effects on its primary audience of students and teachers, it was less successful at affecting those surrounding the participants (i.e., friends, parents, other teachers). The primary effect on others was some increased awareness about program opportunities. Many participants shared their experiences with friends, family, and colleagues informally and formally through such opportunities as *ExplorOlogy in Motion*[®]. However, few participants cited examples where someone expressed further interest in science, the most obvious indicator being that they applied for or were accepted to the program. Teachers seemed to have the greatest opportunity to affect others by implementing inquiry in their classroom and sharing knowledge with their colleagues. A couple teachers did just that; however, a greater contributing factor seemed to be the teacher's prior enthusiasm and motivation for continual improvement. For instance, a couple teachers who entered the program enthusiastically seeking out additional resources and strategies fully implemented inquiry methods in their classroom, while another teacher who expressed less enthusiasm described lack of time and other responsibilities as a barrier to doing so.²

Affecting others, in addition to the primary participants, is a challenge not unique to the *Whitten-Newman ExplorOlogy*[®] Program. Rather than thinking of the community beyond the program participants as a homogenous group, it is helpful to think of the community as diverse types of individuals, with some

² One teacher was seeking out a new teaching position at the time of the interview; thus, she could not implement what she learned in the program.

having greater potential to be affected than others. For instance primary participants' family members have great potential to be affected because of their close contact with the participants. As such, many parents expressed an increased awareness and excitement for their child's interest, and some also became more interested in the Museum. Similarly, teacher participants present a great opportunity for the program to indirectly affect their students. Furthermore, participants' fellow students and colleagues have the opportunity to be affected, most likely in a variety of ways—with some simply becoming aware of the program and others gaining interest in the program. One indication of this is the number of applicants who applied for the program based on their contact with previous participants. For instance, of about 340 applications in the past two years, 40 were from applicants known to have found out about the program from another participant or the outreach program. Building awareness of the program and Museum offerings beyond families and select students will take time as the Museum continues to establish long-term relationships with participants' communities. For instance, at least one community's local paper ran a story on the *Whitten-Newman ExplorOlogy® Program*. With that kind of exposure the program will likely become an ingrained part of the community over time.

REFERENCES

- Anderson, D. (2005). Factors that Shape Vivid Long-term Memories: Issues for Science Centers to Ponder. *ASTC Dimensions*. November/December 2005: 8-9.
- National Research Council. (2009). *Learning Science in Informal Environments: People, Places, and Pursuits*. Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, Editors. Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.
- National Research Council. (2000). *How people learn: Brain, mind, experience, and school* (expanded ed.). Committee on Developments in the Science of Learning. J.D. Bransford, A.L. Brown, and R.R. Cocking (Eds.). Washington, DC: The National Academies Press.
- Randi Korn & Associates, Inc. (2010). Audience Research: Teachers' and Students' Needs for Museum Visits and Outside Resources. Unpublished manuscript. Washington, DC: Capitol Visitor Center.

INTRODUCTION

This report presents the findings from a summative evaluation of the *Whitten-Newman ExplorOlogy® Program* conducted by Randi Korn & Associates, Inc. (RK&A) for the Sam Noble Museum. This study explored 16 program participants' (i.e., students, classroom teachers, and scientists) personal and scientific growth and development over time, beginning with their participation in the program and following them over the course of approximately one year. Data for this study were collected from June 2010 to 2011.

This study explored the effect of the program on participants':

- ◆ Sense of themselves, including personal beliefs, thoughts, and opinions; this *might* include:
 - ❖ their ability to communicate their ideas and relate to others (within the program and in their community)
 - ❖ their ability/willingness to take risks and ask questions
 - ❖ confidence with regard to pursuing professional and personal goals (e.g., skills)
 - ❖ whether they perceive the program to be a turning point in any respect
- ◆ Sense of who they are in relation to the idea of science and being a scientist; this *might* include:
 - ❖ what “science” is and what it means to be a scientist
 - ❖ their capacity to think scientifically (i.e., critically) and how they value the ability to do so
 - ❖ their interest in science and communicating science to others (and its overall importance to them and others)
- ◆ Ability to affect and/or facilitate change in those around them with regard to personal beliefs, thoughts, opinions, and the idea of science and being a scientist.

PROGRAM DESCRIPTIONS

This study explored participants' experiences in three *Whitten-Newman ExplorOlogy® Program* programs—Science Institute, Oklahoma Science Adventure, and Paleo Expedition. A brief description of each program is provided below.

SCIENCE INSTITUTE

Science Institute is a professional development program for elementary, middle, and high school teachers interested in building a deeper understanding of science, inquiry, and the nature of science. Sixteen teachers participate in a five-day institute at the Museum where they conduct scientific investigations with university scientists and learn how to facilitate inquiry in the classroom, adapt existing curricula to include more student inquiry, and use a variety of technologies to collect and analyze data as well as communicate results.

OKLAHOMA SCIENCE ADVENTURE

Oklahoma Science Adventure is a one-week field experience for middle school students (grades 6 to 8) that explores the question “What is science?” Fourteen students are selected to participate in the overnight program where they work with scientists on field research projects, hike, canoe, and participate in leadership and team-building activities.

PALEO EXPEDITION

Paleo Expedition is a field experience offered to Oklahoma high school students (grades 9 to 11) who demonstrate an interest in and enthusiasm for paleontology. Twelve students are selected to participate in an overnight program that lasts 18 days; during this time, participants work with paleontologists to study the history of life based on the fossil record. Students excavate real fossil sites while learning field techniques such as mapping, GPS navigation, and camping survival skills.

METHODOLOGY

The *Whitten-Newman ExplorOlogy® Program* is an in-depth program experience available to a select group of middle and high school students and K-12 teachers who demonstrate their interest and qualifications through a rigorous application and interview process. That is, the number of participants is small, yet their program experience is rich and nuanced. As such, we chose to conduct an exploratory study, focusing on 16 participants' meaning-making and identity work over time, beginning with their participation in the program and following them over the course of approximately one year. This approach was selected as the best way to examine the effect of participants' program experiences in-depth, over time.

For this study, RK&A, in partnership with SNOMNH staff, purposely selected three programs from which to draw study participants. The programs selected were Science Institute, Oklahoma Science Adventure, and Paleo Expedition, three programs where participants' level of involvement is at its highest. RK&A collected informed consent from all participants willing to take part in the study. From these participants, 16 were randomly selected from the three programs, including 10 students, four teachers, and two scientists.

Data were collected using participant observations and interviews conducted between June 2010 and June 2011.³ One observation was conducted for context at some point during participants' program experience (see Appendix A for the observation guide). Participant interviews—which concentrated on participants' reflections of their program experience over time—were conducted in Fall/Winter 2010, Winter 2010/2011, and Spring/Summer 2011. Additionally, interviews with scientists, staff, and family were conducted in Spring/Summer 2011 to provide a more holistic picture of each participant's experience (see Appendix B and C for the interview guides). All interviews were conducted via telephone and audio-recorded with participants' consent to facilitate analysis.

DATA ANALYSIS AND REPORTING METHOD

Observations and in-depth interviews conducted for this study produce qualitative data, meaning that results are descriptive. When analyzing qualitative data, the evaluator studies verbatim transcripts and observations for meaningful patterns, and, as patterns emerge, groups similar responses and behaviors, eliciting trends in the data.

Trends within the data are presented in thematic sections based on study objectives. This report uses verbatim quotations from interviews (edited for clarity) to give the reader the flavor of participants' experiences and illustrate their ideas as fully as possible. Within quotations, the interviewer's comments

³ Given some logistical constraints, observations were conducted of the whole program rather than individual participants. Thus, observations were used as context to inform analysis and reporting rather than as raw data.

appear in parentheses. For interviews, the number of the participant interview (e.g., Interview 1) or type of interview (e.g., Staff Interview) appears in brackets following the quotations.

HUMAN SUBJECT PROTECTION

RK&A secured approval to conduct research with human subjects from the University of Oklahoma's Office of Human Research Participant Protection. RK&A's Institutional Review Board (IRB) number is 13046.

Per IRB requirements, consent/assent was secured from all study participants, including parents of student participants 17 years and younger. Consent included permission to audio-record interviews and conduct interviews with additional individuals, such as staff, scientists, and parents, who could provide valuable insight about participants' experiences.

All data generated from the study are confidential. Participants' names were stricken from all data and replaced with ID numbers. RK&A generated and maintains the ID numbers.

Study findings are organized around the following three areas:

SECTIONS OF THE REPORT:

1. Student Participants
2. Teacher Participants
3. Scientist Participants

PRINCIPAL FINDINGS

INTRODUCTION

SNOMNH staff purposefully selected three *Whitten-Newman ExplorOlogy® Program* programs in which to explore participants' experiences—Science Institute, Oklahoma Science Adventure, and Paleo Expedition. Each of these programs requires a high level of participant involvement and thus, represents a best-case scenario for program engagement, suggesting what is possible to achieve through a more in-depth exposure to program activities. Sixteen participants—10 students, four teachers, and two scientists—were randomly selected from among the three programs. RK&A conducted interviews with each participant at different points during his or her program participation, additional interviews with those who have worked with and know the participant well (i.e., family, staff, scientists), and observations of participants during the program. Data were collected June 2010 to 2011. Findings are presented by participant group—students, teachers, and scientists—and then by individual study participant.

STUDENT PARTICIPANTS

STUDENT ONE

Student One is a middle school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Student One include:

- ◆ Two interviews, one in Fall 2010 and one in Spring/Summer 2011
- ◆ One interview with his parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student One's parent learned about the *Whitten-Newman ExplorOlogy® Program* from a teacher newsletter and encouraged him to apply due to his interest in science and being a scientist. Student One's pre-program interest in science was fairly diverse and rooted in curiosity about the natural world. He expressed a desire to learn about rocket science and said he enjoys looking at animals and insects in nature. His in-school science background included some elementary-level experiments, but his pre-program exposure to formal science was minimal compared to his enthusiasm for learning about it. Staff shared that Student One was selected for the program in part because he demonstrated enthusiasm for the hands-on discovery process, even though his previous opportunities to pursue science were limited (see the quotation below).

[Student One] seemed just naturally easy going, naturally enthusiastic about everything. He didn't have a lot of science opportunities, and also, he was from an area we've never had a participant apply from before. [Student One, Staff Interview]

MEMORABLE PROGRAM EXPERIENCES

In keeping with his background interest in science, the most memorable *Whitten-Newman ExplorOlogy® Program* experiences for Student One were opportunities to study things in nature in a hands-on way. His discovery of a fossilized fish scale was a program highlight, and it led to a special opportunity for

him to learn more about fossils from a paleontologist. Through the program, Student One also built meaningful relationships with other participants (see the quotation below).

(Can you tell me about an experience that seemed particularly meaningful to him?) Some of the teamwork activities [the participants] did to get involved with each other. . . . He really looks forward to going back and seeing the friends he made, the *Whitten-Newman ExplorOlogy® Program* team. He has a connection with those kids. They're not the typical student body that he goes to school with every day. They are as curious about learning as he is and want to be exposed to [science opportunities]. [Student One, Parent Interview]

PROGRAM SUCCESSES AND EFFECTS

Most notably, the program built Student One's social confidence and improved his ability to effectively communicate science to others.

CONFIDENCE AND SOCIAL ABILITIES

Building social confidence was one of the most distinguishable outcomes of Student One's experience in the *Whitten-Newman ExplorOlogy® Program*. During his first interview, Student One acknowledged that not knowing anyone in the program was initially challenging. In a later interview, he identified the opportunity to establish new friendships as one way the program positively impacted his life (see the quotation below). His parent also said that making friends who shared his interest in learning about science was an important outcome for Student One. According to his parent, the program also increased Student One's maturity by encouraging him to take a leadership role in this and other activities and increased his academic confidence.

(How has [the *Whitten-Newman ExplorOlogy® Program*] impacted your life?) I have met new people and learned some things that I didn't learn in science, and I made a lot of new friends. [Student One, Interview 2]

COMMUNICATION AND COLLABORATION

Although working with a group was sometimes challenging for Student One, the opportunity to make friends and interact with others around science was a positive part of his experience. His interest in working with peers seemed to be strongest when the group was engaged in science learning or gathering data. Communication with others, especially adults, was a growth area for Student One (see the first quotation below). Increased confidence and opportunities to talk about science or present his findings were instrumental in helping him become more comfortable with others (see the second quotation). Staff said that presenting at his school in front of younger students for *ExplorOlogy in Motion®* was especially positive for him.

In the beginning, I think [Student One] was shy. . . . He's very good at talking to adults one on one, and he's fine giving his opinion, but sometimes he backed down if someone disagreed with him. I think that towards the end, [there] was a subtle change; I think he felt more comfortable [talking to his peers]. [Student One, Staff Interview]

[Since the *Whitten-Newman ExplorOlogy® Program*, Student One is] not as shy to stand up in front of people and talk. I think [the program] gave him opportunities to do things like that in small groups that really helped him. And, they practiced and got ready for the presentation, and he hasn't really been on stage in front of a crowd before, and [his group] asked to go last because they wanted to make a big splash. [Student One, Parent Interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student One was interested in science before participating in *Whitten-Newman ExplorOlogy*® Program and that interest grew throughout his program experience. When asked what he thought of the program in general, Student One quickly identified it as fun because of the opportunity to do science. This natural enthusiasm distinguished him from other program participants (see the quotation below), and his parent said it continued at home after the program. Student One did not express great interest in science as a career path; for him, scientific exploration is fun and recreational, even when approached in a serious or academic way, and the program enhanced this perception.

I think [Student One] just naturally has an enthusiasm and curiosity [about finding things out through science]. Some students don't like to get dirty, they don't like to be outside, they don't like to be uncomfortable, but he was just all over and he didn't care.
[Student One, Staff Interview]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Pre-program, Student One viewed science holistically (“studying different things [in] the past or future”) and seemed to maintain this view of science throughout the *Whitten-Newman ExplorOlogy*® Program. Staff said that the program experience helped turn his enthusiasm for science into a broader understanding of scientific processes. While Student One struggled to identify ways he has applied what he learned in the program, he did tell a story about testing his hypothesis about bats while fishing. And, while it was challenging for him to make connections to his in-school experiences with science, he seemed to understand that the scientific method can be applied in many circumstances and that his *Whitten-Newman ExplorOlogy*® Program experience presented a special opportunity to explore science in a hands-on way, something he does not do much in school (see the quotation below).

(How did the *Whitten-Newman ExplorOlogy*® Program change your views about science?) It changed in that I knew that there was more than the water cycle and some other stuff we're [learning about] at school; there was other stuff that I learned that we don't learn in school. (Okay what were some of those things that you learned that you didn't learn in school?) They taught us how to use binoculars and how to spot for birds and mammals. (And what else?) How to make plaster casts of tracks. [Student One, Interview 2]

EFFECT ON OTHERS

Student One's experience in *Whitten-Newman ExplorOlogy*® Program did not have a substantial effect on others. He encouraged some of his friends to apply for the program, but none of them have seriously pursued participation. When he presented at his school for the *ExplorOlogy in Motion*® program, the younger students seemed to really enjoy it, saying “it was cool.” Student One's parent also said their family has become more engaged in the Museum since he participated in the program (see the quotation below).

I think that with the family we have developed more of an appreciation for the Museum. We like to go up there and see the traveling displays and let him be involved in the *Whitten-Newman ExplorOlogy*® Program follow-up meetings and things like that. [Student One, Parent Interview]

STUDENT TWO

Student Two is a high school student who attended the *Whitten-Newman ExplorOlogy*® Program in the summer of 2010. Data points related to Student Two include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Two learned of the *Whitten-Newman ExplorOlogy® Program* while looking at summer camp opportunities with his mom. Student Two is from a rural area, and he had an interest in nature before applying. He spent a lot of time outdoors observing wildlife prior to the program and always wanted to learn more about nature (see the quotation below). He was motivated to participate in the *Whitten-Newman ExplorOlogy® Program* because he wanted to explore Oklahoma, meet new people, and learn about nature and paleontology.

I go outside and stuff; I've always been interested in nature because I live in the country and by woods. I see animals, fish, amphibians, [and] reptiles all the time. So I've always wanted to know more about [nature]. [Student Two, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

Student Two most enjoyed program experiences that were hands-on and presented opportunities to work with a partner to overcome challenges. For example, Student Two mentioned the Rogers State University Ropes Course, scavenger hunt, and canoeing trip, all three of which posed challenges that had to be overcome. The canoeing trip was also exciting because Student Two had to work with his partner to successfully navigate the river (see the quotation below).

(Are there any other experiences that stand out in your memory as it relates to this particular program?) The canoeing, it was really fun too. (What made it fun?) Working with my partner on getting down the river without getting stuck and without hitting all the rocks. [Student Two, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Student Two's program experience encouraged him to be more outgoing and collaborative in his interactions with others. His experience also made Student Two feel more confident pursuing academic and enrichment opportunities and more dedicated to the idea of working hard to achieve his goals.

CONFIDENCE AND SOCIAL ABILITIES

For Student Two, the *Whitten-Newman ExplorOlogy® Program* was a great opportunity to meet new people who are interested in science. Staff said he was initially shy, and Student Two admitted this was the first time he had participated in such a program. He built strong relationships with students and staff in a short period of time and gained confidence in knowing he could easily get along with new people. He also seemed energized to find out that he was not alone in his passion for learning about science (see the quotation below). At the reunion, he enjoyed not only connecting with those he had met at the program, but also meeting new people who attended the year before.

Just knowing that there are a lot of people interested in the same kinds of things [was an exciting part of the *Whitten-Newman ExplorOlogy® Program*]. They're actually excited about their education, wanting to learn about stuff. [Student Two, Interview 1]

COMMUNICATION AND COLLABORATION

As Student Two's comfort level with people increased, so too did his ability to communicate and collaborate with them. He indicated an initial fear expressing his thoughts and opinions, and the program helped him communicate more openly with both peers and teachers (see the quotation below). Student Two also learned a lot about collaboration and compromise because he and his

partner initially disagreed, but then found effective ways to compromise in order to successfully complete their projects. Student Two has utilized his collaboration skills in school and at home since the program. At school, his ability to collaborate and compromise has influenced his involvement in clubs and allowed him to help his classmates (see the quotation below). Student Two also recently helped his brother develop a science project that had been put off until the last minute.

(In what ways did the program affect your ability to work with others, either your peers or adults?) It's allowed me to be more open with my thoughts and not be afraid to say what I think, so it's helped me a lot with other students and my teachers as well. (Can you give me an example of that?) Just not being afraid to say what's on my mind because I think people would think it's ridiculous or sophomoric.

[Student Two, Interview 2]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Two gained a deeper interest in science as a result of his program experience and the hands-on learning opportunities it provided. Student Two was drawn to the program because of his interest in paleontology, but by the second interview, he began to express an interest in studying medicine. The program contributed somewhat by encouraging him to think more about this future and potential careers. By the third interview, Student Two said that he had enrolled in an engineering camp, which will provide a hands-on opportunity to apply his math and science skills. His *Whitten-Newman ExplorOlogy® Program* experience motivated him to pursue another camp since it was so positive for him (see the quotation below).

[*Whitten-Newman Whitten-Newman ExplorOlogy® Program*] opened my eyes to more [science] [opportunities], I guess that engineering thing. I might not have considered that before the camp just because I come from a small town. I [might not have known] if I can do an engineering camp and be successful. . . . I didn't think I would be able to do the *Whitten-Newman ExplorOlogy® [Program]* and go through with it and have as much fun as I did, but I did. [Student Two, Interview 3]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Pre-program, Student Two expressed a holistic perspective of science that he maintained throughout his program experience. He said that "science is everything," and "everything involves science." By piquing his interest in science, *Whitten-Newman ExplorOlogy® Program* encouraged him to learn more about science and how to apply it. Student Two also reiterated that science is hard work, and he understood from *Whitten-Newman ExplorOlogy® Program* that in addition to being challenging, science necessarily involves collaboration. The program allowed him to experience this first-hand when they collected samples (see the quotation below). Student Two's knowledge of science also expanded purely because he was exposed to new things, such as different fossils in Oklahoma. He said *Whitten-Newman ExplorOlogy® Program* opened his eyes, not only in terms of what he saw in the world, but also in terms of how he saw it.

[Science] takes a lot of hard work. You have to be focused on what you're doing, you have to be willing to listen to the people you're working with and listen to the people who know what they're talking about. (Can you give me a specific example?) Well, it was really hot [one] day, and we had to find the places that we were going to [collect] information. And, then, we had to judge which way the tracks were going, and that takes a lot of focused attention, and it's really mind straining sometimes.

[Student Two, Interview 2]

EFFECT ON OTHERS

Because a parent interview could not be conducted for Student Two, it is difficult to report on ways in which *Whitten-Newman ExplorOlogy® Program* led him to affect others after the program. Student Two did say that he has enthusiastically encouraged his brother, cousin, and friends to apply for the program in the coming year, and he thinks they will do so. He also talked at length about his increased willingness to meet others and help them with science projects. He also expressed greater openness for collaboration and teamwork, which may have an effect on his brother and school classmates.

STUDENT THREE

Student Three is a high school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Student Three include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with her parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Three's parent, a science teacher, encouraged her to apply for the *Whitten-Newman ExplorOlogy® Program* and helped her with the application. Pre-program, Student Three and her parent participated in outdoor science activities, including water testing at an area creek with a science group from their school. Her parent encouraged her to apply because *Whitten-Newman ExplorOlogy® Program* offered an opportunity for Student Three to do similar kinds of science exploration (see the quotation below). She also enjoys searching for fossils in the creek behind her house, and she was particularly interested in the water activities provided by the *Whitten-Newman ExplorOlogy® Program*.

[*Whitten-Newman ExplorOlogy® Program*] was something that was just kind of up her alley anyway, something she already enjoyed and she could do it on her own and I had nothing to do with it.
[Student Three, Parent Interview]

MEMORABLE PROGRAM EXPERIENCES

The program experiences that were most memorable for Student Three were those that involved water activities, especially at the Aqua Lab. While at the Aqua Lab, she went sailing and caught fish, frogs, and tadpoles (see the quotation below). Student Three also enjoyed the opportunity to get to know her fellow participants, and she built meaningful relationships. She said the water activities were even more fun to experience with others.

[Student Three's most memorable experience] was when we were at Roger's State University, and she was completing her project and actually getting into the water and pond and getting dirty and doing real research. (Why do you think that was meaningful to her?) The hands-on approach, actually going out and collecting the data just really seemed to get her motivated to do science. [Student Three, Staff Interview]

PROGRAM SUCCESSES AND EFFECTS

As a result of the program, Student Three gained social skills, teamwork abilities, knowledge of scientific observation, and technical skills in PowerPoint. She continues to struggle with public speaking, which was her most challenging experience during the program.

CONFIDENCE AND SOCIAL ABILITIES

Student Three said it was initially awkward not knowing anyone, but she made friends easily and has stayed in touch with them through Facebook and texting. Pre-program, she was afraid of not being accepted by others, however, she soon realized that she had a lot in common with the

other participants, especially because they shared an interest in science. This positive experience has increased her confidence and social skills (see the quotation below). Student Three's confidence in the classroom also increased as a result of her program experience. She is now more likely to raise her hand to answer a question, whereas she used to fear how people would react to her response.

[Recently at a conference,] I just walked up to people and started talking to them. And, I think I was able to do that because that's what I had to do at *Whitten-Newman ExplorOlogy® Program*. I didn't know anyone [at first], so I have more friends now, and a lot more confidence going up there, saying 'hi,' and getting that friend. [Student Three, Interview 2]

COMMUNICATION AND COLLABORATION

Student Three's communication skills increased during the program, enabling her to establish new relationships easily and collaborate with others. Teamwork was one of the things she learned from having a partner throughout the program. Working with others enabled her to overcome shyness, which has had a significant effect on her (see the quotation below). She also said that the program improved her ability to socialize, and she bonded with her fellow participants. Though the presentations were challenging for Student Three, she acknowledged that they helped improve her communication skills.

[The program] affected [my ability to work with others] tremendously. I really just worked alone because I was so shy. And now I can work with people. (Is there anything specific about the program that had that effect for you?) Just working with my partner and then we had to [work] with other [sets of] partners, so that ties in together. [Student Three, Interview 2]

INTEREST IN SCIENCE AND BEING A SCIENTIST

The program experience clarified for Student Three that she really enjoys science, and it enhanced her sense that science is fun. *Whitten-Newman ExplorOlogy® Program* staff said that the program was valuable for her because it further engaged her in science outside the classroom. As a result of the program, she has become excited about pursuing other science activities, and she looks more closely at things in nature when exploring with her family (see the quotation below). Student Three was unsure about her career plans; however, she did develop a positive impression of what it means to be a scientist by observing the program staff.

I think [Student Three is] more open now to trying more science things. Like this summer, we're going to be doing a microbiology class, and I think she's actually excited about it. [Student Three, Parent Interview]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Scientific exploration came naturally to Student Three throughout the program, and she returned home with a deeper understanding of how to collect scientific information in the natural world (see the quotation below). Although Student Three was comfortable with the science activities in the program, during interviews she had difficulty explaining her hypotheses and conclusions. However, she also said that the program has made her more academically strong in science by improving her observation skills. For instance, she learned how to tell what direction a fossilized track was going by looking at how the mud is pushed back.

With their first project that they had to complete at the University, she and her partner seemed to really get through the project quicker and faster. They really narrowed down the variables of what they were trying to test. [Student Three, Staff Interview]

EFFECT ON OTHERS

Student Three's participation in *Whitten-Newman ExplorOlogy® Program* strongly affected her parent, who is a teacher at her school, and therefore it affected her school's science program. Her parent has become more interested in hands-on science opportunities, and she has learned about the importance of student-driven science activities (see the quotation below). *Whitten-Newman ExplorOlogy® Program* staff confirmed this and said that since Student Three's participation in *Whitten-Newman ExplorOlogy® Program*, the school participated in the Museum's Science Escape program over spring break and also had two teachers accepted to the Science Institute program.

Because of [*Whitten-Newman ExplorOlogy® Program*], I asked if there were any other programs that our school could participate in, and we got to do a science inquiry [over] spring break. I learned a lot about allowing students to choose their projects, where I was trying to guide them too much. They were taking whatever idea [the students] had and letting them adapt it. So I learned a lot about not being so controlling of the projects. [Student Three, Parent Interview]

STUDENT FOUR

Student Four is a home-schooled student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2011. Data points related to Student Four include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with his parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Four discovered the *Whitten-Newman ExplorOlogy® Program* from an e-mail a friend sent him. Pre-program, Student Four experienced self-directed learning without a school curriculum, and he was encouraged to explore things of interest to him. Although he did not enter the program with an extensive science background, he is a strong math and science student and has conducted informal science experimentation (see the quotation below).

We have quite a few ponds in our pasture, and [when I was younger], I would get a little metal tray and go out there and get some water out of the pond and sift through it. I guess you call that an experiment. I was just seeing what there was in the pond and [observing] lots of little critters and water beetles and stuff. [Student Four, Interview 2]

MEMORABLE PROGRAM EXPERIENCES

Student Four's most memorable program experiences included being with other participants, learning, and getting dirty while exploring in the pond. He did not share many stories or program takeaways during the three interviews, but according to *Whitten-Newman ExplorOlogy® Program* staff and his parent, he seemed to enjoy all of the program activities (see the quotation below).

He always seemed to have a bright and cheerful attitude no matter what we [were] doing. [Student Four, Staff Interview]

PROGRAM SUCCESSES AND EFFECTS

Although Student Four had a positive and fun program experience, it was not easy for him to explain how it had affected him or what specific skills he had gained; however, he described some change in his view of science and being a scientist, as well as increased interest in pursuing a science career.

CONFIDENCE AND SOCIAL ABILITIES

The *Whitten-Newman ExplorOlogy® Program* was the first time Student Four had ever worked with a partner on a project, since he has been home schooled for his entire education. He appreciated that the other participants selected for the program were “high quality,” knowledgeable, and easy to work with, and he has kept in touch with participants through Facebook. In a later interview, he expressed that the program improved his social abilities (see the quotation below). His parent confirmed that there have not been significant changes in Student Four since the program but that his already high confidence has been maintained and possibly strengthened.

I think it [the program] did help with [my] social abilities. I'm not the most social person, and I don't have a ton of friends because in general home-schooled people don't have a lot of friends. But I have some friends and it [has] helped me socially communicate better. [Student Four, Interview 2]

COMMUNICATION AND COLLABORATION

Student Four's parent said that as his interest in science grew, so too did his ability to talk about it. Student Four said that through the program, he learned how to better communicate about the data he collected. Using a journal was especially helpful in improving his written communication and record keeping. Student Four also became more comfortable and skilled at presenting, although he was already quite experienced with PowerPoint. He has utilized his expanded presentation skills in Boy Scouts. Student Four said that the program did not significantly improve his ability to work with others, but that his collaboration skills may have improved somewhat through working with a partner. According to staff, he tended to direct most of the work that was meant to be shared with his partner. Over time, however, his listening skills improved, and he reached out to help other participants (see the quotation below).

[Student Four] learned to listen a little bit more, whether that is to other participants' ideas, thoughts or questions, or to the scientist and staff. Also, I think he saw that he can aid other participants in their research, whether it be actually collecting their data or just guiding them on how they would collect their data or maybe even analyzing their data. [Student Four, Staff Interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

In the first interview, Student Four said that he was unsure whether or not the *Whitten-Newman ExplorOlogy® Program* changed how he feels about science, but in a later interview, he said that it increased his interest in and curiosity about science (see the quotation below). Student Four said that the program has made him more interested in a science-related career and the scientific role in making discoveries. Although he was clear about wanting to keep his career options open, he said that he could envision himself pursuing zoology or biology. His parent confirmed that the experience opened him up to the possibility of a career in science, attributing this interest to being around peers and adults also interested in science.

I've always been a little bit interested in science, but since [the program] I think I've been even more interested in the general idea of science and the study of a lot of things. [For

example, I occasionally] wonder about something and look it up on the internet, or ask my dad about something that I might have not been wondering about before the program. [It has] made me think about things more. [Student Four, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

In interviews, Student Four easily and thoroughly explained his hypothesis, data collection, and research conclusions from the program. Even in the third interview, nearly a year after he attended the program, he comfortably made conjectures about the implications of his research results. His understanding of certain scientific and data collection methods increased through program participation. For example, he used a D-net for data collection, which he said he had heard about but had not fully understood before using it in the program. When asked what science means to him, Student Four said repeatedly that science is the study of everything that truly matters. While Student Four initially described a scientist as “someone in a white lab coat,” he said that the program helped him develop a more in-depth view of the work of a scientist (see the quotation below), and he recognized how long it takes for them to learn even a small amount of knowledge. Both Student Four and *Whitten-Newman ExplorOlogy® Program* staff said that he learned that scientists must be willing to make changes to their research plan and hypotheses.

I already had an idea that scientists weren't just people in white lab coats working in a dark building. That's only half of it; they do a lot of going out and doing hands-on. . . . Science is huge; it's so much. It really is the study of most everything that actually matters, like any living thing or even geology. [The program] helped me understand that a little better. [Student Four, Interview 2]

EFFECT ON OTHERS

Student Four shared his program experiences with family and friends, including his grandparents and Boy Scout troop, for whom he did the *ExplorOlogy in Motion®* presentation. He thought that his Scout Troop enjoyed and learned from his presentation, but that it probably did not have a significant effect on them (see the quotation below). Student Four also mentioned that his local newspaper had done a small article on his participation in *Whitten-Newman ExplorOlogy® Program* and that several people had read and inquired about the article. Although he did not think his participation had an effect on his family, Student Four's parent said that as a result of the program, she had learned a lot from the Museum and gained more enjoyment from the Museum's rural facilities and exhibits.

(What impact do you think your *Whitten-Newman ExplorOlogy® Program* presentation had on your Scout Troop?) I think they liked it. I think they had a lot of fun, and I don't know how much they learned, but I think they learned a little bit. I don't think it made a big impact on any of them, but it could have. [Student Four, Interview 2]

STUDENT FIVE

Student Five is a middle school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Student Five include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with her parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Five found out about the *Whitten-Newman ExplorOlogy® Program* from her science teacher, and because science was her favorite subject, she was excited to apply for the program. Her parent

supported her in the application process because she thought the chance to learn from real scientists for a week would be beneficial (see the quotation below). Pre-program, Student Five did not have many science opportunities, but she enjoyed being outside and exploring, and staff said she showed a lot of enthusiasm in her application for learning about the natural world.

[Student Five] loves science, she also likes to go outside and she likes to explore. [The program] was a week-long opportunity to be with real scientists, so I thought [it would be] good for her and that she could have an opportunity to really learn more than she's able to get from her teacher at the school. [Student Five, Parent Interview]

MEMORABLE PROGRAM EXPERIENCES

Student Five remembered many details about program activities and seemed to enjoy all of them. When asked what was most memorable, she mentioned canoeing at Tamaqua, participating in the museum scavenger hunt, exploring the ponds at Claremore, and doing paleontology work at Perry. She spoke frequently about how much she liked being in the water and working with fish, both while canoeing and also at Claremore. Student Five enjoyed many aspects of the outdoors, including seeing a lizard during a night walk, canoeing in really cold rapids, and getting to touch and pick up fish in the river (see the quotation below).

There was this one time when we got out of the canoes, and we were swimming. There was this part of the river where you could sit down and these fish would just go by you, and you could pick them up. They were really cool. [Student Five, Interview 2]

PROGRAM SUCCESSES AND EFFECTS

The program deepened Student Five's interest in and understanding of science, leading her to enthusiastically share her passion for science with others. She also said she gained more respect for the environment as a result of program activities.

CONFIDENCE AND SOCIAL ABILITIES

Student Five was among the youngest participants in the program, and conducting in-depth, hands-on research with older students, sometimes under uncomfortable conditions, led to personal growth and increased confidence (see the quotation below). She felt, and her parent concurred, that she learned more about herself throughout the program, noting that she became aware of her own limitations and how to overcome them while participating in the ropes course. Although Student Five always easily made friends, her participation in the program enabled her to reach out to new students through her interest in science.

[Student Five] didn't like to be uncomfortable. She didn't like it when it was hot, or she didn't like to get dirty. [So for] her, [the program provided an opportunity for] personal growth. I think towards the end she became more confident.
[Student Five, Staff Interview]

COMMUNICATION AND COLLABORATION

As a quiet student, initially Student Five did not seek interaction with her peers and adults in the program; however, she became more comfortable speaking up, initiating interactions, and sharing her opinions in front of the group (see the quotation below). She was effective at communicating through presentations and blog posts. Student Five and her parent confirmed that since the program, she has become more vocal and able to play a leadership role at her school. Staff said that by collaborating with other program participants who had leadership abilities, Student Five grew and emerged as a leader herself.

Initially [Student Five] was pretty quiet as far as interaction with her peer group. Then I think over the course of the week, she definitely gained a lot more confidence in talking about her opinions and also saying things in front of the group. That would be what I consider probably her biggest growth. [Student Five, Staff Interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Five's interest in science increased as a result of the program, primarily because she was able to learn more about science in a hands-on way, which made it more fun (see the quotation below). The program enhanced her interest in science in the classroom as well. Since participating, life science has become her favorite subject, and she made connections between her life science studies and activities from *Whitten-Newman ExplorOlogy® Program*, specifically at Claremore. As a result of the program, Student Five became more interested in being a scientist, but her career goals were uncertain. She realized through *Whitten-Newman ExplorOlogy® Program* that being a scientist is very tiring, but she also came to believe that scientists are "cool." She also said that she was proud of her work at *Whitten-Newman ExplorOlogy® Program* because it made her feel like a real scientist.

Before the program I was learning things about animals and stuff in books and tests. And when I went to the program, I actually got to do it hands-on. So it was really fun actually getting out in the field and finding out more things. [Student Five, Interview 1]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Throughout interviews, Student Five was able to discuss her hypothesis, methods of data collection, analysis, and results. Her parent and *Whitten-Newman ExplorOlogy® Program* staff confirmed that her knowledge of the scientific method had grown as a result of the program. When asked to explain what science means to her, Student Five repeatedly made connections between science and nature. She described science as the process of finding out things you and others do not know through experimenting in nature, and her explanation of what it means to be a scientist reflected this. She also realized there are many more things scientists study than she previously imagined. The program helped Student Five understand that answers to questions about the world do not always have to come from a book, and she has utilized some field skills she learned in the program while exploring at home (see the quotation below). And, her grades in science, especially life science, have been higher since the program.

Since it's been a little hot and rainy, there's been a lot of horny toads around my house. And when we went to Perry, Oklahoma and did the paleontology, [*Whitten-Newman ExplorOlogy® Program* staff] caught a lizard, and she told us how to hold it around the neck to where it won't drop out of your hands, but not too hard. [Student Five, Interview 3]

EFFECT ON OTHERS

Student Five shared her program experience with others and enthusiastically encouraged her friends to participate in *Whitten-Newman ExplorOlogy® Program*. Her *ExplorOlogy in Motion®* presentation was also well received (see the quotation below). Student Five's program participation was featured in the local newspaper, and her parent said this news coverage increased the attention she got from her science teacher.

I think that [the *ExplorOlogy in Motion®* presentation] really piqued the interest of the other students, and hopefully a lot of them, or at least some of them, went ahead and applied for the program this year. [Student Five, Parent Interview]

STUDENT SIX

Student Six is a high school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2009 and 2010. Data points related to Student Six include:

- ◆ Three interviews, once in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Six initially learned about the *Whitten-Newman ExplorOlogy® Program* from a family member who saw an advertisement for the program and shared it with her. She applied a second time the following year and was selected as a peer mentor because she showed a passion for and long-term career interest in science. She was also recommended by *Whitten-Newman ExplorOlogy® Program* staff because of her positive, “team-player” attitude. Pre-program, Student Six participated in other science and math camps, but she was interested in the peer mentor position because she wanted to gain leadership skills, learn more about paleontology, spend time in nature, and explore science careers (see the quotation below).

[The 2010 *Whitten-Newman ExplorOlogy® Program*] was more focused on leadership skills because it was a pure mentor position this time. I wanted to learn that. And I also wanted to learn more about the subject, paleontology. [Student Six, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

For Student Six, the chance to build leadership skills was the most memorable aspect of the program. She recounted many specific details about the various program activities, including field trips to the sulfur fountains, prospecting at White Mound, and hiking in the Arbuckles. Student Six occasionally linked her specific program memories to the scientific knowledge that was gained (see the quotation below).

We hiked and ate lunch [at the Arbuckles] and got to see the land forms [and] striates. We got to learn the different striations in the rocks and how part of each striation is part of the levels of the years, and how you can learn by the way the faults are pushing them.
[Student Six, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Student Six was already experienced and interested in science prior to her peer mentor role in the program, but through *Whitten-Newman ExplorOlogy® Program*, she gained confidence in herself as a leader and in her goals to pursue a career in science.

CONFIDENCE AND SOCIAL ABILITIES

As a peer mentor, Student Six and her partner organized daily games for the other participants and supported them throughout the program. She enjoyed the mentor role, and through it, gained confidence in her leadership abilities. She learned that being organized and communicating effectively are important leadership skills, and she felt increasingly comfortable being in charge of her peers (see the quotation below). Although she has not had another leadership position since the program, Student Six felt that her increased leadership capacity was the most important outcome of the program, enabling her to pursue and secure scholarships for college. *Whitten-Newman ExplorOlogy® Program* staff said that she also gained confidence in her choice to pursue science as a career.

It's helped me [gain the] confidence to be able to speak in front of people more. I was able to [before] but [now I'm] a lot better. And I made good friends there, and I [was not] afraid to take charge sometimes. [Student Six, Interview 2]

COMMUNICATION AND COLLABORATION

Student Six learned about the value of good communication, teamwork, and collaboration through program experiences such as the ropes course and mentoring the partner teams. The program taught her that groups work more effectively together when they have first established a mutual understanding (see the quotation below). Student Six's communication skills also increased as a result of the program, both in terms of public speaking and also using PowerPoint. She has put these skills to use in school since the program, such as during her senior presentation.

We learned a lot about building a team and that should be more connected before you try to get into things because everyone is different. So you have to understand everyone on a more personal level before you dive into things because then you know what makes everyone tick. [Student Six, Interview 3]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Six had a prior interest in science, but her experience in the program strengthened this interest and helped her identify specific areas of interest, including vertebrate paleontology and biology. She enjoys comparing the past with the present and decided to focus her senior project at school on whether or not people should fund paleontology, using her program experience to support her argument (see the quotation below). As stated previously, she said that *Whitten-Newman ExplorOlogy® Program* reinforced her decision to pursue a science-related career, and staff confirmed that she benefited from the unique opportunity to work with people who are passionate about, supportive of, and experienced in science.

At my school paleontology is not a career that people are really interested in, and they don't know about it. So I liked telling them about it, giving them information and knowledge. [Student Six, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

When asked what science means to her, Student Six said that science is "all the forces in nature working together." She learned a lot about paleontology during the program and has applied knowledge gained at *Whitten-Newman ExplorOlogy® Program* in her AP Biology class (see the quotation below). She also gained basic analytical skills that have helped her academically. Student Six also learned from the program that scientists must share their findings with other people, which she hopes to do some day. She also described how scientific research allows you to observe the interconnectedness of eco-systems in the natural world.

I've learned a lot about paleontology and ancient history. I'm taking AP Biology right now, and it [my program knowledge] comes into play sometimes. We talked about evolution and the dinosaurs and the different eras, and I already knew them because of *Whitten-Newman ExplorOlogy® Program*. [Student Six, Interview 2]

EFFECT ON OTHERS

Student Six could not clearly articulate how her program experience had affected others, but she said that her teachers were proud of her for participating and that she had strongly encouraged other students to apply for the program. *Whitten-Newman ExplorOlogy® Program* staff said that Student Six had encouraged them to share her post-program successes with others in order to set an inspiring example

for other minority students interested in science (see the quotation below).

[Student Six] expressed to me that she really wanted me to [share her experiences with others] because she wanted to inspire other girls and also other minority girls to do science.
[Student Six, Staff Interview]

STUDENT SEVEN

Student Seven is a high school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Student Seven include:

- ◆ Two interviews, one in Fall 2010 and one in Winter 2010/2011
- ◆ One interview with her parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Seven discovered the *Whitten-Newman ExplorOlogy® Program* while reading a brochure on a Museum visit. She was interested in science and has wanted to be a paleontologist since she was in elementary school (see the quotation below). She was motivated to attend the program because she wanted hands-on experience digging for fossils and learning how to differentiate between species. Student Seven's school does not have a strong science program, but she studied science and paleontology books on her own. The program presented an opportunity for her to have hands-on experiences in paleontology and make real-world connections with the information in books. Her parent was supportive of the program because it aligned well with Student Seven's interest in learning and being outdoors.

[It was] second grade when I first really wanted to be a paleontologist because they were excavating a dinosaur on my great aunt's property, and I thought that was so cool.
[Student Seven, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

When asked to recount memorable program experiences, Student Seven said she really enjoyed digging in Ashfall, learning to track animals at the Museum, and camping in the Wichita Mountains. In particular, she remembered finding a rhino bone and feeling a connection to the animal it once was. She also remembered camping, seeing a buffalo, and learning about how to survive in the wild (see the quotation below). *Whitten-Newman ExplorOlogy® Program* staff thought Student Seven most enjoyed the fieldwork, especially the unique opportunity to find fossils and learn from the scientist mentor, with whom she connected well. She recalled receiving a compliment about her "eye for fossils" which made her proud. Student Seven's parent confirmed that meeting other people interested in paleontology was beneficial and memorable.

We went to the Wichita Mountains, and those [trips] were really fun. We got to camp there. (Tell me about that.) When we were camping there, a buffalo went by our campsite, and we went on a few nature hikes and learned about the plants we could eat and how to survive in the wild. [Student Seven, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Student Seven was interested in paleontology for many years, and the program deepened that interest by providing hands-on experiences in the field. It also reinforced her decision to pursue a career in paleontology by connecting her with real scientists.

CONFIDENCE AND SOCIAL ABILITIES

Student Seven felt a sense of personal accomplishment that she was accepted to the program and from specific program successes, such as discovering rhino ribs. She also became less shy and more willing to take risks by participating in *Whitten-Newman ExplorOlogy® Program*. Her increased confidence has led her to try harder academically and feel more comfortable in school group work. Student Seven also said the program helped her learn that people have “multiple layers” that you must get to know as you form a friendship. Student Seven’s ability to interact socially improved, and she hopes to put this to use as a peer mentor (see the quotation below). *Whitten-Newman ExplorOlogy® Program* staff also confirmed that she became much more confident in her peer interactions throughout the program experience.

I learned to interact with people better, and I think about it every day because I [am] going to apply to [be a peer mentor] this coming summer. [Student Seven, Interview 2]

COMMUNICATION AND COLLABORATION

Student Seven is naturally quiet, but she said her speaking skills improved, and it was easier for her to work with a team as a result of the program. She has presented to elementary students about dinosaurs, but collaborating with her peers was more challenging for her. *Whitten-Newman ExplorOlogy® Program* staff said that she became better at speaking in front of peer or adult crowds and more comfortable with the group dynamic. At first staff said Student Seven tended to prefer alone time to noisy group interactions; however, she became more willing to engage with and stand out in the group over time (see the quotation below). Staff also said that Student Seven was chosen for the peer mentor role, in part, because it will help build her leadership skills.

[Student Seven is now] more willing to be part of the group dynamic, and [throughout the program, it became easier] for her to be the center of attention or to call attention to herself. [Student Seven, Staff Interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Seven has wanted to be a paleontologist for many years, and she entered the program with a strong interest in science. The program expanded her sense of paleontology as fun, and she came to believe that “if you do what you love, it’s not really a job.” It also helped her identify specific areas within paleontology that she is most interested in by giving her a range of experiences in the field. Staff also said that the program helped encourage her goal of becoming a paleontologist by making her goal seem more attainable (see the quotation below). Student Seven’s parent also confirmed that she plans to become a paleontologist and that the program reinforced her long-time interest in this area of science.

I think [the program] made the dream or the aspiration [of pursuing paleontology] tangible to [Student Seven]. It wasn’t some kind of far-off thing, like being an astronaut or something like that. She saw that [a career in paleontology] is possible and you can do it. [Student Seven, Staff Interview]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Student Seven entered the program with a firm understanding of paleontology, but the program helped her better understand the scientific process and gain practical experience that she had not gotten in the classroom. In interviews, she provided examples of the practical paleontology skills she learned throughout the program (see the quotation below), and she also said she learned how to identify species from their bones. When asked what science and being a scientist means to her, Student Seven struggled to clearly articulate a definition, but she expressed very

positive associations with the concepts. She also said that being a scientist requires dedication and patience, and she explained the program activities helped her learn this.

We learned how to level out the digging surface, so you wouldn't just be digging a hole [and] hurt the bones. We learned how to get the bones ready for showing in the museums, in the prep lab. That was really fun. [Student Seven, Interview 1]

EFFECT ON OTHERS

Student Seven encouraged her friends to apply for the program and said she even got them to reconsider science as a career. Beyond this, her participation has not had a significant effect on others. However, her parent said that her family has gained a deeper appreciation for and understanding of something that Student Seven has always wanted to pursue (see the quotation below).

[Our family has gained] a new perspective about what [Student Seven] wants to do, and I respect that and I'm just happy for her. [Student Seven, Parent Interview]

STUDENT EIGHT

Student Eight is high school student who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Student Eight include:

- ♦ Two interviews, one in Fall 2010 and one in Winter 2010/2011
- ♦ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

A teacher at Student Eight's school told a family member about the *Whitten-Newman ExplorOlogy® Program*. While this family member could not attend, he shared the program information with Student Eight, and her parents encouraged her to apply. Pre-program, she conducted some science labs in school and attended science camps, and she applied for the program because she wanted to learn more about fossils, paleontology, and the work of scientists (see the quotation below). She had very little prior knowledge of paleontology but described being intrigued by the process and techniques involved.

I [was] curious about excavating fossils, and I really wanted to see how it's done and just get my hands on it . . . and really do what the scientists do. [Student Eight, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

When asked what was most memorable about the program, Student Eight said she liked getting to travel out of state and see more of the country. She especially enjoyed digging in the rhino barn, which she liked because it had not been excavated before. In addition to digging, she enjoyed the chance to make new friends from different places (see the quotation below).

I really liked digging because I'd never done it before. It's really cool to experience that, and I especially liked making new friends. I actually think that was the best part of the whole thing. [Student Eight, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Student Eight was shy but she gained social skills and became more comfortable in a group as a result of her program experience. Her interest in science also grew, and she is interested in possibly pursuing a career in science education.

CONFIDENCE AND SOCIAL ABILITIES

Student Eight gained confidence in her ability to be independent during the program (see the quotation below). She also said that the chores assigned during the program, such as cooking, were not only fun, but also contributed to her sense of independence. Student Eight was initially apprehensive about making friends but said it was easy to meet people because everyone was very friendly. She has kept in touch with her *Whitten-Newman ExplorOlogy® Program* friends over Facebook and also attended the reunion. She indicated that the program's small size helped her relate more easily to others. *Whitten-Newman ExplorOlogy® Program* staff also described a time toward the end of the program when she was comfortable being the center of attention, which was unusual for her.

I felt like I could be more independent now since I was away from home for a long time [for the program], and that really helped me grow up as living apart from my family. [Student Eight, Interview 2]

COMMUNICATION AND COLLABORATION

Since the program, Student Eight has been more comfortable talking in class; for example, she raises her hand in class to ask questions more than she did before the program. The program also encouraged Student Eight to talk to new people and make friends, leading her to be more outgoing in school. *Whitten-Newman ExplorOlogy® Program* staff said that she was initially more outgoing one-on-one or with adults than in a group of her peers, but she became better able to engage verbally with the group over time. The program and the ropes course in particular helped her build trust in her peers and collaborate with people in order to work through challenges (see the quotation below).

[The program] helped me a lot, especially with peers. It's pretty easy for me to trust adults because I see them as an authority figure, and I listen to whatever they say. Sometimes I disagree with [people], but I'm learning to talk to them about it and work it through. [Student Eight, Interview 2]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Eight admitted that she did not really like science prior to the program, and the program made it more fun and exciting to her. It also exposed her to different areas of specialization in science. Student Eight initially expressed interest in pursuing a career in science, and later, said she would like to work in education as a science teacher. When asked if the program had encouraged this in any way, she described the sincerity and care of the *Whitten-Newman ExplorOlogy® Program* staff, who she saw as role models (see the quotation below).

(You said you wanted to be an educator. Did the *Whitten-Newman ExplorOlogy® Program* help influence that?) I think it did actually. . . . I thought it was cool how much [*Whitten-Newman ExplorOlogy® Program* staff] cared about us, and you could really see [the staff] as friends, not really as authority figures. I want to be able to relate to kids like that when I grow older. [Student Eight, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Student Eight had difficulty recalling the details of her research project. She did not come into the program with a strong background in paleontology, but she said she learned about the different scientific eras, how to excavate, and how to experiment in order to test a hypothesis. When asked what science means to her, Student Eight said that science is the process of observing nature and living organisms and making conclusions about things through

experimentation. She said that the program helped her see science and the world anew, and she applied this on a recent trip to the Grand Canyon (see the quotation below). Student Eight also learned that scientists must be patient through trial and error.

I went to the Grand Canyon after the [program], and I looked at it a whole different way, in terms of how I saw the rocks and the forms and the layers and everything. I think that really let me see more science. [Student Eight, Interview 1]

EFFECT ON OTHERS

Student Eight's participation in the program did not have a significant effect on others. She said she told her family and friends about her experience and encouraged her friends to apply for the program (see the quotation below); however, she did not think any of her friends had followed through with an application. She did not participate in *ExplorOlogy in Motion*[®].

I just [told my friends] that they wouldn't regret going to [*Whitten-Newman ExplorOlogy*[®] Program] because I learned a lot that I've never learned about, and I made a lot of new friends that I'll never forget. [Student Eight, Interview 2]

STUDENT NINE

Student Nine is a high school student who attended the *Whitten-Newman ExplorOlogy*[®] Program twice in Summer 2009 and 2010. Data points related to Student Nine include:

- ◆ Two interviews, one in Fall 2010 and one in Winter 2010/2011
- ◆ One interview with his parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy*[®] Program staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Nine's parent discovered the *Whitten-Newman ExplorOlogy*[®] Program when planning a trip to the Museum and encouraged him to apply due to his prior interest in paleontology. Pre-program, Student Nine and his family engaged in science-related activities like going to museums and exploring the outdoors (e.g., streams around the house). Student Nine said he was interested in the program because he wanted to explore more about being a paleontologist (see the quotation below), and both he and his parent confirmed that such hands-on science opportunities were rare at his school. Further, staff said Student Nine repeated participation in the program due to a desire to share his interests and experiences with others and to gain leadership skills.

My mom found the program on the internet, and I have always been interested in paleontology ever since I was little, and I enjoy going to different places and learning about science. I thought it [the program] would be a good opportunity for me to earn some experience in the paleontology field and explore my job options. [Student Nine, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

Student Nine's most meaningful program experiences were learning from real paleontologists, discovering techniques for preserving fossils, and meeting new people whose science interests aligned with his. Specifically, Student Nine said, and staff confirmed, that discovering articulated fossils and helping to excavate them with care was extremely rewarding (see the quotation below), as was time spent in the prep lab.

I'm most proud of finding 12 ribs in a quarry that we worked on in Nebraska. [We] found, me and one of the leaders [who] were working in this little area, found 12 rhino ribs that were pretty

well articulated, which means assembled and together in good condition. I really enjoyed finding [those fossils], that was awesome. [Student Nine, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Notably, Student Nine improved his ability to lead, communicate, and collaborate with others. He also deepened his interest in pursuing paleontology as a career and changed his view of what it means to be a scientist (i.e., “a normal person doing what they love”).

CONFIDENCE AND SOCIAL ABILITIES

Student Nine built his confidence in leading others and learned to get along with various personalities. Specifically, his prior experience in the program helped him facilitate the excavation and team-building experiences for others (see the quotation below).

I think [the program] helped me because I was almost like a teacher; they [other participants] could come to me and ask questions. And, at school, [students] come and ask for me for help, and it [the program experience] helps me to relate [to] what they need and [answer] questions they need me to answer. [Student Nine, Interview 3]

COMMUNICATION AND COLLABORATION

Student Nine had to present about his experience to his peers, visitors to the Museum on Science Action Day, and a community group during *ExplorOlogy in Motion*[®]; this helped increase Student Nine’s confidence speaking about ideas of importance to him even among people with different beliefs. Further, staff felt the program helped Student Nine more effectively communicate his scientific discoveries and understandings to others (see the quotation below). The team-building aspects of the program (e.g., ropes course) and collaborating with a partner on a research project and presentation were two ways Student Nine could demonstrate and use his collaborative abilities, which his parent and staff said came naturally to him.

I think [he and his partner] gained a better understanding of how to report their data and observations to a wider audience than what they had done the previous year. I think their project was a little bit more detailed and [involved] more data analysis than the previous year. [Student Nine, Staff interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Nine said he always had an interest in being a paleontologist, and the program experience confirmed his interest in pursuing paleontology as a career, specifically vertebrate paleontology. Post-program, Student Nine began pursuing high school courses needed for this area of study and researched colleges and universities with paleontology programs (see the quotation below). The program also helped forge connections with paleontologists who work at the University of Oklahoma, a university program he is strongly considering. He further expressed a desire to return to some of the dig sites as an intern during college to learn more from the scientists he worked with, citing the enthusiasm they exhibited for their work as inspiring.

I’m taking physiology and chemistry, that’s all working towards being a paleontologist. (Tell me a little bit about those classes?) Physiology is studying the bones and the muscles of the human body, which pretty much transfers over to dinosaurs. The chemistry of the soil [is important to know] because some [soil] preserves [fossils] better than others. . . . I’ve always had an interest in science, but I can apply it to what a paleontologist would use it for now. That helps me [to] do better in [science class] and be more motivated. [Student Nine, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Student Nine's understanding of the process of doing science, specifically as it related to paleontology, grew as a result of the program. Student Nine said he learned that observing and noting details is an important aspect of doing science, and staff said he gained skills communicating his findings to others. Specifically, Student Nine said he gained an understanding of the techniques and skills used to discover, preserve, and learn from fossils, including how to reconstruct the story of fossilized animals from evidence (see the quotation below). While Student Nine discussed a broad view of the application of science ("science is exploring the world around you and how everything works"), he hesitated to apply this view to anything other than paleontology. Notably, he changed his view of scientists from those he had seen in the movies to "normal people doing what they love."

We would look at the fossils and a lot of them had been stepped on so they were vertical in the sand. So, we would make that observation and that would tell us that there were other animals, probably pretty big animals, walking around in that area, too. A lot of times we found scratches on them, and that helped us place together what happened to that animal. Sometimes we would also find aquatic creatures around too and that would tell us that maybe a pond was nearby. So we were trying to reconstruct that environment or what happened to these fossils, a lot like a crime scene.
[Student Nine, Interview 2]

EFFECT ON OTHERS

Student Nine's program participation had a mild effect on others. He participated in Science in Action day (a public Museum event) and *ExplorOlogy in Motion*[®], where he communicated with Museum visitors and/or members of his community about his program experiences. He felt visitors and younger children were genuinely interested to find out about such opportunities. Similarly, he has communicated with friends about the program and encouraged them to apply. His parent also stated that hearing about his program experience has piqued their interest in pursuing science opportunities (see the quotation below).

If they did a [similar] family program, my whole family would be interested and would go, because, I'm not much of a camper, but if we were doing some of the things that [he] has done, I would be [interested]. [Student Nine, Parent Interview]

STUDENT TEN

Student Ten is a high school student who attended the *Whitten-Newman ExplorOlogy*[®] Program in Summer 2010. Data points related to Student Ten include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with his parent in Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy*[®] Program staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Student Ten's parent is a teacher and encouraged his application to the program; his parent thought the program was a good opportunity for him to meet new people and be away from home. Student Ten discussed a general interest in science and math and was interested in exploring more hands-on science opportunities through the program. Pre-program, he attended numerous science and engineering camps and enjoyed all of them for the opportunities to be outdoors and/or explore science and the

environment. Student Ten also described spending significant time in nature with friends and family, including hunting, camping, and fishing.

MEMORABLE PROGRAM EXPERIENCES

Student Ten discussed a few experiences that were memorable to him, including digging for fossils in the unique soil of the Rhino barn and meeting paleontologists and getting to see what they do. Student Ten recalled the experience of finding a bird fossil and the scientist's enthusiastic reaction which made him feel successful (see the quotation below).

Going to White Mound was definitely a good experience because there's just a white mound in the middle of a pasture, and you just look down and grab a rock and you find something. It was unbelievable that there's something like that. And, then, [the scientist], it was amazing how nice he was. You might find a rock, and he still would congratulate you. And, if you found a fossil, he was excited, and it was really nice to have people that were really interested in what you found and what you did. (So what would you say stood out most about that experience?) I found a fossil of a bird bone, and it was hollow, and, at first, I didn't know what it was. So I took it up to [the scientist], and he started jumping up and down, and it was really neat to find something kind of original. I [also] found a lot of bone fragments and a couple of rhino vertebrae with tooth marks; it was just really neat to find all that different stuff. [Student Ten, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Student Ten most notably gained social confidence through his program experience. He also increased his interest in a science career and broadened his understanding of what it means to “do” science and be a scientist.

CONFIDENCE AND SOCIAL ABILITIES

Student Ten felt his biggest accomplishment was increased confidence meeting and interacting with new people. Staff and his parent reiterated that he grew the most in his confidence as it related to interacting with peers, and both he and his parent said that building confidence in social interactions is something that will apply to many new environments, including college (see the quotation below). Student Ten also gained increased confidence and flexibility in approaching problem-solving or academic challenges, and he attributed this to program experiences where he had to use trial and error to solve problems.

I think having to meet new people and knowing that you're going to be with them for the next 19 days [makes you realize] you'd better get to know them and be friends with them pretty quickly. . . . It's really neat because you learn how to be more social, and it really will help you for the rest of your life [and] when you go to college and have to meet new people that you've never seen before. [Student Ten, Interview 3]

COMMUNICATION AND COLLABORATION

Student Ten discussed moderate gains in communication and collaborative skills; he learned to be more open when listening to others' ideas in order to collaborate effectively on tasks, a skill he has also applied in school. This was in part due to the ropes course activity where he learned to build trust with the other participants. Student Ten, staff, and his parent also said that he gained increased comfort communicating his ideas to others, including prioritizing what data he and his partner would present (see the quotation below). Student Ten attributed this increased comfort to the open and respectful environment created by the program. He and his parent also said presenting his program experience to community groups after participation contributed to this increased level of comfort.

They [he and his partner] had collected a lot of data, and we gave them a specific number of slides they [could use] so they really had to narrow down and focus their question and [choose] what observations and data were really pertinent to the presentation and [would] keep the audience engaged as well.
[Student Ten, Staff Interview]

INTEREST IN SCIENCE AND BEING A SCIENTIST

Student Ten described entering the program with a fascination for science. The program experience increased Student Ten's interest in science careers, as he realized there are more opportunities than just working in a lab; and he expressed a great deal of respect for the scientists he worked with who seemed passionate about their work and teaching young students like himself. He also expressed interest in a science career (potentially meteorology) because he feels confident in his math and science skills, appreciates the challenges it would afford, and likes that people view scientists as smart. He also said that learning new things, such as how the Earth and species have evolved, has further piqued his interest in science (see the quotation below).

[Seeing] different times in the history of our world and [getting] to see what the world looked like at certain periods, you get to see what kind of animals lived back then . . . [and] how it's changed now, the world has evolved over time and has continued to change and will continue to change. Just being able to learn new things, [that] always captures [your] interest and you start to think more about what it was like back then, and it always continues to make your interest grow. [Student Ten, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENTIST

Student Ten emerged with an expanded understanding of what it means to be a scientist, explaining that before the program he viewed being a scientist as a "boring life inside a lab." He also learned that certain aspects of science can be tedious (e.g., recording the details of a fossil's surroundings), but that this hard work typically pays off in terms of discoveries. Further, Student Ten stated that program experiences helped him realize that one must be open and flexible in the field of science; he explained that there is no one way to excavate a fossil and that outdoor conditions can change unexpectedly, either aiding or impeding progress (see the quotation below). More specifically, Student Ten described many skills he learned, including excavation techniques such as creating a pedestal around the fossil and a jacket to preserve it. He also learned how to collect data about the environment surrounding the fossil (e.g., noting the layer of soil it came from).

I [gained] an awareness that everything changes constantly. For example, we were working at this one site . . . [and] that night it rained and revealed where the fossils were. It just made me aware that your work can be destroyed in a short amount of time, but [you can] also make new discoveries; everything is constantly changing [in the] environment. . . . It's a real mystery and [you] never know what to expect, [and] you just learn to handle it as it comes. [Student Ten, Interview 3]

EFFECT ON OTHERS

Student Ten's experience had a minimal effect on others; however, he said that he presented or intended to present about his program experience to various community groups and felt it was a positive experience. He has also discussed his experience with family and friends and encouraged them to apply for the program, although he is not aware of anyone who has expressed interest.

TEACHER PARTICIPANTS

TEACHER ONE

Teacher One is an elementary school teacher who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Teacher One include:

- ♦ One interview in Fall 2010
- ♦ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Teacher One discovered *Whitten-Newman ExplorOlogy® Program* opportunities through e-mails that she receives from the Museum. Teacher One said, and staff confirmed, that she was motivated to participate in the program by her love of science as well as a desire to learn how to use the inquiry method with her students. She also expressed enthusiasm for working alongside scientists. While Teacher One has taught other subjects in the past, she recently began teaching science and would like to continue to do so. And, while she has not had the opportunity to engage her students in many hands-on science opportunities in the past, she has personally engaged in activities such as bird watching and exploring the outdoors with her son.

MEMORABLE PROGRAM EXPERIENCES

Teacher One said, and staff confirmed, that one of the more rewarding experiences was collecting pond samples and looking at them through the microscope. She enjoyed the hands-on nature of the experience and discovering new things (see the quotation below). Staff elaborated that many teachers enjoy looking through the microscopes because it is surprising to learn about the wide range of organisms that live in pond water.

The college has some ponds that they've set up with different types of things. For our experiment, we got the plankton from those ponds. (And so what was it like being in a pond scooping up plankton?) For me, I loved it because I don't have a problem with any yucky or gross stuff. I was absolutely having fun because I like to get out in nature and do stuff like that. It was really quite fun for me. [Teacher One, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Most notably, Teacher One gained an understanding of how to use the inquiry method and reinvigorated her interest in teaching science through her program experience.

CONFIDENCE AND LEADERSHIP ABILITIES

Teacher One discussed gaining increased confidence in using the inquiry method with her students. Specifically, she already had plans to integrate the inquiry method into her classroom once she began teaching again in the fall (see the quotation below).⁴ Similarly, staff said increased science confidence (i.e., the confidence to teach science in a more hands-on, interactive way) is something many teachers, including Teacher One, gained through program participation.

I [realized that] I should've done more with my students, but I learned about inquiry and how [to facilitate] that, and I went 'Oh! I could've done more.' I realized from the [program] how I could involve the kids more. I was always afraid to take them out [to] do things by water [because I was] afraid somebody was going to get hurt. But, the kids

⁴ Because Teacher One was only interviewed once, we could not glean anything further about how she may have implemented the inquiry method in her classroom.

are responsible; I just didn't give them enough control of things. I always wanted to control it as a teacher, and I realized, through this [program] that I need to give the kids a little bit more control [and have] more faith in them. [Teacher One, Interview 1]

COLLABORATION

Staff said Teacher One and her group worked very effectively together throughout the program experience, assigning roles and delegating tasks without much guidance. Staff attributed this cohesion both to teacher's personalities and the program's structure (i.e., small group size) (see the quotation below). While Teacher One and her colleagues exchanged contact information to stay in touch post-program, she had not communicated with any teachers at the time of the interview (attributing it to the fact that she was not currently teaching).

I think in some ways the teachers were responsible for that cohesion, but at the same time, I think because the group of teachers was small, having four teachers, [teachers] got a lot of individual attention, especially in the beginning. And, with four people, it's really easy for everyone to have a job and to figure things out and work together and group dynamics settle themselves quickly. [Teacher One, Staff Interview]

INTEREST IN SCIENCE EDUCATION AND BEING A SCIENCE EDUCATOR

As stated previously, Teacher One has taught a variety of subjects at the elementary level; however, her true interest lies in teaching science. While she is currently looking for a new position and may need to be recertified in science, the program helped excite and motivate her to begin teaching science again (see the quotation below).

[The program] really excited me about possibly getting another teaching job until I found out that have to go back and get a science certificate if I really want to teach science again. But, [the program] was really good fun, and I really enjoyed it. [Teacher One, Interview 1]

UNDERSTANDING OF SCIENCE AND BEING A SCIENCE EDUCATOR

Teacher One's greatest program gain was learning about the inquiry method. She also discussed learning specific strategies for presenting science content to her students, and she personally gained additional experience with the process of science by choosing a research question and an experiment to explore (see the quotation below).

We had six different flasks set up; the first [flask] was the same for all three groups. In the second [flask], we put fertilizer, and in the third [flask], we put insecticide. That way we could see if something strange [occurred] in one of the [flasks]. If it wasn't consistent between all three, we could figure out [that] something strange [occurred] in that one [flask]. . . . On the third day, we took samples of the nutrients in [the flasks]. . . . [The scientist] had this really neat machine where [you] could look [at] the water sample. It sends light through a prism and would be able to tell you what [amount of] light is not passing through so you could tell if [the sample] had a lot of algae in it or not. . . . And, on [the fourth day], we took the samples back to look at them [to] see what grew. The [flask with] insecticide killed all the little Zoë plankton, and there were some algae, which is phytoplankton, in the [flask]. In the [flask] with fertilizer, of course, the algae grew really fast! [The flask] was green the second day. . . . [That flask] definitely had some algae growing because the fertilizer made the algae grow really fast. [Teacher One, Interview 1]

EFFECT ON OTHERS

It is difficult to gauge any effect Teacher One's participation had on others, as she only participated in one interview and was not currently teaching at the time. However, she expressed enthusiasm for the inquiry method and was excited to apply the skills she learned in her classroom once she began teaching again. She also mentioned that she had discussed her program experience with another teacher, but that nothing had resulted from that interaction.

TEACHER TWO

Teacher Two is an elementary school teacher who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Teacher Two include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Teacher Two was involved with the Museum's offerings prior to applying for the *Whitten-Newman ExplorOlogy® Program*, including participation in Science Escape with her students and summer teacher trainings; she discovered the *Whitten-Newman ExplorOlogy® Program* through an e-mail she received from the Museum. She applied to the program to learn more about the inquiry method so she could facilitate more effective science experiences for her students and obtain her board certification (see the quotation below). Staff reiterated that Teacher Two seemed extremely motivated to learn about additional resources that would improve her ability to facilitate science experiences for her students, something she often seeks out. Personally, Teacher Two also participates in a wide variety of science-related activities with her son and attributes her initial interest in science to his desire to learn more about science.

I teach textbook science without fail. However, the current trend is toward inquiry-based science, and the words 'inquiry-based' were in the description of the course. And, to keep up with that trend, I wanted to be more exposed to that method of thinking or teaching. (Had you been exposed to inquiry-based science before?) Yes, but only enough to confuse me. (Can you be a bit more specific?) Inquiry-based science is one of those things, it's almost like algebra. Someone can describe to [you] what algebra is, but until you do it, you really aren't going to get it, and inquiry-based science is the same. [Teacher Two, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

Teacher Two's most memorable experiences were looking at phytoplankton under the microscope, taking pictures of her experiences, and keeping a research journal. The former because she was genuinely surprised that microscopic organisms could be so interesting (see the quotation below), and the latter two because she could share these experiences with her students. Staff also emphasized that she appreciated resources and activities that she could share with her students, including building models of phytoplankton out of clay and the brine shrimp aquarium supplied by the program.

I was very skeptical when [the scientist] said she was interested in plankton; I was sitting there [thinking], 'plankton; right.' But, after we looked at [the plankton] under [the] microscopes, it was amazing, and I was really excited. In fact, we were late to lunch because none of us [the teachers] would get off the microscopes. [Teacher Two, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Most notably, Teacher Two became more confident in her ability to use outside resources and support to effectively facilitate science experiences for her students (including use of the inquiry method). She also grew her interest in science through interaction with program scientists.

CONFIDENCE AND LEADERSHIP ABILITIES

Teacher Two said she became much more confident in her ability to find and utilize outside resources to facilitate exceptional science experiences for her students (see the quotation below). Throughout interviews, she discussed many ways this newfound confidence has impacted her post-program. Specifically, she has purposefully sought out other professional development opportunities similar to *Whitten-Newman ExplorOlogy® Program*, explored published research to learn more about her students' unique struggles, reached out to *Whitten-Newman ExplorOlogy® Program* scientists and staff to help her with board certification and to help facilitate science experiences for her students, and shared or plans to share many of these resources with colleagues and parents. Staff also emphasized that Teacher Two came into the program with an enthusiasm and proclivity for learning more about resources for her students, and the program built her confidence in this area.

Teachers tend to teach in a vacuum, and I guess I'd gotten to where I saw it [teaching] as something I do in isolation almost. And, the [*Whitten-Newman ExplorOlogy® Program*] experience showed me that there are a lot of resources out there . . . and that's just been a huge growth experience for me. [Teacher Two, Interview 2]

COLLABORATION

During the program, Teacher Two said her group worked very well together to explore the research question, something staff reiterated and expanded on, saying that Teacher Two demonstrated an enthusiasm for and knowledge of outside resources that helped her colleagues (e.g., she helped one teacher who was looking for a new teaching position). Post-program, Teacher Two described numerous ways in which she has continued to collaborate with others. While she has not maintained contact with other teacher participants, she has sought out advice from *Whitten-Newman ExplorOlogy® Program* scientists and staff, including using them as a valuable resource for her classroom and own professional development; she has also continued to share her experiences and resources with other teachers, especially younger teachers who are eager to improve their teaching (see the quotation below).

I've been able to encourage some of our kindergarten teachers to incorporate some more science into their activities and show them how they can change [activities] into writing activities and meet their curriculum, but still [have them] be science based. And they've actually been very responsive and positive about it, because they're younger. [Teacher Two, Interview 2]

INTEREST IN SCIENCE AND BEING A SCIENCE EDUCATOR

Both Teacher Two and staff emphasized that her interest in science was high when she entered the program; however, Teacher Two discussed ways in which the program helped grow this interest. Specifically, she discovered new ways she could engage students in science and learned about new opportunities for personally engaging with science (e.g., participating in a BioBlitz with her family). She also said that seeing how enthusiastic the *Whitten-Newman ExplorOlogy® Program* scientists were about their work made her even more interested (see the quotation below). Finally, she said that, at some point, she would be interested in pursuing museum education because she feels staff at the Museum have a unique opportunity to impact a large number of students and teachers.

[I enjoyed] seeing a scientist who was so enthused about her field of study, something I did not think I would be interested in at all [but] ended up being very interested in. She seemed to have the heart of an educator, and she was even able to show us how to do some activities with plankton that we could use in class. [Teacher Two, Interview 1]

UNDERSTANDING OF SCIENCE AND BEING A SCIENCE EDUCATOR

Teacher Two said the program built her capacity to teach science using inquiry by providing simple ways that a normal science lesson could employ inquiry methods (e.g., journaling as a way to encourage close looking and observation). Specifically, she feels she has built her capacity to create lessons that encourage students to use a deeper level of questioning. She also described growth in her understanding of what science is and what a scientist does, namely that science involves more creativity than she originally thought and that being a scientist involves a great deal of collaboration, as well as reading and writing skills. Teacher Two also personally engaged in the scientific process during her program experience, developing an original scientific question based on her and other teachers' interest and exploring this question by designing a controlled experiment (see the quotation below).

Our hypothesis was that the chemicals that ran off the golf course and the park would change the amount of plankton in the pond water [compared] to the [pond] at the wildlife park. . . . Then we did a controlled experiment where we used Miracle Grow [and] Weed Killer to see how, in a controlled setting, we would alter the [amount] of plankton. (How did your group form that hypothesis?) Scientists took us to the [different ponds], and we looked around [and] gathered samples . . . [and] we took our samples back and used very powerful microscopes [to] look [at] what we found. We're actually the ones who came up with the hypothesis because we started asking [the scientist] questions. We saw this [type of plankton] in Wildlife Center's [pond], but we didn't see it in the [other] pond. [Teacher Two, Interview 2]

EFFECT ON OTHERS

Teacher Two's program experience has had numerous effects on others. Teacher Two said her integration of the inquiry method into her science classes has made her students more interested in science, built their confidence in their scientific abilities and skills, and helped them learn how to more effectively ask questions. Specifically, Teacher Two cited examples of students who are usually not engaged as being more fully engaged in science lessons and with *Whitten-Newman ExplorOlogy® Program* staff when they visited her classroom (see the quotation below). For instance, female students were excited to meet a female scientist. Further, students were prepared to ask more in-depth questions and felt proud of being able to do so. Also, as mentioned previously, Teacher Two has shared or plans to share science education resources she has amassed with colleagues and parents, and one teacher in her school applied for and was awarded a *Whitten-Newman ExplorOlogy® Program* grant. Lastly, the scientist said she has gained valuable insight from Teacher Two about the realities that public school teachers must manage.

Having [the scientist] come out [helped the students] see this [science] as something they can do. [They think], 'Oh, I can do that. I can ask questions like that,' especially because she talked about how artistic and creative you've got to be as a scientist because you have to design your own [experiments]. She [tells] the students [if they like to] draw or doodle, [they] might be a research scientist because [they] have the skills. But, [she] opened their eyes to that, and I think we let [the] girls know what it [science] is all about. . . . There was this one girl, she was bending over, sitting in the grass, getting in the water to pick up a good water sample that nobody had picked up, and if you said, 'Which one of your kids do you think will be in the mud?,' it would not have been that child. She was very impressed by [the female scientist]. [Teacher Two, Interview 3]

TEACHER THREE

Teacher Three is a middle school teacher who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2010. Data points related to Teacher Three include:

- ◆ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Teacher Three is familiar with the Museum and discovered the *Whitten-Newman ExplorOlogy® Program* when searching for summer professional development opportunities online. Teacher Three was motivated to participate by an interest in learning about more hands-on ways to teach science, as well as a desire to meet and network with other teachers. Staff reiterated that Teacher Three seemed interested in the program for these reasons and was further motivated by the stipend that teachers receive from program participation. Teacher Three also discussed a prior personal interest in science and named some experiments she and her children sometimes initiate at home (see the quotation below).

I like to know how things work and why they work that way and science is amazing [in terms] of what it can explain or how you can use it to research. [Teacher Three, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

Teacher Three appreciated aspects of the program where she learned how to apply what she learned to her classroom (i.e., afternoon pedagogy sessions) and sharing ideas with other teachers. More specifically, she enjoyed the BioBlitz where she and other teachers counted the number of plant species in a given area (see the quotation below). Staff felt Teacher Three and the other teachers in her group enjoyed learning about the surprising world of small vertebrates that are not normally encountered without a microscope.

We went out in the evening, and we got to walk around and count all the plants. . . . And, that was actually really cool because you never realize how many different types of species of plants are in one area. [Teacher Three, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Teacher Three became more confident in her ability to integrate inquiry in her classroom and broadened her view of what it means to “do” science.

CONFIDENCE AND LEADERSHIP

Teacher Three said she felt more comfortable in her role as a science teacher, specifically teaching science in a more hands-on, exploratory way (see the quotation below). She also explained that she felt more confident teaching in this way even though other, more experienced teachers at her school were not doing so.

Last year was my first year teaching, and I can just see differences. I’m sure just the fact that this is my second year teaching [helps], but also, I’m more confident [in] trying different [approaches] and not being [as] leery [that an approach] is different [from] the other teachers’ [approaches]. [I think] ‘Who cares, let’s just go ahead and do it’ because I got to see firsthand [that] hands-on [approaches to science] in class or hands-on [approaches in] *Whitten-Newman ExplorOlogy® Program* [are beneficial] because you go out and explore, discover, and learn that way. [Teacher Three, Interview 2]

COLLABORATION

Teacher Three said she appreciated networking with other teachers and learning about their style of teaching in general (not necessarily science education strategies). She also generally stated that working on a research project with other teachers reiterated for her the importance of collaboration (see the quotation below). Staff also said that she and other teachers worked well and diplomatically with a difficult member of their group throughout the program.

(What else did you learn from the research project?) You can attack things alone, but everybody had a different perspective on something, and so I think when we have teams in my classroom for projects, everybody clicks to get a different perspective so they might be able to help lead each other around or put new light on a topic. So, I think teams are very important; they are very beneficial. [Teacher Three, Interview 2]

INTEREST IN SCIENCE AND BEING A SCIENCE EDUCATOR

As with many teachers, Teacher Three entered the program with a prior interest in science, and the program helped reinforce this interest. She enjoyed learning new ways she could teach science in her classroom, and the program piqued her interest in finding new, similar professional development opportunities. She also requested that she be able to teach more science classes in her second year (see the quotation below).

I asked the principal [if] I can go ahead and teach a key science class next year because I want to be able to help build an interest in science in some other kids, not just my students. [Teacher Three, Interview 2]

UNDERSTANDING OF SCIENCE AND BEING A SCIENCE EDUCATOR

Teacher Three's understanding of science and being a science educator was reinforced and expanded on during the program. Her view of what science is broadened through the program (see the quotation below), and she has implemented more inquiry-based methods in her classroom post-program. She also came away with the idea that one's assumptions or hypothesis being incorrect is not a failure, but a learning opportunity.

I thought it was interesting that [the scientist] does so much, and he gets out there and knows so much about the little itty-bitty-tiny parts [of nature] that you don't realize are there. I [also] thought the [scientists] that [worked with] dinosaur bones were cool. There [are] so many different aspects to science and natural history that I think we only scratched [the surface]. [Teacher Three, Interview 1]

EFFECT ON OTHERS

Teacher Three has shared her program experience with other teachers who she said are now interested in applying for the program. She also has integrated inquiry methods into her classroom, although she did not elaborate on how she feels this has impacted her students. However, in the final interview, Teacher Three articulated that the end of the year is often so busy that she has not had time to apply her program experience in all the ways she would have liked.

TEACHER FOUR

Teacher Four is a high school teacher who attended the *Whitten-Newman ExplorOlogy® Program* in Summer 2009 and 2010. Data points related to Teacher Four include:

- ♦ Three interviews, one in Fall 2010, one in Winter 2010/2011, and one in Spring/Summer 2011
- ♦ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Teacher Four has had many prior experiences with the Museum, including participating in Science Escape with her students. She was motivated to participate in *Whitten-Newman ExplorOlogy® Program* by an interest in working with Museum scientists “behind the scenes,” as well as an opportunity to meet other teachers and learn more about the inquiry method (see the quotation below). She expressed a strong interest in teaching science and has participated in or encouraged student participation in informal science education opportunities such as BioBlitz, robotics competitions, and conservation activities.

[I wanted to] to be working with the scientists to see behind-the-scenes of the Museum, find out about opportunities for field trips with my students, about type of workshops and classes they had, and to hone my classroom skills, specifically, teaching through the inquiry method.
[Teacher Four, Interview 1]

MEMORABLE PROGRAM EXPERIENCES

Teacher Four’s most memorable experience was creating a cast of a fossil that she could take back and share with her students (see the quotation below). Staff also said many of the teachers, including Teacher Four, enjoy working with the mice carcasses because they arouse morbid curiosity, and teachers appreciate being able to take the bones back to share with their class.

My fossil that we made the casts of and hung in the classroom, I was really proud of that; it was a nice teaching tool and something that had we ordered from a catalogue would have not been in our science budget for this year. So, it was really neat to have something tangible to take back to use as a teaching tool, but also just to use to open the doors of communication with the students. [Teacher Four, Interview 1]

PROGRAM SUCCESSES AND EFFECTS

Most notably, Teacher Four became more confident in her ability to integrate inquiry in her classroom and broadened her view of what it means to “do” science.

CONFIDENCE AND LEADERSHIP

Teacher Four thought she gained the greatest confidence in her ability to teach using the inquiry method, something that felt awkward to her in the past. She attributed this gain to the program staff’s approach to promoting use of the inquiry method (see the quotation below). She also appreciated having experiences and resources to share with her students because it made her feel more confident in her abilities to support them in her role as a teacher.

I would just say that the [program] instructors were very supportive and teacher friendly, but, at the same time, they were able to push teachers to try things a little differently. That takes a balance to do that, to not feel like you’re being told, ‘You’re not doing this right; do it this way.’ They [program staff] were experts at what they did, [and] they said, ‘we’ve tried it this way; it’s worked for us. Go ahead and try it; if it doesn’t work, go back to the old way, but give it a shot.’ And, we weren’t good at it the first few times we did it, but a lot of it just came down to their personalities and their expertise, and, throughout [the program], they modeled those techniques. [Teacher Four, Interview 3]

COLLABORATION

Teacher Four said she appreciated working in a group of solely high school teachers because it was easier to communicate and collaborate with those in a similar situation as her (see the quotation below). Designing and conducting the research project with other teachers also

reinforced the importance of teamwork in science, especially since she had difficulty finding some of the fossils that other teachers located.

High school teachers were grouped with other high school teachers, and I think we really learned more and opened up more with the other teachers and shared experiences just because we were coming from a like mindset. I really appreciated that. (So when you say like-minded, tell me about some of the experiences you had with the other teachers.) They came from a variety of backgrounds, so there [were] a lot of different experiences that [teachers] had, [but] you found out that it didn't really matter where we came from, students are students, and they seem to like and respond to the same things, which is experiential learning, hands-on learning. [Teacher Four, Interview 1]

INTEREST IN SCIENCE AND BEING A SCIENCE EDUCATOR

Prior to participating in the program, Teacher Four had a great interest in science and science education, as evidenced by her undergraduate degree and pursuit of science professional development opportunities. Thus, she said that the program did not necessarily affect her interest in science, but was an opportunity to pursue that interest. She continues to pursue professional development in science education and opportunities for her students to experience hands-on science. She has also continued to use the Museum as a resource post-program (see the quotation below), and would like to continue her role as a science educator.

(When you are in contact with the Museum, what do you discuss?) Some of the methods that they [staff] used to create the water table so that I could duplicate things like that. And, the Museum came out to the school and did a presentation for students. We [also] went to visit the Museum one day. . . . When [the Museum staff] came out, they brought specimens. I did not borrow specimens from them, but I know that that's available. . . . I had one student in particular that was doing a presentation, and he wanted rock samples for something, so I gave him their contact [information], and they actually loaned him some things. [Teacher Four, Interview 3]

UNDERSTANDING OF SCIENCE AND BEING A SCIENCE EDUCATOR

Teacher Four entered the program thinking of science as an active discovery process, and scientists as explorers in this process. Teacher Four felt the most significant impact of the program has been on her ability to teach science in the classroom using the inquiry method (see the quotation below). During the program, she also actively participated in designing and implementing an experiment about how Earth processes affect the fossil record. She learned to let the data speak for itself and not to enter with preconceived notions about the process or results. She also learned about activities that she could replicate in her classroom, including journaling to record data and one's thoughts.

One of the main points that they [program staff] were trying to teach was [how to] improve our inquiry method in the classroom. And, I think that's probably one of the most difficult tasks for a classroom teacher to learn, especially if you're as old as I am. . . . It takes a lot of practice to learn how to guide your students without providing the answers [so] they can make discoveries on their own. . . . The first time [the inquiry method] was [introduced to me], it was awkward. I've been practicing since then, and this time [in the program], it all seemed to fit into place We've been back a little over three weeks now, and I can tell that there is a difference in my classroom. Sometimes you go to workshops and you get some ideas but it doesn't really change the way you teach or it just reinforces things you already believe. I think this [program] has actually changed the way I teach. (How so?) It's allowing students the freedom and the

time to come up with things on their own. Even from the very first day, they came up with their own definition for science. . . . You give them the experience first, and then when they discover the definition, then you can say, ‘there’s a word for that.’ Then, it has a whole lot more meaning for them, and it sticks with them, and students love the class. [Teacher Four, Interview 1]

EFFECT ON OTHERS

Teacher Four described multiple examples of how she thinks her participation has affected students. She said that her students are much more engaged in science lessons and science in general (see the quotation below); specifically, she said that students expressed interest in applying for *Whitten-Newman ExplorOlogy® Program* programs and opportunities. She has also shared her experiences with many middle school teachers who have expressed interest (but they have not applied for *Whitten-Newman ExplorOlogy® Program* as far as she knows).

I have [seen a difference in students’ interest], especially towards the end of the year. It [using the inquiry method] took practice on my part; I tried to incorporate more of the things during the year that I had seen modeled [during] the [program], but I think I got better [toward] the end of the year; that was when I really saw the students branching out more. I [also] have doubled the number of students now who have applied for Science Institute for this summer. . . . That interest in some students who had not shown an interest in science [before], I think is from the way science was presented this year. And, the way I presented it was definitely influenced by the [program]. I [did not] teach [that] way last year. [Teacher Four, Interview 3]

SCIENTIST PARTICIPANTS

SCIENTIST ONE

Scientist One is a scientist who facilitated experiences in the *Whitten-Newman ExplorOlogy® Program* in Summer 2009 and 2010. Data points related to Scientist One include:

- ◆ Two interviews, one in Fall 2010 and one in Winter 2010/2011
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Scientist One has worked with the Museum to facilitate many educational outreach experiences. He was asked to participate in *Whitten-Newman ExplorOlogy® Program* and facilitated experiences for both students and teachers. For Scientist One, being a scientist is working on serious research questions, not purely experimenting in one’s backyard. However, he does see science as something that is applicable to one’s everyday life (see the quotation below). Staff described Scientist One’s motivation for participating in the program as wanting to share his knowledge and love of science with younger students.

Science to me is the basic principle behind everyday life. It’s what you use to make the decision [about] what you’re going to buy at the grocery story. In its simplest form, science is just looking at things, doing the analysis of what the benefit is, and then acting on it. [Scientist One, Interview 1]

PERCEPTION OF PROGRAM’S STRUCTURE

Scientist One praised the program’s structure in many ways. He appreciated having teachers from out of town who were completely immersed in the program and committed to the activities while there. He also said that year-to-year, staff are successful at reflecting and adjusting the program structure to better

serve both scientists and participants. He felt the greatest strength of the program is that it immerses teachers in scientific research with real scientists (see the quotation below).

The fact that [the program] actually immerses [teachers] in the research [is beneficial]. These are people that don't necessarily have that chance in everyday life, but they can come to the University for a week and participate in actual research, be part of something bigger than what they would get to do at their own school. (Why do you think the program is strong in that area?) It actually brings the teachers into [contact] with the [university] researchers; I've worked with similar programs, and it's the ability for the Museum to bring teachers and professors or graduate students [together]. [Scientist One, Interview 2]

PROGRAM SUCCESSES AND EFFECTS

Scientist One was proud of getting to know the teachers and building their appreciation for small animals. He also felt the program impacted his ability to work effectively with non-scientists. Specifically, Scientist One says he now has more respect for the viewpoints and unique backgrounds of non-scientists. He also said he has grown his capacity to facilitate experiences for non-scientists by helping them relate to the subject matter and slowing down to see science from their perspective (see the second quotation), something staff echoed. Scientist One attributed his growth in this area to the program's structure of immersing teachers with scientists. Staff also emphasized that Scientist One was successful at engaging participants because he is enthusiastic about what he studies, citing an example of him bringing specimens from his own collection to share with teachers.

[I have grown] my ability to interact with the teachers, understanding that they're not necessarily familiar with some of the deeper concepts. (Can you give me an example?) I do a lot of work with the evolution of body size and talking about why animals are different sizes doesn't necessarily make sense to people that have never thought about it before. But, I can talk about basic reasons, like the benefits of an organism being large, and just talk about it in terms of things they might experience [in] a school yard, [like] 'What's the benefit of a big kid versus a little kid?' [Scientist One, Interview 2]

PROGRAM CHALLENGES

Scientist One cited his main challenge as not having enough time to prepare for the program given other professional responsibilities (see the quotation below). Staff also said it can sometimes be challenging for scientists to spend an equal amount of time with each participant when groups are large (i.e., student groups).

This year, my biggest [challenge] was having time beforehand to make sure everything was set up. I was doing a whole bunch of other work this summer, so normally, if I'd had more time, I could [have] gotten a lot more things set up before [the program]. [Scientist One, Interview 2]

EFFECT ON OTHERS

Scientist One described ways teachers benefited from the program, including that they were genuinely surprised by the amount of small animals they found in water samples, building their appreciation for the role of small animals. He also said he has had informal discussions with his colleagues about effectively working with teachers (see the quotation below).

I've talked to some professors, when they're talking about working with other groups, just reminding them that when you're working with teachers, just because they don't have the same experience or the same background [as a scientist] doesn't mean that they're something less. [I] think [scientists] have a tendency to forget that. [Scientist One, Interview 2]

SCIENTIST TWO

Scientist Two is a scientist who facilitated experiences in the *Whitten-Newman ExplorOlogy® Program* 2008 to 2010. Data points related to Scientist Two include:

- ◆ One interview in Fall 2010
- ◆ One interview with *Whitten-Newman ExplorOlogy® Program* staff in Summer 2011

BACKGROUND AND MOTIVATION TO PARTICIPATE

Scientist Two has participated in many Museum education outreach programs, including working with both middle and high school students during the *Whitten-Newman ExplorOlogy® Program*. Scientist Two is passionate about helping young people appreciate nature and science, something about which he has often conversed with staff (see the quotation below). Thus, his participation in *Whitten-Newman ExplorOlogy® Program* is one way he can help do this. He also feels that scientists today have so narrowed their field of expertise that they often have difficulty communicating with non-scientists; he believes it is important to find ways to effectively communicate with non-scientists, something he does through the program.

I feel like I am giving something back; I've spent my entire career and life doing stuff outdoors as much as possible. I'm stuck indoors at the computer a lot nowadays. And, I see so many students, even here at the University, who [have] little idea of what the natural world is, and I feel like I've gained so much from it by studying it and spending [time] in it that I don't want to lose that, and I don't want them to have no connection, because I think it's a huge part of why the world is in the condition that it's in. [Scientist Two, Interview 1]

PERCEPTION OF PROGRAM'S STRUCTURE

Because Scientist Two did not participate in a second interview, he was not able to comment extensively on his perception of the program's structure. However, he did say that he appreciated the freedom to conduct open exploration with students, as opposed to having to follow a more rigid, experimental structure.

PROGRAM SUCCESSES AND EFFECTS

Scientist Two feels his program experience has impacted his confidence in and style of facilitating science experiences for young students (i.e., middle and high school). Specifically, he has adopted a more open-ended method of facilitating experiences, asking probing questions to encourage students to think more critically, and pays careful attention to what excites each student so he can more easily relate to them (see the quotation below). Staff also emphasized that Scientist Two is very approachable, making it easy for students to ask questions, and flexible in terms of facilitating aspects of the program when staff need help. Further, he has contributed additional ideas for program activities.

I remember coming upon a log right in the middle of the campground, and it had obviously been hacked up by somebody with an axe. I just stopped at this thing and thought, 'okay, here's a teaching moment.' So I started asking them as many questions as I could think of hoping that they would come up with some of their own. Some of them, having grown up in the system, feel compelled to provide answers. So I would ask [things] like, 'Was the person that cut this [log] using an axe or a machete or a hatchet or a knife? Were they right- or left-handed? Was it an adult or a kid? How did they cut it, standing or sitting? Was it part of a live tree?' Some of them try immediately to provide answers or make guesses, but, in a few instances, you could tell that they stopped trying to say anything and just started wondering about the answers. I guess that's partly what I'm trying to achieve. [Scientist Two, Interview 1]

PROGRAM CHALLENGES

Scientist Two cited his biggest challenge as discovering each student's passion so that he can effectively relate to them during the program (see the quotation below). Staff also said that the open-ended approach that Scientist Two employs can sometimes be challenging if there is not some structure or simple goal that students are working towards during the experience.

Most challenging is trying to connect with these kids and find out each one's passion or special gift. Or, if they have fears of certain things, trying to make them more comfortable in nature, just getting them a little more attuned [to] what I think of as the real world as opposed to the artificial world indoors. [Scientist Two, Interview 1]

EFFECT ON OTHERS

During the program, Scientist Two encouraged students to feel more comfortable in nature, including learning how to canoe and using their senses to explore the outdoors while camping (see the quotation below). As stated previously, he also encourages open-ended exploration to help students think more critically. Staff said that Scientist Two also has facilitated and continues to facilitate many other educational outreach programs, but did not elaborate on any potential effects of this participation.

I try and get them comfortable in the outdoors and connected with nature, [helping them] learn to use their senses. . . . Almost all kids nowadays have spent very little time out in nature. The only ecology they know is urban ecology and most of that is indoors. So, we spent one night camping, and we just tried to teach them to pay attention to what they hear, to listen for bird calls or insect sounds. [Scientist Two, Interview 1]

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