INCREASING INTEREST IN SCIENCE AND SCIENCE CAREERS THROUGH PARTNERSHIPS WITH SCIENCE PROFESSIONALS

by

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In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

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ABSTRACT

This action research-based classroom project was set into place to answer the question, “Do partnerships between science professionals and students increase opinion of learning, science in school, going to college, and students’ interest in pursuing science related careers?” After six science professionals were invited to come into our classroom with a presentation of their choice, a positive increase in learning and interest related to science were confirmed by the results.

INTRODUCTION AND BACKGROUND

Ronan Middle School is located in northwest Montana in the town of Ronan on the Flathead Indian Reservation. Ronan is a rural agricultural community with a population of about 2,000 people. The Flathead Indian Reservation was designated for the Confederated Salish and Kootenai Tribes in1855. The reservation was opened up to the public for white settlement so there are many nonnative locally owned farms and property in the community. The community is a combination of mostly Native American and Caucasian ethnic groups. The tribal headquarter is located about five miles north of the Ronan Middle School, along with the Salish and Kootenai College (http://www.nelsonpub.net/docs/MissionValley_10_FullBook.pdf).

The 5th grade was recently added to the Ronan Middle School (RMS) that now includes 5th through 8th grade with a total of 406 students. RMS has a diverse population of students including approximately 63% Native American, 33% Caucasian, and a combined 4% of African American, Asian, Pacifica Islander, and Hispanic contribute to the school enrollment (M. Johnston, personal communication, September 22, 2011). Ronan Middle School has a high population of socioeconomically challenged students. About seventy percent of the student body qualifies for the Free or Reduced Lunch program that provides assistance to low income families (A. Makepeace, personal communication December 7, 2012).

I have a class of 22 5th grade students. There is a wide range of abilities of advanced, proficient, and below level students in my classroom according to the Criterion Reference Test (CRT), our state mandated test. Two students qualify for special services

related to English and one student receives counseling from our Alta Care program. The class has 15 girls and 7 boys, with 11 Native American and 10 Caucasian students.

I have been teaching fifth or sixth grade for almost five years. When listening to my students talk about what they wanted to be when they grow up, I mostly heard sport athletes, musicians, and different laborer positions. I wasn't hearing a lot of science related careers as aspirations, so I thought that I would expose my students to several different science related professions to determine if it would increase the interest in science related careers through experience with professionals in the community. The study was put into place to answer the question, *Will bringing in science professionals increase student's interest in science and interest in science careers?*

I invited six different science professionals to my classroom as guest instructors during the school year. A wild life biologist, dentist, hygienist, a NASA group, dietitian, and zoologist came to our classroom to teach a lesson or make a presentation. Science professionals were invited in to increase the interest of students in science careers and science in school.

CONCEPTUAL FRAMWORK

Science professionals who serve as mentors in the classroom are beneficial to students. Students who have been a component of mentoring programs or projects show an appreciation for science and also obtain science related skills such as the ability to collect and share data, run experiments, and use critical thinking to solve problems (Dooley, Bardwell, & Bethea, 2000). Teachers also report that students have a higher

interest in science careers after participating in scientist and student partnership programs. Other studies provide evidence that students who have been involved in scientist/student relationships will often seek higher education in science related areas (Dooley, Bardwell, & Bethea, 2000). Scientists can bring in a deep understanding of their science field that not only helps the students, but also benefits the teacher (Siegel, Mlynarczyk-Even, Brenner, & Nielsen, 2005).

Many times, elementary teachers are not confident teaching science (S. Stenberg, personal communication January 10, 2011) which contributes to their negative attitudes toward science. In 2002, the United States Congress passed the No Child Left Behind Act mandating all schools to test their students in reading and mathematics, stating that all students should be scoring proficiently or above the proficiency level by 2014 according to their formula. Schools that continually fail in these subject areas are required to pay for supplemental education or other means of education and parents are then allowed to take their child to another school of their choice (Gingerich, 2003). One fallout from NCLB is that teachers aren't teaching science because of the focus on reading, writing, and mathematics. Instead teachers are striving for better scores on state mandated tests and squeeze science in when they can, rather than making it a priority (Goldberg, 2005).

Science professionals have a deep understanding of their science related fields. Content knowledge is an important factor in discovering what a student does or doesn't understand to help direct future instruction. The lack of knowledge some teachers have in science is detrimental to students studying science because they don't have the ability to scaffold learning to guide students in the right direction to think critically (Burgoon, 2008; Goldsten, 2005). According to Burgoon (2008), "In order for students to achieve

the success expected by state governments and local school boards, they need to be taught by professionals who are fully competent in subject-matter knowledge and able to motivate, encourage, and facilitate student learning" (p. 6). Teachers with misconceptions of their own can be harmful to students in a science classroom. If a teacher has low content knowledge they could pass their misunderstandings onto their students (Burgoon, 2008). Mentoring programs are one way to bring a person with deep understanding of subject matter in their particular field of expertise to the classroom.

Horizon Research (2003), an educational research center for math and science, reported teachers do not feel adequately prepared to teach science. It is essential to bring in science professionals from real world professions. Partnerships between students and retired scientists and engineers have proven to be beneficial to students in California's Teaching Opportunities for Partners in Science (TOPS) program. The effectiveness of coupling students with science professionals was a positive experience for students and teachers (Wilson, Krakowsky, & Herget, 2007).

Scientists in Schools (SiS), a non-profit organization in Canada, brings scientists into the classroom from the community to help increase students' interest in science by participating in classroom and community investigations. A study conducted by the University of Toronto reported that after participating in the SiS program, 75% of the students said their interests increased in science and 90% of the teachers reported that they felt an increase in their confidence for teaching science and technology (Scientists in School, n.d.).

METHODOLOGY

The purpose of this study was to see if a partnership between fifth grade students and science professionals increased the low interest in science related careers in fifth grade students and science as a class, and if it increased students' interest in going to college. Below I described the methodology for my action research and summarized the data collection methods in a triangulation matrix. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

The Student Career Choice and Attitude Questionnaire was administered both pre and post treatment to measure differences in student perception related to the scientists' visits. The questionnaire included seven open-ended questions related to students' favorite subjects, possible career choices, and interest in attending college. Differences were determined and tabulated for analysis.

Six science professionals were invited to visit my classroom during the treatment beginning in November and ending in May. A variety of science professionals were invited in to give students information about different science professions they could go pursue. Science professionals were also decided on by connections with the Salish Kootenai College, Big Sky Science Partnership, and family. I wanted to make sure that some professionals represented local Native American science professionals, which was accomplished through the wildlife biologist and NASA Science group.

The first professional to come in was a wildlife biologist. She used a PowerPoint presentation to inform students of the current research that she is conducting to analyze

the impact of the new wildlife crossings on Highway 93, a major highway that runs through our area. After the PowerPoint, students were invited to participate in an art contest by drawing a poster depicting the importance of the wildlife crossings to the local wildlife. One student from my classroom was a winner of the contest.

The second science professional was a dental hygienist from a local family dentist office. This presenter asked that the students to think of a question that could be tested relating to dental care. Students came up with many questions but we decided on the question, "Will brushing your teeth for two weeks improve the health of your mouth?" The hygienist then came in and gave a presentation on proper brushing and flossing. Each student was given a tooth brush and floss. From that day forward students were to brush three times a day, twice at home and once after lunch at school. On the first day I took pictures of their teeth, gums, and saliva to record their oral health for day one to be compared with the pictures that would be taken on day twelve when the hygienist would return with the dentist.

Our next professional was a dentist from the same office. The dentist talked about her profession explaining to the students some of the tasks her career entails such as checking for cavities, giving fillings, and checking for disease. She also helped students interpret their data that they collected which were photos of their teeth, gums, and salvia. Students found that the health of their gums improved by the color of their gums and the saliva trays.

Our fourth science professional was a professor from Salish Kootenai College (SKC) in Pablo, Montana. He is working on a project for NASA with SKC students, in

which they are building a small satellite that will be launched into space. The professor brought in three students, a PowerPoint presentation with video and pictures of related projects, and hands on activities showing how elements of their small satellite worked.

A dietitian was the fifth science professional to visit our classroom. She began her presentation by giving a personal story about why she became a dietitian and what a dietitian was. She talked about what she did, which included helping design healthy diets for people with heart problems, diabetes, and obesity. She stressed to students the importance of eating a healthy diet full of colorful fruits and vegetables. She then provided a large variety of healthy food that she thought would be uncommon to them such as ugly fruit, cuties, and kiwis. She also brought more common snacks like mixed nuts, raisins, chips and salsa. The students asked many questions and seemed to really enjoy talking about their eating habits.

The last professional brought into the classroom was a zoologist. This professional was part of a travelling museum group from Oregon called OMSI, Oregon Museum of Science and Industry. Students were put into groups that consisted of students from different classrooms. The zoologist brought in squids to dissect. Students were given a work station with scissors, tweezers, and a magnifying glass. The students were able to observe and participate by finding and identifying the squid's different anatomy. The zoologist walked them through the process of dissecting the squid and finding different parts of the squid like the ink sac, hearts, and pen.

Two data collection instruments were given after each science professional visited the classroom, the Student Attitude of Science Experience Survey (Appendix B) and the

Student Interest Survey (Appendix C). The first survey contained three opened-ended questions about the visit from the science professional. The second survey was a series of four questions where students were given questions with a scale to rate the experience of the guest in the classroom. The results of the surveys were compiled and analyzed for themes. The questions from the Student Attitude of Science Experience survey were scored with a Likert scale using *strongly agree, agree, neutral, disagree, and strongly disagree*. The open ended questions from the Student Interest Survey (Appendix C) were grouped into three categories, *yes, no, and maybe*. Any answer that had yes in it or indicated that they agreed with the question was put into the *Yes* category, if the student put an answer that said maybe or were they were undecided they were put into the *Maybe* category, and if they said no or indicated they didn't agree with the question their answer was put into the *No* category. Many students gave short one word answers to the open ended questions. The responses were put into a tally chart including the three categories yes, no, and maybe and calculated into percentages.

After the last science professional visited, the post Student Career Choice and Attitude Questionnaire was administered. After all data were collected, the questions and statements were put into three themes, student interest in science, interest in science careers, and going to college.

To gauge if having guest speakers in the classroom increased interest in science careers I grouped the statement *I am more interested in this career after the lessons with the guest speaker,* the question *Are you more interested in the science career after the lesson with the science professional?,* and the question *What do you want to be when you grow up*? I also included the statements, *This was an interesting way for me to learn*

about science and *I like science more when guest speakers with special knowledge come to help*.

In addition, student reflections were recorded in a journal. I also kept records of my reflections during the project (Table 1). The reflections were analyzed for themes and were used to support other data.

Table 1
Triangulation Matrix

Research Questions	Data Source		
	1	2	3
Do partnerships between classrooms and science professionals increase interest in science related careers?	Pre and Post students interest survey	Student Questionnaire	Student discussions
Do partnerships between science professionals and classrooms increase interest in science?	Pre and Post student interest survey	Student Questionnaire	Teacher Reflection
Do partnerships between science professionals and classrooms increase interest in going to college?	Pre and Post students interest survey	Student discussion	Teacher Reflection

DATA ANALYSIS

The results of the Student Attitude of Science Experience indicated that 95% of the students *strongly agreed* or *agreed* when asked if they learned a lot from the wildlife biologist speaker (*N*=24). One student said, “What I found most interesting is saving the

animals." Ninety-five percent of the students also said that they learned from the zoologist. One student, who said they learned from the zoologist, wrote that the most interesting part was "holding a real life squid and actually dissecting it." After the NASA presentation, 94% of the students said that they learned from the science professional. The lowest percentage of students saying that they learned from the guest speaker was the dietitian. Twenty-six percent of the students said that they learned from the guest, 63% said they didn't, and 11% were neutral.

When students were asked about the type of education required for their chosen career prior to the treatment, 40% indicated they would need to go to college and 30% didn't know. After the guest speakers, 79% of the students said they would need to go to college for their chosen career. When asked if they discussed going to college at home, before the speaker experience 45% of the students reported they did compared to 74% of the students who reported talking about going to college at home after the study.

At the beginning of the study, 35% of the students chose elective classes including art and physical education as their favorite subjects. By the end of the study only 13% of the students chose an elective, and science was listed as the favorite subject. In the pre-survey, science was rated as favorite by 30% of the students compared to 50% in the post survey. Social studies increased from 0% to 11% and the other subjects, such as math, reading, language arts, either decreased or stayed the same after the project (Figure 1).

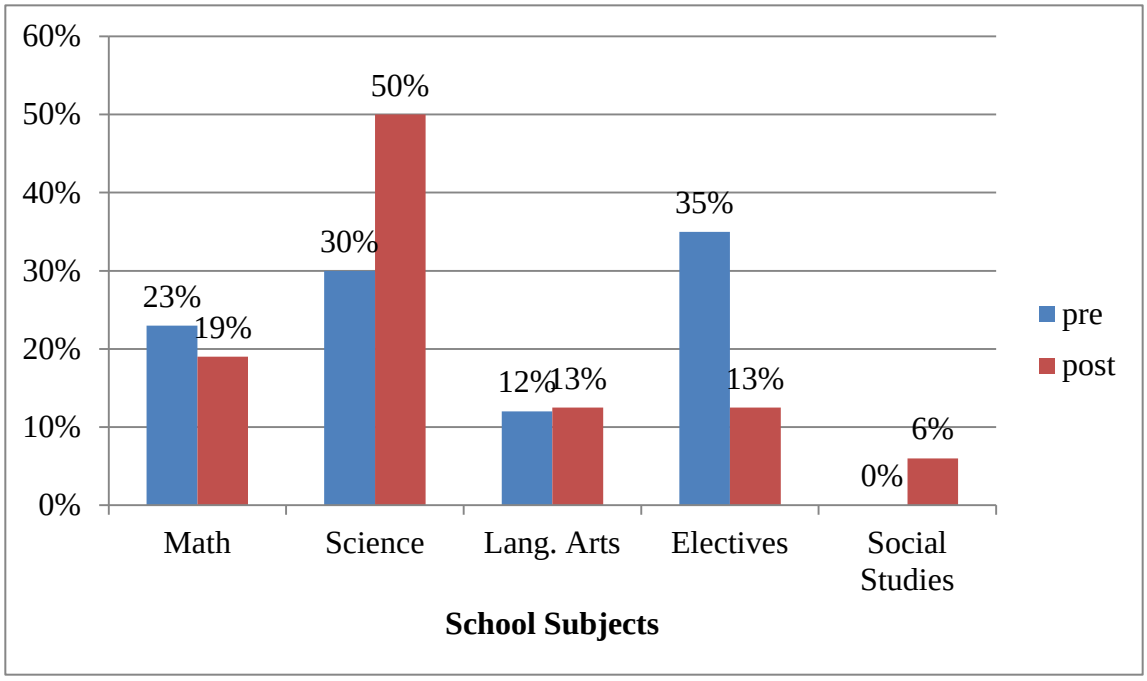

Figure 1. Students' favorite subjects, (*N*=19).

When students were asked, *Are you more interested in science after the lesson with the science professional?*, the data suggested that the zoologist made the largest impact, with all students saying that they liked the hands on activities they engaged in with the presenters. The students reported 95% favorability with the dietitian, 94% with the NASA group, 88% with the dentist, and 59% for the hygienist (Table 2).

Table 2
Responses to the Statement: Are you More Interested in the Science after the Lesson with the Science Professional?

Career	Yes	No	Maybe
Hygienist	59%	24%	18%
Zoologist	100%	0%	0%
NASA	94%	6%	0%
Dentist	88%	6%	6%
Dietitian	95%	5%	0%
Wildlife biologist	94%	6%	0%

The results for the Student Attitude of Science Experience statement, *This was an interesting way for me to learn science,* indicated that students rated the dietitian at 95% *strongly agreeing or agreeing* with the statement. The zoologist received 89% of the students *strongly agreeing* or *agreeing*, and 11% were *neutral*. She was followed by the wildlife biologist who got 100% students rating, *strongly agreeing*, or agreeing. The NASA group's ratings of *strongly agreeing* and *agreeing* were 84%. Overall, the hygienist and dentist were the students' least favorite in regards to how interesting students felt the learning experiences were (Table 3).

Table 3
Responses to the Statement: This is an Interesting Way for me to Learn Science (N=21)

Career	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Hygienist	56%	31%	13%	0%	0%
Zoologist	74%	16%	11%	0%	0%
NASA	67%	20%	7%	7%	0%
Dentist	63%	31%	6%	0%	0%
Dietitian	79%	16%	0%	0%	5%
Wildlife Biologist	71%	29%	0%	0%	0%

Students said that they liked science more when guest speakers with special knowledge came in to help. The only professional getting a response of *disagree* or *strongly disagree* was the dietitian, receiving 5% in each of those categories.

When analyzing students' responses from the pre and post survey on the question *What would you like to be when you grow up?* I grouped the data into four categories: entertainment, science professionals, construction, and other. At the beginning of the study, 37% of the students chose science related careers such as veterinarian, nurse, and

wildlife biologist. By the end of the study, 55% of the students reported that they would like to pursue a science related career, an 18% increase from the beginning of the study. The entertainment category, which includes professions such as a singer, professional athlete, or comedian and was the original leading choice among my students, dropped from 42% of the students' career choice to 18%. The categories Other and Construction remained the same from beginning to end, at 16% and 5% respectively. A new category had to be added after the post assessment because one student said that they didn't know what they wanted to be. As a result, the category Unknown was added, and started with 0% and ended at 5% (Figure 2).

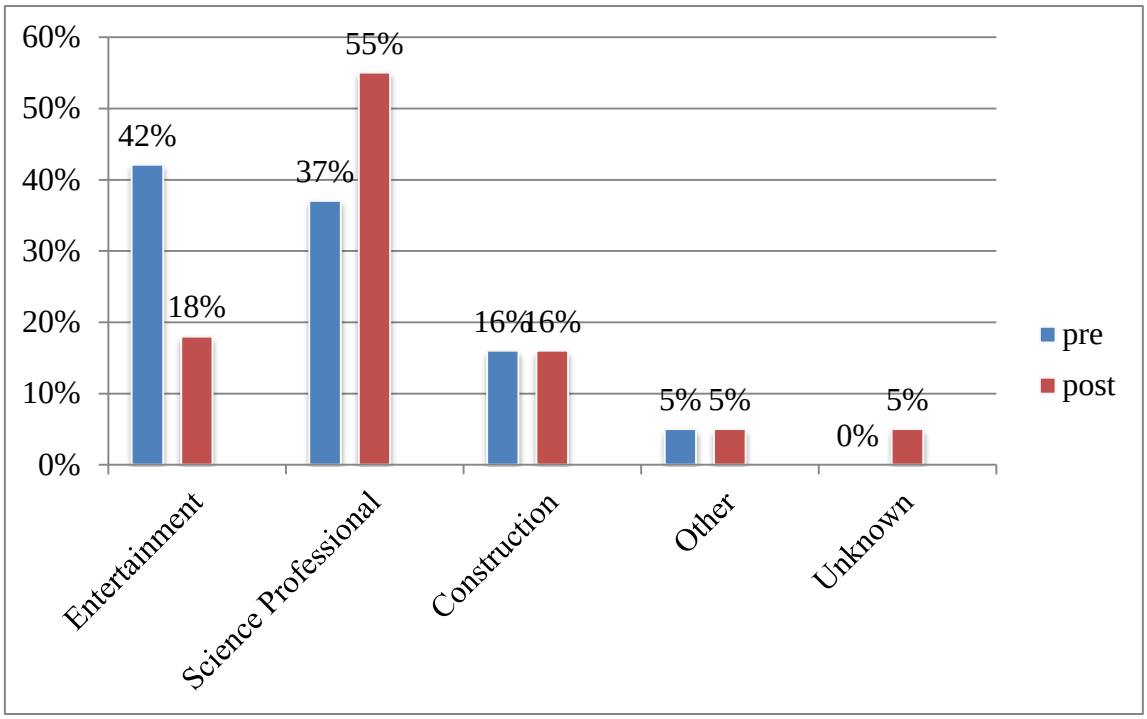

Figure 2. Student career choices, (*N*=19).

After analyzing the statement, *I am more interested in this career after the lesson with the guest speaker*, I found that the wildlife biologist had the most students interested in wanting to pursue their career, with 67% strongly agreeing or agreeing. The wildlife

biologist was followed by the NASA project group, which received a rating of 59% of students saying they would like to pursue a similar career. The dietitian was third highest in this category, with 58% of students strongly agreeing or agreeing with the statement (Table 4).

Table 4
Response to the Statement: I am More Interested in This Career after the Lesson with the Guest Speaker (N=21)

Career	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
NASA	6%	53%	20%	13%	6%
Zoologist	30%	25%	20%	20%	5%
Hygienist	0%	25%	31%	31%	13%
Dentist	6%	44%	25%	25%	0%
Wildlife Biologist	27%	40%	20%	13%	0%
Dietitian	42%	16%	21%	16%	5%

Students were not as interested in pursuing a career in dental hygiene when asked: *After the science lesson with the science professional are you more interested in pursuing a similar career?* Zero percent of the students said that they would be interested in pursuing this career, 53% said they would not be more interested in pursuing a career in dental hygiene and 47% said they were undecided.

As recorded in my teacher reflections, I thought that the dental hygienist was the best with the students, followed by the nutritionist. I wrote, “the hygienist was friendly and patient with the students and answered all the students’ questions with enthusiasm.” I also wrote, “Students were excited to brush their teeth after lunch, reminding me of their required task.” I also thought that the dietitian was friendly and students seemed to

like her. However, I didn't think that the NASA SKC group seemed as "high energy" and kid friendly as the other guests that came into our room. I wrote, "Our guests today seemed a little too laid back and if they were a little more enthusiastic kids might have been more excited about what they are presenting." I also said that students seemed really interested in the short video about the robot that a local SKC student was helping to improve for space missions.

In the discussion about the science professionals in our class during the school year a student reported, "I liked when they came in because it has a better way than reading out of books and we remember better." Another student said, "I think that the science professionals were funner than school work."

INTERPRETATION AND CONCLUSION

Regarding my first research question, *Do partnerships between classrooms and science professionals increase interest in science related careers?*, there was an 18% increase from pre to post in students responding that they would choose a science related career as something they would pursue when they grew up. Among all of the career presentations made, students' highest preference was for pursuing a career in wildlife biology. This may be a result of the area that we live in because students have many options for outdoor activities. Several students also indicated in the pre survey that they would like to be a veterinarian, suggesting an interest in animals.

The dietitian also received a high overall rating, possibly because many of the girls are becoming more aware of their bodies and the importance of eating healthy. The dietitian also brought in many snacks for the students to try which could have influenced

their opinions. In a whole class discussion about the science professional a student said, "It was interesting when the nutritionist came in because she brought the food and fake fat."

The dentist and the hygienist received the lowest rating perhaps because many people have a negative attitude toward these professions due to their previous experiences as patients. Students also mentioned that they thought mouths were gross. The dentist was more popular than the hygienist but this could be because the dentist did mention that her salary was quite high and that was one reason she chose her profession.

In my reflections I thought that the hygienist would be a more popular choice among my students because of her ability to interact with the students. The hygienist is my twin sister so I may be showing bias towards her. The students were also very distracted by the fact that we are twins and they had to be prompted several times to stay on task and stop asking us questions about being twins.

My second research question was *Do partnerships between science professionals and classrooms increase interest in science?* There was a 20% increase in students choosing science as their favorite subject from the beginning to the end of the project, suggesting that the treatment did indeed increase students' interest in science. In part, this may have been due to the nature of the presentations since students reported in whole class discussions that they liked the hands on activities that presenters used, and that this made learning science more interesting. One student said she liked it because, "Science professionals are smarter than teachers." I think students like it when they are able to get the answers they want because of the specialized knowledge that our guests had.

My third research question was *Does bringing in science professionals increase*

students' interest of going to college? Results showed a marked increase from 40% at the beginning to 79% at the end for students reporting that they knew what preparation was needed to go to college for their career of choice. Students also had an increase in talking about going to college at home since only 45% said they talked about going to college in the pre test as compared to 74% talking about going to college by the end of the project. This evidence suggests that the treatment not only increased interest in science and science careers, but also students' awareness of the necessity of college in order to pursue a science related career.

VALUE

As a teacher I feel that I have grown immensely. I have a better understanding of assessment and doing research in my classroom to determine if certain methods or strategies are beneficial to my students, such as bringing in the science professionals. I learned to create my own assessments and how to organize and analyze data to improve my teaching. From the science professionals I have learned new information about each profession that will help me better prepare for next year to create lesson plans that go with guests' presentations.

One of the reasons that I wanted to study this topic was to see if science was a popular choice among students as a career aspiration and subject in school. This project's results suggest that partnerships with science professionals and students increase interest. Science is a vital to our everyday lives, with changes occurring around us and looming issues involving fossil fuels, pollution, space exploration, and medical research science needs to be a priority. According to Farahnaz Movahedzadeh (2011), "From discovering cures for diseases, to creating innovative technologies, to teaching us how to

think critically, science has become an indispensable feature of modern society," (p.14). We need students to be thinking about their future and wanting to be scientists to improve our wellbeing.

Science is not a priority among classrooms in our district because of the emphasis on math and reading which are both needed for science, but science is the application of these two subjects which enables a deeper understanding. I hope to show our curriculum coordinator that science is important with the use of my research and the research of other students in the BSSP. I hope to see our district increase materials and curriculum for science.

I will continue to invite guests into my room. Now that I have a good idea what to expect, I would like to create more lessons to go with the science professionals' presentations. I also saw that students really enjoy having guest speakers in their classroom and it increases their interest in the person and their profession. I would like to further my investigation to include more understanding of how much the students actually learn from the guest speaker, not just by using student opinions, but also by content assessments. I am also interested in looking into the increase in student attendance on days that guests are expected to visit.

There are many factors involved in why students' interest and knowledge increased after the treatment. Each professional had a unique presentation. Each professional interacted differently with the students and students all have different interests. Would I get the same results every year? I am not sure. What I know is that students' interest increased in science careers by 18%, interest in the school subject science increased by 20%, and awareness of going to college also increased. I do know

that I feel like it is a positive decision to bring science professionals into my classroom and I will continue to do so.

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APPENDICES

APPENDIX A

STUDENT CAREER CHOICE AND ATTITUDE QUESTIONIARE

STUDENT CAREER CHOICE AND ATTITUDE INTERVIEW

What would you like to be when you grown up?

What type of education will you need?

What does it mean to be a _____?

How did you learn about this career and why do you want to be a _____ when you grown up?

Do you have to go to college to get a job as a _____?

Do you talk about going to college at home?

What is your favorite subject in school? Why?

APPENDIX B

STUDENT ATTITUDE OF SCIENCE EXPERIENCE

Code_____

Participation in this research is voluntary and participation or non-participation will not affect your grades or class standing in any way. Please circle the answer that best describes your opinion after the lesson(s).

1. I learned a lot from the guest speaker.

Strongly agree Agree Neutral Disagree Strongly Disagree

2. I am more interested in this career after the lessons with the guest speaker.

Strongly agree Agree Neutral Disagree Strongly Disagree

3. This was an interesting way for me to learn about science.

Strongly agree Agree Neutral Disagree Strongly Disagree

4. I like science more when guest speakers with special knowledge come in to help.

Strongly agree Agree Neutral Disagree Strongly Disagree

APPENDIX C

STUDENT INTEREST SURVEY

Code_____

Participation in this research is voluntary and participation or non-participation will not affect your grades or class standing in any way. Please answer the questions to the best of your ability.

1. Are you more interested in science after the lesson with the science professional?

2. What did you find most interesting about the science professional or their lesson?

3. After the science lesson with the science professional are you more interested in pursuing a similar career? If yes, what?