# INSPIRING STUDENTS TO PURSUE SCIENCE:
# A PROGRAM EVALUATION OF *PITT SUMMER SCIENCE OUTREACH*

by

**Marie Christine Fontelo**

BA in Sociology, Marquette University, 2011

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This thesis was presented

by

Marie Christine Fontelo

It was defended on

May 1, 2014

and approved by

Jeanette Trauth, Ph.D.
Associate Professor
Department of Behavioral and Community Health Sciences
Graduate School of Public Health, University of Pittsburgh

Judy L. Cameron, Ph.D.
Professor of Psychiatry, Neuroscience, Cell Biology and Physiology, Obstetrics-Gynecology
Reproductive Sciences, and Clinical and Translational Science
Department of Psychiatry, University of Pittsburgh

**Thesis Director:** Edmund M. Ricci, Ph.D., MLitt
Professor
Department of Behavioral and Community Health Sciences
Graduate School of Public Health, University of Pittsburgh

Edmund M. Ricci, Ph.D., MLitt

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Marie Christine Fontelo, MPH

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## ABSTRACT

Elementary and middle school children in low-income communities often do not receive engaging science curriculum and also role models for careers in science, resulting in a lack of interest in science and lower rates of students who pursue scientific careers.

*Pitt Summer Science Outreach* is a summer camp that brings science education to students in grades 4 through 6 at various underserved YMCA/YWCA locations in the city of Pittsburgh. The camp is offered by the Clinical and Translational Science Institute at the University of Pittsburgh and brings together scientists, college student mentors, and uses sustained experiments to provide a positive, engaging, and memorable experience with science. For 2013, the camp had two curricula: *Science of Nutrition and Exercise* and *Laboratory in Your Bedroom*. The goal of the summer program is to inspire a lifelong interest in science in the elementary school students who attend.

The program was evaluated using semi-structured interviews with all students who attended to measure participants' comfort with science. In addition, the evaluation team used a social networking activity to measure with whom the participants were discussing camp, and an art activity inspired by the creative painting and writing "Visual Voices" methodology to assess participants' favorite activities.

Several themes emerged from the evaluation. We documented that the students were engaged in camp activities, enjoyed hands-on learning, and desired to return to the camp the following year.

The social networking activity showed that participants were discussing camp with family and friends who did not attend camp.

Finally, participants enthusiastically enjoyed the curricula as determined by the evaluation. A number of the students expressed that they felt more confident in their ability to do science and may have an interest in pursuing career in a scientific field.

The public health significance of *Pitt Summer Science Outreach* is its effect on the social determinants of health. By providing engaging science education in underserved communities, the program enables participants the means to improve their health outcomes and impact the conditions in which they live.

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# 1.0 INTRODUCTION

This section reviews the literature on what is known about the effects of early exposure to science in elementary school children and the trends in science careers for children in low socioeconomic backgrounds. In addition, the *Pitt Science Summer Outreach,* a program implemented throughout the city of Pittsburgh designed to inspire lifelong interest in science among elementary school children, is also introduced.

## 1.1 EARLY EXPOSURE TO SCIENCE

Students who receive engaging exposure to science in early education are more likely to continue to pursue science classes. Early exposure leads to an increase in perceived science competence and self-efficacy (Beghetto, 2007). In turn, perceived science competence predicts engagement measured by classroom participation, achievement measured by grades, and anticipated pursuit of science majors and careers (Beghetto, 2007). By providing students with positive early exposure to science, they are more likely to perceive their scientific aptitude to be high and have the confidence to continue science curriculum.

Participatory learning is based upon the idea that if students actually do scientific work, they will be more likely to appreciate and become interested in science. Participatory learning contrasts with formal schooling and includes the following six components:

1. Learners do domain-related practices to address domain-related dilemmas.
2. Scientific and technological knowledge/practice are situationally constructed and socially negotiated.
3. Learning is practicipatory, occurring "at the elbows" of more knowledgeable others, including teachers, scientists, and peers.
4. Practices and outcomes are authentic to and owned by the learner and the community of practice, and are in response to real-world needs.
5. Participants become a part of and develop an identity as a member of a community of practice.
6. Formal opportunity and support for both reflection-in-action and reflection-on-action. (Sasha A. Barab & Hay, 2001)

This type of learning is particularly pertinent to science because it enables students to engage in the scientific method. The scientific method actively engages students in the first component: by asking a question, proposing a hypothesis, designing an experiment, collecting data, analyzing results, and sharing conclusions students are using domain-related practices to address domain-related dilemmas. Through collecting data, students embrace the second component in a topic that interests them and relates to the field. In order to learn science through practice, students learn from mentors with greater knowledge, an objective addressed in the third component. The fourth component speaks to students collecting data that they own. Students take ownership by creating the dataset. By working through the scientific method, students join the scientific community since it is the standard for research in the field. Finally, in science learning students are able to test hypotheses as they complete experiments, which fulfills the sixth component. In summary, early exposure to science can inspire students to further pursue scientific classes and includes dynamic learning, which can be achieved through participatory learning.

On the other hand, negative early exposure can adversely affect students' interests in pursuing further science classes. Negative exposure may prevent students from enrolling in science classes, particularly if they find their previous experiences to be tedious or boring (Lyons, 2006). If students do not enjoy their experience and are uninterested, they will not pursue more science classes. Despite their achievement level some students will perceive that science classes are difficult and that they are not good enough to continue taking classes on the subject (Lyons, 2006). In other words, students will feel particularly critical of themselves and their performance, despite receiving high marks from the instructor (Lyons, 2006). However, some students consider the intrinsic value of science classes, particularly on transcripts, so even if they do not enjoy the subject but see strategic benefits from taking classes, such as university acceptance, students will continue to pursue science (Lyons, 2006). Factors preventing students from continuing science classes include lack of self-efficacy resulting from critical self-analysis and negative classroom experiences. By providing engaging hands-on lessons and empowerment, educators can increase the number of students pursuing science education and eventually scientific careers.

## 1.2 LOW SOCIOECONOMIC STATUS AND SCIENTIFIC CAREERS

Often, students from low socioeconomic backgrounds do not receive the positive early exposure of participatory learning described above. As a result, there is a disparity in achievement. This gap in achievement then leads to an inequality of representation in scientific careers. Since socioeconomic status and race are intertwined, it is necessary to look at the racial gap in achievement related to scientific careers. Aside from Asians, minority populations including Hispanic or Latino, American Indian or Alaska Native, Black or African American, and Native Hawaiian or Other Pacific Islander are extremely underrepresented in the workforce. In fact, the combined total of the above mentioned minority populations is about equal to the Asian population working in science. In a study by the National Science Foundation, of the total number of employed engineers and scientists, minorities account for 24.9% of the population (National, 2013). Excluding Asians, minority populations compose merely 13.3% of the population (National, 2013). These statistics are important when considering the distribution of races in the American population. According to the United States Census Bureau, 13.1% of the total population identifies as Black or African American, 1.2% identifies as American Indian or Alaska Native, 5.1% identifies as Asian, 0.2% of the population identifies as Native Hawaiian and Other Pacific Islander, 16.9% of the population identifies as Hispanic and Latino, and 2.4% identifies as two or more races (2012). Therefore while the minority population describes almost 40% of the American population overall, they only account for about 25% of the engineering and scientific workforce. To combat this disparity, the Executive Office of the President of the United States developed a report, "Increasing College Opportunity for Low-Income Students: Promising Models and a Call to Action."

In the President's report, models highlight pathways to eliminate barriers for success that low-income college students face. These barriers include "lack of guidance and support they need to prepare for college, apply to the best-fit schools, apply for financial aid, enroll and persist in their studies, and ultimately graduate" ("The Executive Office of the President," 2014). Since post-secondary education is necessary for many scientific careers, it is essential to overcome these barriers. Mentioned earlier, self-efficacy is also a factor in choosing science careers, particularly for students of low socioeconomic status.

Self-efficacy refers to whether or not an individual believes that he or she can complete a particular task or behavior. Influences on self-efficacy include academic performance behavior, vocational interests, and perceived career options (Lent, Brown, & Larkin, 1986). Academic performance behavior relates to self-efficacy in that students believe that they are capable of doing science when they accomplish good grades on tests in science class. Self-efficacy relates to vocational interests when students consider outcomes of taking a skills-based vocational class instead of a traditional science class. For example, students consider whether they want a course involving training for nail technicians and automotive mechanics versus a course involving bench science training for chemists and physicists. They examine their performance and the utility of the classes in which they are enrolled. For instance, a student who takes a vocational class, like nail technician training, as well as a science class, like an introductory chemistry class, will consider her ability to be a nail technician versus a chemist based on her achievement in and the practicality of the class. Although she receives excellent grades in both classes, she may consider the nail technician job to be more realistic than a job as a chemist. Similarly, students' self-efficacy is impacted by their perceived career options. For students who have never met a chemist or physicist, they are unlikely to consider that they may become one. To enable students' self-efficacy in science careers, it is essential to consider their academic performance, vocational interests, and perceived career options.

One study examined influences on ecology students from underrepresented populations and discovered that role models and mentors, family support, enrichment programs, early exposure, outcome expectations, and experiences of discrimination influenced their scientific career (Armstrong, Berkowitz, Dyer, & Jason, 2007). The participants of this study were undergraduate ecology students who identified as African-American. Role models and mentors provided them with the awareness and self-efficacy to continue their studies since they were also African American. Students saw someone who looked like them, which enabled and empowered them to continue their chosen studies. Similarly, students felt the benefits of family support. While their families were not in their field of study, they did provide encouragement for these students. The students not only had the support of family, but also scientists in the field, through enrichment programs. Through participatory learning programs, students worked side by side with scientists on applied research (Armstrong et al., 2007). This experience helped them to realize that a career in ecology was not only attainable but also enjoyable and that since they were satisfied, ecologists generally remained in their profession. Another influencing factor for minority ecology students was early exposure. Students acknowledged that they had a meaningful experience before enrolling in an undergraduate program, however some did not realize it at the time. Instead they reported experiencing an engaging outdoor activity in grades kindergarten through twelfth grade (*Ibid*., 2007). Also the ecology students considered the influencing effect of outcome expectations related to a scientific career; they found satisfaction in the field of ecology, in relation to their long-term personal goals (*Ibid*., 2007). Finally, discrimination affected ecology students greatly; encounters of discrimination and feelings of isolation significantly diminished students' confidence (*Ibid*., 2007). Despite overcoming the obstacles of pursuing higher education in a scientific field, and experiencing positive factors that encompass social support and self-efficacy building, negative factors like discrimination still impacted ecology students of color.

## 1.3 PROBLEM STATEMENT

Students from low socioeconomic status neighborhoods do not receive the engaging science curriculum to maintain their interest in the subject. As a result, they do not work towards the academic achievement necessary for a career in the science community. This lack of academic achievement in turn leads to underrepresentation of minority populations in the scientific community.

## 1.4 PITT SUMMER SCIENCE OUTREACH PROGRAM DESCRIPTION

*Pitt Summer Science Outreach* brings science to children in grades four through six in the Pittsburgh area via Young Men's Christian Association (YMCA) and Young Women's Christian Association (YWCA) locations. The camp combines experts in the field, college student mentors, and sustained experiments to provide students with a unique experience. Designed to increase students' understanding of science, the camp provides strategies for designing, collecting, analyzing, and reporting data in a supportive setting. The camp has two curricula: Science of Nutrition & Exercise and Laboratory in Your Bedroom. Science of Nutrition & Exercise was implemented in four locations and Laboratory in Your Bedroom was implemented in one location. This location received the Science of Nutrition & Exercise the previous summer, 2012.

Students participating in the program attend YMCA/YWCA camp and receive science programming one day each week, over the course of six weeks. Each week, an expert provides twenty minutes of instruction followed by a hands-on activity for the students. For example, cardiologist Jim Elson explained the cardiovascular system to students before creating a pump using PVC pipe, water, and a bucket system. Students manipulated the system by turning valves that allowed for lower or higher water flow. After the expert presentations, students continued to work on sustained experiments that they designed with their science mentors. The program concluded after six weeks, with the last week being student presentations. During the last week, students completed posters presenting their data in a way that followed the scientific method.

## 1.5 PURPOSE OF EVALUATION

The overall purpose of the evaluation study described in this report was to evaluate whether the *Pitt Summer Science Outreach* program increased students' interest in and confidence regarding participating in science activities.

## 1.6 RESEARCH QUESTIONS

The research questions explored in this thesis include the following:

1. How did the children participating in the *Pitt Summer Science Outreach* program react to the curriculum?
2. Did the program promote self-confidence regarding children's ability to do scientific activities?
3. Based on their experiences in the *Pitt Summer Science Outreach* program, would students want to return to camp next year?

# 2.0 BACKGROUND

*Pitt Summer Science Outreach* includes two curricula which are full of activities that have been proven by science educators to increase interest in science. Specifically, hands-on laboratory science activities and supported inquiry that demonstrate an increase in engagement for students.

By providing hands-on activities, students are more likely to have a more positive attitude toward science compared to students who do not have hands-on activities (Ornstein, 2006). Ornstein examined students that were similar in all characteristics except interactive classroom experiments, and discovered students had higher levels of positive attitudes to science if given the opportunity to participate in hands-on learning. Richard Zare expresses that laboratory learning provides the curiosity necessary for true scientific understanding, rather than standardized testing. Zare states, "We need to give each student the opportunity to explore and to pursue the answers to open-ended questions. In that way, we will find and nurture the next generation of independent thinkers, some of whom will become our scientific leaders" (2005). Not only will hands-on learning enable students to be more positive about science, it will allow them to think independently as well. Such thinking enables scientific inquiry, a necessary component for sustained experimentation and a future in scientific careers.

Students engage in sustained projects throughout the course of the *Pitt Summer Science Outreach* program. This project embodies the language and methods of inquiry of science, which allows students to be actively engaged participants in the learning process, decide on their own learning goals, and fuse meaningful relations with their own experience and real-world issues (Barab & Hay, 2001). Instead of gaining a superficial understanding and memorization of facts, students are active and choose their investigation. Students learn the scientific method because they are dynamically performing it. Instead of the instructor telling students the correct or wrong answer, they simply enable students to learn through "providing resources, just-in-time lectures, and Socratic questions to facilitate reflection in and on the learning process" (Barab & Luehmann, 2003). Teachers become the support for students without dictating instruction. Sharon Begley iterates the importance of this method, stating the one thing that science educators and scientists desire students to do is "to think critically about scientific data and concepts, and be able to synthesize and apply them" (2004). By guiding students through scientific inquiry, they become interested and have the capacity to become scientists.

Through nurturing students with interactive lessons and supportive inquiry exploration, programs create engaged and curious scientists. *Pitt Summer Science Outreach* follows both principles in its curricula through hands-on activities and sustained group experiments.

## 2.1 TYPES OF PROGRAM EVALUATION

### 2.1.1 Results from Similar Programs

Previous program evaluations of similar science camps explore attitudes towards science through qualitative and quantitative research methods. Two evaluations highlighted here draw from an integrated science activity-based intervention in the academic classroom (Parker & Gerber, 2000) and an informal math and science camp (Simpson & Parsons, 2009). Evaluations demonstrated students' achievement and attitudes towards science, as well as parent perspectives on programming.

The Parker evaluation used mixed methodology and examined students' achievements through surveys and teacher logs (Parker & Gerber, 2000). Including teacher observations provided insight to student interactions with the material before and after each hands-on activity. For example, before students were taught a lesson on density, they took a criterion-referenced test. This 15-item questionnaire assessed student understanding of the concepts provided in the lesson. In the instructor logs, the teacher describes the students' performance on the criterion-referenced test before the lesson and after the lesson. Additionally, the log includes a description of the students' interaction with the activity. A complete picture of student learning and achievement is described through qualitative insight. Similarly, students' attitudes toward science were assessed through a 21-item questionnaire called the "Attitudes Toward Science Survey" at the first and the last lesson. The results from this evaluation demonstrated significant changes in achievement and attitude. Students were learning from the interactive activities and were able to validate this knowledge on the criterion-referenced test. All students increased their scores from the pre-test to the post-test, some with a difference of 13 answers (*Ibid.*, 2000). This difference is extraordinary considering that the criterion-reference questionnaire is composed of 15 questions. The "Attitudes Toward Science Survey" showed that students significantly increased in positive attitudes between the pre-test and post-test. Additionally, the evaluation team found a significance increase in motivation by examining the Science Motivation subscale of the "Attitudes Toward Science Survey" pre-test and post-test results. The Parker evaluation exhibits that hands-on activity increases students' achievement and positive attitudes towards science through questionnaires and instructor observation logs.

The Simpson evaluation considers parental opinions gathered through qualitative interviews from an African American community (Simpson & Parsons, 2009). Parents were interviewed based on their children's participation in the Jordan Academy. Similar to the *Pitt Summer Science Outreach* program, the Jordan Academy is a summer camp facilitated by a university for children in grades three through six to spur interest in science among ethnic/racial groups that are underrepresented in scientific and mathematical careers. Several ideas emerged from parental interviews including a desire for students to engage in hands-on experiments, a lack of being informed about programming, and preferred characteristics for teachers. Parents expressed that they wanted their children to perform interactive work because it would increase their interest and excitement for the subject. Additionally, parents wanted students to see science in context, in "real-life": through laboratory field trips, meeting professionals, and going outside (Simpson & Parsons, 2009). While parents had an idea of what they wanted their children to experience, many did not experience effective communication about the program. Parents learned of the Jordan Academy program through informal communication channels such as word of mouth, rather than from institutions like elementary schools. Although unaware of the primary method that programs like the Jordan Academy advertise, which is through the Internet and the host university, upon hearing of the program and its mission, parents enrolled students right away. Finally, parents stated what they desired in characteristics for teachers in the program. They emphasized wanting teachers who embodied enthusiasm and provided content enforcement and cultural impact. The idea of content enforcement describes exposure to science and math. Parents wanted teachers who would provide meaningful experiences in science and math for their children. Cultural impact describes providing an empowering influence on students about their identity as African Americans. According to parents, teachers should provide education while embodying personality characteristics of a strong role model. In summary, parents believe that students should experience a program that has interactive activities, better communication of opportunities with parents, and teachers that enthusiastically deliver content and cultural identity.

# 3.0 METHODS

To understand students' experience with the *Pitt Summer Science Outreach*, a qualitative program evaluation was completed. Previous evaluations demonstrated disappointing results. Through pre- and post- surveys, administered by clicker and projector technology, students displayed developing disinterest in science as a result of attending the camp. Teachers working with the Clinical and Translational Science Institute and involved with implementation of the program believed that this did not represent students' experience and attitudes. They believed that students enjoyed the program activities and interest in science grew throughout the camp period. In order to obtain students' understanding of the camp, participants 1) participated in interviews, 2) participated in an art project modeled after Visual Voices, and 3) completed a networking worksheet. To grasp what the participants of the *Pitt Summer Science Outreach* were thinking, evaluation methods probed what was on their minds.

By using three research methods, triangulation was established. Concepts that emerged from interviews were emphasized through Visual Voices artwork. As a result of triangulation, credibility and internal validity increased. Not only did students describe themes through speaking of their experiences but they also painted and drew them. Visual Voices allowed for students to richly illustrate the experience of *Pitt Summer Science Outreach* in addition to telling interviewers. Similarly, stories of enjoying science at home described to interviewers were confirmed when participants listed family members in their social network.

## 3.1 PARTICIPANTS

The students participating in the *Pitt Summer Science Outreach* program are enrolled at a summer camp in five different YMCA and YWCA locations. These locations include the Collegiate YMCA, the Hazelwood YMCA, the Homewood-Brushton YWCA, the Wilmerding YMCA and the Irwin YMCA. Those attending the Collegiate YMCA camp were composed of students from two YMCA locations, with the majority of participants attending camp at the Thelma Lovette YMCA four days of the week and a few participants attending camp at Collegiate YMCA for the entire week. These students were interviewed on location at the Thelma Lovette YMCA. Additionally, children from the Irwin YMCA were not included in the evaluation because they were not the target age for camp programming; they were many years younger.

## 3.2 PROGRAM DESCRIPTION

To guide the evaluation design, a logic model (Fig. 1) was developed to display key resources, activities, and expected outcomes in a concise manner. The logic model demonstrates a theoretical framework that guides the way that the *Pitt Summer Science Outreach* program functions. By following the framework provided in the logic model, the program achieved its planned outcomes. Also by providing the outcomes in a linear flowing model, all parts of the program are displayed from the components to the outcomes.

By outlining the inputs in the logic model, the evaluation team saw who would be involved in the program. The collaboration between the Clinical and Translational Science Institute, local YMCA and YWCA locations, as well as camp program instructors such as college student mentors and science experts, is demonstrated in the inputs section. Additionally, the inputs section includes logistical concerns for the success of the program. For example, in order to complete sustained experiments, experiment materials must be provided to students. The website (http://www.pittscienceoutreach.com/content/summer-science-2013) listed in the inputs section, which displays camp activities, was integral to the Visual Voices activity. After painting and drawing, students were photographed with their artwork (Fig. 8). Without considering this in the logic model, it is possible that the evaluation team would not successfully take pictures of the participants during the activity.

The activities section of the logic model shows how the activities are not limited to lectures and experiments. While the program staff is teaching the students through hands-on laboratory experiments, they are also instructing students on what the scientific method is and how to operationalize it. Through explaining this integral aspect of the program, the evaluation team was able to confidently interview children regarding science. Students were aware of what an experiment is and how it proves a hypothesis and were capable of articulating this fact.

The outcomes section of the logic model demonstrates the process by which students will progress through the program and afterwards. After enjoying the activities initially, students will then implement their own science experiments, and increase their understanding. When this process is complete, students will maintain the skills that they have learned to complete research and, eventually, as a result of successive programs, may lead to an increase in science, technology, engineering, and math students.

These assumptions demonstrate necessary components for the program to succeed: community engagement and participant understanding. They are assumptions because in order for the program to take place, they must occur. For example, the community must allow the *Pitt Summer Science Outreach* program staff to enter through the YMCA and YWCA camp locations. Without community approval, the camp would cease to exist. Time would not be allocated from the YMCA and YWCA and students would not attend. The second assumption states that the material provided in the camp sessions is understandable to the participants. If the participants were unable to grasp the concepts presented during the lectures, they would be unable to complete the hands-on laboratory activities and create and implement their own experiments.

The external factor of camp attendance highlights an important limiting factor to the program. While the program may be reasonable and all aspects from key resources to final outcomes considered, it will not succeed if students do not attend. Despite program preparation and implementation, whether or not students attend is something that cannot be controlled. It is a completely external factor. Although the *Pitt Summer Science Outreach* team does not have any control over this factor, it is significant to the program functionality and essential to consider for the evaluation.

| INPUTS | OUTPUTS | | OUTCOMES | | |
|---|---|---|---|---|---|
| | *Activities* | *Participants* | *Short* | *Medium* | *Long* |
| • CTSI provides science camp for underserved children in Pittsburgh<br>• Collaboration<br>o YMCA/YWCA<br>o College students<br>o Science experts<br>o Evaluation Institute<br>• Funding<br>• Cultural competency training<br>• Experiment materials<br>• Lecture presentation materials (audiovisual)<br>• Website displaying camp activities | • Provide interactive lectures on the health benefits of exercise and nutritional eating<br>• Provide interactive lectures on science occurring in their bedroom atmosphere<br>• Train youth on the scientific method and experimental design<br>• Train youth on data collection, analysis, and presentation<br>• Perform sustained experiments under mentors' guidance<br>• Develop confidence for science in youth | • Children enrolled in camps at the YMCA/YWCA at Collegiate, Hazelwood, Homewood-Brushton, Irwin, and Wilmderding | • Participants enjoyed interactive lectures on exercise and nutritional eating<br>• Participants enjoyed interactive lectures on bedroom science<br>• Participants designed own experiments | • Participants implement experiments<br>• Participants collect data and analyze results<br>• Participants compile results into poster presentation<br>• Participants show increased understanding of science concepts, the scientific method, and how to speak about science<br>• Participants feel empowered to do science | • Participants maintain the skills to conduct research and perseverance to complete tasks<br>• Increase in number of qualified underserved students enter and persist in STEM careers |

| ASSUMPTIONS | | EXTERNAL FACTORS |
|---|---|---|
| • Communities are willing to cooperate<br>• Participants are able to understand the concepts taught by camp staff<br>• The curriculum promotes skill building leading to self-confidence<br>• The curriculum is fun and engages students leading to their desire to return to the program | | • Attendance of children in camp |

**Figure 1: Program Logic Model**

## 3.3 MEASURES

### 3.3.1 Approach

In order to understand students' experience of the *Pitt Summer Science Outreach* program, the following methods were used 1) In person interviews, 2) Network Activity, and 3) Visual Voices. These measures are described here.

## 3.4 DESCRIPTIONS OF MEASURES

### 3.4.1 Interviews

In order to enhance the confidentiality of the students' opinions about the course, students were not asked to provide their names; rather, at the start of each interview, sociodemographic data was obtained. This included student age and the grade that he or she would be entering in the fall semester. The information collected at the start of the interview provides the participant demographics described in Table 1. Students were asked four open-ended questions and a few follow up based on their responses.

Question 1: "Can you tell me something interesting that you learned at science camp?"

Follow up question: "What was it that you liked?"

Question 2: "Do you think science is fun?"

Follow up question: "What is fun about science?"

Question 3: "Do you think you can do science?"

Follow up question: "Does science make you a little nervous or are you comfortable with it?"

Question 4: "Would you be interested in coming back to this program?"

Follow up question: "Why? What would you like to do?"

### 3.4.2 Network Activity

To ascertain whether or not students were discussing science camp with their family and friends, the camp director collaborated with Dr. Jason Flatt to develop a network activity. A graduate of the Behavioral and Community Health Sciences department in the University of Pittsburgh Graduate School of Public Health, Jason explored the power of social networks related to information sharing. Using stickers that represent a diverse array of people, students were able to choose a sticker that looks similar to their family and friends. Many students chose stickers based on race, as well as physical characteristics like hairstyle and glasses.

Using the given worksheet, students wrote names of family members and friends in the provided spaces. Some students chose to use names and others used titles such as Mom or Cousin. First, students were asked to list four to six people in their lives that are most important to them. Second, in the next section, students were asked if they had talked to the people listed in the first section about the summer camp activities and to write the corresponding number in the space provided. In the final section, students were asked to write the corresponding number of the people listed in the first section who they did not talk to about the summer camp activities. After completing the list portions, students placed stickers corresponding to each individual in the first section by their names.

### 3.4.3 Visual Voices

To give students an alternative art inspired method of expressing their feelings on the science programming, the evaluation team and camp director consulted with Dr. Michael Yonas to adapt his Visual Voices research method. A researcher at the University of Pittsburgh, Department of Family Medicine, Dr. Yonas established a series of creative arts-based writing, drawing, and painting activities to understand youth interpretations of lived experiences. Due to the limited time for evaluation, the Visual Voices inspired activity had to be implemented and completed within a single two-hour session.

Students depicted what they enjoyed most from science camp through painting on a large (2 feet by 1 foot) piece of paper. The camp team provided a tarp for students to work over as well as paper, paint, and markers. The camp director discussed with students activities that they participated in from previous weeks of science camp programming before asking the students to artistically respond to the question: "What did you enjoy most about summer camp?" Students took time to thoughtfully consider before starting to paint, draw, and write. If students were uncomfortable with the prompt because they did not attend multiple session of the science camp programming, they were asked to draw their favorite science activity from the academic year.

After students completed their paintings, the evaluator asked if she was allowed to take their photo for the website. When students granted permission, the evaluator took a photo of each student holding his or her artwork. Then she asked the student what the painting was about and the student's name. The evaluator then recorded this information in a word document and verified spelling with the student.

Kim Rak, who worked with Dr. Michael Yonas on Visual Voices in the past, attended the first session with students. Her facilitation ensured that the activity was true to what Dr. Yonas has created.

## 3.5 ANALYSIS PROCEDURES

### 3.5.1 Interviews

To analyze the interview data, responses were compiled and organized by each question. For example, all the answers to the first question were compared across participants from all locations. Then, the evaluation team reviewed each answer to identify categories. Once categories were developed, each answer was coded according to each category. From each category, themes emerged. The evaluation team repeated this process of identifying and coding for each question.

After all the responses were coded, the evaluation team counted how many responses fell into each theme. When the counts were complete, the totals for each category were divided by the total number of responses for the question to determine the percentage of each theme. This process continued for every question and location. When calculations were complete, the answers from the two curricula were separated and compared to examine if the respondents answered differently.

### 3.5.2 Network Activity

To analyze the network activity data, respondents' answers were coded based on the name that they chose for each person. While some stickers indicated an age through physical characteristics such as graying hair, they were not used to determine the participants' answers. Instead, names and familial identifiers determined the coding scheme for the network activity.

The data were coded into the following categories: Mom, Dad, Other family members, and Friends. Other family members included siblings, grandparents, and stepparents. Friends were determined by indicators such as "my friend," "best friend," and "neighbor".

Once data was coded, it was entered into a SPSS Statistics document. Next, the range and mean of respondents' answers for the first section was calculated. This resulted in the range and average in size of the network. Then, the number and percentage of students who discussed *Pitt Summer Science Outreach* with each coded category in their network was calculated. This resulted in the average number of each category of person which students discussed *Pitt Summer Science Outreach*.

#### 3.5.3 Visual Voices

To analyze the Visual Voices activity data, the evaluation team examined how many of the students discussed their sustained experiments. The sustained experiments were developed by the students as a group and completed under the guidance of their college student mentors. By explaining their sustained experiments, students demonstrated one significant objective of the camp, which is to receive engaging early exposure to science. This engaging early exposure sparks interest in science and enables students to pursue science classes. Furthermore, students were involved in participatory learning, specifically related to science, and demonstrated the scientific method through their artistic interpretations of experimental design.

The photos of each piece of art created during the Visual Voices activity were uploaded to the *Pitt Summer Science Outreach* website (see Fig. 8). Although many students were photographed with their art, some did not consent to have their photo with their face included but rather consented to just their artwork. Based on the information that the evaluation team gathered after the activity was complete and the photographs on the website, the number of students who depicted sustained experiments was calculated. Each location was assessed separately. The evaluation team examined every image and all notes from the Visual Voices activity related to participants' descriptions of artwork.

# 4.0 RESULTS

The results below demonstrate the found outcomes from the research methods described above. Organized by curriculum, the results display differences in participants' experience based on the Science of Nutrition & Exercise and Laboratory in Your Bedroom programming.

## 4.1 PARTICIPANT DEMOGRAPHICS

**Table 1: Participant Demographics**

| Location | Number of Students | Age (Mean, Range) | Grade Range |
|---|---|---|---|
| Collegiate | 6 | 10.83, (10-12) | 5th-7th |
| Hazelwood | 13 | 9.77, (8-12) | 3rd-8th |
| Homewood-Brushton | 10 | 10, (9-12) | 3rd-7th |
| Wilmerding | 11 | 9.55, (9-10) | 4th-6th |
| Thelma-Lovette | 19 | 9.63, (9-11) | 4th-7th |

Table 1 lists participants' age and grade in school. The majority of students interviewed were at the Thelma-Lovette YMCA location. The students from the Collegiate YMCA were the smallest in number and oldest in age. The students from the Hazelwood YMCA have the largest range in age and grade in school. Despite these differences, the students from all locations only varied in age and grade by four years.

## 4.2 INTERVIEWS

**Question 1 – Can you tell me something interesting that you learned in science camp?**

**Table 2: The Science of Nutrition & Exercise Responses to Question 1 by Category**

| Categories | Number | Percentage |
|---|---|---|
| How the body works | 13 | 27.7% |
| Nutrition | 13 | 27.7% |
| Plants & Animals | 12 | 25.5% |
| Other | 6 | 12.7% |
| No response | 3 | 6.4% |

Table 2 demonstrates that when asked what they found most interesting, the students in the Science of Nutrition & Exercise curriculum mentioned the information about "How the body works" (27.7%) and "Nutrition" (27.7%), most frequently, followed closely by "Plants and animals" (25.5%).

### Representative Comments Made by Students on How the Body Works

- "It was pretty cool how we got to see how the heart beats. There was one of those machines that shows how the heart beats, with the lines and stuff."
- "I learned that your heart pumps blood and it goes faster. The brain sends nerves down to make it go faster"

### Representative Comments Made by Students about Nutrition

- "I've learned at science camp that there was a way how to know the fats and the sugars in your food. So sugar creates fat and it also creates the fat in our body that keeps us warm."
- "That [I] didn't know that cereal had iron, cereal had black things in it."

**Representative Comments Made by Students about Plants and Animals**

- "I learned like that if you put like too much polish on your plant, it'll die. If you put white or clear polish on your leaf it'll turn this grey color."
- "I learned that vinegar can kill a plant in an hour."

**Representative Comments Made by Students about Other Subjects**

- "I never knew that people grow in jumps and not little steps. They grow in tiny baby steps not all at once. Like toddlers don't grow in steps, they grow in jumps"
- "Last week we did this experiment of tasting this little, it was supposed to be a berry that comes from South Africa, it was a pill split in half and you had to taste it and there were sweet tarts and sour patch kids. First we ate the sweet tarts and they were sweet and the sour patches were sour. Then, after we ate the berries, the sweet tarts weren't as sweet and the sour patches weren't as sour."

**Table 3: The Laboratory in Your Bedroom Responses to Question 1 by Category**

| Categories | Number | Percentage |
|---|---|---|
| How the body works | 6 | 54.6% |
| Electricity/mechanics | 4 | 36.4% |
| Other | 1 | 9.0% |

Table 3 demonstrates that when asked what they found most interesting, the students in the Laboratory in Your Bedroom curriculum mentioned the information about "How the body works" most frequently, followed by "Electricity/mechanics" (36.4%).

**Representative Comments Made by Students about Electricity/mechanics**

- "That batteries have different voltages and power. We did an experiment with a motor and saw which battery made it go the fastest."
- "We built a battery powered car"

**Question 2 – Do you think that science is fun?**

**Table 4: The Science of Nutrition & Exercise Responses to Question 2**

| Answer | Number | Percentage |
|---|---|---|
| Yes | 42 | 89.8% |
| No | 2 | 3.4% |
| Maybe | 4 | 6.8% |

Table 4 demonstrates that when asked if they found science to be fun, the majority of students in the Science of Nutrition & Exercise curriculum answered, "Yes" (89.8%) and a small minority said "No" (3.4%), with a few students stating that they "Maybe" found science fun (6.8%).

**Table 5: The Laboratory in Your Bedroom Responses to Question 2**

| Answer | Number | Percentage |
|---|---|---|
| Yes | 11 | 100.0% |

As shown in Table 5, all (10.0%) students in the Laboratory in Your Bedroom curriculum answered "Yes" when asked if they found science to be fun.

**Follow up, question 2 – What is fun about science?**

**Table 6: The Science of Nutrition & Exercise Responses to Follow up Question 2 by Category**

| Category | Number | Percentage |
|---|---|---|
| How the body works | 1 | 2.1% |
| Nutrition | 1 | 2.1% |
| Plants and Animals | 5 | 10.4% |
| Experiments | 11 | 22.9% |

**Table 6 Continued**

| | | |
|---|---|---|
| Chemistry | 5 | 10.4% |
| Learning and/or making new things | 7 | 14.6% |
| Everything | 3 | 6.3% |
| Other | 6 | 12.5% |
| No response | 9 | 18.7% |

Table 6 shows that when asked what is fun about science, the Science of Nutrition & Exercise students answered "Experiments" (22.9%) most frequently. However many students (18.7%) did not answer the question.

**Representative Comments Made by Students on How the body works**

- "We exercised outside and used pedometers"

**Representative Comments Made by Students about Nutrition**

- "Protein could show up in Sprite, yogurt, water, orange juice, sunflower seeds, and chips"

**Representative Comments Made by Students about Plants and animals**

- "I liked working with plants and how they grow. We grew two tomato and two bean plants and put base in the tomato and bean and acid in the other two, figuring out what it would do. It died."
- "We do really fun activities and projects. Like one time we painted plants, one with nail polish and one with paint and saw which would die faster. We prepare and predict stuff. It keeps our minds going."

**Representative Comments Made by Students about Experiments**

- "That you get to do experiments and you don't know what happens until it does"

- “That you get to do a lot of experiments and explore new ideas.  You get to see what can happen, get data, and compare it.”

**Representative Comments Made by Students about Chemistry**

- “I do science every day.  I have a chemistry set at home.  I love chemistry”
- “You can do different experiments like making stuff.  Like chemicals and stuff, it’ll make stuff evolve”

**Representative Comments Made by Students about Learning and/or making new things**

- “I like the part where you learn new things and experiment instead of having someone lecture you”
- “Science is like creating something new.  It brings new life.”

**Representative Comments Made by Students about Everything**

- “Well, everything is fun”

**Representative Comments Made by Students about Other Subjects**

- It's fun because you split into groups and you do stuff. Like science”
- “I love science. I have my own little science lab at home.”

**Table 7: The Laboratory in Your Bedroom Responses to Follow up Question 2 by Category**

| Category | Number | Percentage |
|---|---|---|
| Electricity/mechanics | 1 | 9.1% |
| Experiments | 3 | 27.3% |
| Learning and/or making new things | 6 | 54.5% |

**Table 7 Continued**

| | | |
|---|---|---|
| Everything | 1 | 9.1% |

Table 7 shows that when asked what is fun about science, the Laboratory in Your Bedroom students answered with descriptions of "learning and/or making new things" (54.5%) most frequently, followed by "Experiments" (27.3%).

**Representative Comments Made by Students about Electricity/mechanics**

- "I liked working with the batteries. We tried different batteries."

**Question 3 – Do you think you can do science?**

**Table 8: The Science of Nutrition & Exercise Responses to Question 3**

| Categories | Number | Percentage |
|---|---|---|
| Yes | 37 | 77.1% |
| No | 5 | 10.4% |
| Maybe/I don't know | 6 | 12.5% |

Table 8 demonstrates that when asked if they can do science, the majority of students of the Science of Nutrition & Exercise curriculum stated "Yes" (77.1%), with some saying "No" (10.4%) and others staying "Maybe/I don't know" (12.5%).

**Table 9: The Laboratory in Your Bedroom Responses to Question 3**

| Categories | Number | Percentage |
|---|---|---|
| Yes | 7 | 63.7% |
| Maybe/I don't know | 4 | 36.3% |

Table 9 shows that when asked if they can do science, the majority of students of the Laboratory in Your Bedroom curriculum stated "Yes" (63.7%) and the others stated "Maybe/I don't know" (36.3%). None of the students from this program said "No."

**<u>Follow up, question 3 – Does science make you a little nervous or are you comfortable with it?</u>**

**Table 10: The Science of Nutrition & Exercise Responses to Follow up Question 3**

| Categories | Number | Percentage |
|---|---|---|
| Nervous | 6 | 12.5% |
| Comfortable | 35 | 72.9% |
| Both | 6 | 12.5% |
| No response | 1 | 2.1% |

As seen in Table 10, the majority of students in the Science of Nutrition & Exercise curriculum stated that they were "Comfortable" (72.9%) with science, some stated "Nervous" (12.5%), and others explained that they were "Both" nervous and comfortable (12.5%).

**Table 11: The Laboratory in Your Bedroom Responses to Follow up Question 3**

| Categories | Number | Percentage |
|---|---|---|
| Nervous | 4 | 36.3% |
| Comfortable | 7 | 63.7% |

As seen in Table 11, the majority of students in the Laboratory in Your Bedroom curriculum stated that they were "Comfortable" (63.7%) with science, with 36.3% stating that they were "Nervous".

**Representative Comments Made by Students about Feeling Nervous**

- "Nervous because it takes a lot and you have to be really focused and I can't focus."
- "It makes me a little nervous. It's not that easy. You have to figure out stuff."

**Representative Comments Made by Students about Feeling Comfortable**

- "Comfortable with it because it helps me learn."

- "Yeah I'm going after my sister because she went to Science & Technology so I'm probably going to try to go there too"

**Representative Comments Made by Students about Feeling Both Nervous & Comfortable**

- "I don't know. A little nervous. Well, if somebody is with me I'm comfortable but when I'm by myself then I'm kinda nervous"
- "Comfortable with it. When I grow up I will be nervous because you don't know other people"

**<u>Question 4 – Would you be interested in coming back to this program?</u>**

**Table 12: The Science of Nutrition & Exercise Responses to Question 4**

| Categories | Number | Percentage |
|---|---|---|
| Yes | 41 | 85.4% |
| No | 3 | 6.3% |
| Other | 4 | 8.3% |

Table 12 demonstrates that when asked if they would be interested in returning to the program, most students of the Science of Nutrition & Exercise curriculum stated, "Yes" (85.4%), some stated "No" (6.3%), and the remaining students responded with "Other" responses (8.3%).

**Answered categorized as other included "maybe" and indications of location barriers,**

**For example:**

- "I'm not sure because I'm going to be somewhere else. I could come down here every Tuesday. If I could sign up, I would."
- "No I'll be moving. If I weren't moving, I would come back."

**Table 13: The Laboratory in Your Bedroom Responses to Question 4**

| Categories | Number | Percentage |
|---|---|---|
| Yes | 11 | 100.0% |

Table 13 shows that when asked if they were interested in returning to the program next year, all (100.0%) of students in the Laboratory in Your Bedroom curriculum said "Yes".

**Follow up, question 4 – What would you like to do if you came back to science camp?**

**Table 14: The Science of Nutrition & Exercise Responses to Follow up Question 4 by Category**

| Categories | Number | Percentage |
|---|---|---|
| Art projects | 2 | 3.8% |
| Biology | 2 | 3.8% |
| Chemistry | 8 | 15.4% |
| Dissection | 3 | 5.8% |
| Earth science/space | 2 | 3.8% |
| Electronics/electricity | 1 | 1.9% |
| Exercise | 3 | 5.8% |
| Experiments | 4 | 7.7% |
| Explosions | 3 | 5.8% |
| Food | 6 | 11.5% |
| Other | 3 | 5.8% |
| Plants and Animals | 7 | 13.5% |
| Video games | 1 | 1.9% |
| No answer | 7 | 13.5% |

As seen in Table 14, the students of the Science of Exercise & Nutrition curriculum indicated that should they return next year, they want to learn more about "Chemistry" (15.4%) and "Plants and animals" (13.5%). However a large number were unable to answer, 13.5% of participants did not provide an answer.

**Table 15: The Laboratory in Your Bedroom Responses to Follow up Question 4 by Category**

| Categories | Number | Percentage |
|---|---|---|
| Earth science/space | 2 | 18.2% |

**Table 15 Continued**

| | | |
|---|---|---|
| Electronics/electricity | 2 | 18.2% |
| Exercise | 2 | 18.2% |
| Other | 1 | 9.0% |
| Video games | 2 | 18.2% |
| No answer | 2 | 18.2% |

As seen in Table 15, the students of the Laboratory in Your Bedroom had many interests. While some were unable to respond and had "No answer" (18.2%), they were equally interested in Earth science/space (18.2%), electronic/electricity (18.2%), exercise (18.2%), and video games (18.2%).

**Representative Comments Made by Students about Art projects**

- "More art projects instead of plants"
- "Dance and singing"

**Representative Comments Made by Students about Biology**

- "All types of stuff, how the skin works. I want to learn everything, I want a skin expert to come in"
- "I wanted to learn about photosynthesis and your stomach and your brain"

**Representative Comments Made by Students about Chemistry**

- "I would like to do more experiments with chemicals and stuff"
- "Like different stuff than what we did from this year. I wanna do stuff with chemicals or like little tubes and maybe different water"

**Representative Comments Made by Students about Dissection**

- "Cut open stuff"
- "I'd want to dissect things"

**Representative Comments Made by Students about Earth science/space**

- Learn more about the earth.  Like space how the earth spins and moves.  The thing I want to learn about earth, everyone says the earth spins and moves but we can't feel it"
- "Maybe somewhere down in the ground we could look at fossils or dig up fossils.  Or like we did with the sand and the truck"

**Representative Comments Made by Students about Electronics/electricity**

- "Learn about electricity and how it works 'cause in our school the Science Center comes and shows how to get hair staticky without a balloon or anything"
- "I wanna build a car again, we built a car put a battery on it and made it go.  We were seeing whose was faster.  The other group one of my counselors helped and they made it spin around in circles, ours was really fast and it zoomed really faster."

**Representative Comments Made by Students about Exercise**

- "I want to do another thing like with um sports or like do a project"
- "I would like to go back to the gym"

**Representative Comments Made by Students about Experiments**

- "Experiments! Like volcanoes or something"
- "I would really want to learn way more facts and do more fun activities. More experiments"

**Representative Comments Made by Students about Explosions**

- "Use different chemicals to blow something up"
- "Watch stuff explode"

**Representative Comments Made by Students about Food**

- "Learn about fruit…and the most fun thing about it was tasting how it changed and got sweeter."
- "I would probably want to do something with food again but try something else."

**Representative Comments Made by Students about Other Subjects**

- "I want to see if we could make a boat and see if it could stay in the water and float."
- "First of all I would like to go back in the truck. That's pretty much it."

**Representative Comments Made by Students about Plants and animals**

- "Different stuff. I want to make something in real life. Dinosaurs, or an elephant. Those are my favorite animals. I want to make something I can keep."
- "I would like to study dinosaurs and to experience how long a falcon's claw can grow."

**Representative Comments Made by Students about Video games**

- "I'd come here for everything. I really want to play video games."
- "More video games"

## 4.3 NETWORK ACTIVITY

**Table 16: Number of Students Participating in the Network Activity by Location**

| Location | Number of Students | Percentage of Total |
|---|---|---|
| Collegiate | 4 | 6.8% |
| Wilmerding | 16 | 27.6% |
| Hazelwood | 16 | 27.6% |
| Thelma-Lovette | 11 | 19.0% |
| Homewood-Brushton | 11 | 19.0% |
| Total | 58 | 100% |

As seen in Table 16, students from all *Pitt Summer Science Outreach* locations participated in the network activity with the largest number coming from the Hazelwood and Wilmerding YMCAs and the smallest number coming from Collegiate YMCA.

**Table 17: Overall Network Statistics**

| Average (mean) = 5.6 |
|---|
| Range = 2 to 6 |

Table 17 displays that, on average, students listed a little over 5 people (5.6) in their network but this ranged from 2 to 6.

**Table 18: Persons Listed by Students in Network Activity**

| Person Listed | Number | Percentage of Students |
|---|---|---|
| Mom | 50 | 89.0% |
| Dad | 39 | 70.0% |
| Other family members | 43 | 77.0% |
| Friends | 14 | 25.0% |

As seen in Table 18, most students listed a family member including "Mom" (89.0%), "Dad" (70.0%), and "Other family members" (77.0%). On average, students listed 3.3 family members on their activity sheet

**Table 19: Network Members Discussing *Pitt Summer Science* by Person Listed**

| Person Listed | Number | Percentage of Students |
|---|---|---|
| Mom | 24 | 73.0% |
| Dad | 16 | 29.0% |
| Other family members | 18 | 54.0% |
| Friends | 4 | 12.0% |

Table 19 shows that most students spoke with the program with "Mom" (73.0) or "Other family members" (54.0%). On average, students talked to 2.0 family members about camp

## 4.4 VISUAL VOICES

**Table 20: Students Participating in Visual Voices and Depicting Sustained Group Experiments**

| Location | Number of Students | Related to Sustained Experiments | Percentage of Total |
|---|---|---|---|
| Collegiate | 6 | 3 | 5.0% |
| Wilmerding | 16 | 11 | 18.3% |
| Hazelwood | 16 | 7 | 11.7% |
| Thelma-Lovette | 11 | 10 | 16.7% |
| Homewood-Brushton | 11 | 7 | 11.7% |
| Total | 60 | 38 | 63.4% |

Table 20 shows that more than half of the students (63.4%) painted about the sustained group experiments when asked what their favorite activity is during the Visual Voices activity.

# 5.0 DISCUSSION

*Interviews*

The results from the interviews provided enthusiastic answers to the questions. Students gained comprehension of the material, enjoyed the activities, felt empowered by science, and wanted to return to camp.

It is clear that the students were able to recall the lessons taught during camp. When asked to explain something interesting they learned in camp, the majority of students who attended the Science of Nutrition and Exercise curriculum equally recalled activities related to three categories (27.7%). These categories are how the body works, nutrition, and plants and animals. The engaging activities presented during the curriculum focused on these subjects specifically. Clearly the students appreciated the activities, which left an impression on them.

The subjects that greatly influenced the Laboratory in Your Bedroom curriculum students were how the body works and electricity/mechanics. This is demonstrated by the majority of responses to the first question. More than half (54.6%) of students explained that material related how the body works interested them. Similarly, 36.4% of students explained that electricity/mechanics activities were interesting to them.

The majority of students in both curricula said that science is fun: 89.9% of Science of Nutrition and Exercise students and 100.0% of Laboratory in Your Bedroom. Furthermore when asked what about science is fun, students described hands-on exploration. For example, 22.9% of students from the Science of Nutrition and Exercise curriculum described experiments as fun. Students from Laboratory in Your Bedroom expressed fun in learning and/or making new things 54.5%, whereas 27.3% of students found experiments to be fun.

The majority of students from both the Science of Nutrition and Exercise (77.1%) and students from Laboratory in Your Bedroom believed (63.7%) that they could do science. Similarly, when asked whether science makes students feel comfortable or nervous the majority responded positively. 72.9% of students from the Science of Nutrition and Exercise and 63.7% of students from the Laboratory in Your Bedroom responded that they were comfortable.

When asked about returning to the program, students were excited at the prospect. The overwhelming majority of students would like to return to *Pitt Summer Science Outreach* next year: 85.4% of students from the Science of Nutrition and Exercise and 100.0% of students from the Laboratory in Your Bedroom. Students from both curricula want to explore a variety of subjects for next year. While nine (9) students were unable to decide what to study, the remaining 50 respondents provided 63 answers. The most popular subjects include chemistry, food, and plants and animals.

*Network Activity*

From the network activity, it is clear that students can name people in their network and many students are discussing the *Pitt Summer Science Outreach* camp activities. On average, students listed family as about half of their network (3.3 out of 5.6 people). The coding for family members included parents, grandparents, brothers and sisters, as well as stepparents and cousins. The overwhelming majority of students included “Mom” (89.0%) and “Dad” (70.0%). Interestingly, while students listed both parents, the percentage of students who discussed science camp activities with Mom (73.0%) was greater than all others including Dad (29.0%), other family members (54.0%) and friends (12.0%). While students are in touch with their network and talking to some about the science camp activities, they are not discussing camp with everyone.

*Visual Voices*

The Visual Voices activity provided students with an opportunity to express their feelings towards science camp in an artistic way. Students were not limited in their responses or the way that science was discussed previously. Instead of using the scientific method to explain how they felt, students were given paint and asked about their favorite activity. The majority (63.3%) of students chose to depict their sustained group experiments. Students painted about the activities that the college student mentors assisted them with, demonstrating that they enjoyed the sustained experiments the most emphasizes that students found hands-on learning and experimentation to the be the best aspect of camp.

## 5.1 LIMITATIONS

While the evaluation of the *Pitt Summer Science Outreach* demonstrates that students exhibit the intended outcomes of the program, there are limitations. One limitation is the information obtained during the network activity. Unfortunately some of the students did not complete the activity correctly. For example, some students listed one name for all of the spaces. Other students listed their network members in both the sections that indicate they discussed science camp and did not discuss science camp. As a result, we were unable to include results from all students for analysis. This completion error by some students may be a result of the students not understanding the directions. At each location, students were given the network activity worksheet and told the instructions. Additionally the instructions were provided on the worksheet itself. Despite this, students still failed to properly answer the network activity. The directions may be too confusing for some of the younger students. However, since no demographic information was collected during this activity, it is not possible to discover who was answering each worksheet, whether correctly or incorrectly. By altering the format of the network activity to fit students design, proper completion would be possible. Also, piloting the worksheet with young students or including them in the design process can potentially increase the number of worksheets completed properly.

Another limitation is the Visual Voices activity. Since a limited amount of time was allocated at each location for one day, students were only able to answer one question through their art. If time allowed, multiple visits and opportunities to present the Visual Voices activity would allow students to paint or draw other feelings such as their attitudes to each weekly lesson, their feelings towards science as a future career, or their perceptions of their network's feelings towards science. As a result of limited time, students were only able to express their favorite activity. Additionally, students were discussing the interpretation of their painting with the evaluator. If time allowed, students may be given the opportunity to write or film their interpretation personally. Therefore instead of explaining the work of art to one person, it could be disseminated to many people through the student's own words.

Lastly, the evaluation is limited since it only includes program participants. If parents and caregivers of students in the program could be interviewed, the data would be greatly enhanced. Family support is a significant factor that influences student self-efficacy and predicts students' continuation of science academics. Learning what participants' family thought of the program would help expand the understanding of program impact.

## 5.2 FUTURE DIRECTIONS

To better understand the impact of *Pitt Summer Science Outreach*, evaluation techniques must be enhanced. Changes to the evaluation include improved formatting for the network activity, increased discussion on the Visual Voices activity among their peers, and interviews conducted with family members of participants.

The network activity provided great information about who participants considered close to them. Engaging students in the creation of the document can gather richer data. When students identify members of their network, a member of the evaluation team can ask students to describe that person. For example, if a student writes a name with an accompanying sticker, the evaluator can say "Can you tell me about him? Is he in your family? Is he a friend?" Similarly, discussing with students exactly who each network member is will ensure that the form is completed correctly.

The Visual Voices inspired activity was greatly limited because there were no discussions amongst participants about their artwork. Participants enthusiastically reported to the evaluator what they created however they did not tell each other. Dividing students into smaller groups for discussion and providing prompts will allow peer-to-peer sharing. Also, through discussion participants may touch on other subjects related to camp, not just their favorite activity.

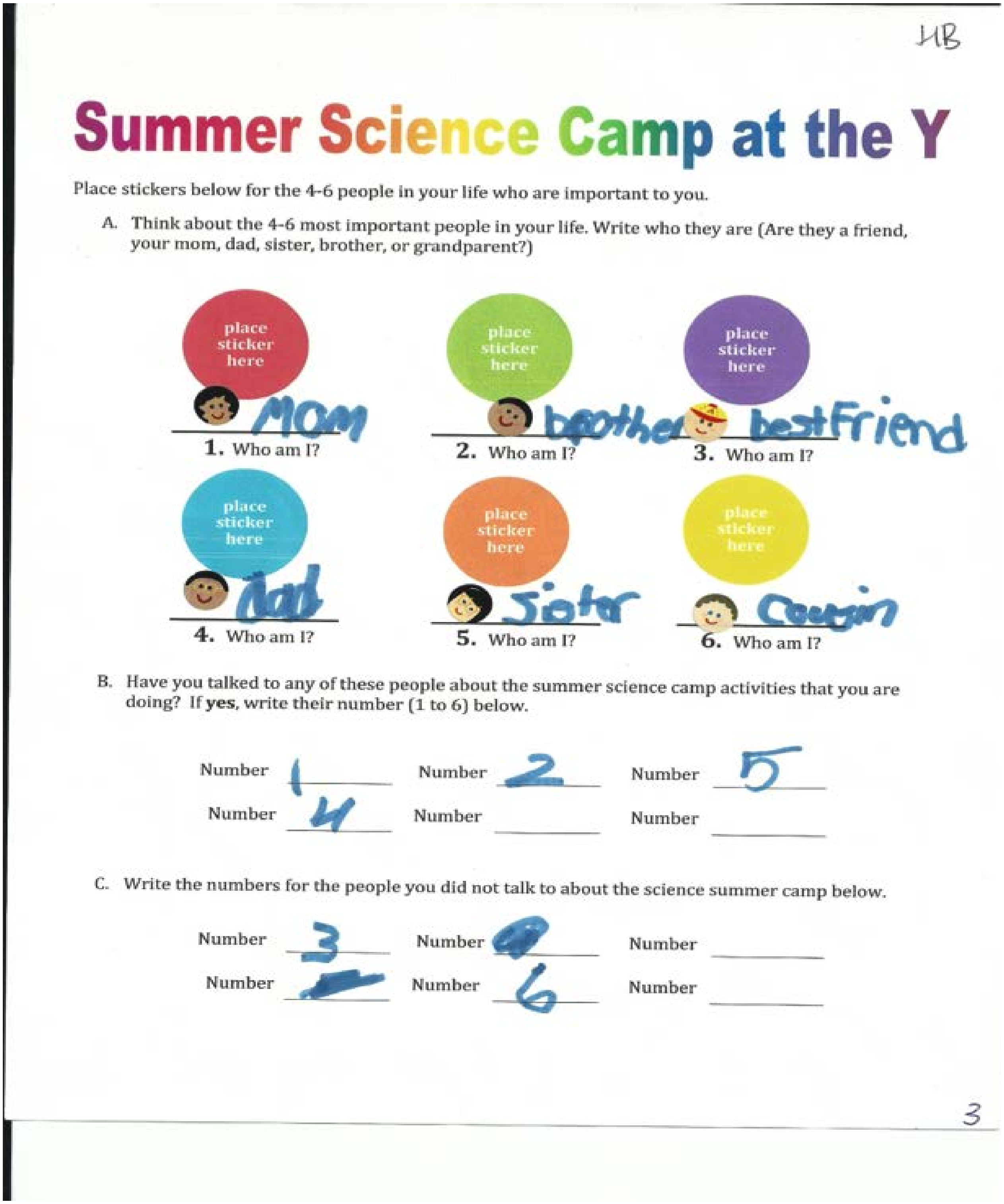
Finally, through inclusion of family interviews, the evaluation team can gain an understanding of the community effect of the program. Interviews could be performed as a focus group to save time and build community. Not only will evaluation team members be able to triangulate data from the network activity, participant family members will be provided a space to meet one another.

**Table 21: Action Items for Future Evaluations**

| Action Item | Rationale |
|---|---|
| Modify the network activity to be a discussion between students and evaluators | Understanding who each network member is in relation to the student on an individual level enables for richer comprehension of the impact of the program in the community |
| Facilitate interactions among students during the Visual Voices inspired activity | Enabling students to discuss the artwork among their peers allows students to appreciate the variety of hands-on activities they completed |
| Interview parents and caregivers of program participants | Inviting caregivers to the discussion of the program provides an opportunity for input of adult community members and sharing of students' accomplishments |

Table 21 describes actions to improve future evaluations of the program and the reasoning behind each action. By implementing these changes, the data can be richly enhanced and increase understanding of *Pitt Summer Science Outreach* impact on the community.

## APPENDIX A: NETWORK ACTIVITY WORKSHEET



HB

# Summer Science Camp at the Y

Place stickers below for the 4-6 people in your life who are important to you.

A. Think about the 4-6 most important people in your life. Write who they are (Are they a friend, your mom, dad, sister, brother, or grandparent?)

place sticker here — Mom — 1. Who am I?

place sticker here — brother — 2. Who am I?

place sticker here — bestFriend — 3. Who am I?

place sticker here — dad — 4. Who am I?

place sticker here — Sister — 5. Who am I?

place sticker here — Cousin — 6. Who am I?

B. Have you talked to any of these people about the summer science camp activities that you are doing? If **yes**, write their number (1 to 6) below.

Number 1 Number 2 Number 5

Number 4 Number ___ Number ___

C. Write the numbers for the people you did not talk to about the science summer camp below.

Number 3 Number [illegible] Number ___

Number [illegible] Number 6 Number ___

3

**Figure 2. Completed Network Activity Worksheet**

# APPENDIX B: PITT SUMMER SCIENCE OUTREACH WEBPAGE SCREENSHOTS

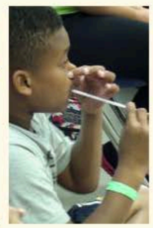

**Figure 3. Summer Science Outreach Main Page**

Dr. Nash and Dr. Chong, asthma specialists at the University of Pittsburgh Department of Pediatric Allergy & Immunology, gave an interactive session on how lungs normally function, what it is like when a person has asthma and has trouble breathing, and what some of the causes of asthma are.


Dr. Nash began by talking to the campers about famous people who have asthma. Campers were surprised to find out that the former President Bill Clinton suffers from asthma. So do Jerome 'The Bus' Bettis, a famous Pittsburgh Steeler half back, and Dennis Rodman, an American Hall of Fame basketball player.

Dr. Nash went on to explain to campers how the lungs work. And then he built a model of the lungs out of balloons that campers could manipulate to see how the lungs expand each time you take a breath.

Dr. Chong discussed the symptoms of asthma with the campers. Campers were given straws to breathe through and they then bent the straws in different ways to get a sense of what it is really like when you can't breathe well and can't get enough air in your lungs.



To get campers to think about the possible causes of asthma, campers played a game where they acted out the various triggers of asthma, including 'cold air' and 'pets' and other campers guessed what they were acting out, as in the game charades.

At the end of the session, Dr. Nash talked about the various medicines used to treat asthma and let campers pass around an inhaler to see how it delivers medicine into the lungs when patients breathe through it.

**Figure 4. Screenshot Wilmerding Location Webpage**

# Homewood-Brushton YWCA

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## The Science of Nutrition and Exercise

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### Week 5 - The Science of Eating

Tim McMurray, who works with the Pitt Science Outreach program, and Elaine Wahl, a nutritionist at the University of Pittsburgh, presented an interactive session about why we choose certain foods to eat and we don't like other foods. The session started with kids talking about the foods they do and don't like to eat. The fact that people usually feel more comfortable eating what is familiar to them was discussed.

The fact that all five senses are used when we eat and help making eating a pleasant experience was discussed. Visual appeal is important when people are deciding what to eat. The texture of food (which is detected using the sense of touch) and the sounds foods make (like crunching) are also important. The sense of smell and taste are VERY important factors affecting how much a person likes a food.

Campers learned about the little bumps on their tongue, papillae, are the homes of their taste buds. They were introduced to the 5 types of taste: sweet, sour, bitter, salty, and umami (savory, like meat, fish, and tomatoes).

Students then did an activity where they were asked to think what would happen if they only had sweet taste buds - Would everything taste sweet? Students then sucked on a lozenge that contained the extract from a 'Miracle Berry' plant. Miracle berries have the protein 'miraculin' that coats the tongue and blocks the taste bud receptors for sour, bitter and acidic flavors. The outcome is that all the foods that campers tried which were originally bitter, sour or acidic now tasted SWEET!! Too bad that effect on their tongues did not last!

**Figure 5. Screenshot Homewood-Brushton Location Webpage**

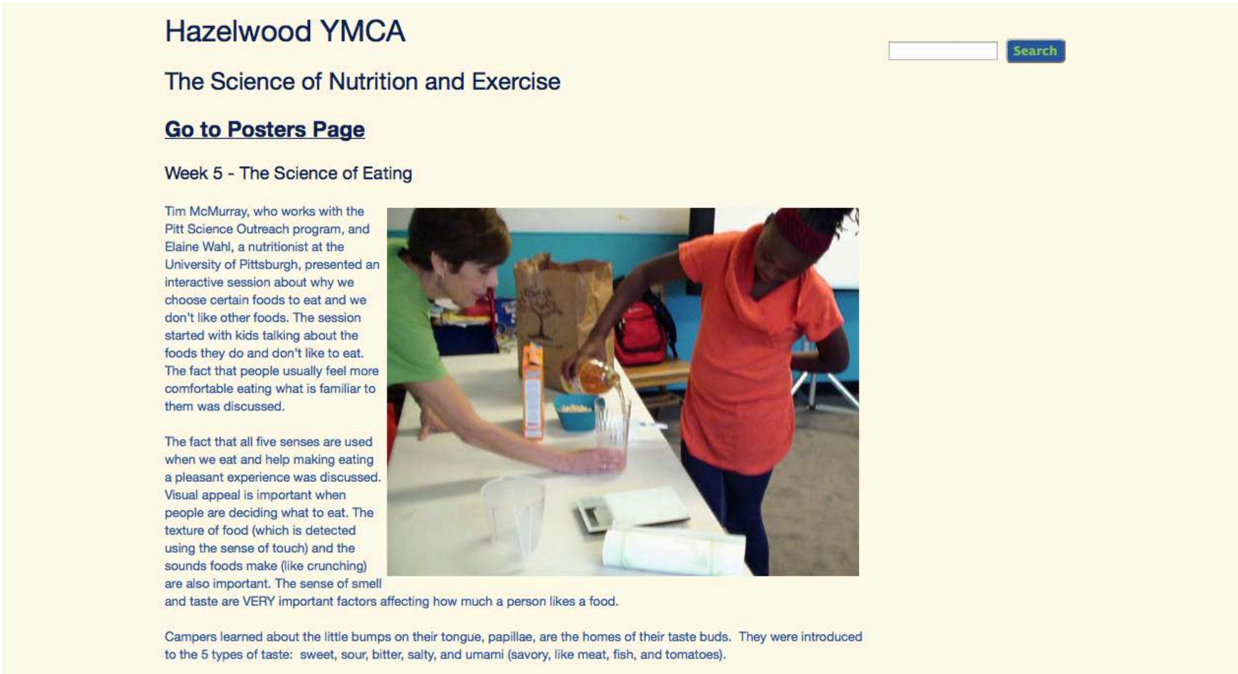


**Figure 6. Screenshot Hazelwood Location Webpage**

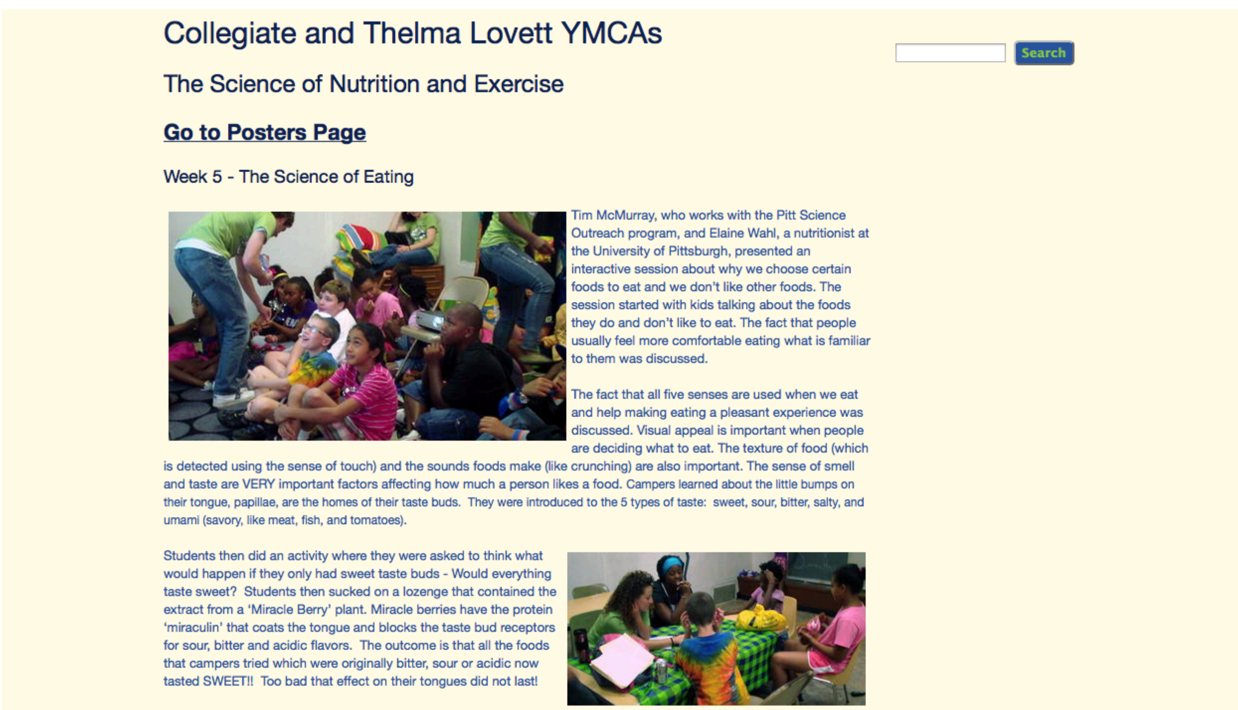


**Figure 7. Screenshot Collegiate and Thelma Lovette Location Webpage**

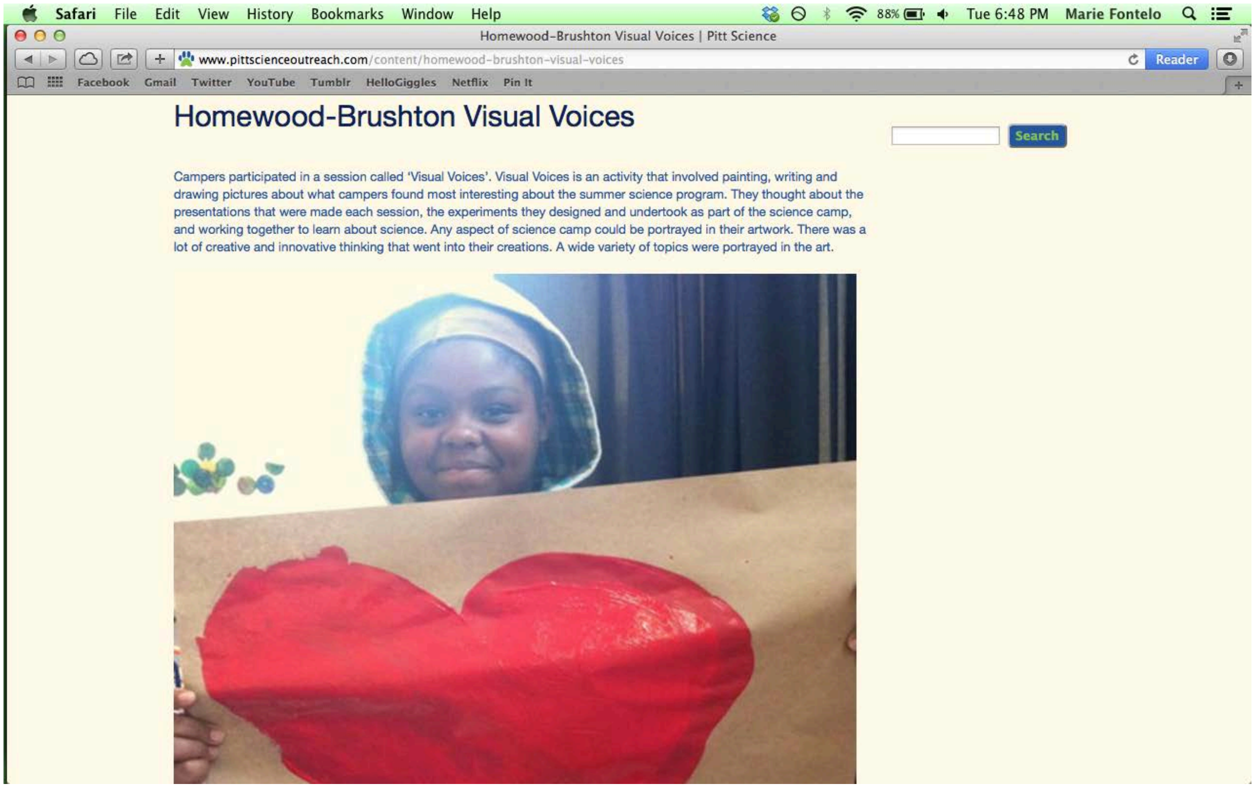


**Figure 8. Screenshot Homewood-Brushton Visual Voices Webpage**

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