

STEM Identity Growth in Girls - Roberts

Appendix A: Example of Camp Activities and Relevance to NRC Framework

CAMP DESCRIPTIONS

STEM GIRLS camp has been in existence since 2006. This is a two-week camp for girls. Each summer, two camps are held at the same time: STEM GIRLS I and STEM GIRLS II. STEM GIRLS I is for rising 6th and 7th graders and STEM GIRLS II is for rising 8th and 9th graders. Both camps are two-weeks long and only for girls. The lead teachers (all women) for STEM GIRLS I and II were the same throughout the time period of this study (2013-2016 summers). These teachers work with local STEM professionals to plan activities that relate to the professionals' work and the girls' lives. The teachers facilitate conversations throughout the camp to link activities with issues relevant to the girls' lives. For example, local engineers work with the girls to build water filtration systems and then talk to the girls about how these same principles are used in the development of water retention ponds in local parks. Then throughout the camps, the teachers remind the girls about these engineering principles as they visit the parks and conduct water testing. The teachers are able to link these concepts to school and home as well, thereby facilitating identity work for the girls.

STEM STARS camp is a co-ed camp that has been in existence since 2010. STEM STARS consists of two one-week camps that occur on separate weeks. Students in STEM STARS are also rising 6th through 9th graders. The same three lead teachers (two women and one man) worked with the STEM STARS camp during the research years (2013-2016). The teachers work with local STEM professionals to plan relevant hands-on activities and field trips to expose participating students to a variety of STEM professionals, STEM careers and types of problem solving activities that can be experienced within those careers. Just like with STEM GIRLS, the teachers are able to facilitate identity work – making connections between the camp, home, and school – for the students throughout the camp. For example, the teachers can take an activity related to force and motion and then help the students reference that when they measure force and motion during an amusement park field trip. The teachers can also link these activities and concepts to the students' classes and events that take place in their homes. The teachers design the camps with the NRC (2009) strands in mind. Consequently, we see both of these camps as spaces where identity work can occur.

Appendix A Table 1. STEM GIRLS Camp Activities

Activity	NRC Practice (Number Reference)
Day 1 Tour of national laboratory facility where camp is housed. Tour guides included teachers and scientists from the physical sciences and biomedical field who work at the facility.	<i>Engagement in STEM practices (5):</i> Showed participants multiple opportunities in STEM and the value each of these plays in research at the laboratory. <i>Seeing oneself as a potential STEM professional (6):</i> Showed types of opportunities at the lab within the larger community of science.
Day 2 Water testing with biologists from the Environmental Protection Agency. The participants learn about the effects of pollutants on local waterways and the role of observation in research. They then test the pond behind laboratory and record data and discuss why these results could be this way.	<i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis). <i>Scientific Reasoning (3):</i> the youth developed explanations for differences in water testing results. <i>Developing STEM interest (1):</i> Saw the interconnectedness of water systems and why water quality is important for healthy ecosystems. <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Understanding STEM knowledge (2):</i> to make conclusions the youth had to use facts from their data collection.
Day 3 Toured local animal shelter. The veterinarian took participants on tour, had them watch and assist in a spay surgery, during which she explained the importance of such processes, learned about various diseases that affect animals within pets and larger local ecosystems, and observed parasites under a microscope. At the end the veterinarian explained her life history as it relates to science and answered participants' questions (female veterinarian and female veterinarian technician staff).	<i>Developing STEM interest (1):</i> Made the focus of the camp relevant to their daily lives. <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis).

Appendix A Table 1 continued... STEM GIRLS Camp Activities

Activity	NRC Practice (Number Reference)
<p>Day 4 Tour of local ecosystem that includes hike wherein the limestone formations and water table are discussed by rangers. Students collect water testing samples and discuss results with rangers.</p>	<p><i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis). <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Understanding STEM knowledge (2):</i> the youth used their data to make conclusions.</p>
<p>Day 5 Visited local marine laboratory facility. The youth learned differences between inference and observation, the role of the moon on the tides, and observed various species under the microscope.</p>	<p><i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis). <i>Scientific Reasoning (3):</i> developed explanations for differences in population samples. <i>Developing STEM interest (1):</i> Saw the variety of species and STEM opportunities in their community. <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Understanding STEM knowledge (2):</i> used their data to make conclusions.</p>
<p>Day 6 Visit to local zoo for behind the scenes tour with biologists</p>	<p><i>Developing STEM interest (1):</i> Made the focus of the camp relevant to their daily lives. <i>Seeing oneself as a potential STEM professional (6):</i> Showed them science opportunities and applications in policy.</p>
<p>Day 7 Built Rube Goldberg machine in groups that had to move a marble from one end to the other. Constructed pasta bridges in groups and tested their structures. Engineers facilitated the activity.</p>	<p><i>Understanding STEM knowledge (2):</i> had to generate ideas and understand concepts <i>Scientific Reasoning (3):</i> manipulate, test, explore, predict, observe, and make sense <i>Engagement in STEM practices (5):</i> worked as a collaborative group using scientific tools <i>Seeing oneself as a potential STEM professional (6):</i> doing the work of scientists</p>
<p>Day 8 The youth visited a local quarry where they were able to explore and collect specimens of bone, teeth, fossils, and rocks. At the end of the day, they showed each other what they had found and the three scientists explained what it was and how they determined how old these specimens were.</p>	<p><i>Developing STEM interest (1):</i> Saw the variety of species and STEM opportunities in their community. <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM.</p>
<p>Day 9 Youth built electromagnets then toured a facility that does magnetic resonance imaging research. Tour guides included physicists, engineers, chemists and biomedical researchers.</p>	<p><i>Developing STEM interest (1):</i> saw other potential STEM careers <i>Understanding STEM knowledge (2):</i> learned more about MRI research <i>Engagement in STEM practices (5):</i> building of electromagnets <i>Seeing oneself as a potential STEM professional (6):</i> saw career opportunities and participate in the work of engineers</p>
<p>Day 10 Youth learn about the communication of science and create presentations on their favorite activities during the camp.</p>	<p><i>Reflection on STEM processes (4)</i> <i>Engagement in STEM practices (5)</i></p>

Appendix A Table 2. STEM STARS Camp Activities

Activity	NRC Practice (Number Reference)
Day 1 Tour of national laboratory facility where camp is housed. Tour guides included teachers and scientists from the physical sciences and biomedical field who work at the facility.	<i>Engagement in STEM practices (5):</i> Showed participants multiple opportunities in STEM and the value each of these plays in research at the laboratory. <i>Seeing oneself as a potential STEM professional (6):</i> Showed types of opportunities at the lab within the larger community of science.
Day 2 am Visited local marine laboratory facility. The participants learned differences between inference and observation, the role of the moon on the tides, and observed various species under the microscope.	<i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis). <i>Scientific Reasoning (3):</i> the youth developed explanations for differences in population samples. <i>Developing STEM interest (1):</i> Saw the variety of species and STEM opportunities in their community. <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Understanding STEM knowledge (2):</i> the youth used their data to make conclusions.
Day 2 pm Visit to local zoo for behind the scenes tour with biologists	<i>Developing STEM interest (1):</i> Made the focus of the camp relevant to their daily lives. <i>Seeing oneself as a potential STEM professional (6):</i> Showed them science opportunities and applications in policy.
Day 3 am Tour of local ecosystem that includes hike wherein the limestone formations and water table are discussed by rangers. Students collect water testing samples and make discuss results with rangers.	<i>Engagement in STEM practices (5):</i> Participated in the process of science (data collection and analysis). <i>Seeing oneself as a potential STEM professional (6):</i> Saw scientists at work and learned about possible careers in STEM. <i>Understanding STEM knowledge (2):</i> the youth used their data to make conclusions.
Day 3 pm Youth built electromagnets then toured a facility that does magnetic resonance research. Tour guides included physicists, engineers, chemists and biomedical researchers.	<i>Developing STEM interest (1):</i> saw other potential STEM careers <i>Understanding STEM knowledge (2):</i> learned more about MRI research <i>Engagement in STEM practices (5):</i> building of electromagnets <i>Seeing oneself as a potential STEM professional (6):</i> saw career opportunities and participate in the work of engineers
Day 4 Trip to local amusement park where they calculated various physics concepts related to roller coasters. (male and female teachers)	<i>Developing STEM interest (1):</i> highlighted role of science in their everyday world <i>Understanding STEM knowledge (2):</i> used physics formulas to generate and explain phenomena <i>Scientific Reasoning (3):</i> had to test, predict, observe, and make sense of the physical world <i>Reflection on STEM processes (4):</i> reflected on their process of learning about the phenomenon <i>Engagement in STEM practices (5):</i> collaborative activity that required math and physics concepts <i>Seeing oneself as a potential STEM professional (6):</i> doing the work of scientists
Day 5 am Built Rube Goldberg machine in groups that had to move a marble from one end to the other. Constructed pasta bridges in groups and tested their structures. Engineers facilitated the activity.	<i>Understanding STEM knowledge (2):</i> had to generate ideas and understand concepts <i>Scientific Reasoning (3):</i> manipulate, test, explore, predict, observe, and make sense <i>Engagement in STEM practices (5):</i> worked as a collaborative group using scientific tools <i>Seeing oneself as a potential STEM professional (6):</i> doing the work of scientists
Day 5 pm Youth learn about the communication of science and create presentations on their favorite activities during the camp.	<i>Reflection on STEM processes (4)</i> <i>Engagement in STEM practices (5)</i>