

Regenerative Medicine Minnesota – Outcome Report

Grant Title: Girls Explore STEM Camp

Grant Number: MRM 215 312ED 001

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Project Timeline: May 1, 2015-April 30, 2016

Brief Description of the Project:

The project consisted of a one-week camp entitled “Girls Explore STEM” in which 26 female, middle-school age students participated in a variety of STEM related activities. The activities were intended to allow students to explore the wide range of topics and careers within STEM through hands-on activities, demonstrations, and interactions with professionals from industry. The project was also extended to include a school-year event with the same title and purpose though geared to female high school students.

Where did this project take place?

Both events were held at the Minnesota State University, Mankato campus

People impacted by project and where they are from:

The female students attending camp were ages 10-14 and primarily resided within the Mankato school district which serves the Mankato, North Mankato and Eagle Lake communities but students from Eden Prairie, Waterville and Rochester were also in attendance.

There were 184 female students whom attended the one-day school year education event and were from the following schools: Waseca, Riverbend, Belle Plaine, Mankato East and West, Gibbon Fairfax Winthrop, and Loyola high schools.

What was the outcome of the project? (Did the project work the way you expected it to? What were the successes? What were the failures? How did it impact regenerative medicine in MN?)

The camp actually ran a lot smoother than expected, especially since this was the pilot. The students were very enthusiastic about the activities and provided positive feedback on the majority of the activity modules, especially, those involving DNA, designing and manufacturing objects, and biology/medical concepts. At the end of the camp 50% of camp evaluation respondents indicated that they are considering a career in STEM, 42% unsure of what they want to do for a career, and 8% who were not considering a career in STEM. This is shown in Table 1. Seventy-five percent of respondents also said they know what engineers, scientists and/or mathematicians do in their careers. Overall students indicated that they learned “a lot” about all the topics they were presented and had a positive experience at camp as shown in Table 2.

Table 1: Girls explore STEM summer camp evaluation data regarding STEM and career choices.

	Yes	No	Not Sure	No Response
Do you know what engineers, scientists or mathematicians do?	18	4	1	3
After this week's camp, I would like to take more STEM classes.	12	1	8	5
After this week's camp, I am considering STEM as part of my career or future.	12	2	9	3

Table 2: Girls Explore STEM Summer Camp Evaluation data regarding learning activities and modules.

How much did you learn about each of the following at camp?						
	A lot	Some	A little	Very Little	Not at All	No Response
Working together in teams	16	5	2	0	0	3
Finding solutions to problems	12	8	2	1	0	3
STEM, in general	17	5	1	0	0	3
Biology/ecology Labs	12	7	2	1	1	3
Regenerative medicine lab	11	4	5	1	1	4
DNA necklaces	15	6	1	1	0	3
Computer coding	12	5	5	0	1	3
3D printing & design	16	4	2	1	0	3
Robotics	9	7	2	1	2	5
Designing and manufacturing	14	4	4	0	1	3
Veterinary medicine	8	10	4	0	1	3
Astronomy	11	5	5	0	2	3
Careers in STEM	17	1	5	0	0	3

There was a lot of time and thought put into the regenerative medicine portion of the week by the instructor Dr. David Sharlin and his team of undergraduates. It was intended that students would travel to Rasmussen Woods, a wetland at near the Minnesota State University, Mankato property to collect specimens, but due to torrential rain we received on the day of collection were unable to do so. Instead we had to use our back up plan of purchased planarian and "muck" that had previously been collected. The muck was mainly used to observe what types of organisms are found in wetlands for the water was far too disturbed to locate and collect planarian. The students utilized the purchased specimens, performed the activities and observed the regenerative processes using those organisms. The students were able to perform then observe several different regeneration experiments using the planarian including decapitation, a longitudinal amputation as well as one that involved removing only half of the head. Students then observed the regenerative process involved with each. Students were also in charge of feeding and doing water changes for their planarian during the week of the camp. Students recorded qualitative and quantitative data regarding the regenerative process which was discussed as a group on the last day of the activity.

We also decided to take the concept of regeneration and expand it beyond the cellular and medical contexts and apply it to ecology to show and discuss with the students that ecosystems, biomes and the biosphere are regenerative. We did this by having students observe pond water that was collected prior to camp and observe

the types of materials and organisms that were found in it and how the different organisms rely on each other and the other substances in their environment for survival and that things like nutrients cycle through the system being reused. Students then constructed a closed biosphere within a quart-sized mason jar using materials and organisms provided. At the end of the day they were able to take this home with them to continue to observe. We talked about how that jar biosphere is able to be completely sealed yet able to continue to thrive, presuming they added the correct amounts of minerals, nutrients and organisms we provided.

A few of the things that did not work as well as we would have liked included the 3D-printing activities. We allocated too much time to this series of activities. Students indicated that they learned a lot from the activities but many indicated verbally that they would have liked to have been able to print the object that they created using Tinkercad® and not just be given an item that was pre-printed and observe other items that were being printed. I too would have liked to have been able to do this, but many of the items being created would have taken many hours to print and due to the numbers of students we could not have gotten them all printed in the time allotted. This could possibly be addressed in the future by planning the activity for the first day of camp then having volunteers available to run the printers during the week to print the objects created by the students. Additionally students struggled immensely with the tetrahedral kites and the activity which was our hands-on mathematics activity. In reflection this activity should have been done in groups rather than individually allowing students to progress through the build process quicker and more efficiently allowing them to engage in the flying of the kites and the “tweaking” of their creations to make them work better thus engaging them more in the engineering design process.

Please list any of the following that have resulted from your Regenerative Medicine Minnesota Grant Funding: (Publications and/or manuscripts submitted for publication, other grant applications and/or awards)

There have been no publications or manuscripts submitted for publication. There have been no additional grant awards or applications directly due to this grant.

Responsible Spending:

The Grants and Contracts Division of the Minnesota State University, Mankato Business Services will be preparing and sending a financial report regarding the spending on this grant.