

Regenerative Medicine Minnesota Progress Report

Grant Title: Exploring the Body's Building Blocks: An Educational RegMed Primer for Minnesota

Grant Number: RMM-2016-312ED-02

Requester: Amanda K. Golden

Project Timeline: June 1, 2016– May 30, 2017

Brief description of project:

Our intent in developing and implementing *Exploring the Body's Building Blocks* was to deliver an outreach educational program for students in 3-8th grades that introduces students to the concept of regenerative medicine. We sought to provide a one-time outreach visit that would consist of basic concepts that incorporated key terms, hands-on activities, videos, and a pre-and-post assessment tool. In addition, participating teachers would also be invited to partake in a post-assessment about the program.

We began the project by making key contacts within southeast Minnesota school systems while simultaneously developing age appropriate curricula for the grades. Our school system contacts dispersed program information to classroom teachers, who then signed up for our program based on their interest in participating. Initially, 22 teachers signed up for the 12 allotted outreach sessions in our program. To develop our curriculum, we used the "Understanding by Design"¹ framework to establish learning goals and long-term comprehension in addition to performance tasks and essential questions. During curriculum development, we also utilized current Minnesota Academic Science Standards and Next Generation Science Standards to implement an accessible introduction to regenerative medicine suited for 3rd, 5th and 7th grades. Outreach instructions were also extended to 4th and 8th grades on occasion.

Between March and May 2017, we implemented the curriculum by providing outreach engagements. We led 24 individual sessions in 9 different schools. This doubled our original goal of 12 outreach sessions.

Where did this project take place?

This project took place in southeastern Minnesota (Fig. 1) in elementary and middle school classrooms within the Rochester Public School system and the Zumbro Education District. Specifically, we went to:

- Bamber Valley Elementary
- Gage Elementary
- Hayfield Elementary
- Jefferson Elementary
- Pine Island Elementary
- Riverside Elementary
- Sunset Terrace Elementary
- John Adams Middle School
- Kellogg Middle School

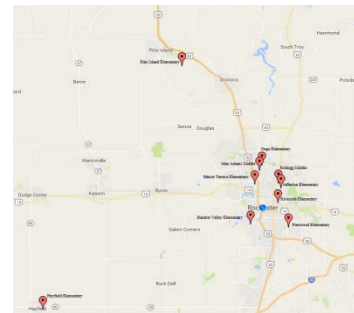


Figure 1: Map of SE MN schools visited

People impacted by project and where they are from:

Both grade school students and teachers involved in elementary and middle school education in Olmsted, Goodhue, and Dodge counties in southeast Minnesota were impacted by this project. The Rochester Public School system and the Zumbro Education District public school system were our targeted populations. In total, 604 students in 3rd to 5th, 7th, and 8th grades along with their 13 teachers learned about the emerging scientific field of regenerative medicine and its future career opportunities, in 24 unique outreach sessions.

In our proposal, we aimed to include underrepresented schools in our outreach visits. Final classrooms, from the original 22 interested teachers, were selected in part based on the percentage of students who were able to receive free or reduced lunch.² We also looked at the ratio of male-to-female students in schools as well as

whether or not some schools were deemed “choice schools” as opposed to neighborhood schools of varying socioeconomic and cultural diverse populations.

In addition, we wanted to reach outside Mayo Clinic’s metro-Rochester area to expand the awareness of regenerative medicine. Two schools, Hayfield Elementary and Pine Island Elementary, fall outside of the Rochester Public School System and are located approximately 27 miles and 24 miles away, respectively, from Mayo Clinic’s Rochester campus.

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 Minnesota?)

Exploring the Body’s Building Blocks project team accomplished our goal to disseminate regenerative medicine concepts to young, school-age students.

In our grant, we committed to offering 12 outreach sessions that would impact approximately 300 students (assuming 25 students per class) and their teachers. Initial sign-up for outreach sessions demonstrated high interest and demand from teachers who wanted extended teaching opportunities beyond the one-hour session as well as inquiry from other teachers in the schools who wanted additional visits. In these cases, we accommodated extra requests based on team member availability and scheduling; however many requests were unfortunately declined. Indeed, this experience validated the high need for education in the regenerative sciences at the elementary and middle school levels. By the end of the grant period, we offered 24 outreach sessions to 604 students and their teachers. This final number far exceeded our initial projection.

Success of this program was largely owed to the team that built it. We represent a diverse professional background with a wide-array of skills and strengths to develop this pilot project. We are all passionate about education and regenerative medicine and found that we were able to develop a successful pilot program that would appeal to students – thanks to our own diverse backgrounds.

We are currently analyzing the data collected from students (talking drawing assessments) and teachers (surveys) to learn more about whether the information we taught students was adequate. Initial feedback from the teachers indicated that this was a positive experience for them and their students. In each outreach session, the students from all grades were engaged and participatory throughout the learning period. We were impressed by their intelligence, curiosity, and emerging critical thinking skills exhibited by inquisitive questioning and active participation; hallmarks of a scientist-in-training (Fig 2).



Figure 2: Elementary students determine organisms that regenerate versus those that do not.

The aspects that were challenging in outreach implementation are listed below:

Curriculum development

Despite partnership with a teacher and the developer of an education program, the core team lacked experience developing formal education curriculum. Creating continuing medical education courses is different from that geared towards younger students. While we had many ideas, tailoring them to the lesson plans that were appropriate for each age group required refining and expertise input from education departments in our institution.

Time

The biggest obstacle was time required in planning and execution. A significant amount of time was devoted to create the curriculum as well as time for external collaborators to evaluate the curriculum.



Figure 3: Middle school students participate in a differentiation activity.

Although we had a robust team, the core group that could devote time to plan and execute the program was much smaller due to primary work priorities and other commitments. One member of the team coordinated a bulk of the organizing, preparing, and wrapping up from each class visit. There was also time to develop the protocol for IRB submission and revisions required from the reviewing committee before the protocol was deemed exempt. Adding additional personnel and additions to the lesson plans also had to go through a review process; occasionally holding up outreach visits.

Developing materials for the outreach also took time. We were able to utilize our in-house creative media team for some projects, but required external collaborations for other resources, which required additional delivery time and also held up some outreach visits.

Outreach scheduling

Contacting teachers via email to schedule visits was time consuming. For each visit, we planned to involve three team members; however coordinating schedules of busy professionals who volunteered to teach outreach sessions along with classroom availability posed as a challenge.

When we initially focused on elementary and middle school students as our subjects, we did not consider the fact that middle school students rotate through classrooms for various subjects. We also did not realize that middle school teachers, who teach up to 6 different periods, would want us to teach all of their classes. This expectation exhausted resources due to team members' time devoted away from work responsibilities. Indeed, it allowed us to recognize that outreach teaching volunteers were valued resources for project implementation; future projects would benefit from community or medical student volunteer recruitment or teach-the-teacher platform.

Furthermore, one teacher included in our pilot program never finalized an outreach visit. Although this teacher self-selected their classroom for a visit, we never finalized a date despite several attempts. This was a lost opportunity to connect with a school that fell into our original selection criteria.

Quality of a key teaching tool

Early in program development, we aimed to introduce 3D bioprinted material as a new technology, which would showcase both a potential regenerative therapeutic and a possible career path. Due to our involvement in a cardiac regeneration laboratory, we decided to 3D bioprint a heart. We also wanted to show students the difference between an infarcted heart and a healthy heart through a visual representation and teach them how regenerative medicine may treat the scar tissue. It took considerable amount of time to find an external group or company to build these models. We were looking for 3D models that were both malleable and incorporated a stiffer material to illustrate the area of damage from a heart attack. We eventually found an external company that could develop these models (Figure 3). However, the materials were not as durable as we would have liked. In fact, the material often did not withstand the tiny hands of one classroom visit. In addition, the company did not meet our deadline and we were not able to leave each classroom with its own set of models. We are still receiving hearts and will distribute these to the teachers before the start of the 2017-2018 school year.



Figure 4: Using 3D models, elementary students compare heart models.

Altogether, considering our huge successes and minimal obstacles, without this program, regenerative sciences would not have been discussed in the school systems. We have created an opportunity for the teachers to continue the conversation that we started with their future students. Teachers can now implement regenerative concepts into their science teachings based on the high-level information we shared with them. In addition, we shared the organization, Regenerative Medicine Minnesota, as a mechanism for them to receive funding to expand their own regenerative medicine scientific endeavors.

Please list any of the following that have resulted from your RMM grant funding:

- Publications and/or manuscripts submitted for publication
In preparation – manuscript describing program development and implementation
- Disclosures/patents
N/A
- Other grant applications and/or awards
 - Poster presentation at 11th annual World Stem Cell Summit in West Palm Beach, Florida (December 2016) titled, *Curriculum Design for Regenerative Medicine Awareness in the 3rd – 8th Grade Classroom*.
 - This poster was awarded the Best Poster for the Ethics, Law, & Social Issues category.
 - Based on the pilot work and experience with this grant, we submitted an updated proposal to RMM that builds and expands upon this pilot project. We received funding (RMM-2017-K12ED-01) to expand this curriculum by teaching the teachers.

Responsible Spending:

Please let us know how you spent the money. Any unspent funds must be returned.

The money we received from the grant was spent purchasing materials to leave with the classrooms to continue the conversation of regenerative medicine and STEM-based activities. We were responsible stewards of this grant, carefully and thoughtfully managing and spending the funds. For each classroom we visited, we were able to purchase several materials to aid in classroom discussion and exploration.

Information about these materials follows:

Description	Final cost
Total Direct Cost	\$12,579
<i>Classroom materials & cost to administer pilot program</i>	
Indirect Cost	\$7,421
Total	\$20,000

References

1. Wiggins GJ, McTighe J. *Understanding by Design, Expanded*. 2nd ed. Upper Saddle River, NJ: Pearson/Merrill Prentice Hall;2006.
2. National Center for Educational Statistics. Common Core of Data Public school data 2013-2014, 2014-2015 Web site. <https://nces.ed.gov/ccd/schoolsearch/>. Accessed October 21, 2016.