Public Health Works: Understanding and Communicating Science through Epidemic Simulation

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Figure 1. The epidemic simulation activity took place in 125 Biology Building East at the University of Iowa on April 14th, 2018.

As someone who double majors in biochemistry and ethics public policy with a certificate in public health, I am aware of the multitude of challenges faced by those attempt to connect science and policymaking. What has recently frustrated me is that there are few resources available for the public to use in order to understand different ways in which science informs public policy and further impacts our daily lives. For example, public health is one of the most important STEM subjects that has frequently been underrepresented in a variety of science educational outreach programs. Instead, the public tends to have more opportunities to learn about basic science through these programs, such as physics, biology and chemistry. For me as a future scientist, my job is not only to inform the public of the science itself in terms of knowledge and mechanisms, but also to empower the public to recognize the importance of science and how it impacts us through the effective communication. I decided to choose public health as the main content of my project because I would like to raise public awareness of public health as one of the fields in which the audience can be efficiently connected with the recognition of basic health science and social perspectives of science.

My overall goal for this project was to improve my science communication skills in a way that teaches me to make sure that the audience can gain a better understanding of the field of infectious disease epidemiology and public health. I hope to empower the audience to be a part of future UI STEM academia while exploring UI health science curriculum through this unique
opportunity. My audience was local high school students- 9th through 12th grade- in the Iowa City area.

After developing the idea of running an epidemic simulation activity to my audience, I immediately started the process of implementing the project by doing research on potential partnerships that fit the goals of my project. I reached out to Project HOPE first via email. However, I had to pass on collaborating with them after I was told by the Project HOPE Program Director that they could only implement my project as an event in early May. This was too late to complete the project for Latham Program. After a few days of researching, I ultimately gained my huge interest in partnering with TRIO Upward Bound. The missions of this federal TRIO program are to help first-generation and low-income high school students prepare for postsecondary education, empower students to advocate for their education, and achieve their postsecondary goals. I shared with this potential partnership with Lori and Brinda, and they suggested that I could consider collaborating with two other Latham Fellows- Marco and Christian- because we all planned to partner with Upward Bound. Therefore, Marco, Christian, and I first agreed to collaborate towards completing individuals’ projects. We met with Upward Bound Program Director Robert and developed an idea of co-hosting a STEM education conference called, Possibilities of Science: Knowledge for the Future, where the kids can have exposure to different aspects of science. My epidemic simulation activity for the project was one of the components of this conference. During this planning process, I also reached out to the College of Public Health to seek for some professional advice on the activity that I was to run. I received a few valuable recommendations and feedback that ultimately promoted the success of the activity, and meanwhile I got some public health information brochures that I could hand out to the kids at the end of my project. The project was completed in a lab at Biology Building East as the venue thanks to Lori’s support. The goals of the project didn’t really change too much over time. This is because of my constant confidence to keep and implement the idea of public health and the worthiness of the science messages that students can take away from this epidemic simulation activity.

The epidemic simulation activity was run with a kit bought from the Carolina Biological Supply Company. The time requirement for preparation of this activity was 15 minutes. The students needed around 45 minutes to proceed the whole activity in the lab. The objectives of this face-to-face-interaction activity are to: (1) simulate and understand the transmission of a disease, (2) understand how public health surveillance happens and impacts our daily lives, and (3) determine the original carrier of the pathogen.

As seen in Figures 2 &3, after ensuring that students understood and adhered to safe laboratory practices while performing any activity in the lab, six vials (one as “infection” containing colorless sodium hydroxide solution” and one as “normal” containing colorless hydrochloric acid) were randomly assigned to six participants. I informed students that the vials containing clear solutions represent bodily fluids and that they would be exchanging the liquid in their vials with those of other students in the lab to simulate direct contact between individuals in disease transmission. Before they started the first round of fluid exchange, students were asked to pipet five drops of the liquid from their vial to the well with their vial
number in the well plate labeled “0, as seen in Figure 4. As seen in Figure 5, students randomly selected a partner to exchange fluid with them for their first exchange and recorded the partner’s vial number and name. Then, students needed to deposit five drops into their well on Well Plate 1. We repeated the same steps for the second fluid exchange. After all exchanges have been made, I added one drop of phenol red as indicator to each student’s vial. Vials that turned red were positive for the pathogen, while vials that turned yellow were negative. Then, I asked students to list the names and vial numbers of all positive tests and list their partners from each round for all to see. I encouraged students to narrow down a list of potential sources of the infection based on the exchange data. Due to the very low number of participants in this activity, there were only two potential sources to be easily formed and determined (i.e. the two vials turning red after adding phenol solution). As seen in Figure 6 and Figure 7, the phenol red solution was added to Well 0 to test the original samples of those two persons.

Figure 2 &3. (left is 2; right is 3) I was ensuring that students understood and adhered to safe laboratory practices while pipetting the liquid from the vial.

Figure 4. I was instructing one participant how to pipet the liquid from his vial to the corresponding well in plate 0.
Figure 5. Participants were writing down their partners’ vial numbers and names on the index cards after the first round of fluid exchange.

Figure 6. I added the phenol red to the well plate 0 in order to test and verify the source of the infection.

Figure 7. The well in plate 0 that turned pink was the original source of infection.
The end of the activity turned out to be very fun, exciting and engaging because everyone became a “detector” for the origin of the infection while understanding how the whole epidemic simulation process led to the result. Lastly, I followed up this epidemic simulation activity by sharing my personal experiences as a first-generation, low-income and minority college student on what led to decisions he made for major/minor/certificate studies at the University of Iowa.

The project partner is TRIO Upward Bound. As seen in Figure 8, the number reached for this science outreach activity was 6. Based on the feedbacks from the workshop survey, the majority of students thought “the infection lab” (i.e. epidemic simulation activity) stood out to them the most at the conference. There was one participant stating in the survey, “I really liked learning about the infections and everything. It was cool to find out who had the virus and how diseases were spread.”

The project is sustainable and opportunistic for the future. We have already maintained great connections with Upward Bound from this project. The process was well documented and can be given to others to conduct and grow the existing project with Upward Bound in the future. Additionally, the kit that I bought was actually for 120 students, and there are still lots of leftovers. The whole set of kit (including teacher manual and student guide) can be readily replicated by others. The fact that the materials and equipment in the kit are also easily accessible in the lab makes this project even more sustainable.

Through my involvement from the beginning to the end of this project, the first lesson that I learned is that collaboration is a persistent process of working with different communities together towards a common goal. I enjoyed every interaction and conversation that I had with Robert from Upward Bound and the two other Fellows Marco and Christian. I am grateful to their input and efforts that have made the STEM Education Conference a more perfect one. During this semester, we held several meetings to create, organize and engage towards the common goals of helping local high school students from disadvantage backgrounds learn and explore science and empowering them to be a future part of UI STEM academia. Even if there were some disagreements or conflicts when we tried to finalize the conference timeline, we all had enough willingness and patience to find common ground for a good cause.

Second, I am so thankful for this incredible opportunity from the Latham Science Engagement Initiative Program to communicate with the public about science; I have become convinced more than ever that people’s lives should always be based on facts, data, evidence and reasoning. This is why I chose science as my academia, professional careers, and purposes.
in life. Days like the day when I led the hands-on epidemic simulation activity to the students always remind me why science is so important.