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National Chemistry Week: From IRL to the Web

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A photograph of laboratory glassware, including a large green graduated cylinder with '250' and '200' markings, and several test tubes containing red, blue, and yellow liquids. The background is a blurred laboratory setting.

NATIONAL CHEMISTRY WEEK:

From IRL to the Web

Ilayda Kelley, Daniela Mesa Sanchez (*Chemistry*)

STUDENT AUTHOR BIO SKETCHES

Ilayda Kelley and **Daniela Mesa Sanchez** are PhD candidates in the department of chemistry at Purdue University. When they are not in the lab willing their instruments to work so they can finally graduate, they can be found planning a new service event. They have been part of Iota Sigma Pi leadership for two and three years, respectively, and National Chemistry Week is their passion project. In this article, they describe their experiences reimagining this science outreach event in light of a global pandemic.

INTRODUCTION

National Chemistry Week (NCW) is an annual community outreach program of the American Chemical Society (ACS) held in the third week of October (*National Chemistry Week (NCW)—American Chemical Society*, n.d.). The program aims to raise awareness about the role of chemistry in everyday life by encouraging scientists to share their love of science with their community. Businesses, schools, and individuals organize and participate in community events to improve the public impression of chemistry, focusing on events for elementary and secondary school children. Over 35 million people celebrate NCW, including hundreds right here in the Greater Lafayette community.

The Purdue University Plutonium Chapter of Iota Sigma Pi (ISP), a national honor society for women in chemistry, organizes an event that celebrates National Chemistry Week in Greater Lafayette annually (Mesa Sanchez et al., 2019). The chapter consists of female graduate students from the Chemistry Department who design and select experiments, purchase necessary materials, and arrange volunteers for a weeklong program to visit local schools and do experiments with

students. Every year this consists of over a hundred volunteers visiting 70+ local elementary school classrooms, directly interacting with over 1,200 kids.

National Chemistry Week is always a large logistical undertaking with many moving parts, but the 2020 event came with its own unique challenges. As of July 2020, when the initial planning for the October event started, it was still unclear whether students would still be participating in e-learning or how in-person education would be possible while keeping the students and teachers safe. Moreover, it was uncertain whether the NCW volunteers would be able to visit classrooms, how the students would participate, and generally, how this annual event could possibly work under pandemic precautions. The event would have to be flexible to be able to work for e-learning and in-person scenarios. This meant that the experiments had to be safe for students to do on their own at home, and they had to be safe to dispose of and to use materials that are easy to access or distribute individually while remaining educational, entertaining, and exciting.

Three graduate students from the chemistry department, Daniela Mesa Sanchez, Ilayda Kelley, and Victoria



Figure 1. National Chemistry Week 2020 logo.



Figure 2. National Chemistry Week 2020 volunteer T-shirts.

Boulos, took these challenges and created a brand-new event that would change the future of their organization. All three had worked on this event previously as outreach committee chairs and ISP executive board members for several years and wanted to make this work, knowing it would not only be a chance to share their love of chemistry with the students but also offer

them a chance to have fun and relieve some stress in the middle of the pandemic. This reflective essay describes the 2020 NCW event organized by the ISP Plutonium Chapter at Purdue, the challenges we faced in transforming a massive in-person event to the Web, how we overcame those challenges, and how this changed our approach to future community events and our future careers in academia.

DESCRIPTION

The executive board of ISP starts planning NCW in July every year. In July 2020, the world was still filled with uncertainty from the ongoing pandemic and the fate of education was still unclear. Strict university guidelines were in place, and many extracurricular events were severely restricted or cancelled altogether. Despite this, the board agreed this event was too important and we could work together to reimagine it in a pandemic world. ISP would continue to share its love for chemistry, serve our community, and attempt to provide kids with some fun and normalcy in their education. After much discussion, a plan was made: our team would create experiment kits for every kid and create an accompanying YouTube video (*National Chemistry Week 2020—Sticking with Chemistry ISP Plutonium*, n.d.) that explained the experiment and the concepts behind it. This was a huge deviation from our well-outlined annual event, with many challenges along the way.

The first challenge we faced in moving the event online was finding exciting experiments that fit the 2020 theme, “Sticking with Chemistry,” and that were suitable to both a classroom and home setting. While our NCW event is always about science exposure and fun for both the volunteers and the kids, and there is no strict pedagogy or curriculum expectations, pandemic limitations still presented some issues. When volunteers went to the classrooms in person, we were able to make demonstrations along with the hands-on experiments and activities for students and gather any experiment waste that required special disposal. With the volunteer element out of the equation, we needed to eliminate any demonstrations that required special handling. Moreover, pandemic measures required our materials to be single-use, which called for budget-conscious experiments. We also wanted the video to be able to be used by anyone who saw it, not just those who received kits in Greater Lafayette, so we needed materials that were available anywhere. That eliminated a lot of potential experiments, but we were able to find a few that suited our needs and even added a little flare with a Halloween-friendly craft. In the end we had six experiments in total: a cohesion

experiment using two cups, a piece of yarn, and some water to show how water molecules stuck together; an adhesion experiment using a strip of paper to show how water molecules stuck to the paper and traveled up; an experiment testing whether water would make a good glue using a piece of paper and some water; an experiment making glue from flour and water; a homemade shear test to test the glue we made; and, finally, crafting a spiderweb using craft sticks, the homemade glue, some yarn, and a plastic spider to talk about sticky animals. We also talked to some friends in the department, asking them to demonstrate a real shear test for the students and talk about some of their own work with glues and adhesives. It was simple and short, fit all of the criteria we needed, but it was nowhere near the end of the challenges 2020 would throw at us.

The second challenge was the packing and delivery of the materials. Both the packing and delivery would have to follow pandemic guidelines to keep the volunteers and the students safe. Packing 1,300 individual kits was not going to be easy and would require a lot of volunteers and enough space to allow for social distancing. Our Chemistry Department and Building manager Ned Gangwer came to the rescue for the space, allowing us to use teaching labs on the weekends to pack the materials. With graduate students from the entire chemistry department volunteering their time, we were



Figure 4. Ana Morales getting ready to deliver experiment kits to schools.



Figure 3. Daniela Mesa Sanchez packing experiment kits.

able to prepare individual amounts of each material needed, pack the materials needed for the experiments in one paper bag, and even include a sticker and a label for each student's kit. Thirteen hundred kits later, we then had to count each individual package and group them by the numbers of students in each classroom and then by schools for our board members like Ana Morales to deliver. We had reached out to schools in the area, especially previous participants and new schools with largely minority populations who are recipients of financial assistance under Title 1 (*Allocations and Served Schools* | IDOE, n.d.). The deliveries were made to the seven schools who chose to participate: Glen Acres Elementary School, Klondike Elementary School, Mayflower Mill Elementary School, St. Lawrence Elementary School, St. Boniface Elementary School, Thomas Miller Elementary School, and Wea Ridge Elementary School. All but Thomas Miller Elementary and Mayflower Mill Elementary were veteran participants of our NCW program. Given this year's uncertainties, the lack of response from most schools was not surprising and overall, we were happy with participation. Nevertheless, we hope to continue our efforts to expand to Title 1 schools in which funding

may not always be sufficient to expose students to extracurricular science activities (Holt et al., 2015). This may entail outreach events other than NCW that better accommodate their needs and our abilities.

The third and last challenge was the video that would tie everything together. We had experience designing online educational content as teaching assistants working during the pandemic, but not as much experience in the filming and editing of the content. With very little filming experience, we first tried to contact professionals on campus for the filming but most of the budget for the event went toward the materials for the kits and hiring them would exceed our budget. We then tried to use campus resources to obtain the equipment to film everything ourselves but were unable to do so as all equipment rentals were unavailable due to COVID. With our options limited by our budget and the pandemic, we did some research to obtain our own equipment to film our experiments. This turned out to be a blessing because it gave us flexibility on time and locations as well as full control over how we wanted to film and edit everything together. We had a certain vision in mind, and in the end, we were able to do exactly what we envisioned.



Figure 5. Filming in the Wilker Lab with Jennifer M. Garcia Rodriguez.

Hannah Brown and Jennifer Garcia Rodriguez were the faces of the video. Hannah met with us on a Saturday in the new STEM building, Chaney Hale Hall of Science, where we had permission to use lab space for filming thanks to Jeanne Meyer, director of Undergraduate Chemistry Laboratories. With the script and the direction of Daniela, Hannah walked through the experiments on camera. We took multiple shots of each experiment with different lighting, angles, and focus, hoping that we could use all of that to piece everything together. It took over eight hours to get the video and audio we needed for the experiments but being able to do all of that ourselves had us pumped up for the event.

The following week consisted of filming some shots around Purdue for some transitions, as well as visiting Jennifer Garcia Rodriguez at her lab to film some of her research on mussels and adhesives. With a video, we were able to incorporate real research (some of our own work!) into the event and bring the students to the laboratories in a way we never could have before. Jennifer discussed her research with us while showing us some interesting aspects of her work, like mussels hanging off metal plates and how they test the glues they make with instrumentation, similar to our homemade shear test experiment. We were able to tie in the experiments to this as well, by testing the flour glue the

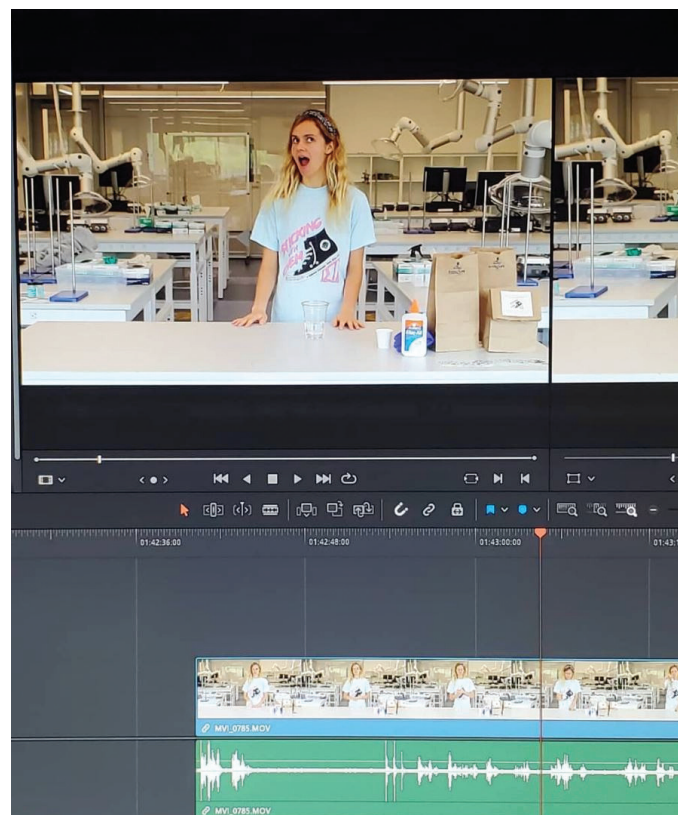


Figure 6. Video and audio editing process.

students would prepare themselves against some other household glues, something we would not have been able to do with our classroom visits in previous years.

We finished filming about a week before the event, which was scary considering everything was distributed, the event was set in stone, and it all relied on us to edit it together and publish it in a week. With almost no editing experience, Ilayda worked all week to stitch together the pieces, clean up the audio and video to sound more professional, and work out the glitches. But even after all of that, we did not feel that the work was done. We wanted to be as inclusive as possible, reach more people, share our love of chemistry and the fun we had putting this together. Daniela added subtitles in both English and Spanish to our video while Ilayda worked on expanding our social media to spread the word. The final video was not perfect, with some audio issues we did not have time to resolve, but we felt good about what we had done with the time and resources we had despite the challenges.

This online event was not the only product of our 2020 NCW project. Rather, it began a conversation in our graduate community about science communication in the new-normal pandemic world and beyond. ISP, like many other science organizations, focuses on networking with fellow scientists, sharing our work with each other and our communities, and figuring out how to improve our skill sets to benefit our science. Whether it is communicating with our colleagues or with our greater community, science communication is a core skill, but one that until this point we primarily exercised in person or within the stiff boundaries of academic journals. With everything shifting to online for our health and safety, it was clear we needed to learn new skills to keep up with this year and perhaps beyond. NCW 2020 was our first large event fully online, but it is not the only event we organized through the year. With the new skills and knowledge we gained from this experience, we were prepared to adapt our organization for similar events and consider the role of digital science communication in a postpandemic world, which would allow us to expand our reach, sharing more of our science enthusiasm with the world through the Web.

COMMUNITY IMPACT

Every year after NCW, we receive feedback on the event from volunteers and teachers to make improvements for the following year. This year, as it was an asynchronous event, we also measured our impact through video and social media analytics. As of March 1, 2021, our video has had over 300 views and continues to attract viewers

even after the event has passed. Our Twitter and Instagram accounts and Facebook page also continued gaining more attention from the event, with the initial tweet of our video garnering over 1,800 impressions. We want to keep that up for the future of the organization and the community. As expected, the majority of views (109) were located in Indiana during the week of the event. A pre-event survey had indicated most teachers had planned to use our kits as an in-class activity. Postevent responses indicated >75% of teachers did so. All teachers reported their students had a positive enjoyment of the activities; 90% of teachers deemed the activities to be educationally valuable, with 10% remaining neutral. All respondents agreed our virtual National Chemistry Week was a successful replacement for our in-person program.

While the online event did not have widespread interest beyond our community, with improvements suggested by our postevent survey for the teachers, we know we can do better in the future. Notably, 45% of teachers reported some technical difficulties. While many of these are out of our control, some common issues we will be able to address in the future were with audio inconsistencies and the difficulty level of some activities for the youngest students. Overall, the feedback we received for the event was very positive. One of the teachers who participates in our event regularly said, “We are so lucky to have Purdue University in our backyard. Even though you could not be in person with us, the students still were able to have fun learning some science. Each year I am amazed at how clever and grade level appropriate the learning is for students in grades K–5. Thanks again for planning, organizing, and delivering the materials to our schools.” Comments like that alone are why we will continue doing events like these no matter what life throws at us and why we want to expand our program to reach more and more students each year, especially the largely minority populations in our community who were not able to participate this year.

STUDENT IMPACT

The event inspired us to continue what we started. We decided to dig up some of our old experiments and post them online as well as plan to have more hybrid events in the future to allow the participation of more schools and more children. Daniela will be wrapping up her graduate career and retiring from her executive board position but will still be participating in the events as a volunteer. Ilayda will be holding her position on the board for a third year, working on these events, and has already started planning the next and also upgrading

some audio and video equipment. Regardless of our involvement, both of us will be taking the skills we learned to use in our careers now and after graduate school. Outreach is an important part of being a scientist. We need to be able to work with our communities to resolve many of the world's issues whether it's climate change, pollution, or a health crisis, and clear and effective communication, digital or otherwise, is key!

This event definitely had a positive impact on the teachers and children in our community as well as our skillset for the new normal of our lives, but the most important impact was probably the one on us and our volunteer graduate students. The graduate students of our department, like others worldwide, were suffering from severe strain on their mental health because of the pandemic (Woolston, 2020). Our research time was restricted for months and still is being restricted due to social distancing and room capacities with the same expectations on workload as before the pandemic. The events we used for brainstorming, socializing, and stress relief were cut, and we were not able to organize any events in person. Budget cuts are pushing our departments to give us more work with very little room to breathe for the same pay. Most of our work was limited to reading and writing in our offices or homes, in front of the same screen on the same chair all day. We are stressed, stuck, and overwhelmed. A lot of us (including the authors of this article) felt that we were often falling apart. This is another reason we did not want to cancel this event. It meant a lot for the teachers and the students, but it also meant a lot to us. It became an outlet for us to create and communicate, knowing that even in times like this we could do great things with our work and make people happy. We could still talk about our science with others and see the excitement in their eyes. We could still make this work. And being able to reach out, not only to our community, but to other people further away excited us. It gave us purpose during the pandemic, and it still gives us purpose now. After all, what is the point of all the science that we do, if it is locked in an office? Even writing this article brought that excitement back into our lives for a few more moments, and we cannot wait to do even more.

CONCLUSION

Moving an event online and maintaining its impact on student learning is a struggle that educators from all levels faced in 2020. As future members of the scientific community, an online NCW was a challenge that taught us a lot about navigating the new normal of scientific communication. The pandemic has made videos a vital part of everyday life, and learning skills to make better

videos is necessary for scientists and educators alike. This does not only mean video and audio quality, but also improving the engagement and accessibility of video content. Until we reach a point where videos skills are as widely developed as Word and PowerPoint skills, we have a lot to talk about and a lot to think about. We hope our experience with moving this event online and the challenges we faced will give both educators and students a new perspective on this and inspire more educators to work on their skills to make online learning a better experience for students. We know that we will be working on our video and audio skills for our next event, as well as communicating with teachers and students in our community to make a better experience for them next year. In the meantime, this will take a lot of effort on the part of educators and a lot of patience and understanding from students as we adjust to the new normal in the future of science and education.

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