



Outreach Playbook

SWEtastic Stem Challenge

Metrics:

Grade Level:	# of Student Participants:	Duration (hrs):	# of SWE Volunteers:	Partner orgs (if any):
9-12	23	6 hours total, 2 hours on 3 different Saturdays	20	

Overview of Activity

This program is a virtual STEM poster challenge for high school students, aiming to give them the opportunity to exercise their creativity and improve their problem solving and critical thinking skills. Students work independently or in a small group of 2 or 3 and get to choose one of three exciting challenges modeled after various engineering disciplines to tackle. Then, they have to solve the problem by brainstorming and designing a solution while thinking of practical implications. Once a final design has been agreed upon, they create a digital poster using Google Sheets, Google Docs, or a similar application to convey their solution, and they present this poster to the other students as well as a panel of judges (3 SWE volunteers). Each group/individual is paired with one or two college mentors (SWE volunteers) to guide them along the process.

The three challenges we created for our event were as follows:

1. Design an automatic snack transit and distribution system for a house and create a digital poster displaying its features and mechanisms.
2. Design a device or app that can help humans maintain or improve their health. Create a digital poster displaying the device or homepage of the app and its features.
3. Improve a current piece of technology or create a new technology that draws inspiration from the features of an animal, exploring the concept of biomimicry. Create a digital poster displaying the technology and how it relates to the animal's features.

These challenges all require the students to do some research, brainstorm, and think critically. There isn't a quick, direct solution to any of them, which makes it perfect for high schoolers to be creative and problem solve. They also all draw on skills and concepts that are relevant to what engineers do and skills they have to use in day to day work.



The connections to real-life in this program are abundant. For example, scientists and engineers use nature as inspiration for designs all the time. A few years back, a new class of robots were created called FlyCroTugs that were able to lift objects 40 times their weight thanks to design ideas borrowed from wasps and geckos. Challenge number 3 requires students to do research about these topics and improve a piece of biomimicry related technology they find or design a new piece of technology themselves.



Outline and Script

When students registered for this event, we had them indicate whether they wanted to work individually or in a group, and if they selected group they could either list the names of people they wanted to work with or ask to be put into a randomly selected group. We recommend keeping groups to a maximum of three students, especially if it is virtual. This way all students have the chance to be involved and no one gets left out with nothing to do.

The actual event took place over the span of four Saturdays. The first Saturday was a two hour meeting on zoom. On this day, we presented the intro slides. This included an overview of the competition including what the challenge consisted of, the timeline, and what they could aim to learn or take away from participating in this event. We also shared one of our main tools for students to navigate this challenge which is the website we designed on Google Sites: <https://sites.google.com/view/hsoutreachspring2021/home?authuser=0> This website contains general information such as the schedule, descriptions of the three challenges, as well as resources for each of them.

Then, we presented the three challenges students could choose from and gave them time to meet with their group to decide which one they wanted to take part in by filling out a Google Form. Once they chose a challenge, they were given a one page document that included background/an overview on the problem, their goal, parameters, as well as guiding questions and an example. Then, they were able to do research and brainstorm their own ideas. Additionally, they had a portion of the time to get to know their college mentor(s) to make sure they were comfortable asking questions about both the challenge and college in general.

The second Saturday was focused on narrowing down and finalizing a design solution as well as starting to create the poster. This was also a 2 hour meeting on zoom. College mentors asked thought provoking questions to help guide students' designs. These could be ones they came up with on their own as their team worked on a solution or ones from the mentor tip sheet provided to them. A tip sheet for each of the three challenges including possible solution ideas, anticipated pain points, and leading questions was provided to all of the college mentors.

The third Saturday, there was no synchronous meeting. Groups and individuals could work on the poster and finish it at their own pace and on their own time. They were given the emails of their college mentors on the first Saturday so they could reach out with questions or ask to set up a separate meeting if they wanted to.

Finally, the fourth Saturday, which was also a two hour zoom meeting, was for teams to present their posters. Each group had 2-5 minutes to present. One each group presented to the other students and judges, we had a panel of 3 SWE volunteers answer students' questions about college, the admissions process, engineering, or anything related. During this time, the judges decided on the winners for each of the three design challenges by each filling out a judging Google Form. After the panel concluded, the winners were announced. The winners each received a prize. This could be anything high school students might want.



Lessons Learned

Based on feedback forms completed by our SWE college volunteers, 100% of them thought the website and mentor tip sheets were extremely helpful in keeping the event organized and making sure they were all prepared for their role.

Based on the feedback form completed by 22 of the participating high school students, 19 of them rated a 4 or 5 out of 5 for how much they liked the format. 19 of them rated a 4 or 5 out of 5 for how much they liked the prompts. 20 of them rated a 4 or 5 out of 5 for how well they were able to connect with their mentor.

That being said, we did find that many students worked on mute or without the need of strong guidance from collegiates. While this is great because the students were confident in their abilities, it did create some quiet zoom calls and used up our volunteer's time. In the future, it would definitely be better to have one volunteer assigned to each participating group, whether it's an individual or group of 3.

There was also some difficulty in break out rooms to get students to ask questions and reach out to their mentors. This is very common on zoom and our volunteers suggested that we allow more time for students and mentors to connect with one another before diving into the project. We want the students to feel comfortable speaking up on zoom or emailing their mentor throughout the challenge window. Also, some students did not receive feedback from their mentors before presentations because of scheduling issues, so incorporating feedback time into the zoom calls is very important.

There are many best practices from this event. The first was meeting with volunteers before the event to ensure everyone understands their responsibilities as is ready and energized to put on a great event. The mentor tip sheets also helped with this. Further, it was very beneficial to allow students to pick their own teams, especially if it is a virtual event. There were some students who were able to work with their friends, while others met someone new! In fact, 19 of the students said they were extremely happy with how their group worked together which is high for an online event.

One of the main best practices was the website we created for this event. Having all of the main information in one place made it easy for both students and volunteers to access. 18 of the students said the website and resources provided were very helpful in completing the challenge.

Finally, with any outreach event it is always helpful to remind participants of scheduling and the progress that they should be making through a multi-week event.



Accessibility Adaptations

This activity is very adaptable depending on the circumstances given. First, since the event is based on creating and presenting a digital poster, no budget is necessary if there is computer access. This applies for both in person and virtual events since students just need to be able to do research and create an online poster. If computer or internet access is an issue, the student can work individually and make a poster by hand following the same steps. They would just need paper and some markers/pens. Additionally, this event could be made fully in person. Here, there would be the choice of continuing to make digital posters. This would keep the budget to \$0.00. Another option is having teams make handmade posters. All this would require are supplies such as poster paper, some colored paper, scissors, glue, and markers/pens. While this would increase the budget slightly, it might be more fun or exciting for students. Some students from our event even suggested having time to build a quick, rough prototype of their design, which is a wonderful idea for them to help visualize their designs. Supplies needed for this would be very basic craft items such as cardboard boxes, popsicle sticks, pipe cleaners, etc.

Materials and Costs

Item	Quantity	Where to Buy (link if applicable)	Total Cost
No cost because the event was held on zoom, laptop accessibility is necessary if you are also making digital posters.	N/A	N/A	N/A



Describe any additional funding sources outside of section budget (if applicable):