Team Maverick
Danielle Porten, Noah Sell, Cameron Strong, Benjamin Tung, Shan Sma
The Challenge 2020
June 22\textsuperscript{nd}, 2020
The New Normal

- Social distancing is the best way to avoid COVID-19 (1)
  - Disease spread through respiratory droplets from infected to not infected person
  - Limited social interactions
- 124,000 U.S. public and private schools closed/switched to online lessons (2)

Plexiglass Barrier in Target

Social Distancing with Masks

Photo credit
School Issues - Science Classes

- **13 objectives** - must have in-person labs to meet these objectives
- **10 objectives require physical presence:**
  - Instrumentation
  - Experimentation
  - Design
  - Creativity
  - Psychomotor
  - Safety
  - Communication
  - Teamwork
  - Ethics in the Laboratory
  - Sensory Awareness

“Hands on component enhances learning... each student has a role... [however] students are close to each other, moving around classroom, touching equipment”

- Kim Heinzer, science teacher and engineer
Problem:
How can science classes safely allow students to learn science by having a hands on experience in a lab.
The Science Labs (Hamilton High School)

- Students and teachers use this space most frequently
- Teacher instruction in the front, lab area in the back
- Size: Around 1400 square feet
- Classes made switch to online after COVID19 hit

The Science Classroom

Photo Credit
Our Creative Design Process

1. Identified the Problem
2. Brainstormed Ideas
3. Evaluated Our Ideas
4. Came up with some solutions
5. Thought of How the solution(s) would work
6. Came Up With Final Solution(s)
Solution

- Change the setup of the classroom by getting rid of student desks and using just lab tables
- More lab tables would be added
- 2 students would be on each end of an approximately 6.5 x 2 ft lab table.
- Engineers needed: design and technical engineers
- In a science class of approximately 1200-1400 sq ft 6-6 65. x 2ft desk and still adhere to the social distancing guidelines
Classroom Before:

Classroom After:

Standard Setup of a High School Science Lab
Photo credit: Click here

Picture of a Physical Science Lab
Photo credit: Click here
Solution Cont.

- Use new schedule that limits the amount of student that are on campus through the week.

- Students are on campus for only 2 required day with 1 optional day where students can come in additional help from their teacher.

- On every required day students are assigned a block time to come on campus for 45-50 minutes which also allows cleaning time in between.

- During the rest of the week the students would complete their lessons online through google classroom. Teachers can also teach their lesson through zoom if needed.

- We also decide to decrease class sizes to the maximum amount of students (12-15 students) that adheres to the regulations and keeps the students and teachers safe.
# Science Lab Schedule

**Start Time:** 7:30 AM  
**Time Interval:** 60 (in minutes)

<table>
<thead>
<tr>
<th>Time</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 AM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td>Online lesson with google classroom or zoom class</td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>8:30 AM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td>Online lesson with google classroom or zoom class</td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>9:30 AM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td>Online lesson with google classroom or zoom class</td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td>Online lesson with google classroom or zoom class</td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>10:30 AM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td></td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td></td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>11:30 AM</td>
<td>Teacher Break</td>
<td>Teacher Break</td>
<td>Teacher Break</td>
<td>Teacher Break</td>
<td>Teacher Break</td>
</tr>
<tr>
<td>12:30 PM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td></td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td></td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>1:30 PM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td></td>
<td>Optional in-person check-in with teacher for extra help if needed</td>
<td></td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
<tr>
<td>2:30 PM</td>
<td>Lesson Plan Overview, Pass out assignments for 2 weeks, Review test or quiz</td>
<td></td>
<td></td>
<td></td>
<td>Every other Friday Mandatory Lab or Test</td>
</tr>
</tbody>
</table>

Figure 1, Science Lab Schedule. Made by Danielle Porten
Barriers to Design Implementation

- Lack of funds and supplies - Fundraise and partner with colleges for equipment
- Since less students have to be in each class you might not have enough teachers - hire more teachers
- Spacing in classroom - desks taken out, lab tables to fill up space and allow room for social distancing

Photo credit: [Here](#)

Photo credit: [Here](#)
Face Shields

The shield frame models are able to be nested 2-3x on the print bed for bulk 3D printing.

Photo credit: Here

Dr. Alexis Dang wears an assembled face shield over a N95 respirator.

Photo credit: Here
Outside Resources

- Rapid Prototyping Laboratory (Embry Riddle Aeronautical University in Prescott Arizona)

The Rapid Prototyping Laboratory’s Makerbot Printers
Photo credit: Here
Cost/Impact

#1 - Rearrangement of the classroom - low cost benefit because the school already has the supplies

#2 - Schedule - medium cost because the school would have to hire more teachers would be needed to support the extra classes

#3 - PPE (i.e. face shields) - school would partner with colleges to use their 3D printer for a fee, students would pay a small fee also for their own personal face shield

Costs around $0.95 per face shield; buy paper towels, soap, etc.

#4 - disinfectants/supplies -
Discuss How Your Solution will Change the Space

- **Major change** - The space will be converted from a part classroom part lab to a full on science lab.
- Student desks are removed and lab tables are added.
- Instead of 6 people to a table, there would only be 2 people per table, one on each side.
- Different desk setup to allow social distancing and a new schedule that uses physical and digital teaching methods.
- Positive changes - Don’t have to move around for labs, cleaner surfaces, and frees up more space in the classroom.
- Negative changes - Less student interaction and students that are visual learners might struggle.
- COVID-19 contact will be reduced due to: gloves, goggles, constant sanitation, and face shields in replacement of masks.
- Allows close interaction between students and teachers to be possible.

Picture of a Physical Science Lab

[Photo credit]
Discuss What You Learned and How You Worked as a Team

- **Successes:**
  - Collaborating well
  - Many creative ideas were generated and incorporated
  - Creating a comprehensive solution

- **Failures:**
  - Struggling to find a solid beginning solution (small ideas fizzled out)
  - Not being able to find certain costs of sanitary equipment in bulk

- **What We Learned:**
  - Creative process of how to market a product/idea
  - Logistics behind the cost of a product/idea
  - Working in a team virtually takes a lot of collaboration and individual work
  - Thinking through trial and error
Citations

Brown, Lauren V. “How to Design a Fantastic High School Science Lab for Inquiry-Based...” VLK Architects, VLKArchitects, INC, 14 Nov. 2018, vlkarchitects.com/insights/design-fantastic-high-school-science-lab-inquiry-based-learning#:~:text=The%20TEA%20defines%20a%20science%20laboratory%20as%20a%20specialized%20classroom.&text=A%20science%20laboratory%20shall%20have,student%20in%20excess%20of%202024.

“How Long Will Coronavirus Survive on Surfaces?” Health Essentials from Cleveland Clinic, Health Essentials from Cleveland Clinic, 24 Apr. 2020, health.clevelandclinic.org/how-long-will-coronavirus-survive-on-surfaces/.

“How to Build PPE Face Shields, with a 3D Printer or Without.” NewBoCo, newbo.co/building-face-shields/.


