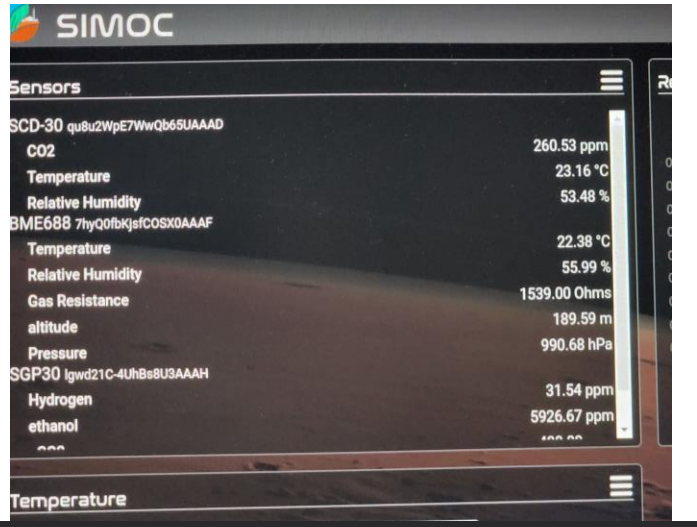
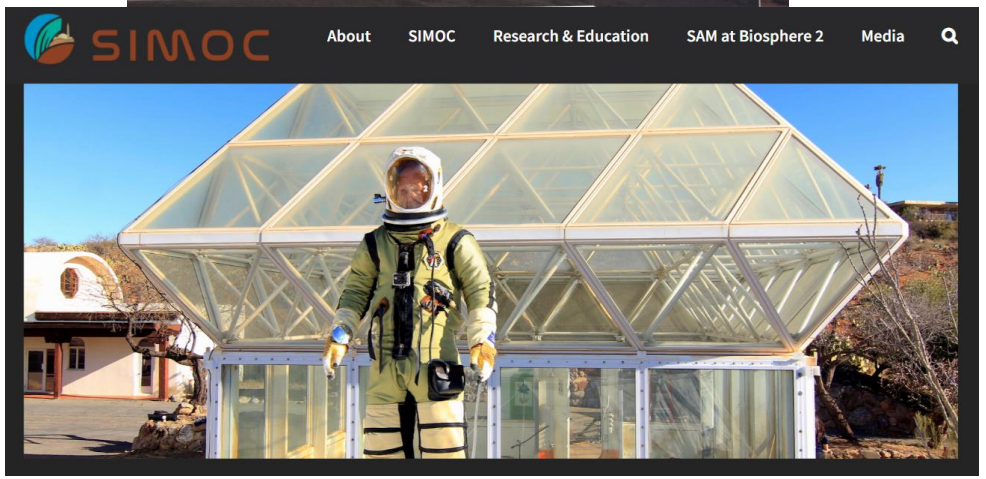
Gretchen Hollingsworth's
10th Grade Honors Lit Class
Barrow Arts and Sciences Academy

In Partnership with the
Arizona State University
Computer Science Capstone Team
Spring 2022

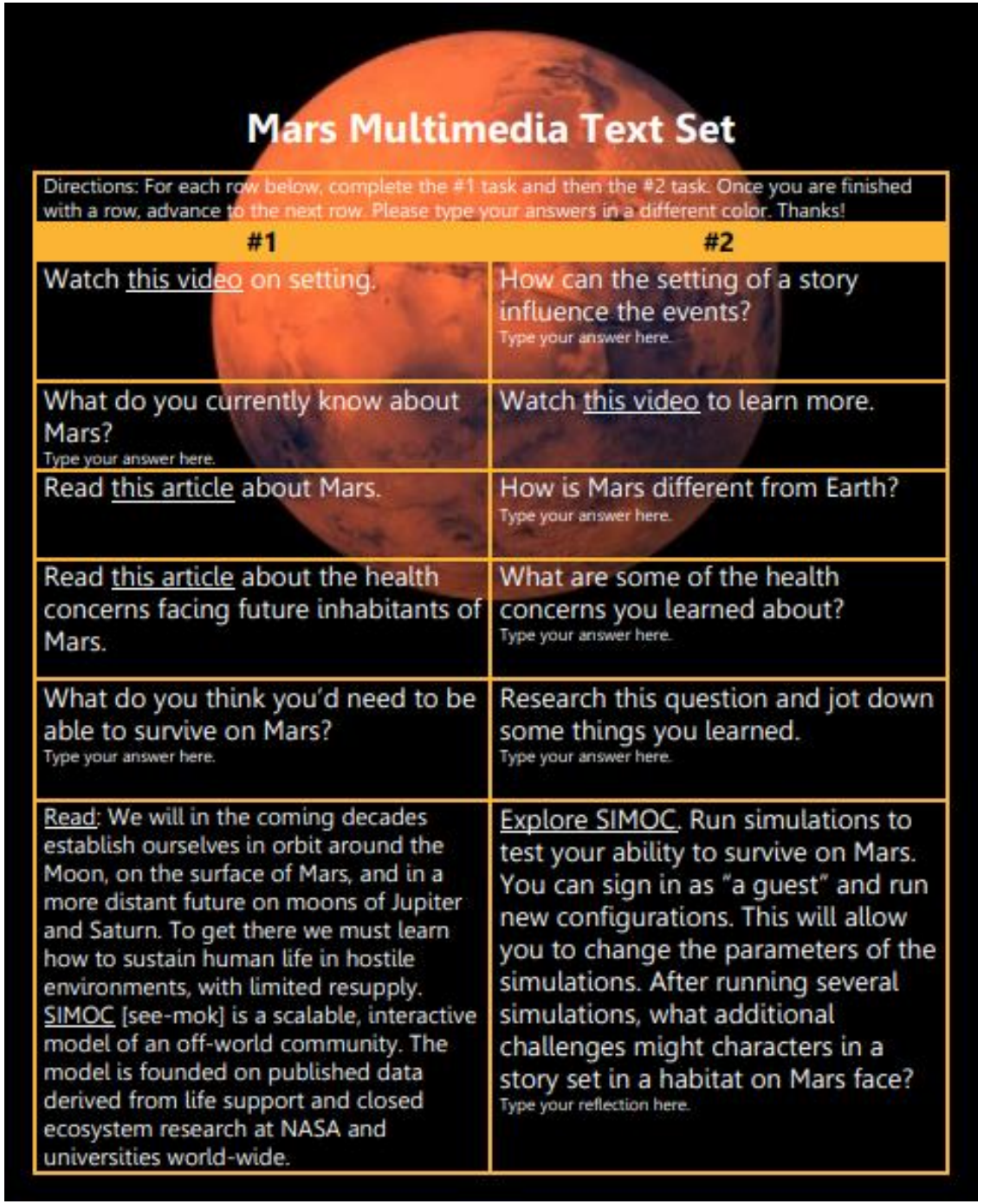
SIMOC Mars Exploration
Guided Inquiry Project





Engage

Students explored the setting of Mars using a Mars Multimedia Text Set (MMTS) Activity. They also ran several simulations using SIMOC.



Mars Multimedia Text Set

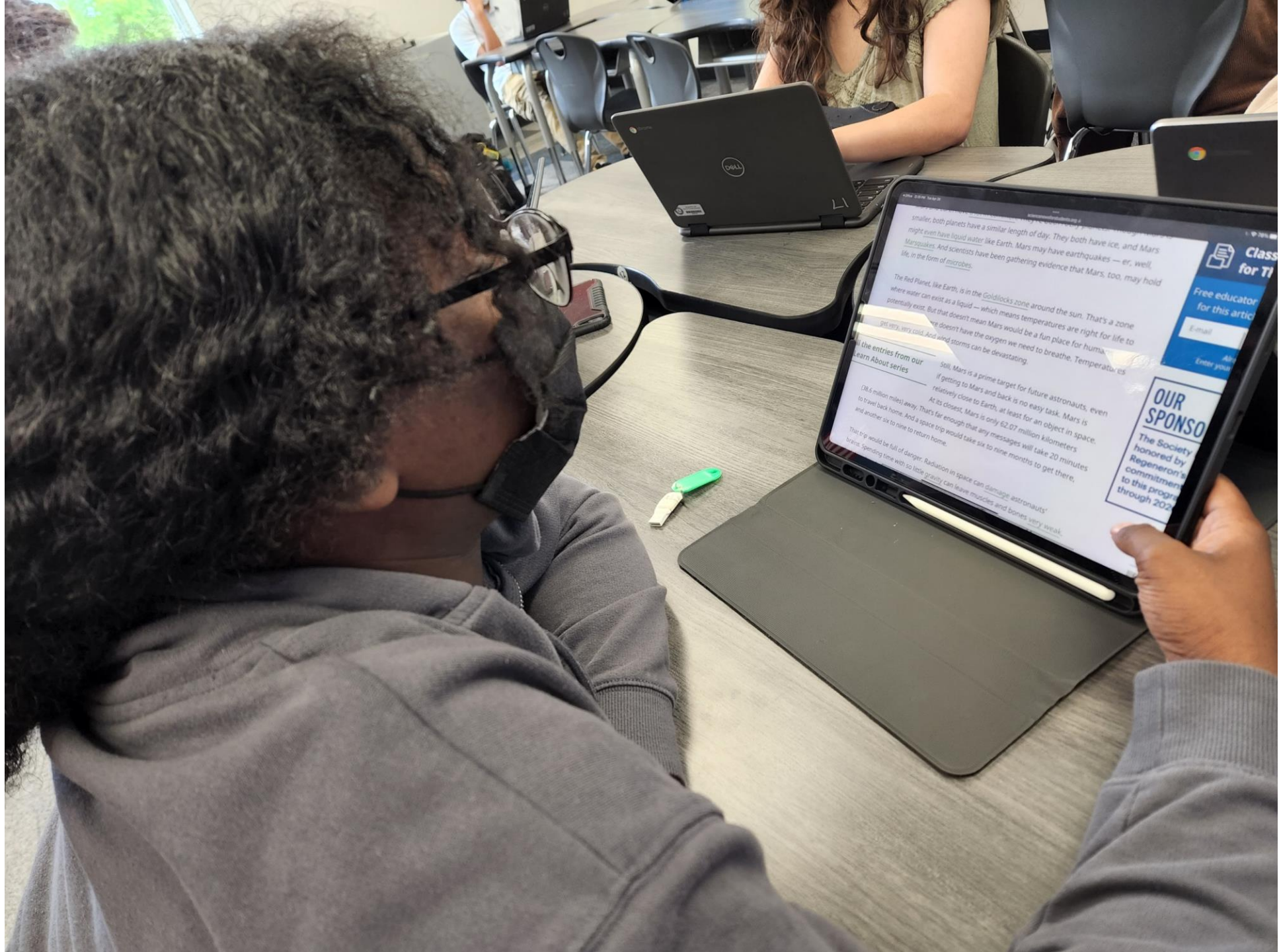
Directions: For each row below, complete the #1 task and then the #2 task. Once you are finished with a row, advance to the next row. Please type your answers in a different color. Thanks!

#1	#2
Watch this video on setting.	How can the setting of a story influence the events? Type your answer here.
What do you currently know about Mars? Type your answer here.	Watch this video to learn more.
Read this article about Mars.	How is Mars different from Earth? Type your answer here.
Read this article about the health concerns facing future inhabitants of Mars.	What are some of the health concerns you learned about? Type your answer here.
What do you think you'd need to be able to survive on Mars? Type your answer here.	Research this question and jot down some things you learned. Type your answer here.
Read: We will in the coming decades establish ourselves in orbit around the Moon, on the surface of Mars, and in a more distant future on moons of Jupiter and Saturn. To get there we must learn how to sustain human life in hostile environments, with limited resupply. SIMOC [see-mok] is a scalable, interactive model of an off-world community. The model is founded on published data derived from life support and closed ecosystem research at NASA and universities world-wide.	Explore SIMOC. Run simulations to test your ability to survive on Mars. You can sign in as "a guest" and run new configurations. This will allow you to change the parameters of the simulations. After running several simulations, what additional challenges might characters in a story set in a habitat on Mars face? Type your reflection here.


Mars MMTS
DELL


What do you currently know about Mars?
Watch this video to learn more.
Read this article about Mars.
How is Mars different from Earth?
What do you think you'd need to be able to survive on Mars?
Research this question and jot d
some things you learned.
Type your answer here.
Stay in the know. Turn on desktop notifications
DELL


DELL


smaller; both planets have a similar length of day. They both have ice, and Mars might even have liquid water like Earth. Mars may have earthquakes — er, well, Marsquakes. And scientists have been gathering evidence that Mars, too, may hold life, in the form of microbes.
The Red Planet, like Earth, is in the Goldilocks zone around the sun. That's a zone where water can exist as a liquid — which means temperatures are right for life to potentially exist. But that doesn't mean Mars would be a fun place for huma
gets very, very cold. And wind storms can be devastating.
Still, Mars is a prime target for future astronauts, even
if getting to Mars and back is no easy task. Mars is
relatively close to Earth, at least for an object in space.
At its closest, Mars is only 62.07 million kilometers
(38.6 million miles) away. That's far enough that any messages will take 20 minutes
to travel back home. And a space trip would take six to nine months to get there,
and another six to nine to return home.
This trip would be full of danger. Radiation in space can damage astronauts'
brains. Spending time with so little gravity can leave muscles and bones very weak.
l the entries from our
Learn About series
OUR
SPONSO
The Society
honored by
Regeneron's
commitment
to this progr
through 202
Free educator
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E-mail


ASUS
dixie

Explain

Students gathered data from SIMOC to help establish setting for a Mars Creative Writing Activity. They used this information as they created storyboards and planning for their stories.

Jada + Lee

Simoc - Stimulation Notes

- Presets:
4 humas + Garden

Duration:
100

Crew Quaters
Medium

Food Supply:
1000 kg

Life Support:
3ECLSS Modules

Green house:
Medium

Plant Species:

- Rice
- Cabbage
- Strawberries
- Radish
- White Potatoes
- Peanut

Power Generators

Solar pv Array

Power Storage

Batteries →
400000 kWh

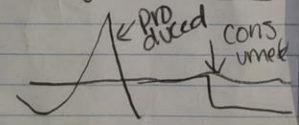
Records:

CO_2

- In our habitat, we were consuming ~~[illegible]~~ enough so the CO_2 levels got too high

Response 2 it:
CO_2 Mask

Energy Records



- At times, the energy would fluctuate between too much + not enough

Heros Journey Cycle

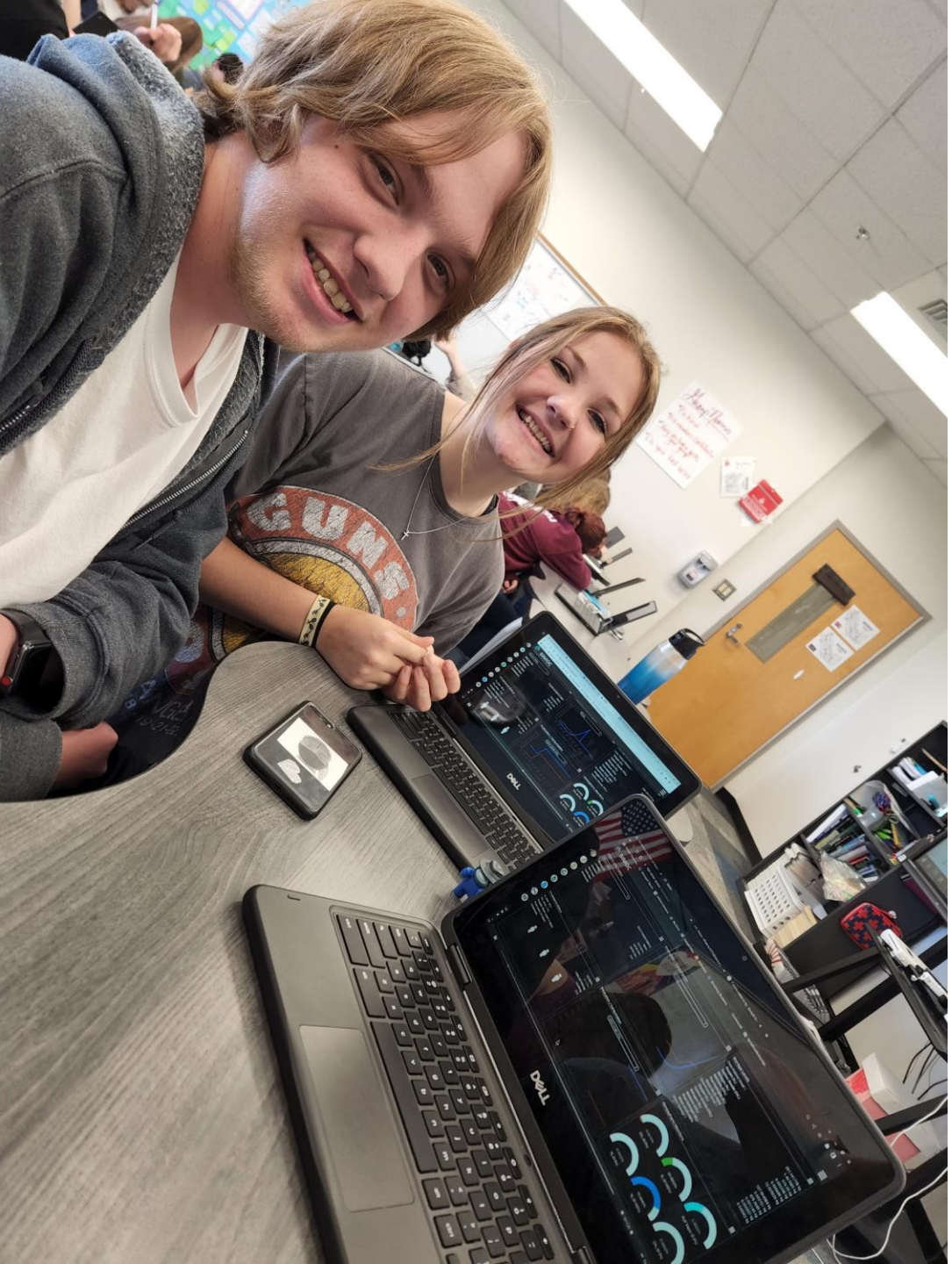
Background info:	Call to Adventure:	Meeting a Mentor:
(23) 2 College Couples John + Rissa ↳ Astrology Majors	- New Movie - Ads on the radio - Bill Boards	Johns Astrology Professor also is a BD Specialist for NASA.
(22) Tina + Ike * Ag Majors	They felt they needed to try it out	They all spoke with him

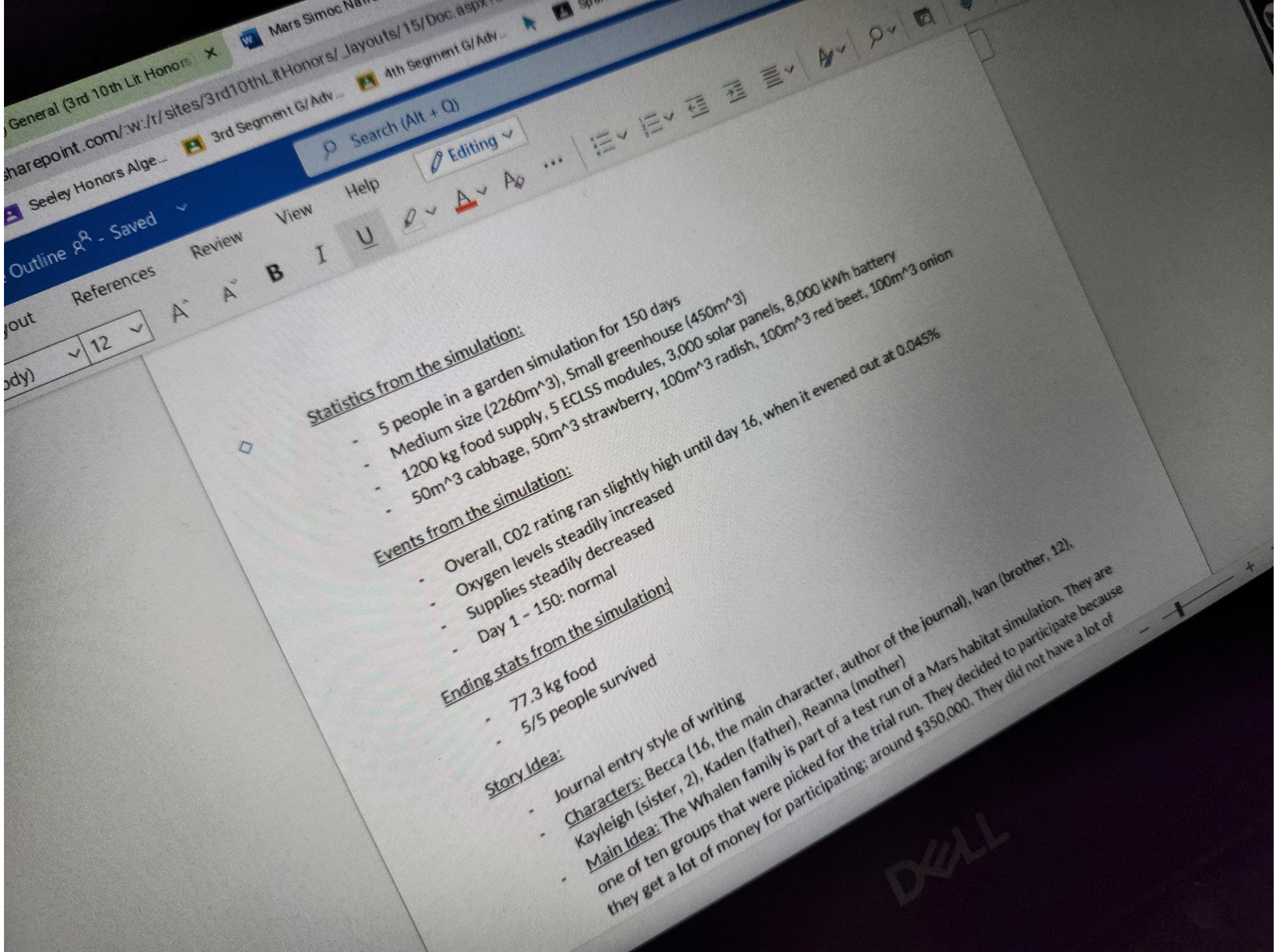
Getting 2 Mars	Good / Bad	Growth
- Came back w/ Stimulators - Professor approved	Good: good - They love the scenery / cash prize Bad- MURDER TOWN	- Ike + Tina start collaborating with John + Rissa. - learn New things - Find New Strategies

Death	Revelation	Final Changes
- John + Rissa ↳ - Ike + Tina Shoot them	- Ike + Tina calls Johns Professor and acts like he killed John + asked for help w/ body dispo	- Ike + Tina realizes that they f[illegible] up friendship for money

BEN EE DA JA

Monday
Crew




General (3rd 10th Lit Honors
sharepoint.com/:w:/r/sites/3rd10thLitHonors/_layouts/15/Doc.aspx
Seeley Honors Alge...
3rd Segment G/Adv...
4th Segment G/Adv...
Search (Alt + Q)
Editing
Outline
- Saved
References
Review
View
Help
12
Statistics from the simulation:
- 5 people in a garden simulation for 150 days
- Medium size (2260m^3), Small greenhouse (450m^3)
- 1200 kg food supply, 5 ECLSS modules, 3,000 solar panels, 8,000 kWh battery
- 50m^3 cabbage, 50m^3 strawberry, 100m^3 radish, 100m^3 red beet, 100m^3 onion
Events from the simulation:
- Overall, C02 rating ran slightly high until day 16, when it evened out at 0.045%
- Oxygen levels steadily increased
- Supplies steadily decreased
- Day 1 - 150: normal
Ending stats from the simulation:
- 77.3 kg food
- 5/5 people survived
Story Idea:
- Journal entry style of writing
- Characters: Becca (16, the main character, author of the journal), Ivan (brother, 12), Kayleigh (sister, 2), Kaden (father), Reanna (mother)
- Main Idea: The Whalen family is part of a test run of a Mars habitat simulation. They are one of ten groups that were picked for the trial run. They decided to participate because they get a lot of money for participating; around $350,000. They did not have a lot of


Project Calendar
Theme
DELL

Mars Story setting

Location: Mars

Mission Duration: 90 Earth days

Crew Quarters: Medium (2260 m^3)

Inhabitants: 3

Food Supply: 3298 kg

Life Support: 9 ECLSS modules

Greenhouse: Small (490 m^3)

Plant Species: Snap Bean 90 m^3, Rice 50 m^3, White Potato 30 m^3, Sweet Potato 30 m^3, Spinach 76 m^3, Strawberry 42 m^3

Power Generation: Solar PV Array 42 panels

Power Storage: Battery 9000 kWh

8x speed

The CO2 levels rise and drop pretty rapidly. The O2 level drops fairly quickly. The food and water supply seem to be doing fine and everyone survives. The O2 storage level stays about the same in the greenhouse and is decreasing steadily in the crew habitat. About a third of the way through the energy production and consumption become about the same. The oxygen production spiked but almost immediately dropped. The amount of CO2 produced also was almost the same as the amount consumed.

Title: The 90 Day "Vacation"

Characters: Page Byrd, Asahina Loveknot, Nora Twist

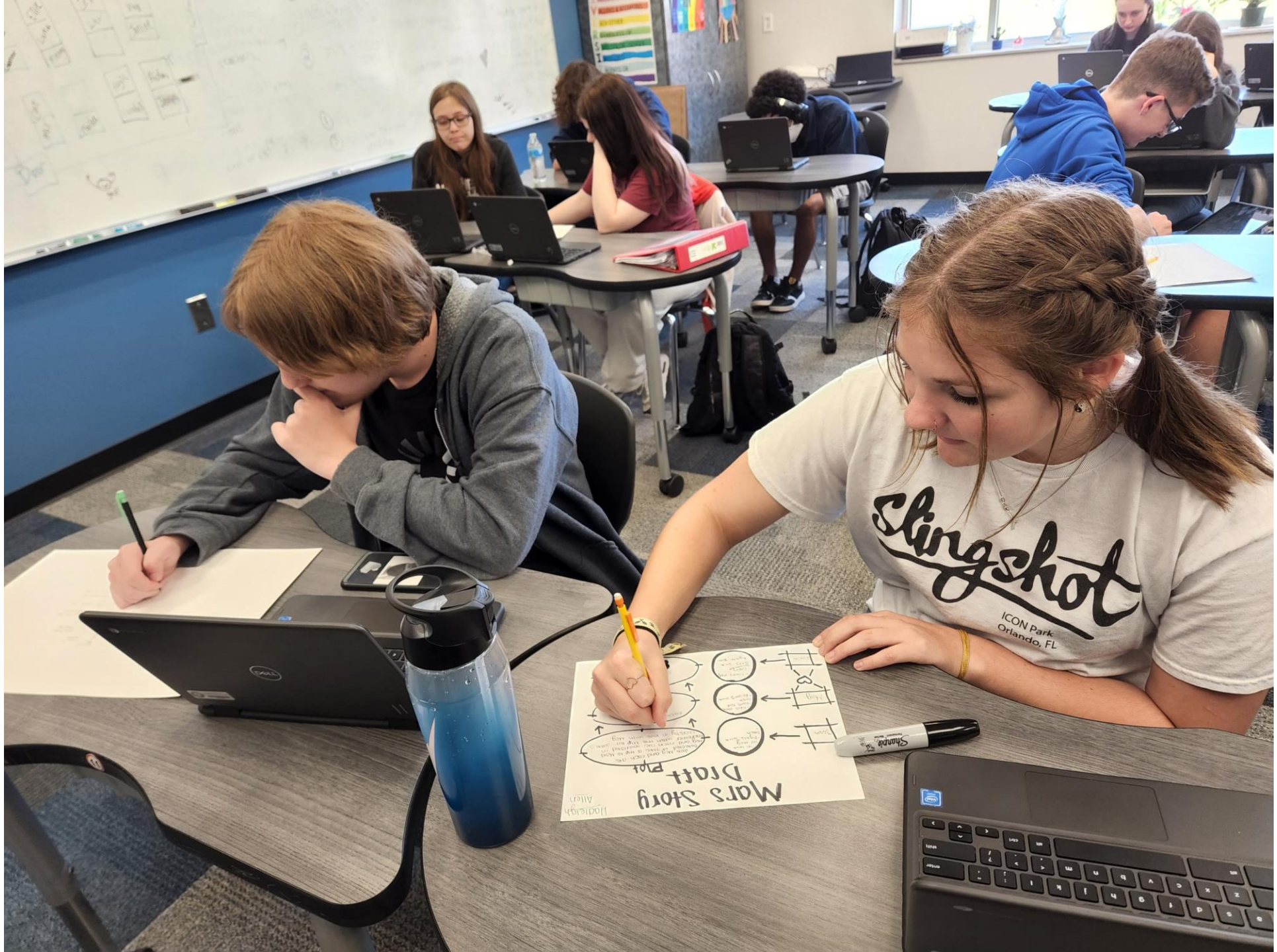
Setting : Mars

POV: 3rd Omniscient

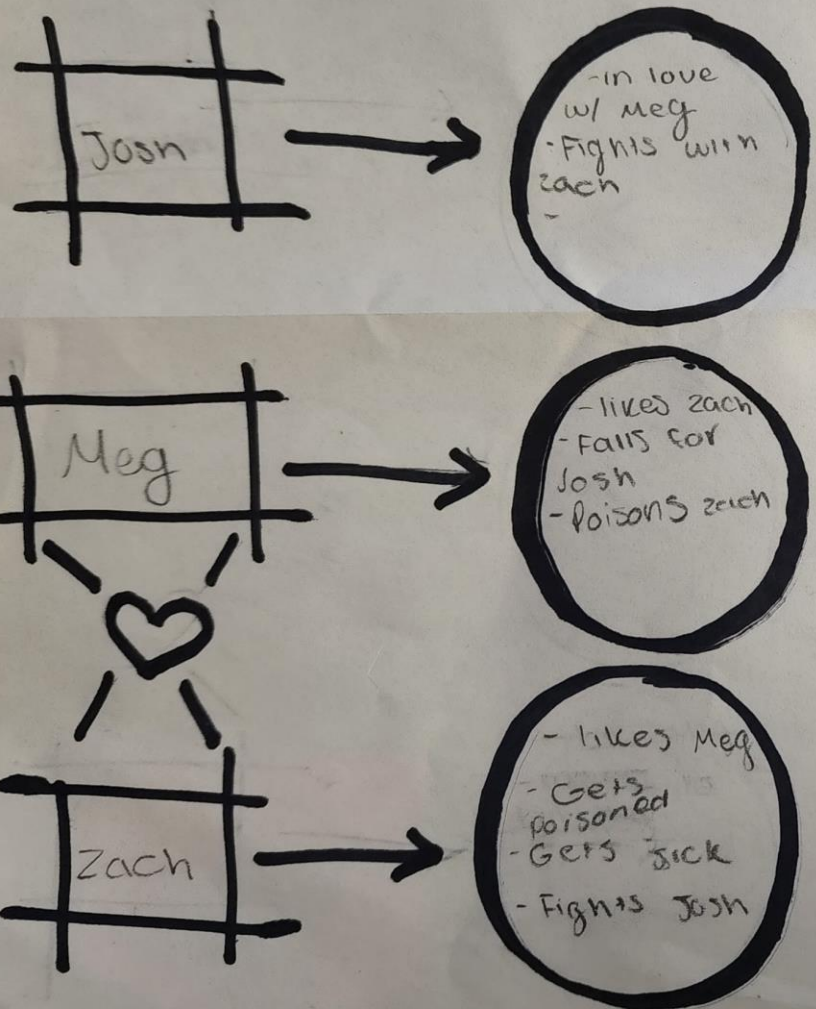
Plot: Three friends wake up on Mars, almost as if it's a simulation, and have to try and survive for 90 days.

Conflict: Start to get annoyed with each other.

Resolution: Resolve their differences and build stronger friendships.


Slingshot
ICON Park
Orlando, FL
Mars Story
Draft

Mars Story Draft

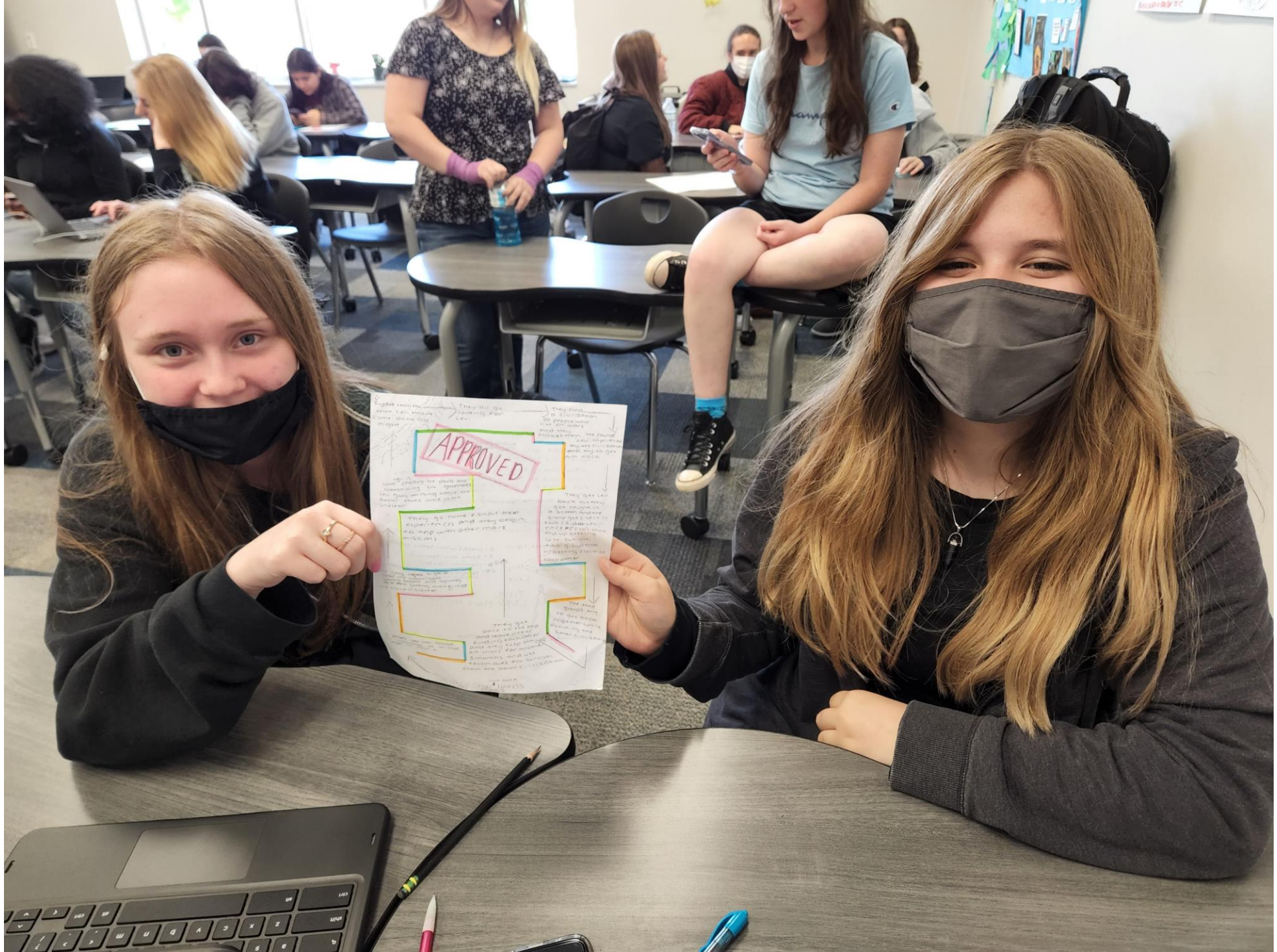


Plot

Josh, Meg and zach are selected to take a trip to Mars. Meg and zach are interested in eachother when the trip. But Josh is secretly in love with Meg.

zach gets sick and Josh and Meg spend some more time togetner. Josh confeses his love and Meg realizes she has feelings for Josh.

Meg plans to Poison Zach. But zach finds out and comes up with his own plan. zach and Josh fight over Meg, and of them doesn't make it.

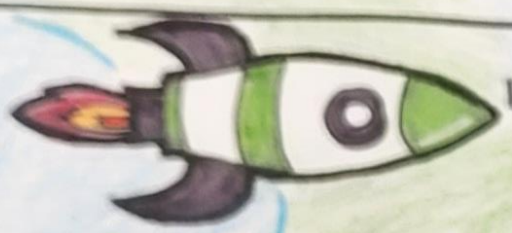

APPROVED

transporting to mars

the end

life before mars

the mars experiance



Plot twist?

- big moment
- changes for better or worse.

→ seeing the climax

Play out

characters

- Jesse, Mary, Johannes
- Dr. Dinkleberg
- Roger White

how was me nission?

how is the competing against the change?

- keeping calm
- learning new things

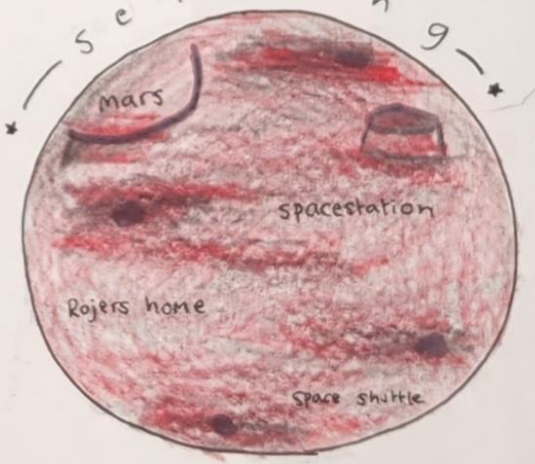
lit match

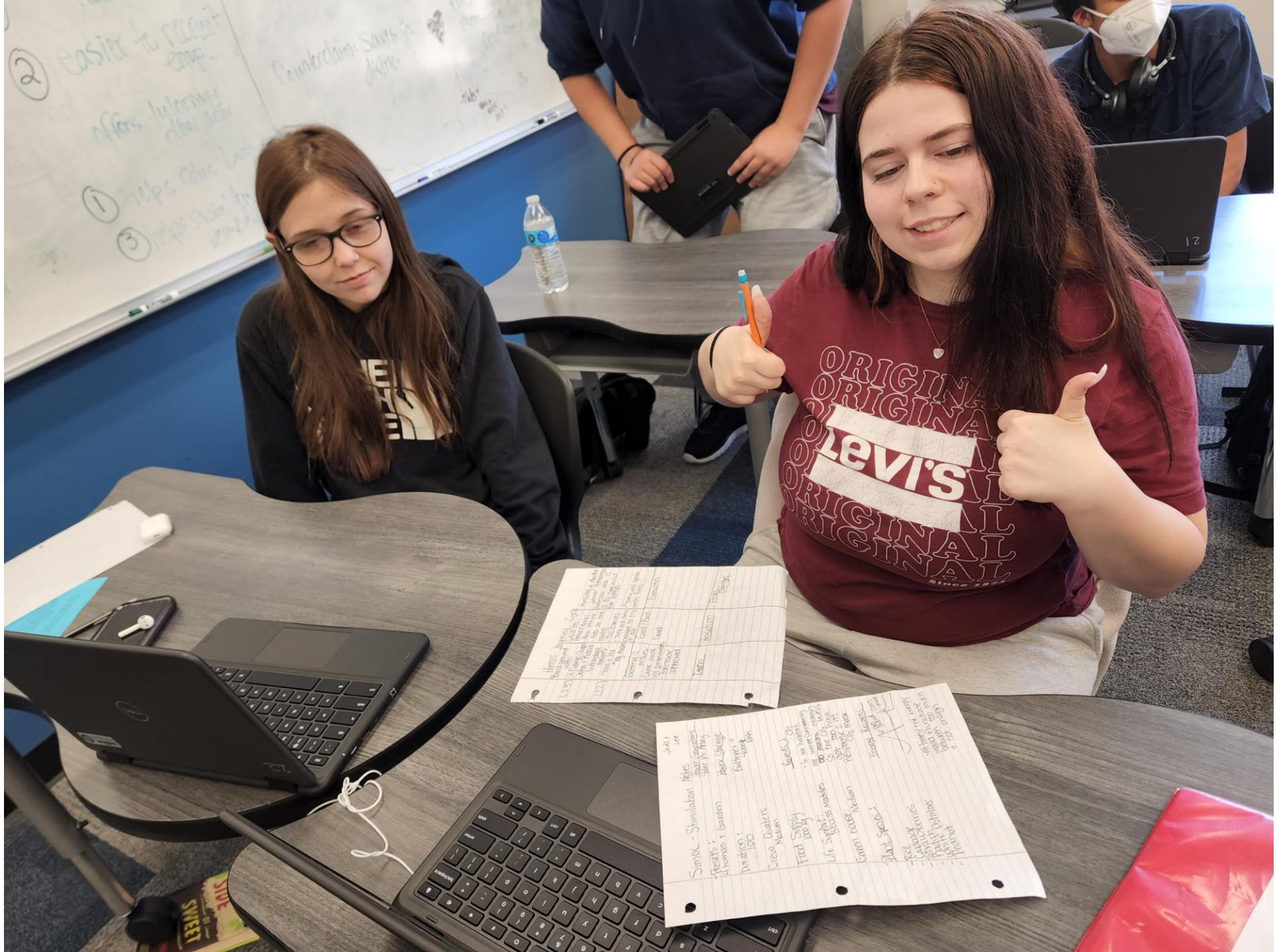
used match

unlit match

- how is earth life?
- what is the norm?

- What is the change in the norm?
  - going to mars!
    - its dangerous
    - new
    - leaving norm




Levi's
ORIGINAL

Plot Diagram

Exposition/Beginning: Parts of Earth got hit by a huge asteroid 2 years ago. Four human survivors successfully have been living in a spaceship however they all figured that Mars is good enough to be considered as an Earthly home to them now. All decided to experiment first on going onto Mars for 3 days and see if it's truly possible and successful to live on Mars forever.

Rising Action: The 4 prepare space gear and equipment to get ready for the 3 days. They get into spacesuits and are aware Mars' surface is severely freezing. They land on Mars and unpack everything. Spending the rest of the day setting things up. They packed 30kg of food that'll last them surely for the remaining days. After building, they rest the night away. 2nd day on Mars, their energy is down for the morning but shoots up at noon. Their energy is a rollercoaster of ups and downs, it's hard to adjust to the gravity and environment. The oxygen is very thin and filled with carbon dioxide therefore they all brought a bunch of their own oxygen and kept their spacesuits on the whole 2nd day.

Climax: However, on the 3rd day, their energy was worn out, too much carbon dioxide was exposed and living on Mars forever will not be successful. Everyone hurries to pack up before it's too late before their organs rupture.

Falling Action: They get back onto the spaceship with everything and decide to stay on the spaceship, sadly. They take a trip back near where Earth is. Earth used to be gray and blown up, but when they arrived after 2 years, Earth was starting to grow a few little green areas and blue areas.

Resolution/End: They decide to check out Earth and see if it's okay to live on Earth again. They successfully landed on Earth and the planet seemed to be healing and continuing to heal. All decide to live on Earth forever again like before.

DO NOT READ before Story

Planning

SPOILERS

Exposition

- Starts off with them flying to mars
- 7 month "flight"
- couple goals

#cutiepies

Rising Action

- Their relationship starts to grow
- They start to feel at home on mars

#futurehome

Climax

- They realize the oxygen system is failing
- They start calling Earth trying to get back

#losingmybreathe

falling Action

- max dies
- Alex gets back to earth

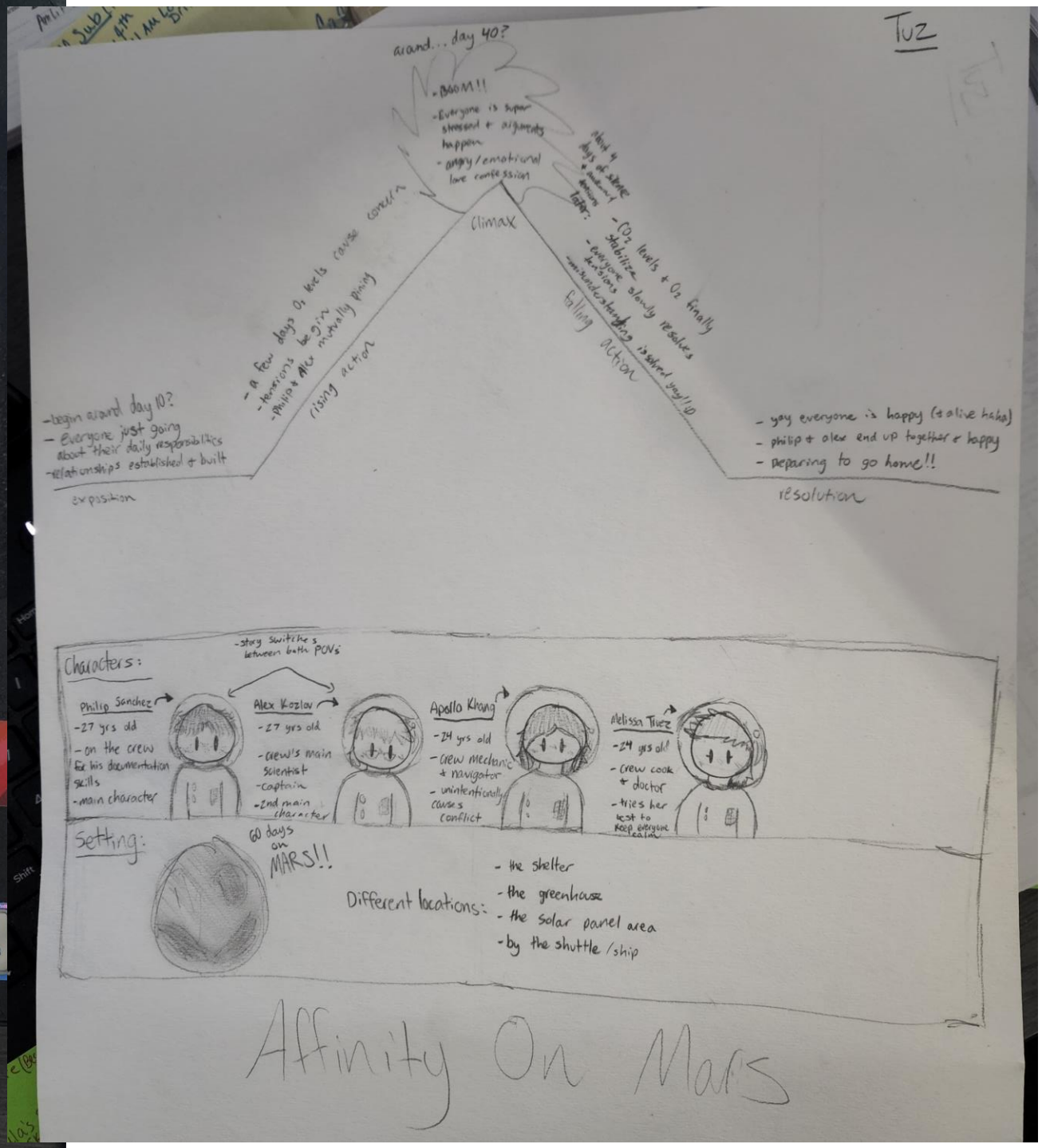
#BREAKINGMY HEART

Resolution

- Alex learns to live, even though they haven't found someone since Max's death but they're atleast content

#The End

- Rory + Ally



Elaborate

Students composed short stories using the information gathered while running their SIMOC simulations.

Here are some teasers!

Home

It has been two years since an asteroid hit parts of Earth, presently it is 2048. There were four survivors living on a spaceship for the remainder of time. Rema, Laurie, Jo, and Kam. Rema and Jo were both girls while Laurie and Kam were boys. The four were complete strangers before the asteroid hit, all in their mid 20s. The oldest to youngest list was Jo, Laurie, Kam, and Rema.

Jo is a 26-year-old woman who had worked as a science teacher at a school in Washington D.C. She taught highschoolers for five years and enjoyed her work. Every student liked her because she was considered as the 'fun' and 'cool' teacher at the school. She won the award of 'Teacher of The Year' three times in a row recently. During the spring semester of the school year, 2046 was the time of the asteroid hitting most of Asia, Africa, Pacific Ocean, Atlantic Ocean, half of Europe and parts of North and South America. The asteroid created shock waves that traveled 748 mph across Earth. The asteroid first hit Asia and traveled around the globe of Earth. Hours before the hit, Jo was taking her students on a NASA headquarters field trip. Their host was Kam who was best friends with Laurie, an astronaut.

25-year-old Kam was always following Laurie, his best friend who was a few months older than Kam. Kam looked up to Laurie because they had been friends since 3rd grade. Laurie befriended him and they've been glued to each other's sides forever since then. Kam liked talking and showing off his works of art or his projects. Laurie and he would do presentations together and Kam would always be the one talking. Laurie had always been interested in space, astronauts, stars, and spaceships. Both decided to work together at NASA as a goal and eventually they did. Kam was a visitor center staff member who was a host regularly for field

First Earth People To Live On Mars

The journey through space to reach Mars began on December 28th, 2033. Four people were sent on a mission to experiment life on Mars. This mission would last two years total; the four people selected for this mission returned December 28th, 2035, as the first people who lived on Mars. The selection for who would take on this mission was offered to all, no matter how your life on Earth was. The selection was a long and complicated process, but in the end the four people selected were: Rydel Clayton, a 27 year old famous band member, Ezra Lynch a 29 year old astronaut who works with NASA, Levi Held, who is 22 and a normal civilian trying to live life, and Vince Gajda a very sophisticated and observant 27 year old who is a smart workaholic. The day of departure from Earth to Mars had come. Departure day was chaotic but by the end of the day everything went according to plan. After the launch, once they were safely in space Ezra checked for any possible damage to the ship. Everything was in order and working

“Ready Lola?”

I leaned over and began the new video log.

“Video log Day 1825, and only one more day until my eighteenth birthday. Today I plan on making some final finishing touches or whatever I need done by tomorrow for STELLA.”

Lola and I have been working on STELLA since I was 15. My Mom came up with this name due to her love for stars. STELLA was the spacecraft that my Dad has worked on for countless years after we moved here. I was able to learn how to take care of the green house thanks to my Mom’s videologs. They are the only thing I have left of my family and are the only reason I have been able to survive out here. STELLA is still a work in progress. Unfortunately I was never good at the engineering side of things. My mother and I left that to my dad in hope that one day he would be able to get it up and running one day. We both continue our everyday lives, we wake up, we work then sleep. Luckily, Lola has been a great help and believes that the spacecraft will be able

The death of a Martian

When Drake Thomson was twenty, he had no purpose in life, no family to rely on, no friends to talk to, and no money to get by. Drake was kicked out of the house by his parents when he turned eighteen; he had told his parents that college was not for him and was disowned within seconds. From that point forward Drake wandered the concrete jungle for years, stumbling on hard asphalt in torn shoes and tattered clothes, daydreaming for hours at a time about his former life as a shut-in.

Drake imagined himself at home in his room, sitting at his desk, staying up late at night gaming with strangers online, bragging about how much money he had, and the expensive gaming equipment he had bought: his computer, monitor, headphones, and chair all totaled up to nearly one hundred grand of gaming equipment. However, Drake never had money, his parents did; they made the mistake of spoiling him and his younger sister because they were deluded into thinking that both of their children were prodigies and were determined to convince Drake to reveal his latent intellectual abilities. Drake's sister, Lisa, had diligently studied art and sold several hundred thousand Dollars worth of photorealistic, surrealist Pantings; at the age of thirteen she was renowned for her artistic talent. Drake was seventeen years old and completely average in every sense of the word. In pursuit of the lascivious gifts that his parents bought Lisa, Drake fueled his parent's delusions, and convinced them that he had a grasp of mathematics unlike any man had ever obtained. But His grades were poor, and he was constantly doubted,

"You're so great at mathematics, why are you failing your geometry tests? "

"Because they're trivial so I don't try. If I really wanted to, I could ace them in an instant."

"Ok son, but could you at least try a little bit harder? Just shoot for passing and move on."

March 3rd, 2047

Takeoff was one of the scariest moments of my life, but the rest of the trip was something I'll never forget. Within those seven months Alex and I grew closer than ever before. It wasn't like I didn't love them before; this was just different. Just us for seven months. Today was like nothing I'd ever experienced. I'm on a whole different planet. I never thought this was something I'd ever get to do. Not only that, I'm here with my favorite person. I'm still taking it all in.

March 4th, 2047

I'm still getting used to the way things are here. When I told Alex I wanted to go to mars I never thought they would take it seriously, but I guess that's what happens when your daddy's a billionaire. Not that I would know considering the fact that I'm literally broke,

Affinity on Mars

"Crazy we've been here for only a week or so, huh?"

Philp nods in agreement towards Alex's comment, leaning against the wall of the greenhouse, and chuckles softly.

"Yeah, seems like longer. I haven't quite gotten used to the routines here even after ten days," Philip says, smiling lightly, "Living on Mars isn't what I expected... Particularly being here with you, Melissa, and Apollo."

Alex stands up from his crouching position from beside the planting beds and makes his way over to Philip, nudging him in the shoulder.

"Aw really? You dislike us that much?" he says, snickering.

Philip snorts and softly shoves him back. "Of course not, you goof. I'm lucky to have this experience with people I at least know a little bit, rather than complete strangers. Then this would be a whole lot more stressful."

"You've got that right... Especially with our current circumstances," Alex agrees, lightly clapping Philip's shoulder, "C'mon. Let's go join the other two back in the crew quarters."

Smiling lightly, Philip nods and follows Alex back through the hallway connecting the main hub and their greenhouses. While he does enjoy being here with the others, the nagging knowledge of their 'current circumstances' itches his thoughts, distracting him. Since the first day, the carbon dioxide levels went slightly above the ideal levels, causing some concern in the crew members. The levels are not dangerously high, so they haven't been affected greatly, but Philip worries this might change soon.

Shaking the feeling off, he catches up to Alex, who has joined Melissa and Apollo in the main hub. The girls smile when he reaches them, and Apollo gives a small wave. On their crew, everyone had been selected based on their skills to fill critical roles needed to live on Mars. With only four of them, it

The Case of Roger White

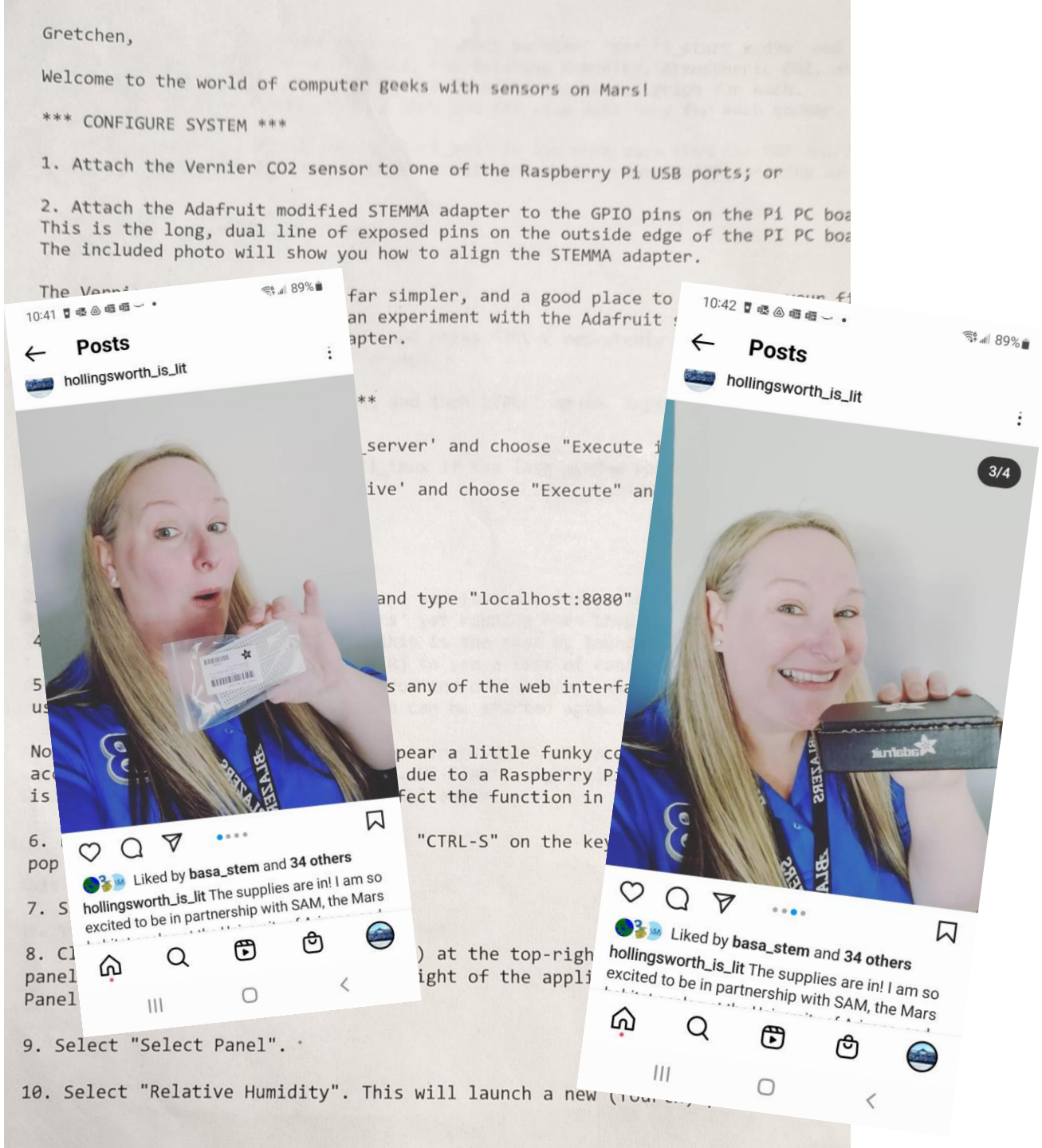
Salutations everyone, My name is Dr.Dinkleberg. I am here to inform and present the situation of a now lost astronaut known as Roger White. As some of you may know, approximately 2 months ago, Mr. White had reached the planet Mars in a 3 person expedition after 7 months of traveling. Unfortunately, after an estimated 13 days into the mission, we lost contact with Mr. White. Luckily, data logs were still available, and were recovered after 49 days into the mission; the 49th day was the final day that was accessible so no more data logs were sent from Mr. White after this day. We do not presume him dead; however, the habitat that Mr. White stayed in, still is detecting an organism.

Log 1: Beginning (Message received 6/12/2039 at 3:32:43 PM EST)

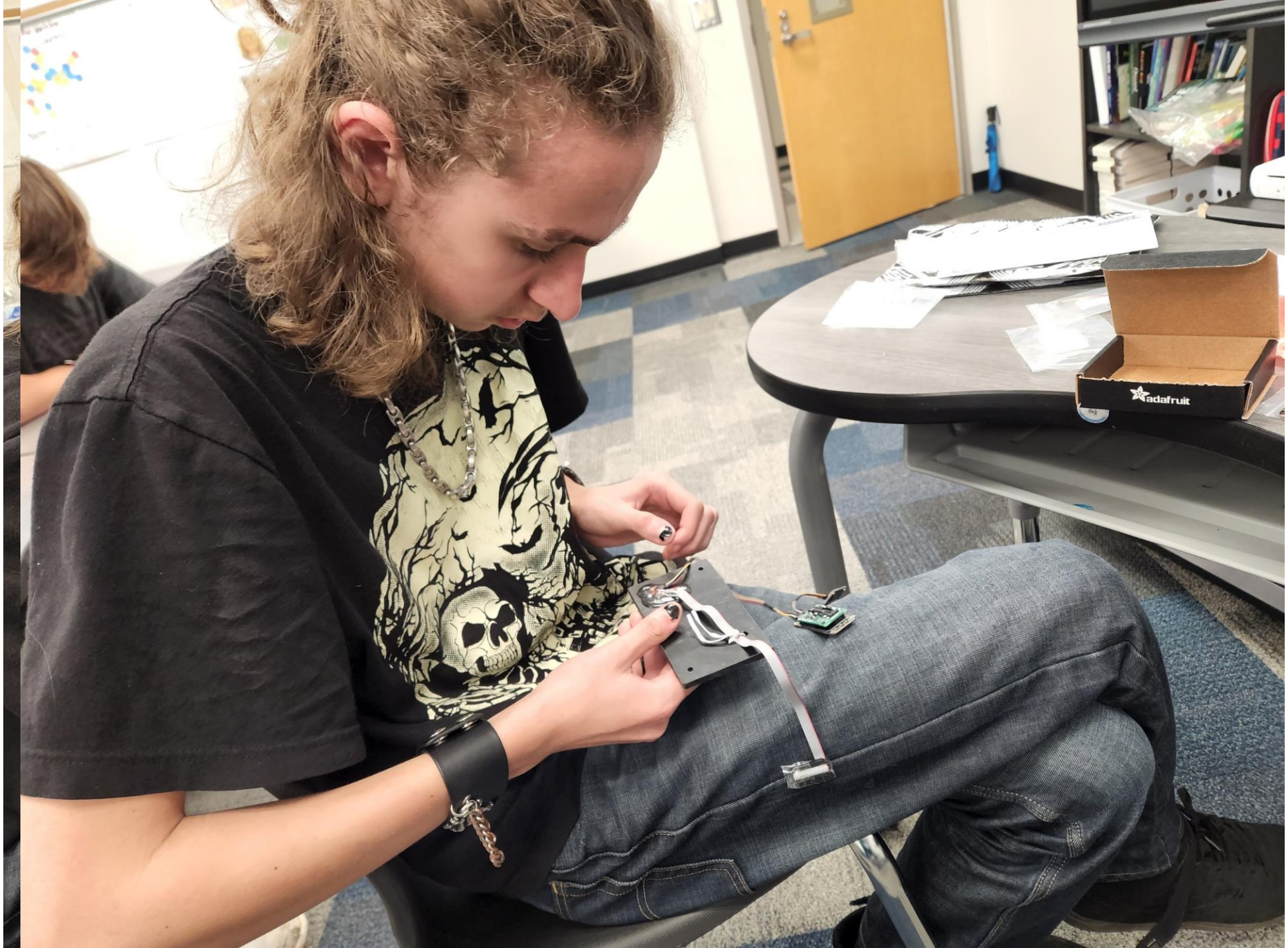
Earth has been the only place I've known, but that may soon change. My husband, Jesse, has been mentally preparing me for this moment since the idea of traveling to Mars was brought up by professionals at NASA. Jesse is the most caring person I have ever met. He'd put everything on hold for my dreams, and that is something I can never repay him for. So, it was no surprise that he was calm when the news came out from NASA that I was heading to Mars. While Jesse was suppressing the sadness he felt when the news was released that I was going on one of the most remarkable but dangerous missions of NASA, he still kept a smile on his face for me. At least Jesse still

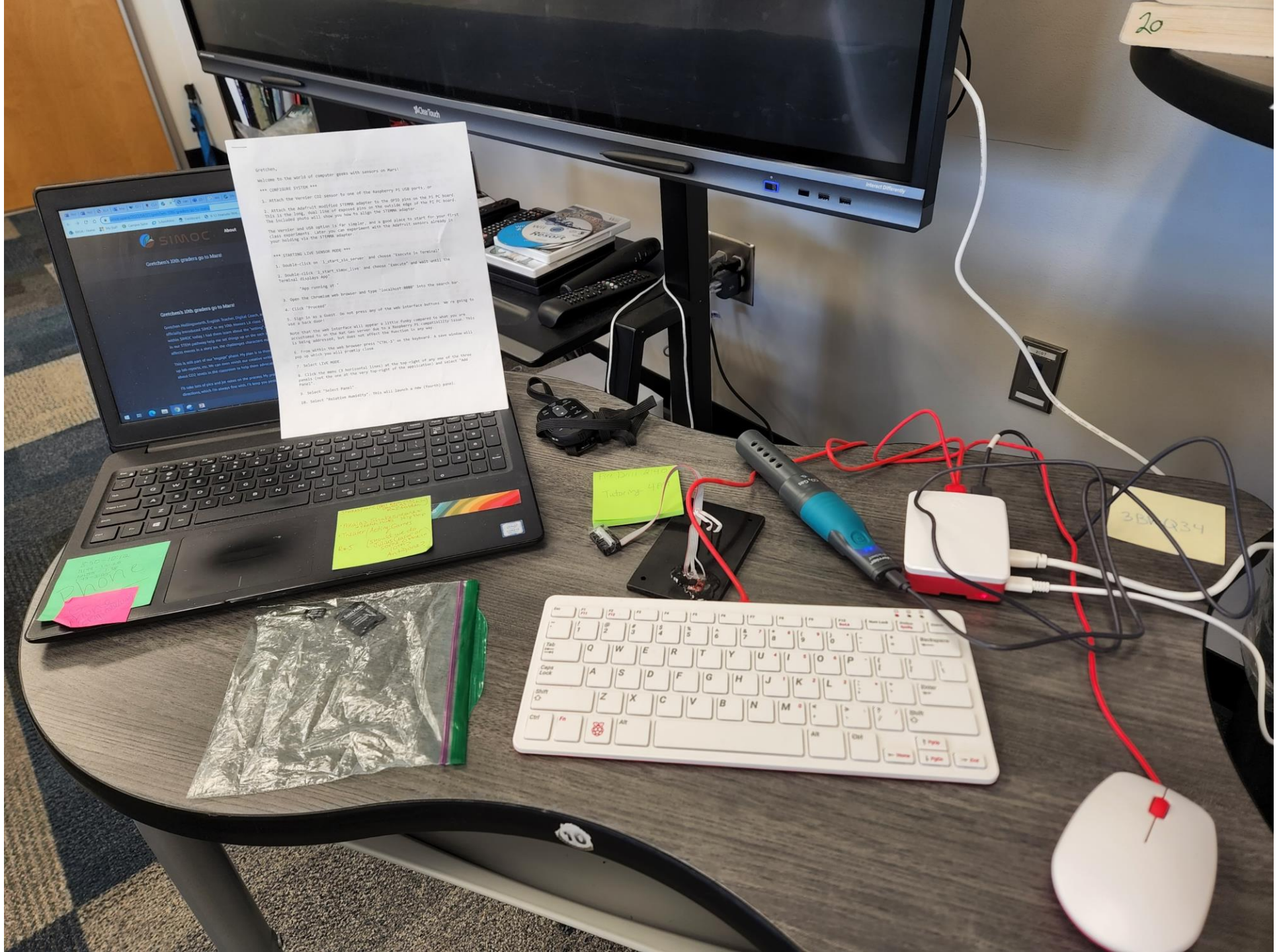
Explore

After exploring SIMOC and Mars from a literary standpoint, we were ready to conduct some classroom experiments and engage in scientific writing. We received a variety of sensors and an Adafruit modified STEMMA adapter from the ASU Computer Science Capstone Team, and we went right to work getting hooked up and exploring the air quality in our classroom. When we ran into issues getting the sensors to work with our Raspberry Pi, Greg worked with us to get things running smoothly. We were ready to start experimenting!

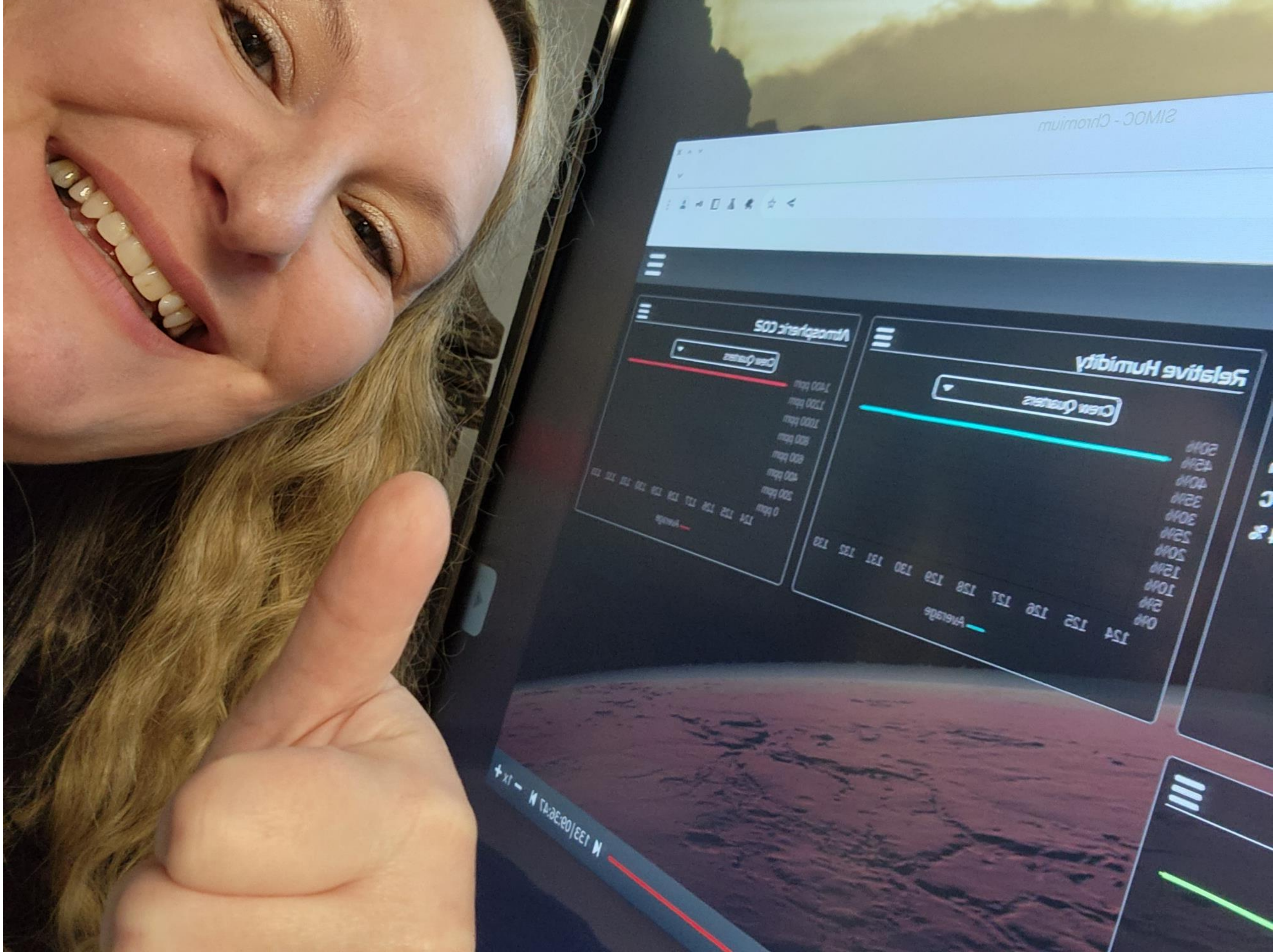


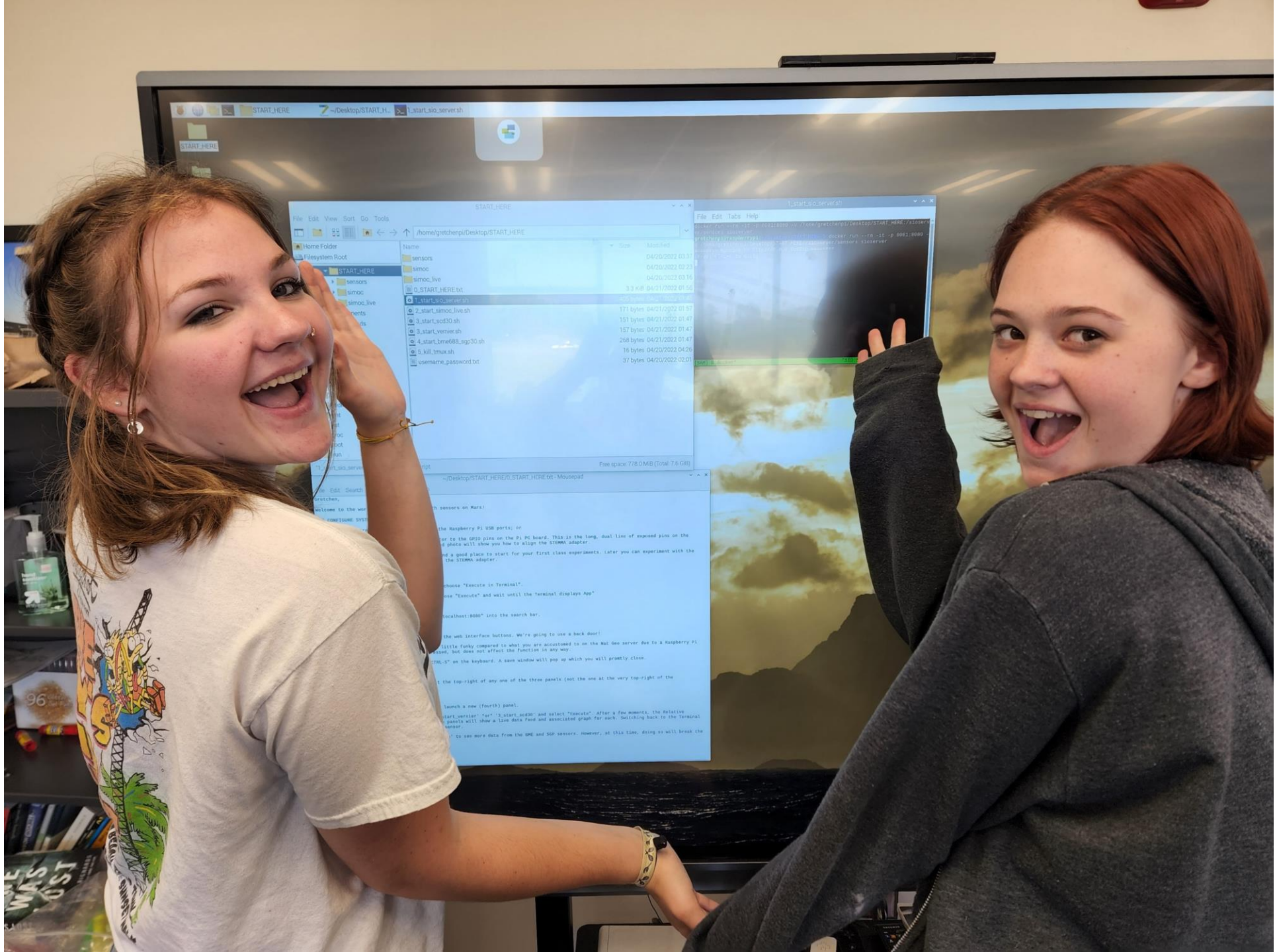

Instaclass
EMERGENCY
DELL


adafruit


Gretchen,
Welcome to the world of computer geeks with sensors on Mars!
*** CONFIGURE SYSTEM ***
1. Attach the Vernier CO2 sensor to one of the Raspberry Pi USB ports, or
2. Attach the Adafruit modified STEMMA adapter to the GPIO pins on the Pi PC board.
This is the long, dual line of exposed pins on the outside edge of the Pi PC board.
The included photo will show you how to align the STEMMA adapter.
The Vernier and USB option is far simpler, and a good place to start for your first
Class experiments. Later you can experiment with the Adafruit sensors already in
your holding via the STEMMA adapter.
*** STARTING LIVE SENSOR MODE ***
1. Double-click on `1_start_sio_server` and choose "Execute in Terminal"
2. Double-click `2_start_simoc_live` and choose "Execute" and wait until the
Terminal displays `App`
`App running at `
3. Open the Chromium web browser and Type `localhost:8080` into the search bar.
4. Click "Proceed"
5. Sign in as a Guest. Do not press any of the web interface buttons! We're going to
use a back door!
Note that the web interface will appear a little funky compared to what you are
accustomed to on the Mac Geo server due to a Raspberry Pi compatibility issue. This
is being addressed, but does not affect the function in any way.
6. From within the web browser press "CTRL-I" on the keyboard. A save window will
pop up which you will promtly close.
7. Select LIVE MODE
8. Click the menu (3 horizontal lines) at the top-right of any one of the three
panels (not the one at the very top-right of the application) and select "Add
Panel"
9. Select "Select Panel"
10. Select "Relative Humidity". This will launch a new (fourth) panel.
SIMOC
About
Gretchen's 10th graders go to Mars!
Gretchen's 10th graders go to Mars!
20
10


SIMOC
Sensors
Temperature
Relative Humidity
Atmospheric CO2
Temperature
ClearTouch


SIMOC - Chromium
Atmospheric CO2
Crew Quarters
Relative Humidity
Crew Quarters
Average


START_HERE
~/Desktop/START_H...
1_start_sio_server.sh
File Edit View Sort Go Tools
/home/gretchenpi/Desktop/START_HERE
Home Folder
Filesystem Root
sensors
simoc
simoc_live
0_START_HERE.txt
1_start_sio_server.sh
2_start_simoc_live.sh
3_start_scd30.sh
3_start_vernier.sh
4_start_bme688_sgp30.sh
5_kill_tmux.sh
username_password.txt
Free space: 778.0 MiB (Total: 7.6 GiB)
~/Desktop/START_HERE/0_START_HERE.txt - Mousepad
File Edit Tabs Help

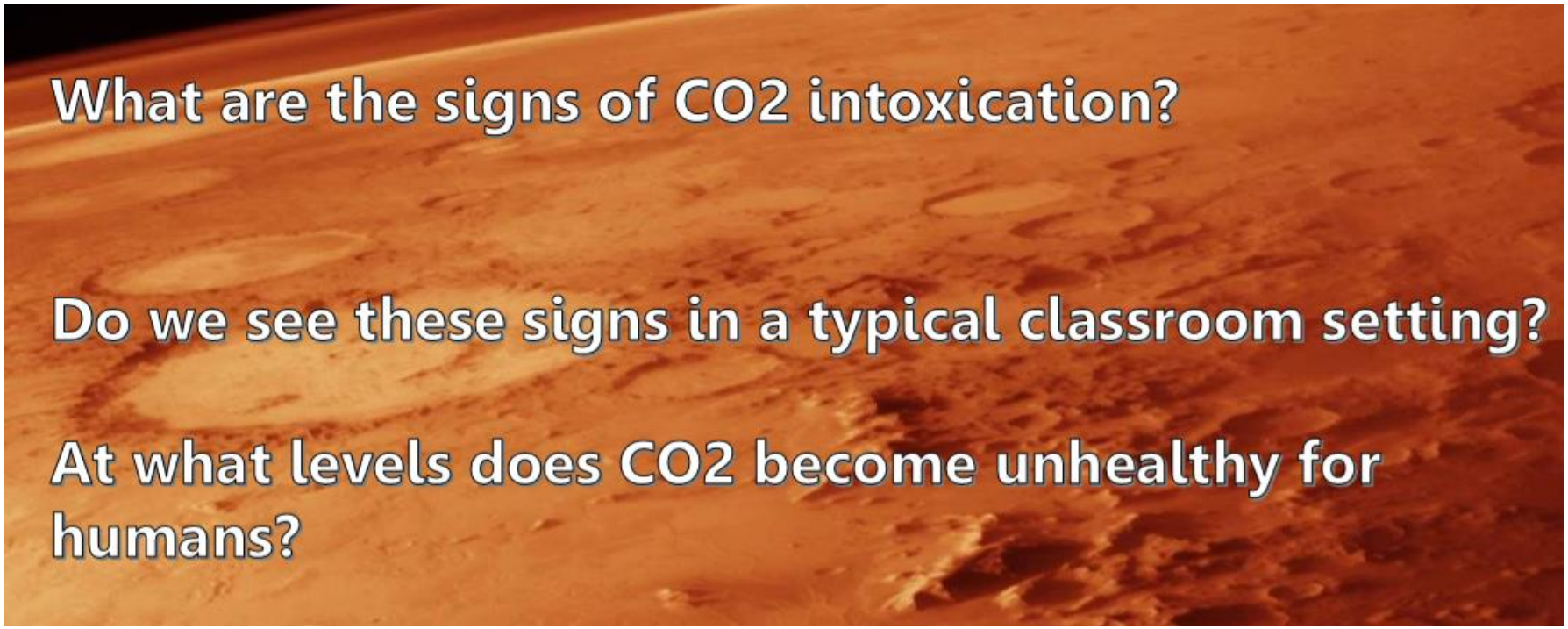
Students played around with the sensors and watched the CO2 levels increase as they blew on the sensor.


SIMOC


SIMOC
SIMOC

Explore/Explain

Students asked questions and researched the effects of CO2 on human health to help them elaborate on that question.



Elaborate

In order to expand on their learning, students designed an experiment that would use the Adafruit sensors and SIMOC to compare the levels of CO2 in a "mini Mars habitat" to the levels in the classroom .

Building the mini Mars habitat to use in our trials

Getting ready to start conducting trials!

Mars Mini Habitat Experiment

Question: What is the rate of change in CO2 levels in our mini-Mars habitat in comparison to the rate of change in CO2 levels in our classroom, and how can we use that information to colonize Mars?

Research Summary:

- Missions observing CO2 that exist: Atmospheric Infared Sounder (AIRS), Orbiting Carbon Observatory (OCO-2), and Orbiting Carbon Observatory (OCO-3)
- Released through human activities such as deforestation and burning fossil fuels, as well as natural processes such as respiration and volcanic eruptions
- A person's reaction to chemicals depends on several things, including individual health, heredity, previous exposure to chemicals including medicines, and personal habits such as smoking or drinking. It's also important to consider the length of exposure to the chemical, the amount of chemical exposure, and whether the chemical was inhaled, touched, or eaten.
- Exposure to CO2 can produce a variety of health effects. These may include headaches, dizziness, restlessness, tingling or pins or needles feeling, difficulty breathing, sweating, tiredness, increased heart rate, elevated blood pressure, coma, asphyxia, and convulsions.

Research Summary:

- Exposure to CO2 can produce a variety of health effects. These may include headaches, dizziness, restlessness, tingling or pins or needles feeling, difficulty breathing, sweating, tiredness, increased heart rate, elevated blood pressure, coma, asphyxia, and convulsions.
- The levels of CO2 in the air and potential health problems are: 400 ppm: average outdoor air level. 400–1,000 ppm: typical level found in occupied spaces with good air exchange. 1,000–2,000 ppm: level associated with complaints of drowsiness and poor air.
- Toxic levels of CO2 would be 40,000 ppm. This happens when levels above 5,000 ppm are continuously circulating or being produced in the air for several hours
- The average human exhales about 2.3 pounds of carbon dioxide on an average day. The exact quantity depends on your activity level—a person engaged in vigorous exercise produces up to eight times as much CO_2
- High CO2 levels are over 1,000 ppm which can indicate a problem with air circulation and fresh air
- 1,000-2,000 ppm level is associated with drowsiness and poor air
- 2,000-5,000 ppm level is associated with headaches, sleepiness, and stagnant, stale, and stuffy air
- C02 is a chemical compound which has a density of about 53% higher than oxygen.
- C02 can be removed by enhancing the storage capabilities for it in a given ecosystem, or by creating more natural carbon absorbers (such as planting trees).
- CO2 is a waste biproduct from breathing. Without it we wouldn't be able to breathe, and you only have to worry when it is highly concentrated.
- An excess amount of CO2 wouldn't only negatively affect humans, but also the environment. Carbon dioxide traps radiation at the ground level, which can prevent the area from staying at a cool temperature.

Hypothesis: If 2 students spend an hour in the mini-Mars habitat, then the CO2 levels will be higher than the levels in the regular classroom with the rest of the class because the levels of CO2 will be more concentrated in a smaller enclosed space rather than a wider open space.

Independent Variable: People in the classroom or mini habitat
Dependent Variable: The levels of CO2
Controls: Same habitat used, same classroom, CO2 levels checked every 15 minutes for a total of 60 minutes

Procedure:

1. Baseline data recorded inside the habitat and in the classroom.
2. Two humans put inside the mini habitat
3. Data recorded every 15 minutes measuring temperature, relative humidity, CO2, hydrogen, ethanol, eCO2, and VOC
4. The same process of measuring was also happening in the classroom simultaneously
5. 3 trials were conducted and averages were calculated.

Emerging from the habitat after their 1 hour trial!

Even after we conducted our 3 official trials, several groups still wanted to take a turn spending time in the habitat.

Using the sensors and SIMOC, students were able to collect data to test their hypothesis.

Students gathered data from the 3 trials and recorded the results. Their focus was CO2, but since they had access to the other data using SIMOC and the sensors, they recorded it as well.

Data Table for Mini Mars Habitat Test 1 (2 humans)

	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	25.09 C	58.19%	607.44 ppm	1.80 ppm	165.84 ppm	400.00 ppm	171 ppb
15 minutes	26.97	59.06	2611.07	5.16	182.50	400	201
30 minutes	27.38	59.07	2706.94	5.00	143.53	400	123.00
45 minutes	27.55	59.76	3018.46	4.90	125.92	400	71.00
60 minutes	27.86	59.77	3648.44	4.93	112.66	400	41.00

Said they didn't feel any different until they came out and they realized it was much cooler in the classroom.

Data Table for Mini Mars Habitat Test 2 (2 humans)

	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	24.23 C	59.67%	448.70 ppm	2.02 ppm	30.74 ppm	400.00 ppm	68.00 ppb
15 minutes	28.34	57.99	2882.49	7.35	80.67	601	514.00
30 minutes	28.67	59.90	3153.63	8.15	90.52	666	573.00
45 minutes	28.21	58.53	2941.21	7.58	79.88	605	509.00
60 minutes	28.48	58.72	5742.89	4.93	69.27	400	427

Didn't realize they felt different until after they came out. A little lightheaded/dizzy and kind of hot. People inside the habitat realized that the classroom was cooler than inside the habitat.

Data Table for Mini Mars Habitat Test 3 (2 humans)

	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	25.21	52.73	968.55	2.33	30.92	400	65.00
15 minutes	28.57	59.32	2968.86	3.88	51.58	400	243.00
30 minutes	29.03	66.71	3311.87	4.75	62.34	400	349.00
45 minutes	28.93	64.05	4062.89	4.71	60.54	400	322.00
60 minutes	28.17	57.37	3860.64	4.88	58.56	425	319.00

Test subjects said legs were asleep, were very thirsty, irritable, tired, and had a headache

Students gathered data from the 3 trials and recorded the results. Their focus was CO2, but since they had access to the other data using SIMOC and the sensors, they recorded it as well.

Data Table for Entire Classroom with Class Present Test 1

	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	22.85 Celsius	56.41 %	254.83 ppm	1.40 ppm	201.22 ppm	400 ppm	134.00 ppb
15 minutes	24.20	55.24	560.34	0.93	13.83	400	0.00
30 minutes	23.97	54.29	640.53	0.93	12.86	400	0.00
45 minutes	24.01	56.26	710.55	1.09	14.27	400	0.00
60 minutes	24.34	53.54	766.00	1.09	14.29	400	0.00

Data Table for Entire Classroom with Class Present Test 2

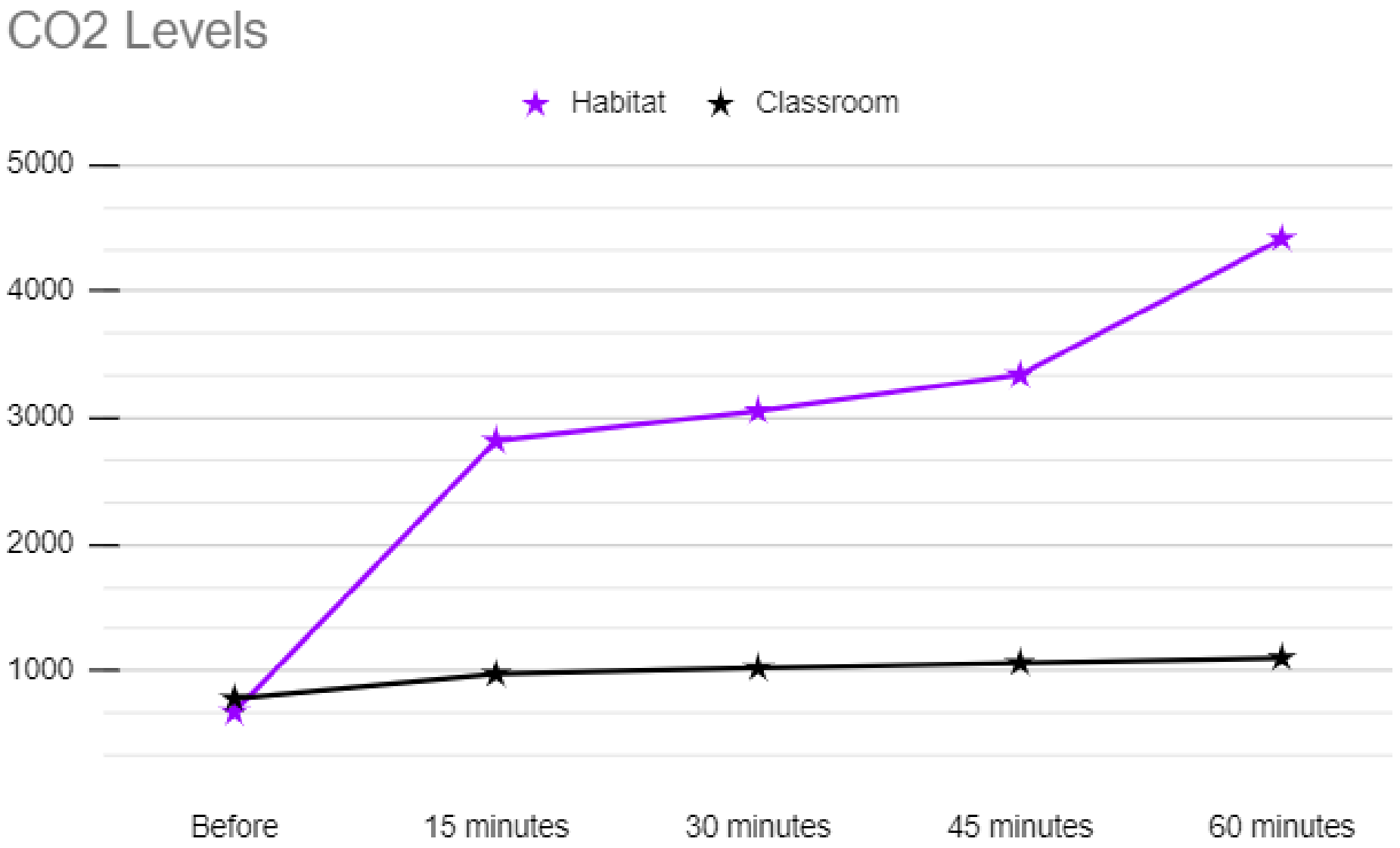
	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	23.59	55.37	835.61	1.31	17.24	400.00	33.00
15 minutes	23.90	54.35	1037.65	1.36	17.65	400.00	60.00
30 minutes	23.81	54.79	1100.91	1.71	28.04	400.00	185.00
45 minutes	23.97	55.45	1143.32	1.72	26.14	400.00	165.00
60 minutes	24.17	55.95	1200.35	1.78	26.04	400.00	168.00

Data Table for Entire Classroom with Class Present Test 3

	Temperature	Relative Humidity	CO2	Hydrogen	Ethanol	eCO2	VOC
Before	23.88	54.21	1257.94	1.79	27.82	400	186.00
15 minutes	23.46	54.17	1330.17	2.00	28.60	400	191.00
30 minutes	23.86	54.37	1335.63	2.01	29.63	400	200.00
45 minutes	24.05	55.01	1340.52	2.02	30.54	400	215.00
60 minutes	25.06	55.20	1347.12	2.02	31.04	400	227.00

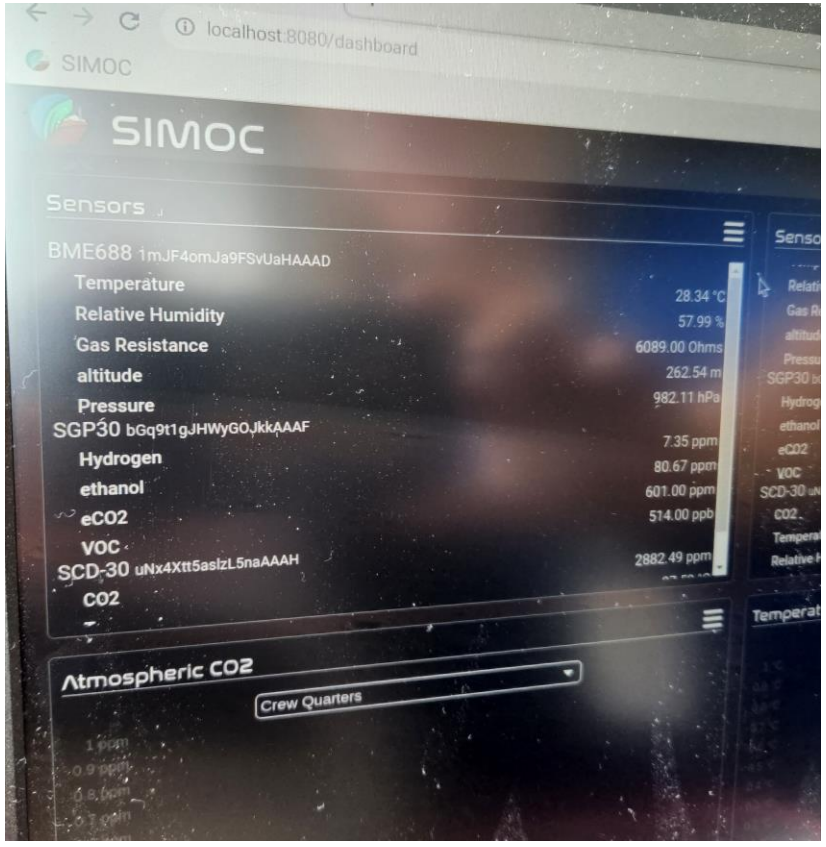
Students calculated the averages and create graphs to display the results.

Based on their results, they drew the conclusion that the data supports their hypothesis. The CO2 levels in the habitat increased at an alarming rate as compared to the levels in the classroom.



What conclusions can be drawn from this data?

- One conclusion that can be drawn from this data is that the longer people are in a confined space the higher the CO2 levels, temperature, relative humidity, hydrogen levels, ethanol levels, and VOC become. Another conclusion is that the CO2 levels will climb faster in smaller spaces than in bigger spaces where it can escape. This means that the size of the area has a larger effect on CO2 levels than the amount of people. If a person or more stays in a tight and contained space for a certain amount of time, they'll start to be dizzy, hot, and/or lightheaded.



Students identified some of the limitations of their experiment.

What were the limitations of this experiment?

The limitations are we didn't have a real mars habitat, we had to make our own that isn't very realistic. We also had different people during each experiment and every human is different so this could have caused a variety of different issues within our experiment. Another way that limitations could have played a factor is that the box could not be completely sealed and could have allowed CO2 to release from the box.

What were the limitations of this experiment?

- Some limitations of this experiment include a small population to sample from, openings in the habitat, and limited materials for building.

Students also considered how the information from their experiment could help with the colonization of Mars.

How can we apply this information to help with the colonization of Mars?

This information can help with the colonization of mars because it gives us valuable information that can be used on tests and mock trials that could possibly one day help us get to mars.

How can we apply this information to help with the colonization of Mars? The amount of co2 that is produced which can be used for the rate of survival if an oxygen production machine went out

How can we apply this information to help with the colonization of Mars?

This experiment shows how much CO2 we can be able to survive with being in a small, confined area and how much CO2 two individual humans make in an hour.

How can we apply this information to help with the colonization of Mars?

- We can apply this information to help with the colonization of Mars because it lets the scientists know how much CO2 is emitted by a specific number of people in a certain confined space. This will help them with how much CO2 and other gas regulation is needed in a given space with a certain number of people in it. This information can help with the design of the mars habitats, and how much space people who live in them will get to have.

Students generated questions that can be explored further.

What questions can we explore, and what are some future experiments we can conduct to help with the colonization of Mars? The amount of plant consumption of co2 compared to the rate of co2 produced

- Some questions that we can explore would be how other species affect CO2 levels such as cats and dogs. We could also make the habitats out of different materials, shapes, and sizes to see how those changes affect the levels of CO2 and other gases. I think it would also be beneficial to try building the habitat in places other than this classroom to see if that has an affect such as the hallway, outside, different buildings, etc. Another thing we could try would be putting objects in the habitat other than just people, like cots or tables. It would be interesting to see if non-living objects taking up space in the habitat would affect gas levels.

- **How much oxygen will a plant produce in the Mars habitat after two people are in there for an hour?**
- **What is the highest amount of CO2 we can be around before we start to feel dizzy and unfocused?**
- **How much CO2 can one person make in a full day?**

Questions that we can explore are what other living organisms are potentially able to live on mars animal's plants etc. Some future experiments we could do, the survivability of animals and plants on mars would be.

Students also reflected on how this type of scientific writing is different than the creative writing they composed during the first part of the project.

Further reflection: How is this type of writing different from the writing you are used to in ELA class?

This type of writing is different because it's less of telling a story and more about the information in facts but still written well. Writing we're used to in ELA is more of telling stories and well written out plots and themes, this writing is mostly facts.

Further reflection: How is this type of writing different from the writing you are used to in ELA class?

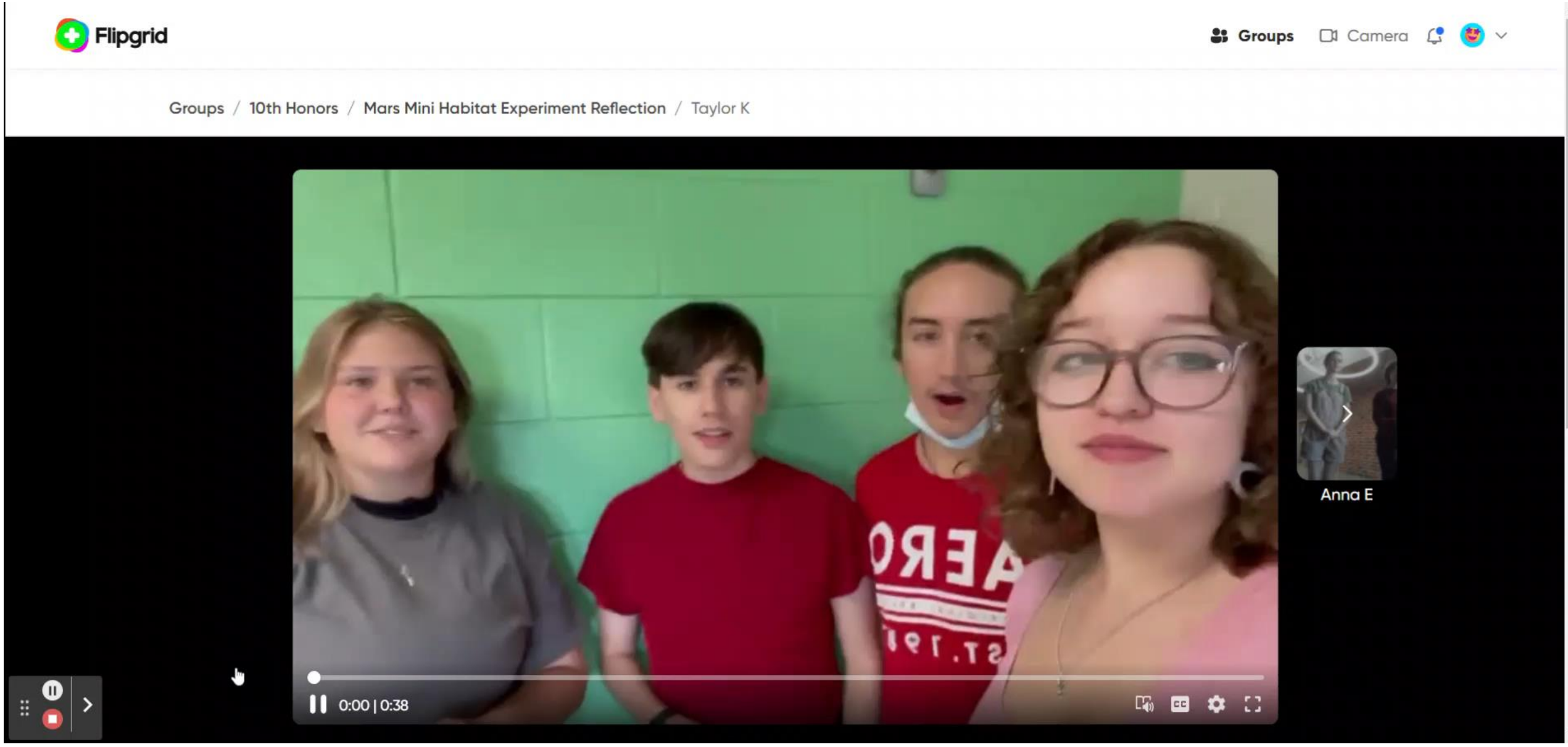
This type of writing is more numbers based, but also strictly data based. Not room for lots of opinions, and it's mostly to deal with the results from the experiment.

Further reflection: How is this type of writing different from the writing you are used to in ELA class?

- In the creative writing assignment, we used our creativity and made up possible situations that can happen from being on Mars for a certain amount of time. In ELA class, we made a story/script however, in this assignment we had actual and accurate tests of being in a secure and small area with test subjects. We concluded the trials with data and information that was put in graphs. This assignment combined both subjects, science and ELA. In both of these different assignments, everyone did some research on Mars and CO_2.

Evaluate

Students reflected on their experience via Flipgrid.



Is Mrs. Hollingsworth boring, or are we CO_2 intoxicated?

Conclusion: It depends on the day!