Storylines

Investigations grounded in students' own questions.

Why did...

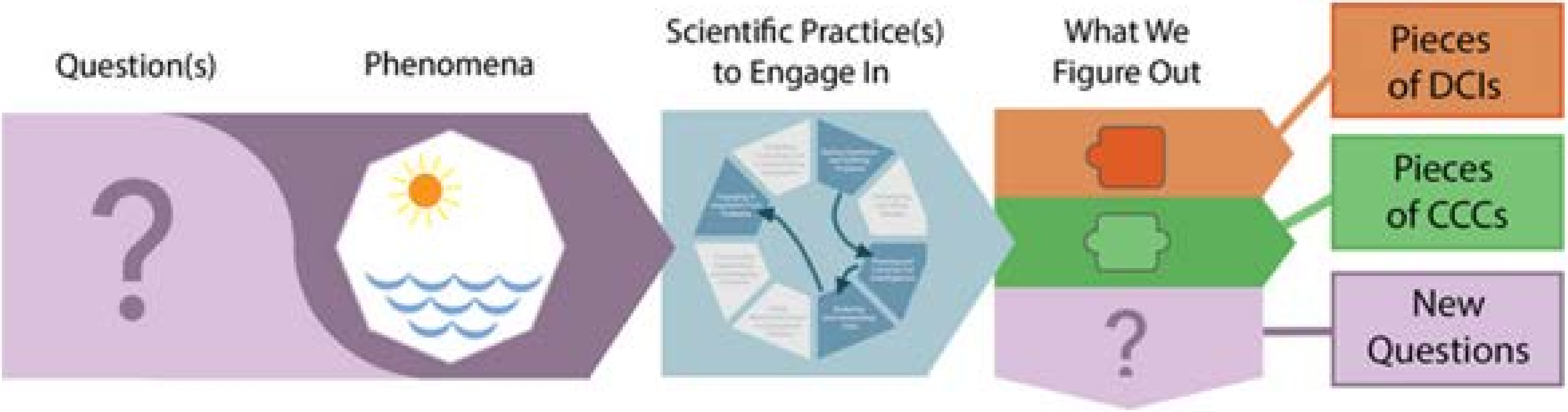
I Wonder...

I noticed...

How often does...

What if...

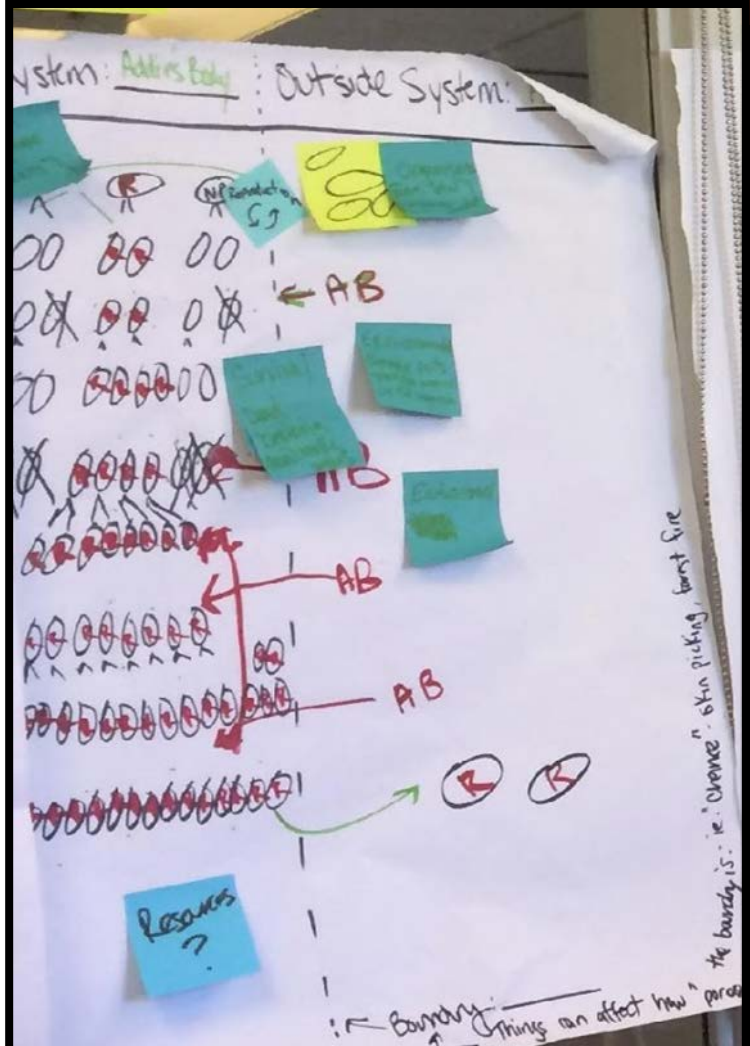
Figuring out answers to questions about phenomena leads to more questions!

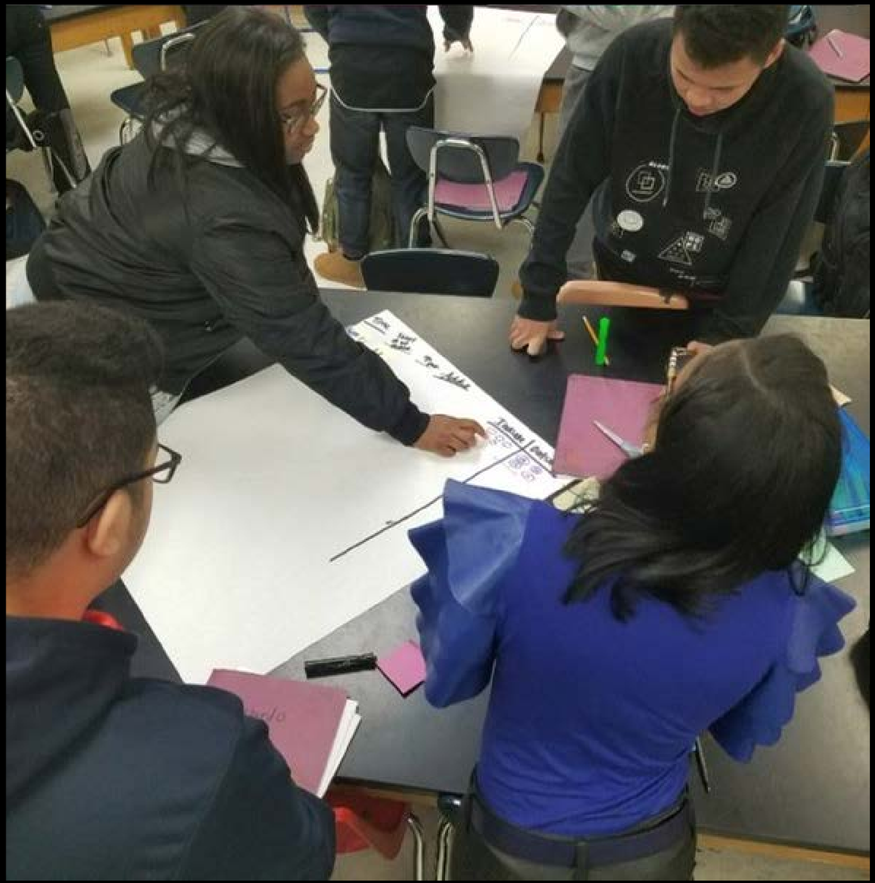


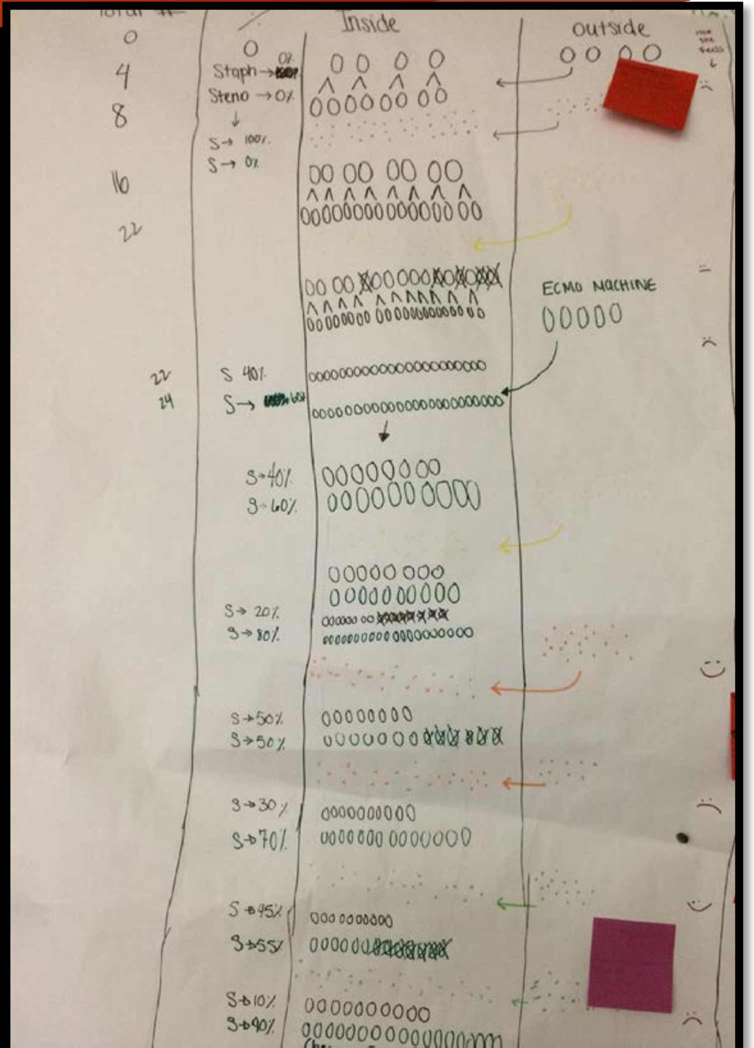
Anchoring Phenomena

Having the END in Mind!

What do you want students to produce?

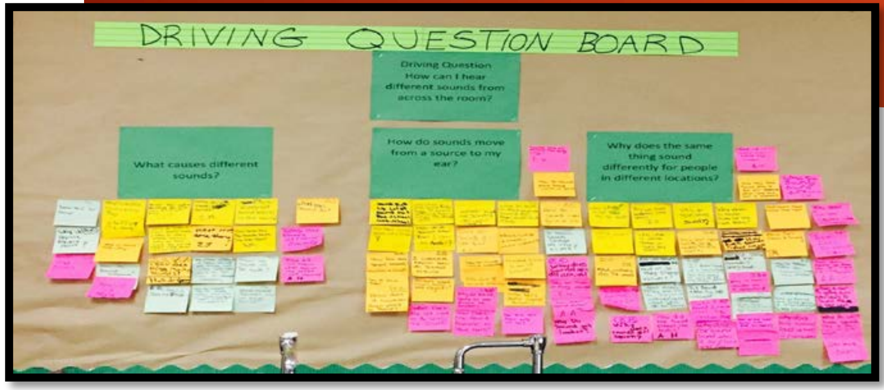


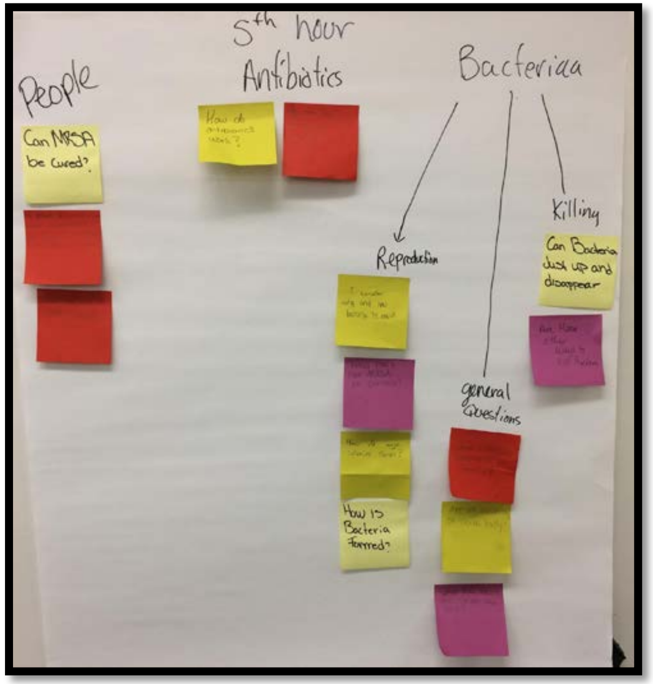


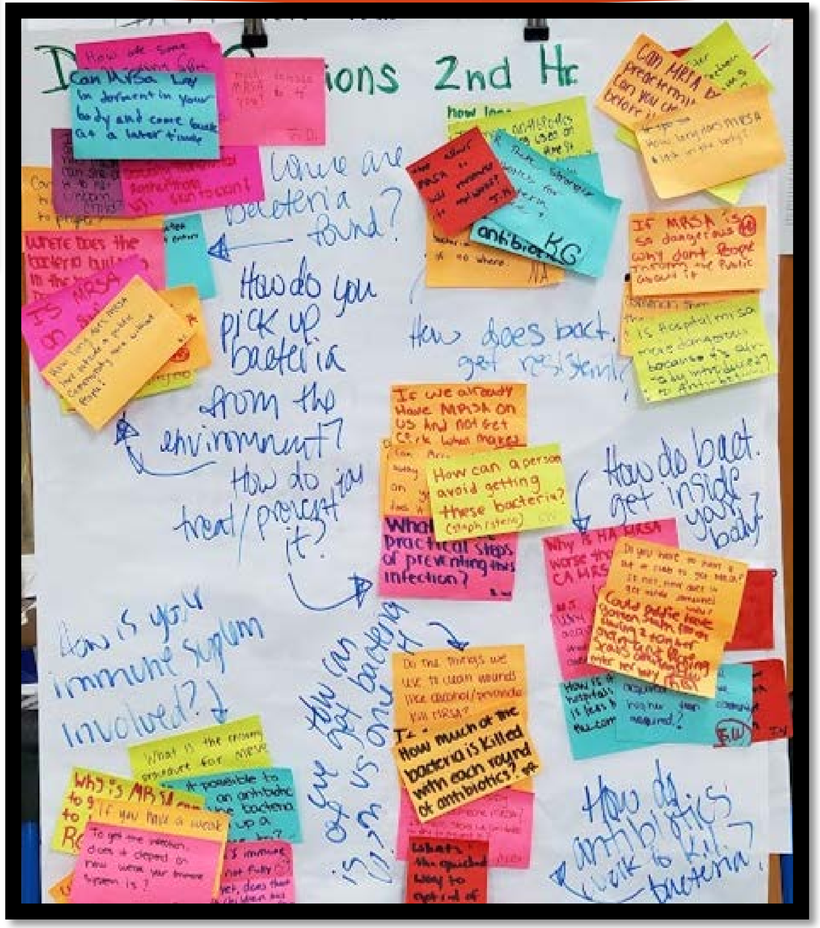


Driving Question Boards

Not about how it looks but how it is used!







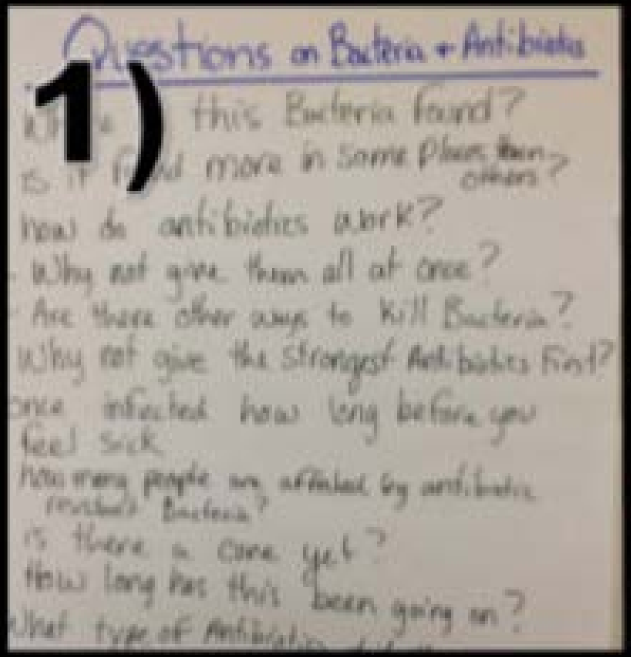
Initial Questions vs. Driving questions

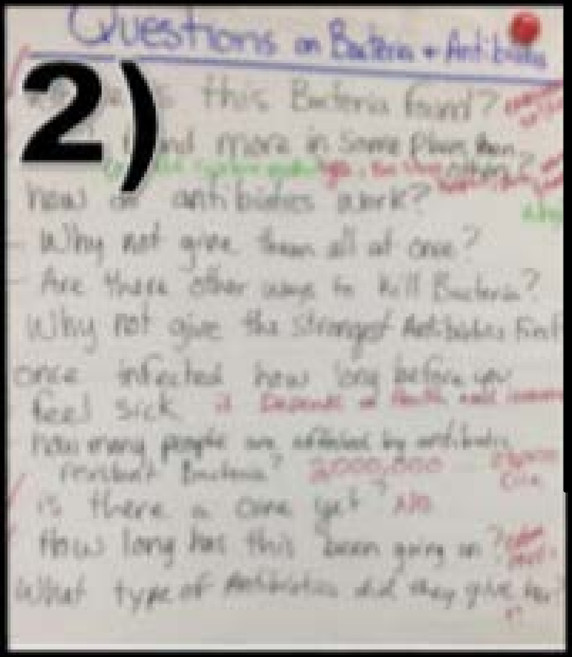
What about parking lots?

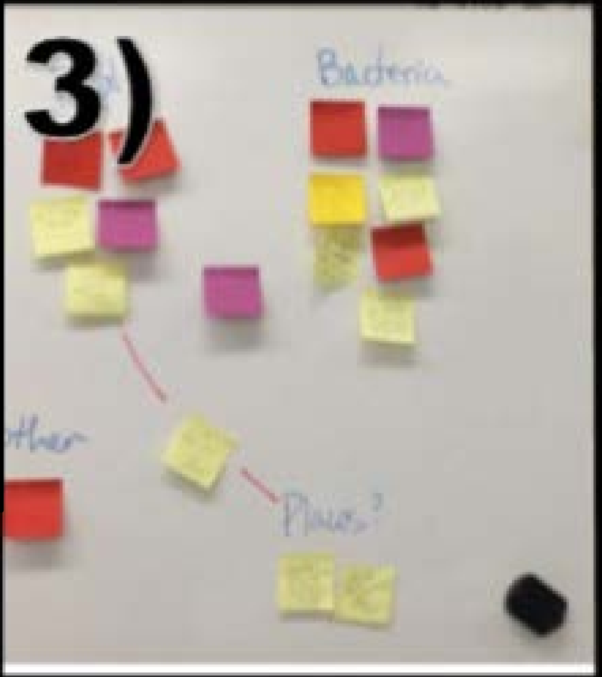
Initial Questions

Frustration →

Driving Questions







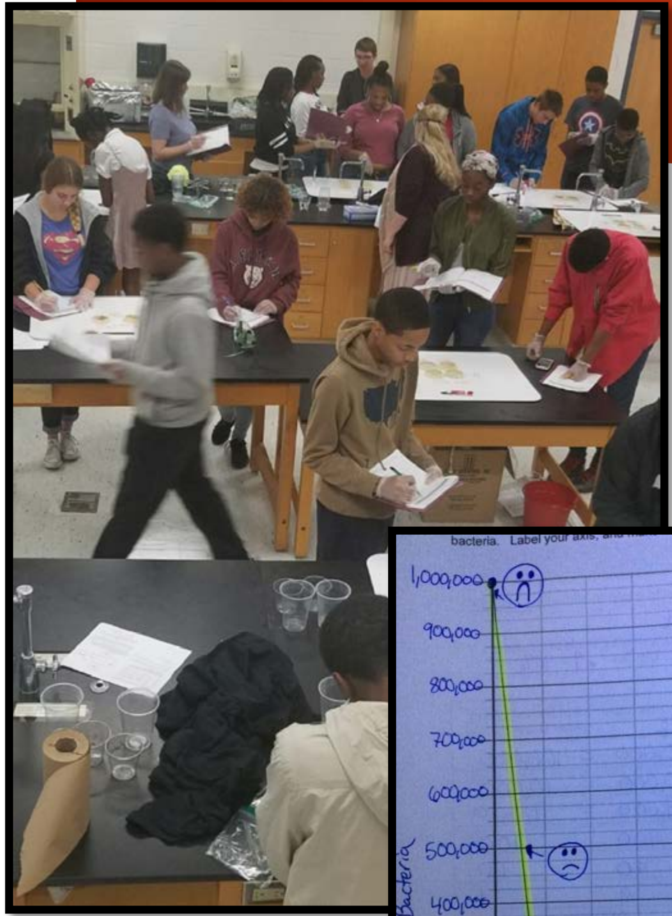
Driving Question Boards

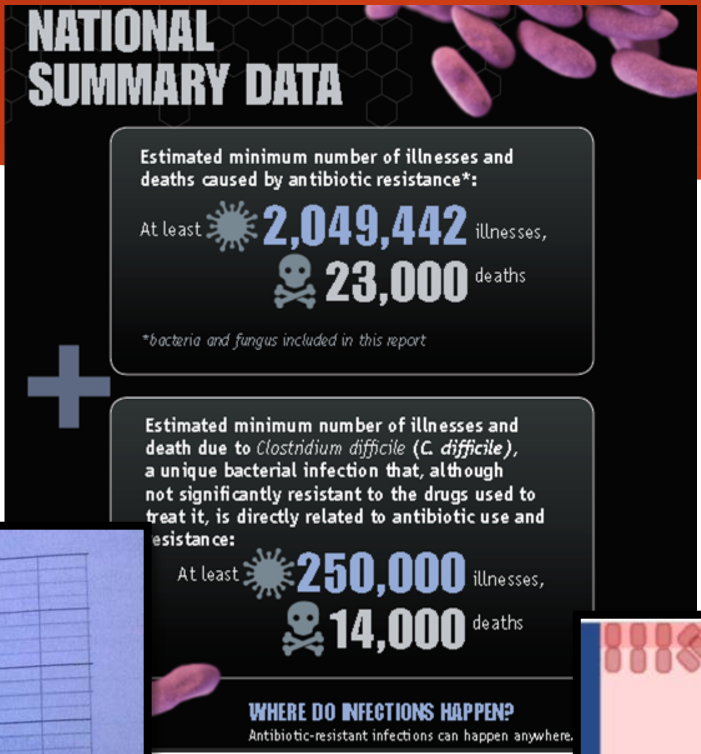
Not about how it looks but how it is used!

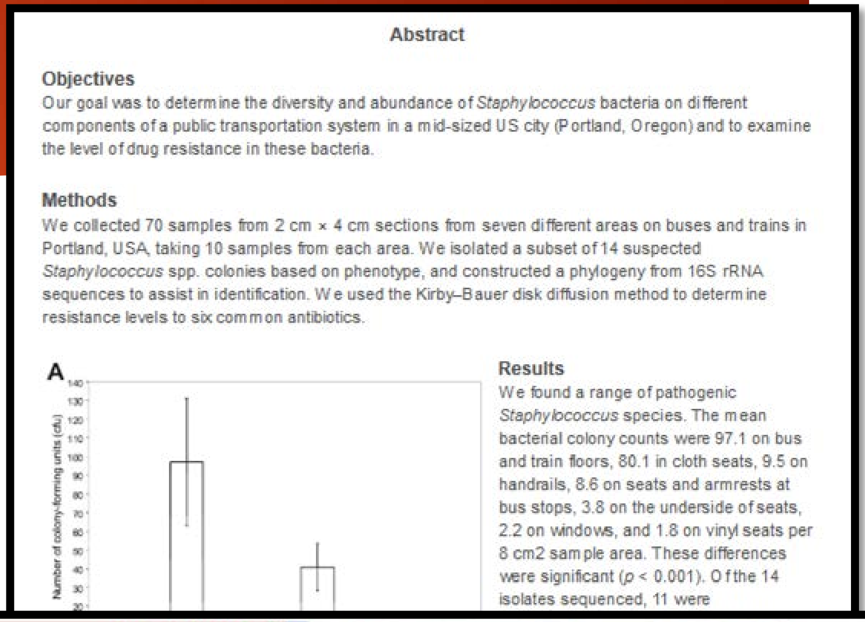
Driving Question Boards

Not about how it looks but how it is used!

Students Figure it out



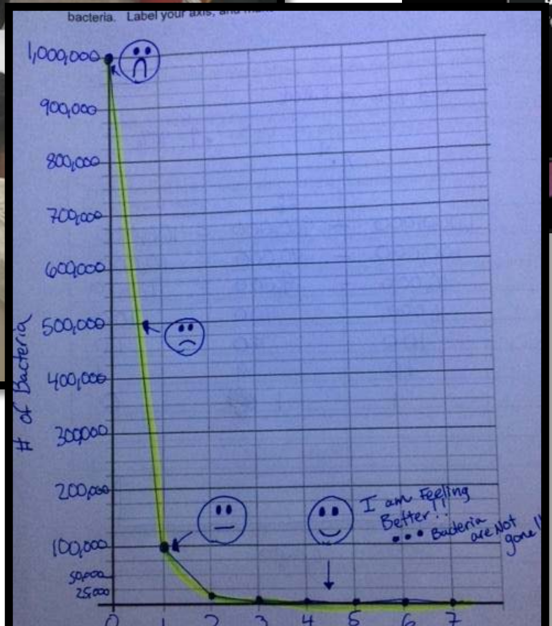


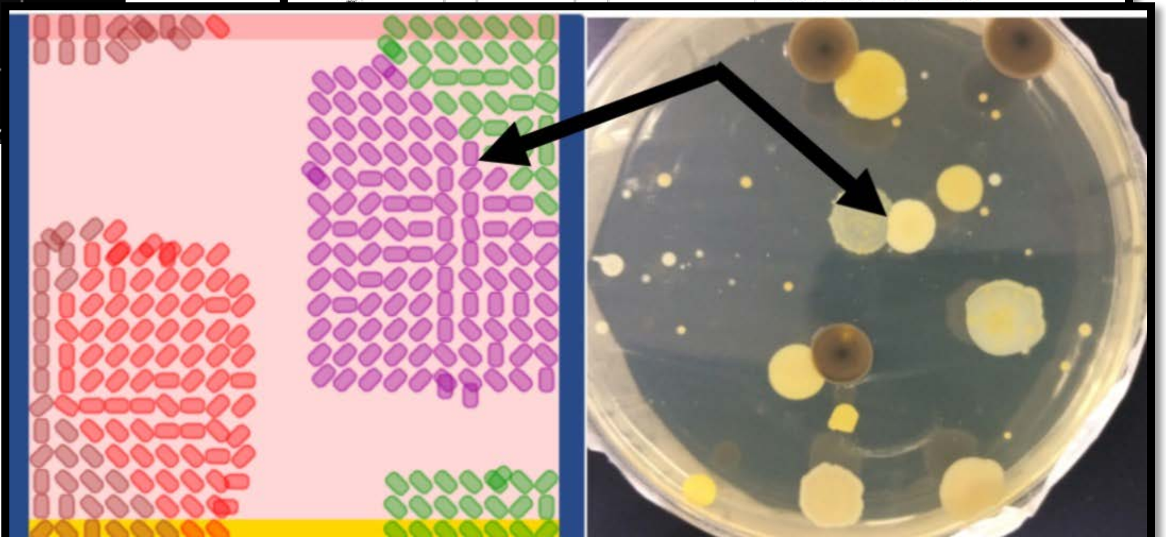

Abstract

Objectives
Our goal was to determine the diversity and abundance of *Staphylococcus* bacteria on different components of a public transportation system in a mid-sized US city (Portland, Oregon) and to examine the level of drug resistance in these bacteria.

Methods
We collected 70 samples from 2 cm × 4 cm sections from seven different areas on buses and trains in Portland, USA, taking 10 samples from each area. We isolated a subset of 14 suspected *Staphylococcus* spp. colonies based on phenotype, and constructed a phylogeny from 16S rRNA sequences to assist in identification. We used the Kirby–Bauer disk diffusion method to determine resistance levels to six common antibiotics.

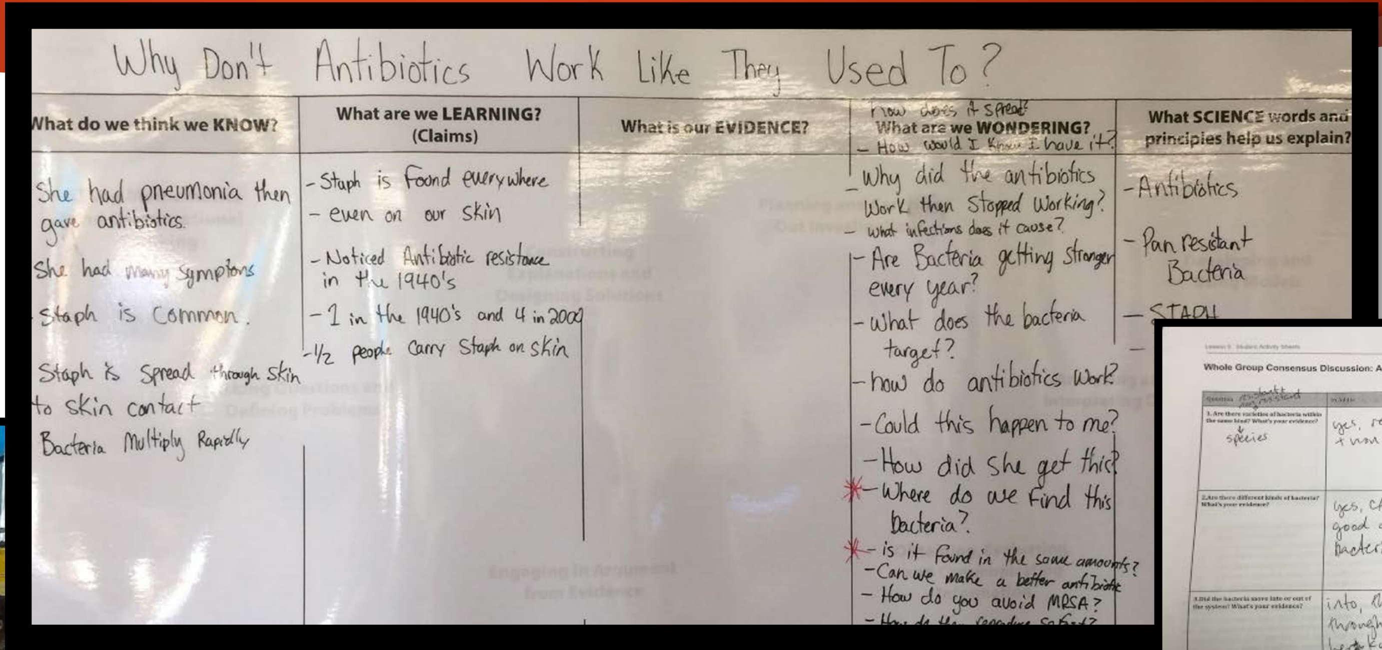
Results
We found a range of pathogenic *Staphylococcus* species. The mean bacterial colony counts were 97.1 on bus and train floors, 80.1 in cloth seats, 9.5 on handrails, 8.6 on seats and armrests at bus stops, 3.8 on the underside of seats, 2.2 on windows, and 1.8 on vinyl seats per 8 cm2 sample area. These differences were significant ($p < 0.001$). Of the 14 isolates sequenced, 11 were

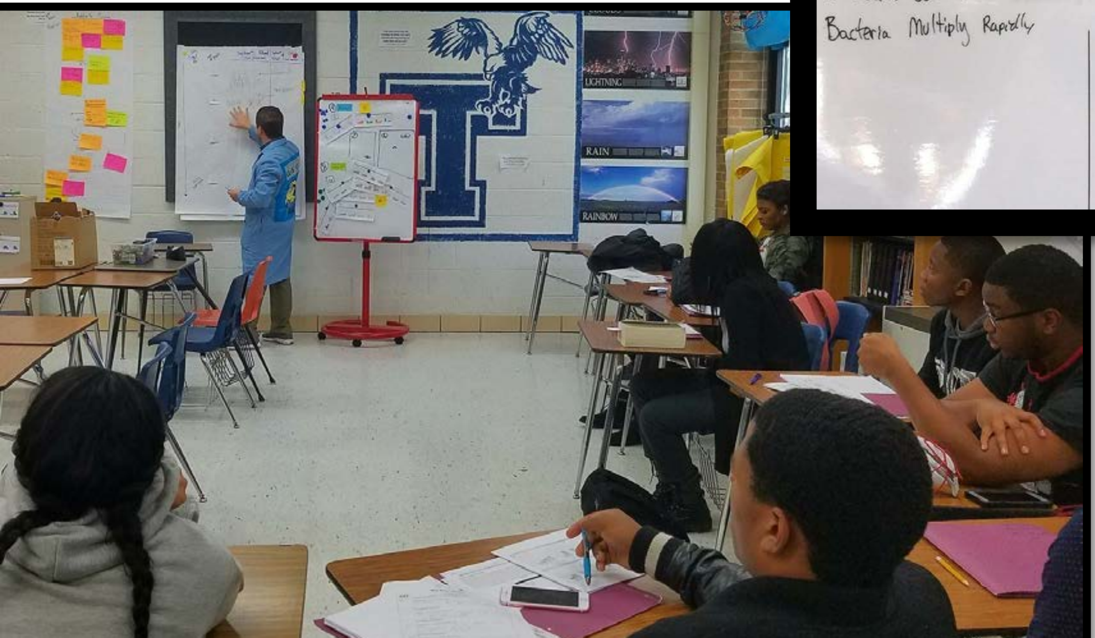


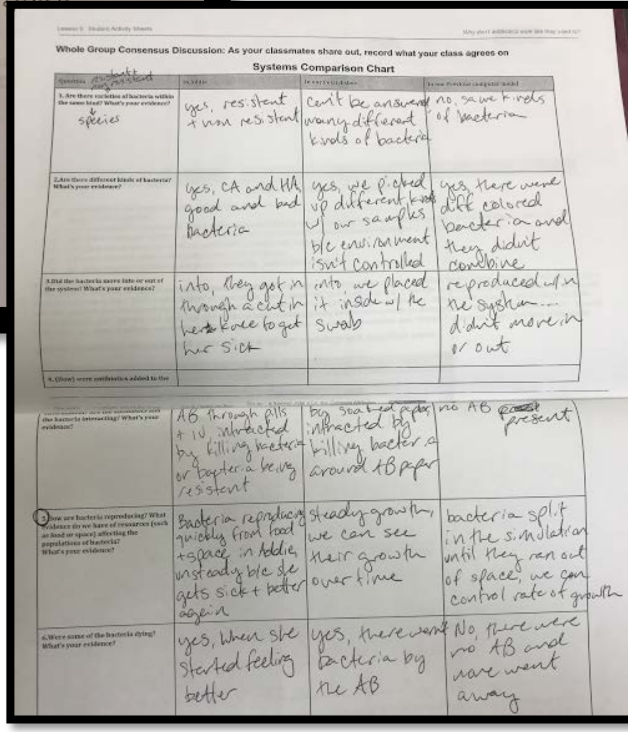


Students Figure it out

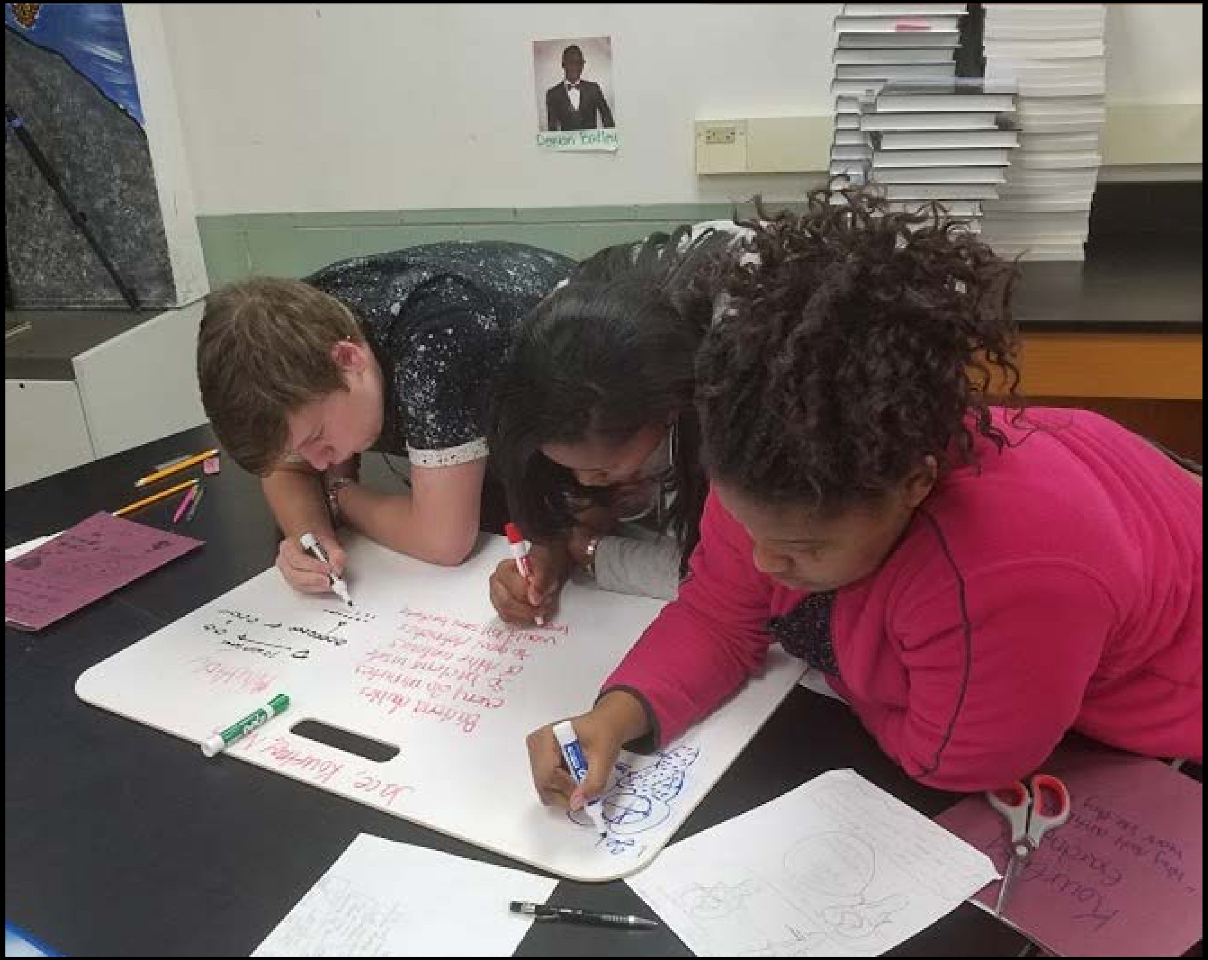
and keep track of it.







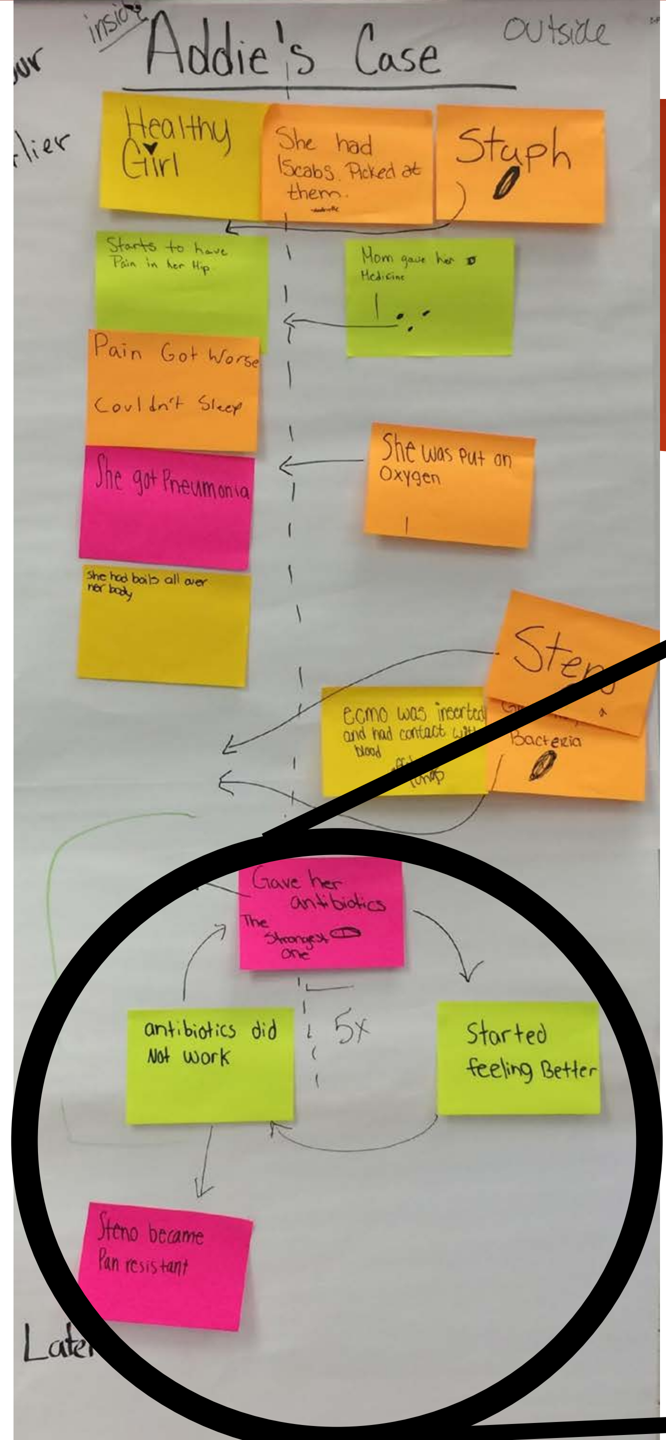
Students Call To Action

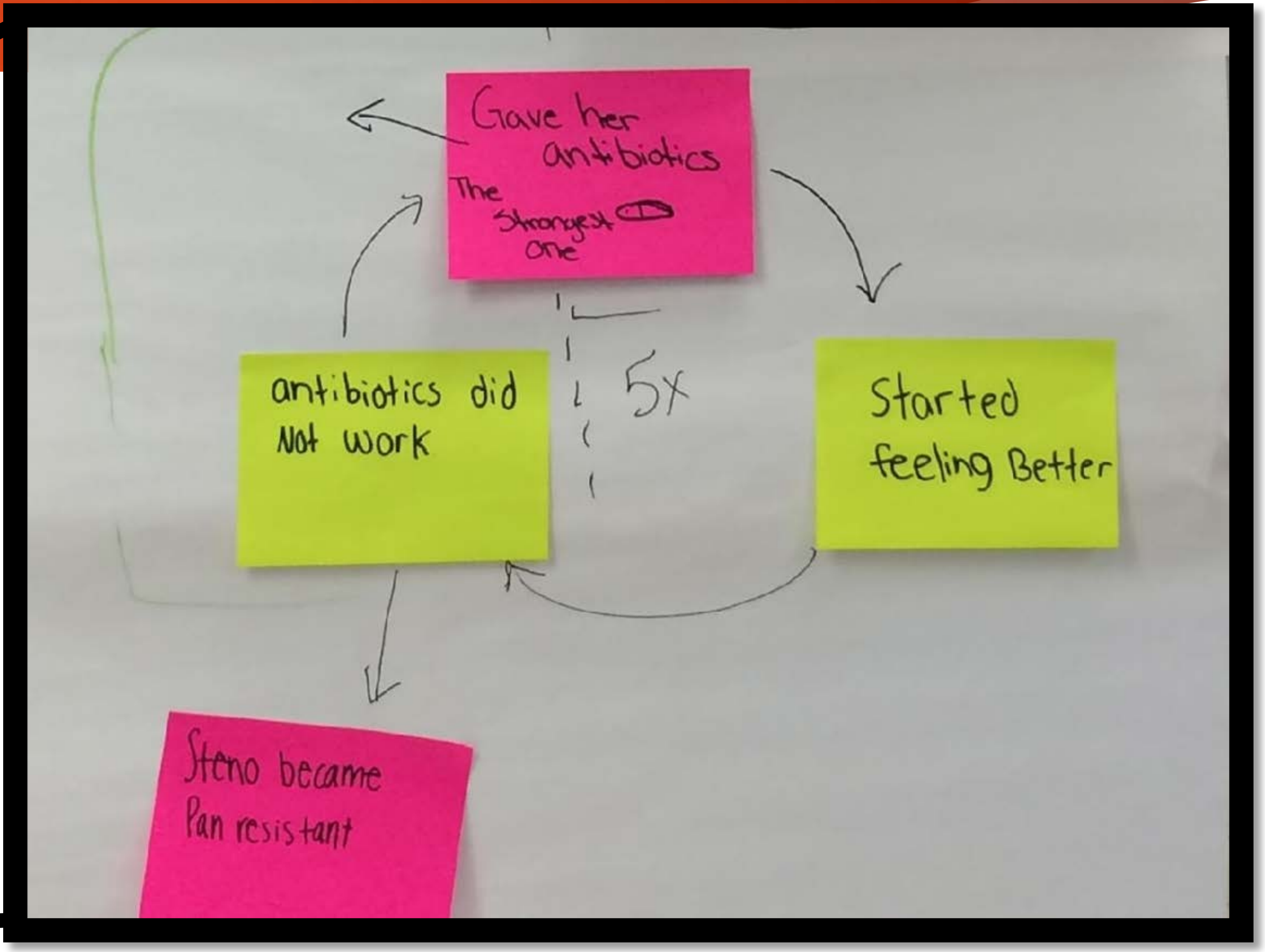


Why Don't antibiotics work like they use to?

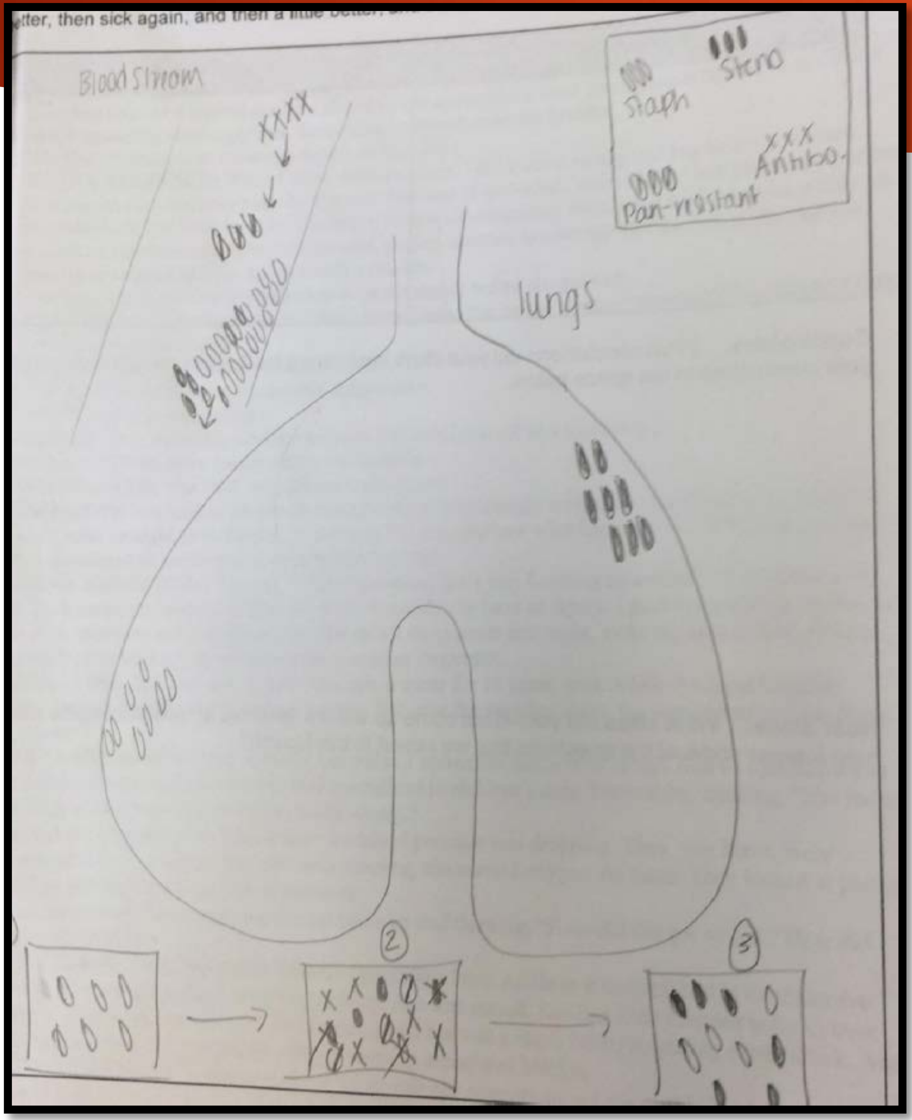
- Have you ever been really sick where you needed to go to the hospital?

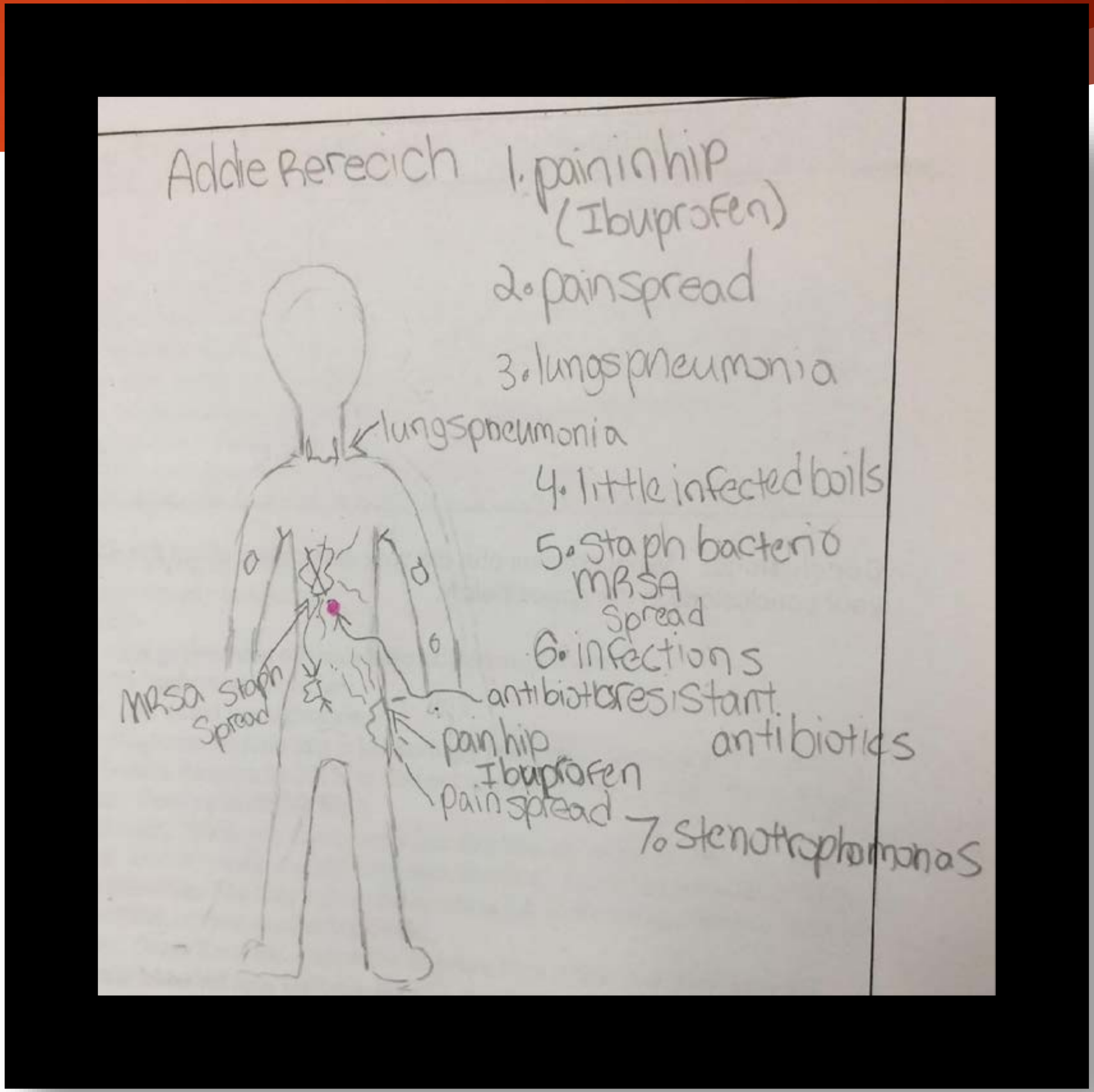
Students develop a timeline of events.



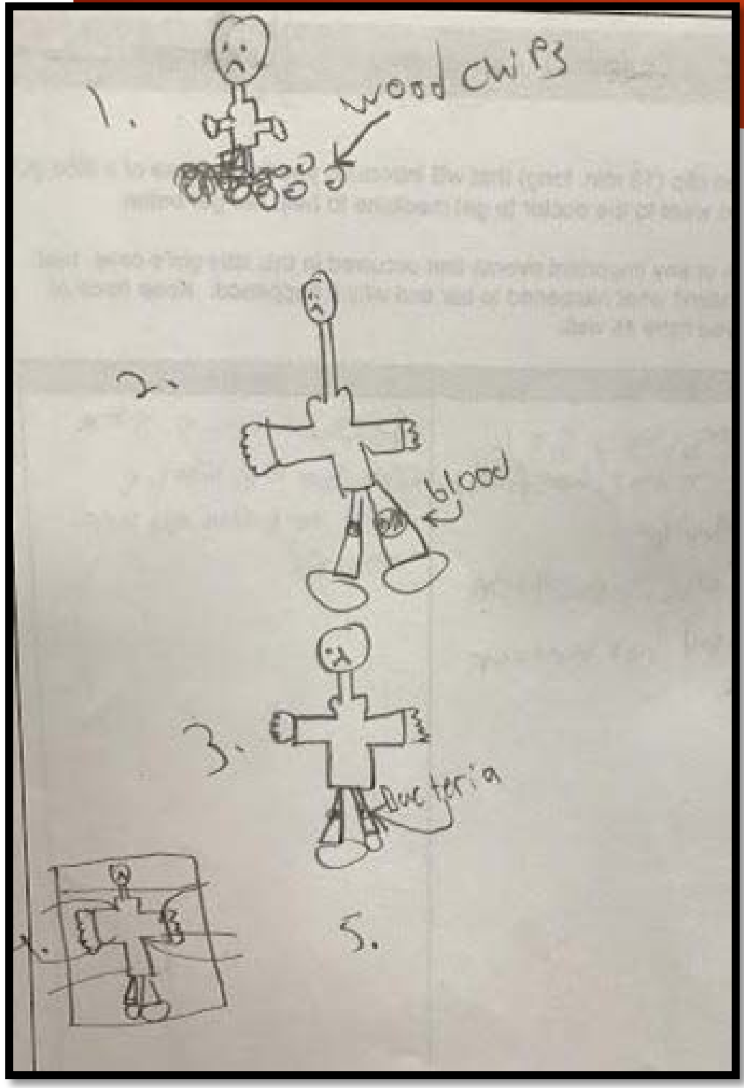


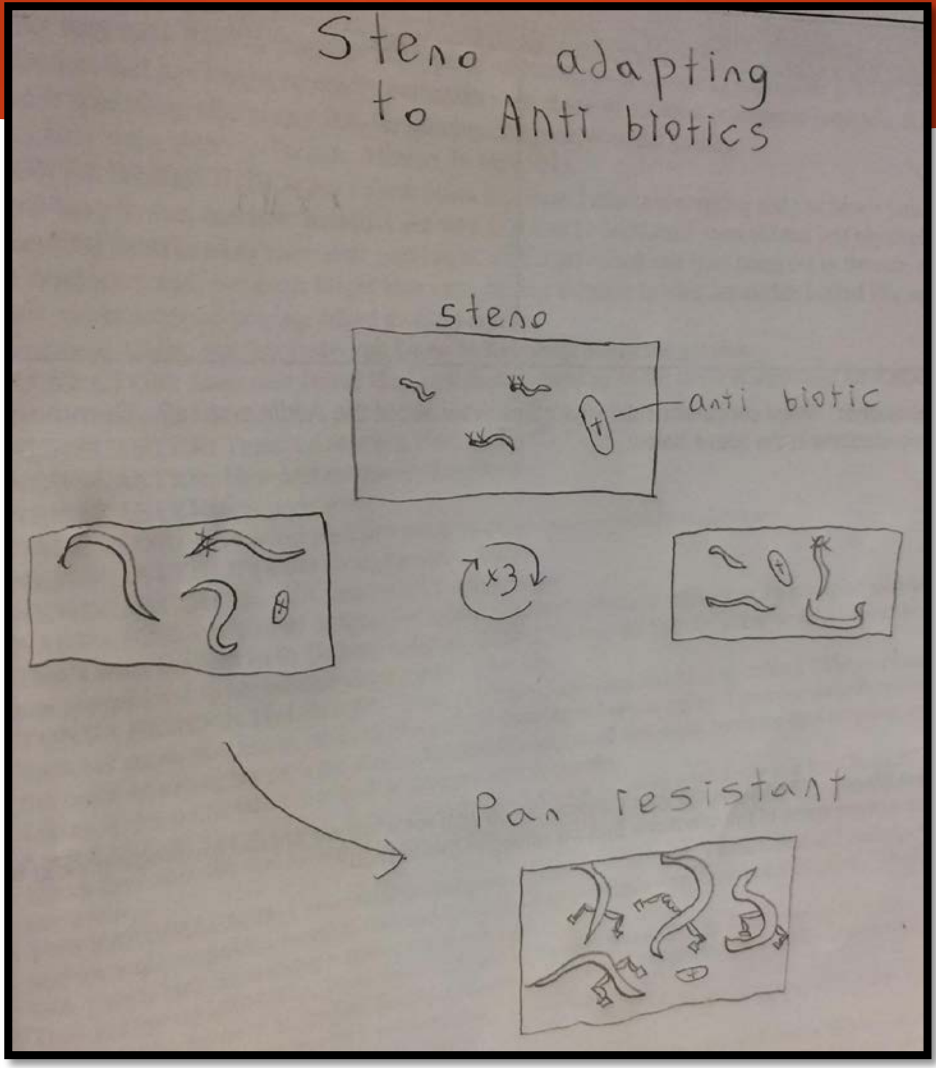
Students create an initial model

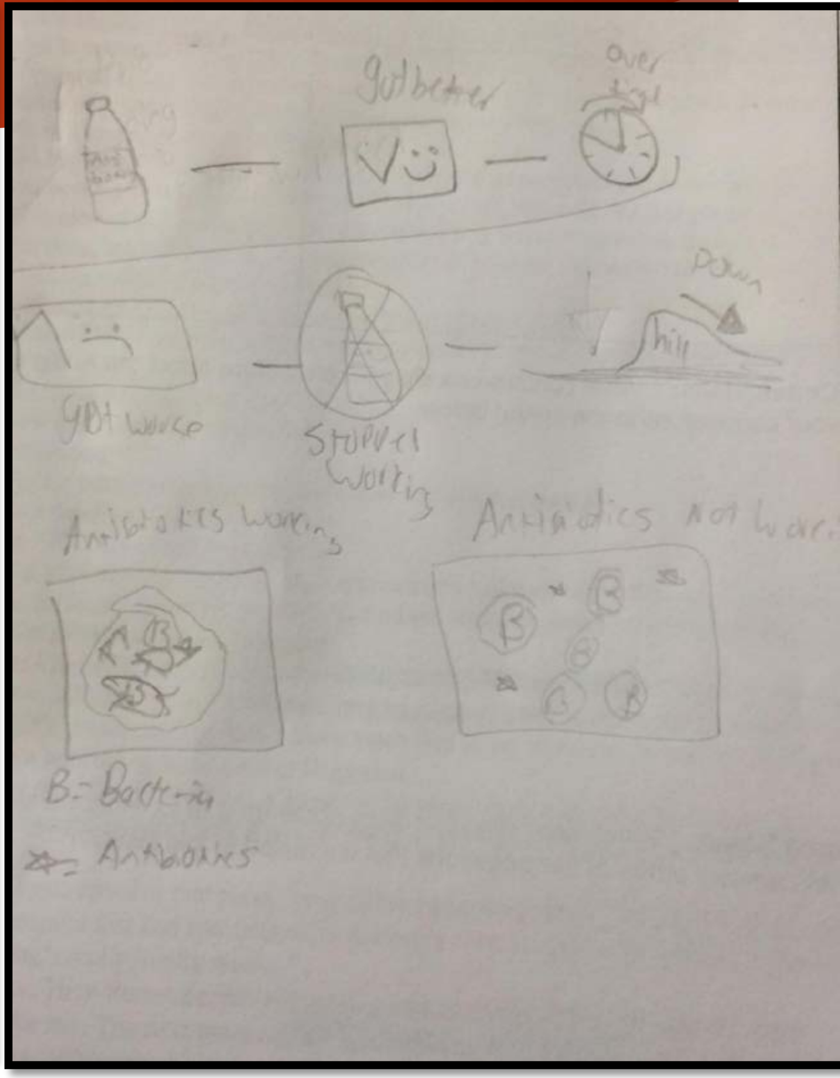




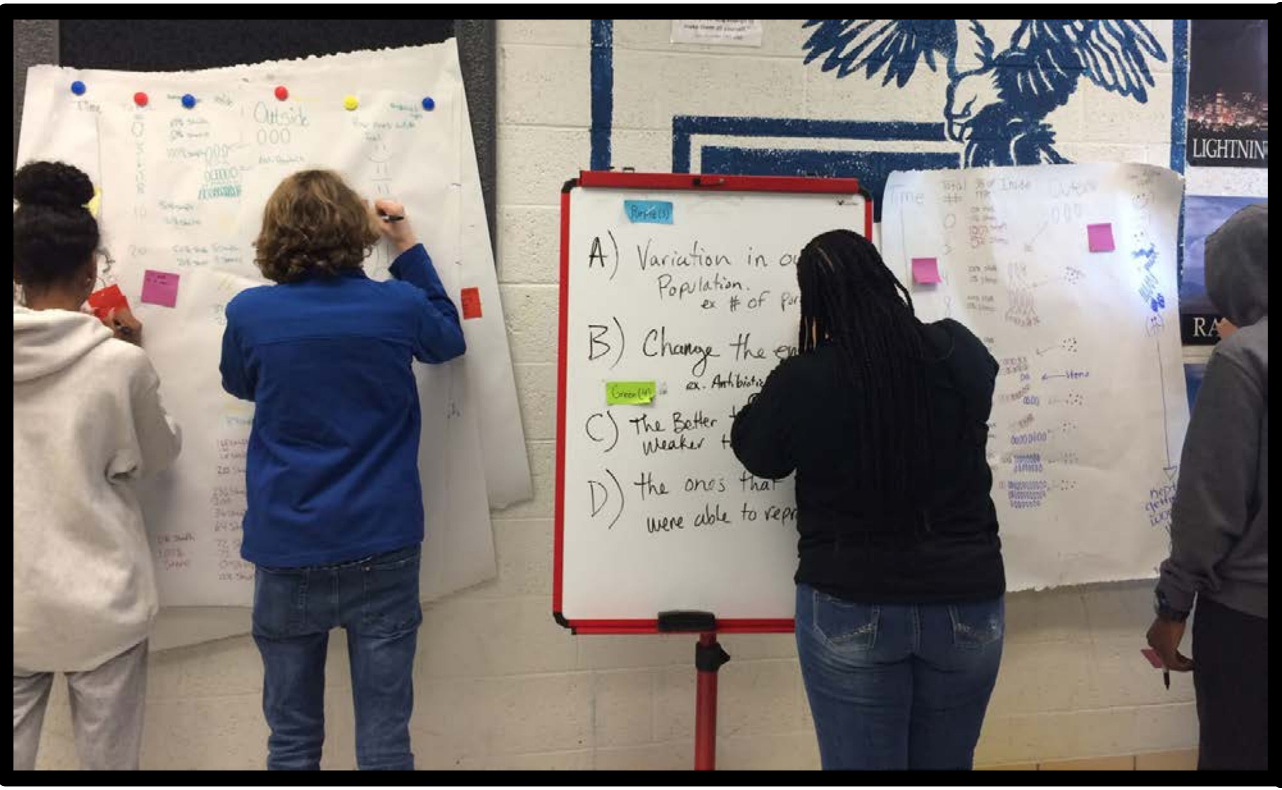
Students create an initial model

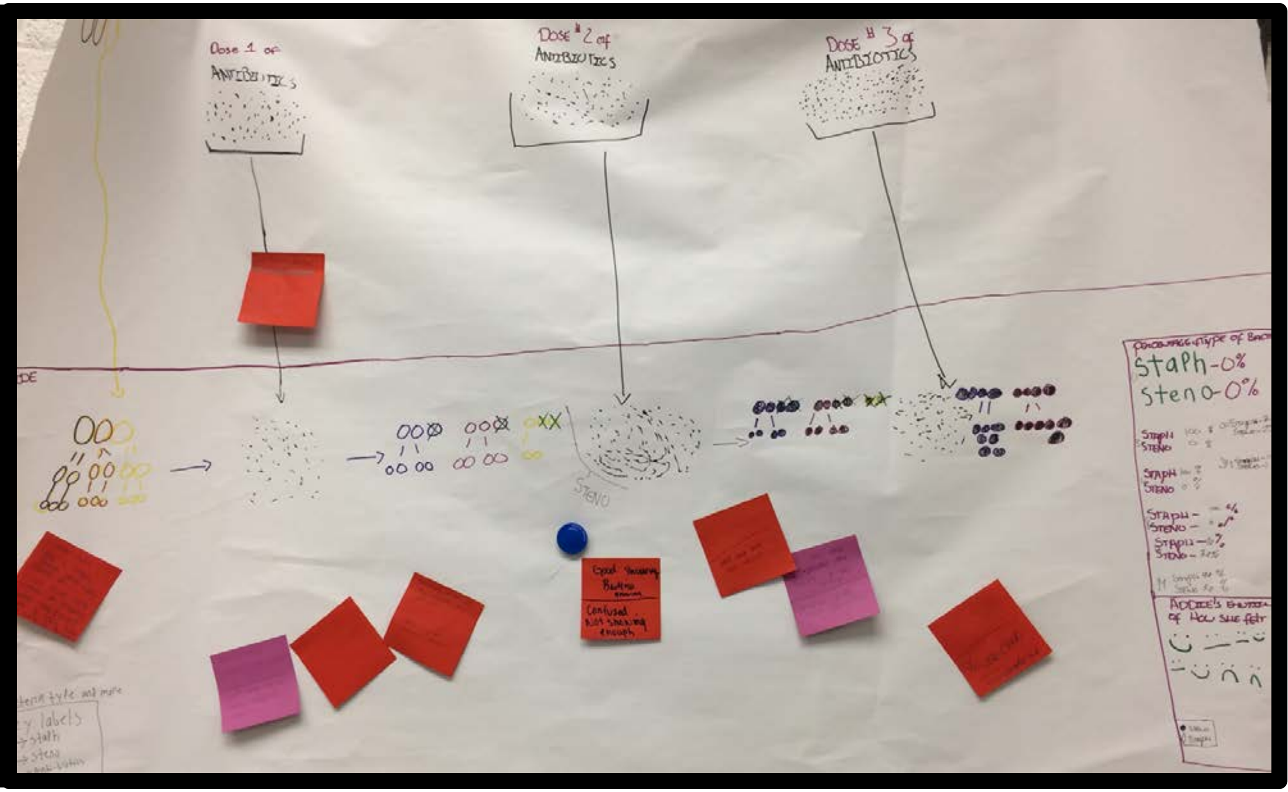






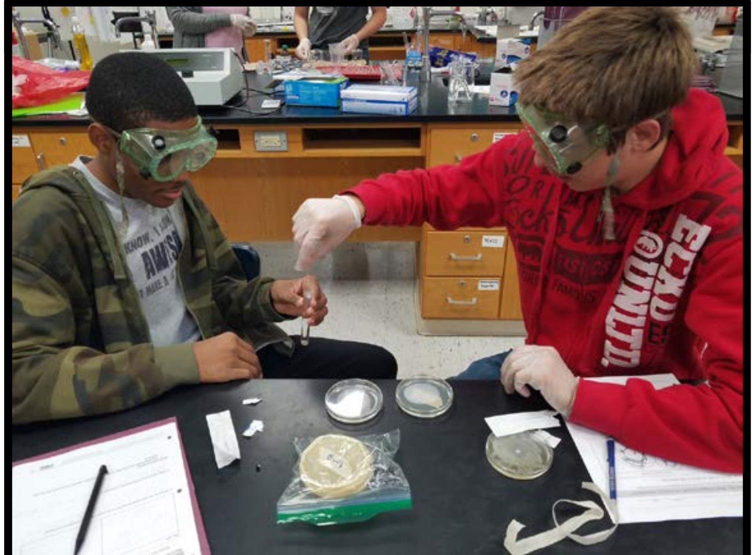
Students generated more questions after seeing other students models



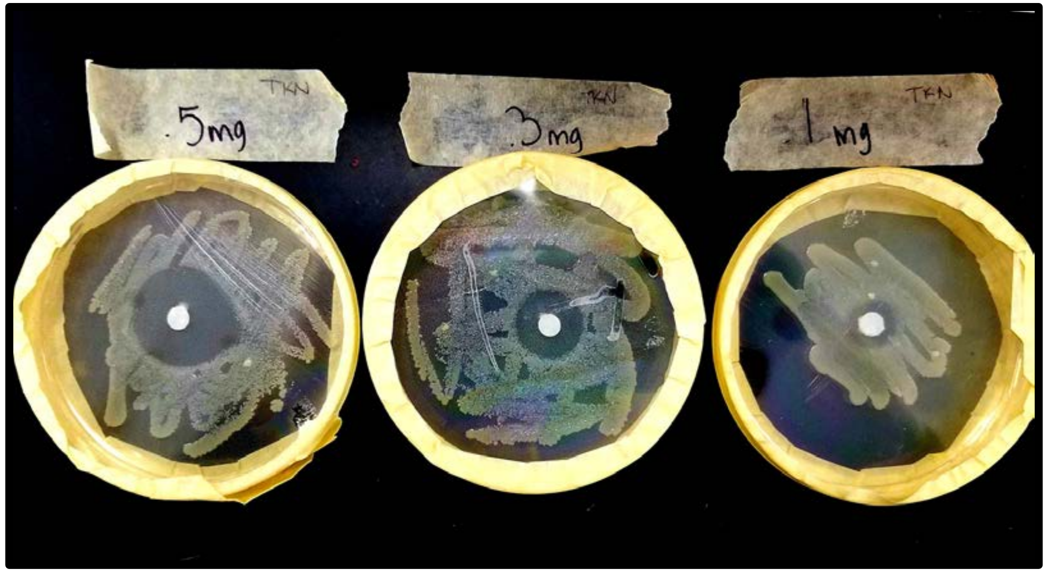


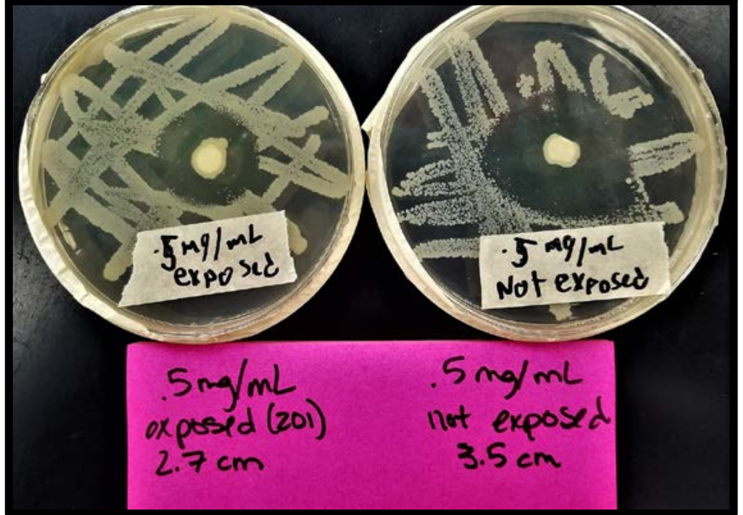
Scientist Circles

Planning investigations to answer Qs



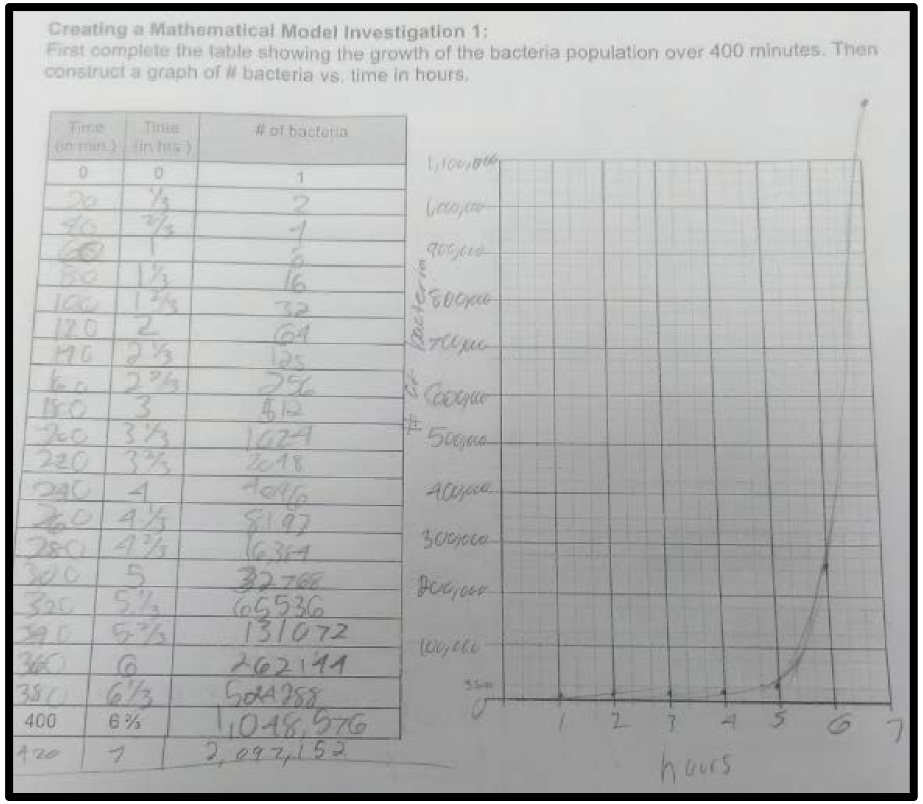
Using the practices to uncover DCIs

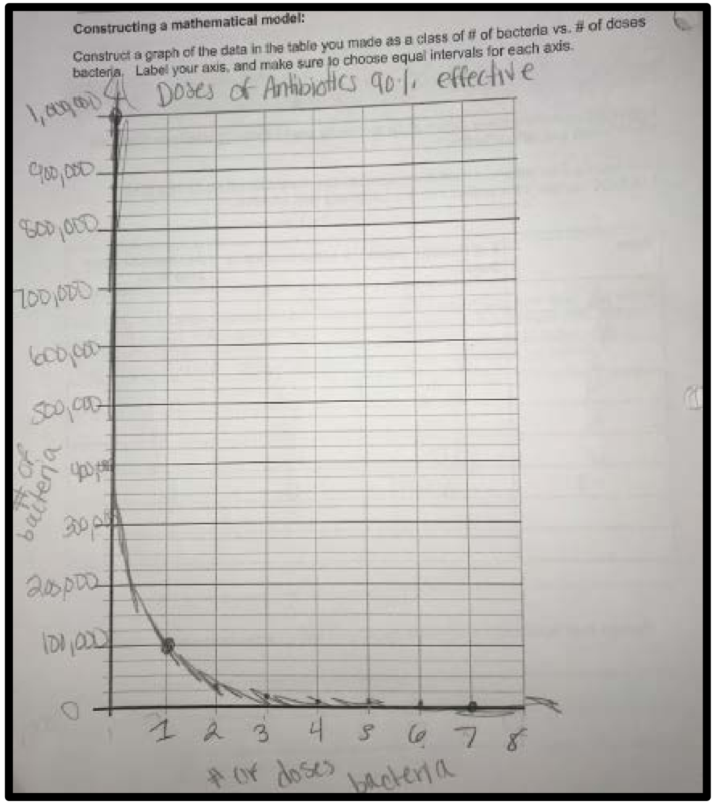


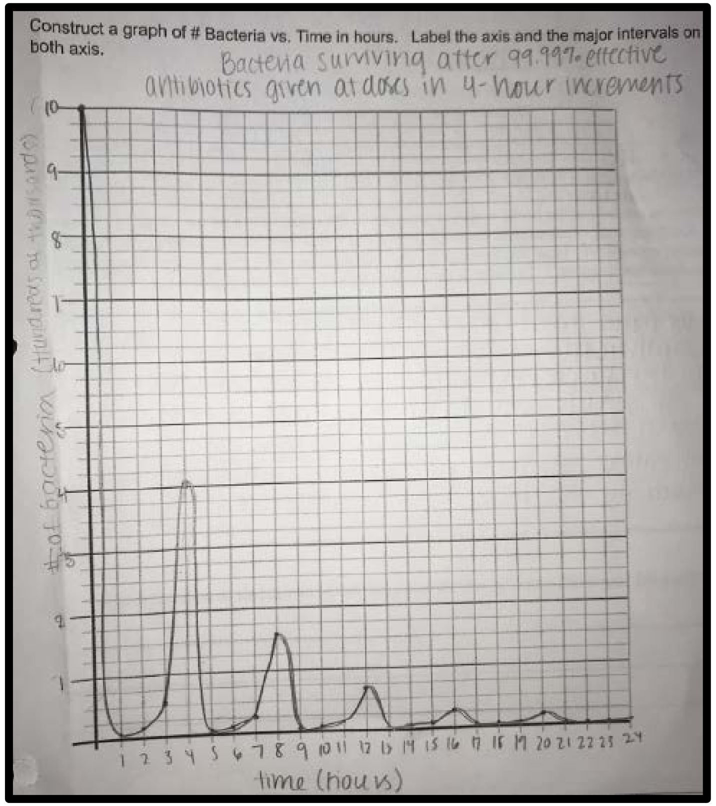


Mathematical Models: Creating models that allow students to make predictions

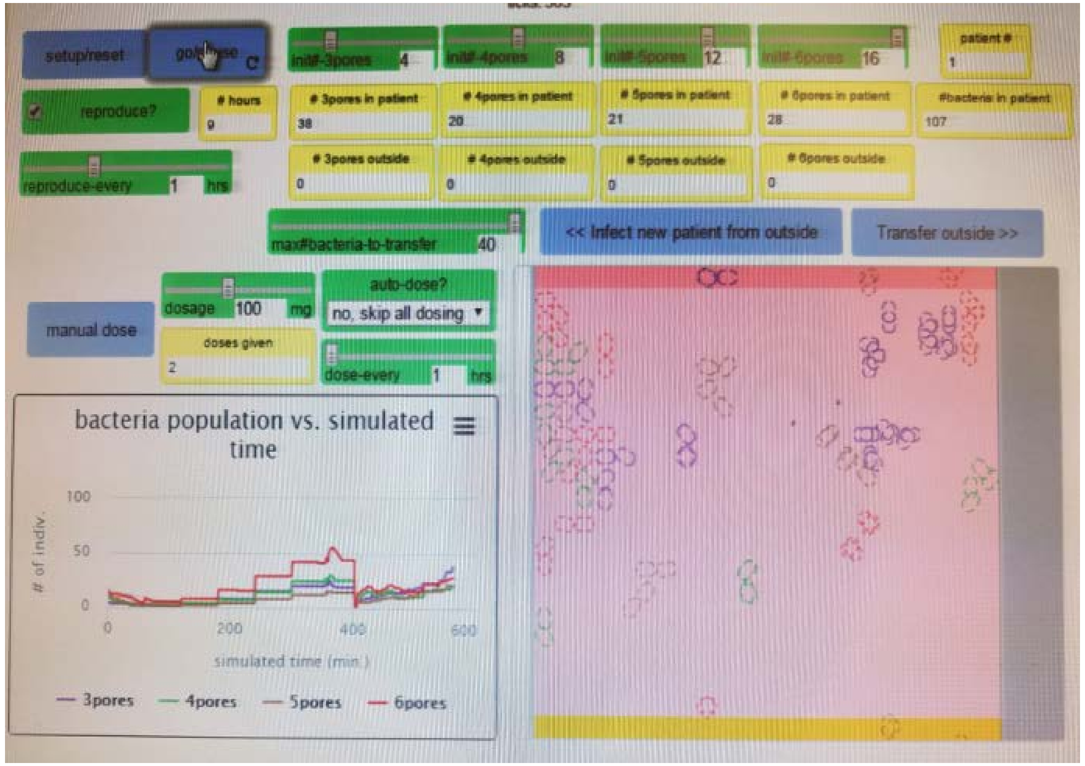
Using Science Practices to discover and use patterns (CCCs)

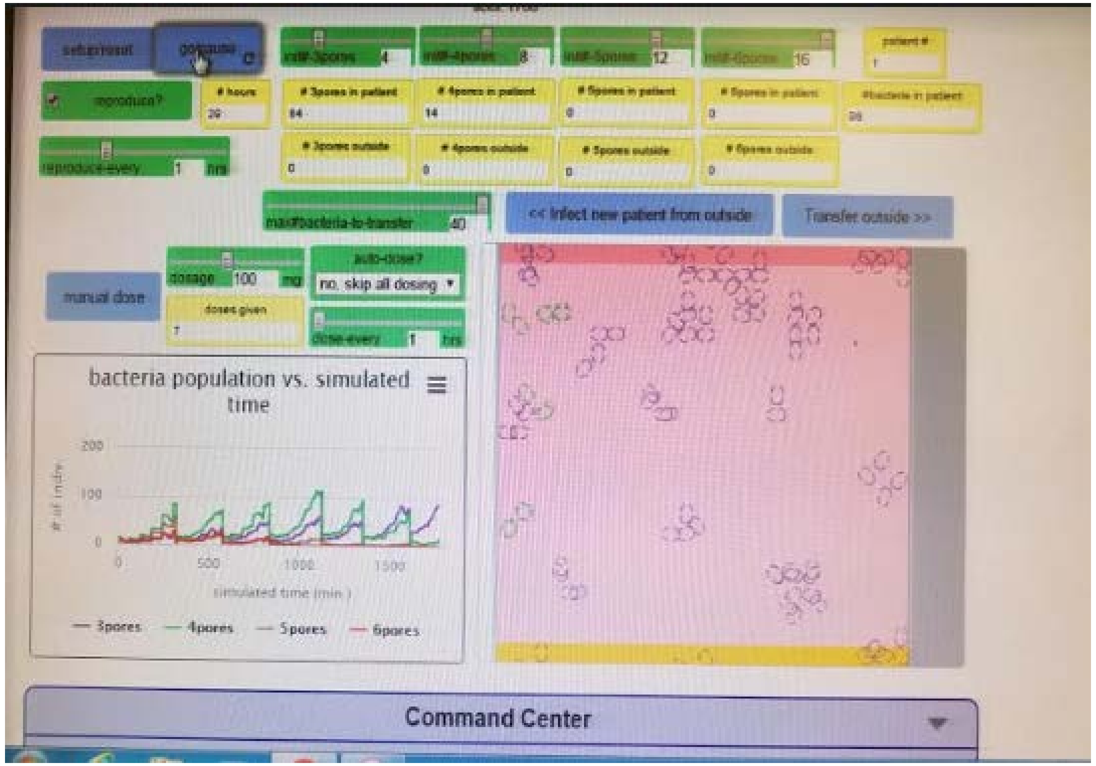






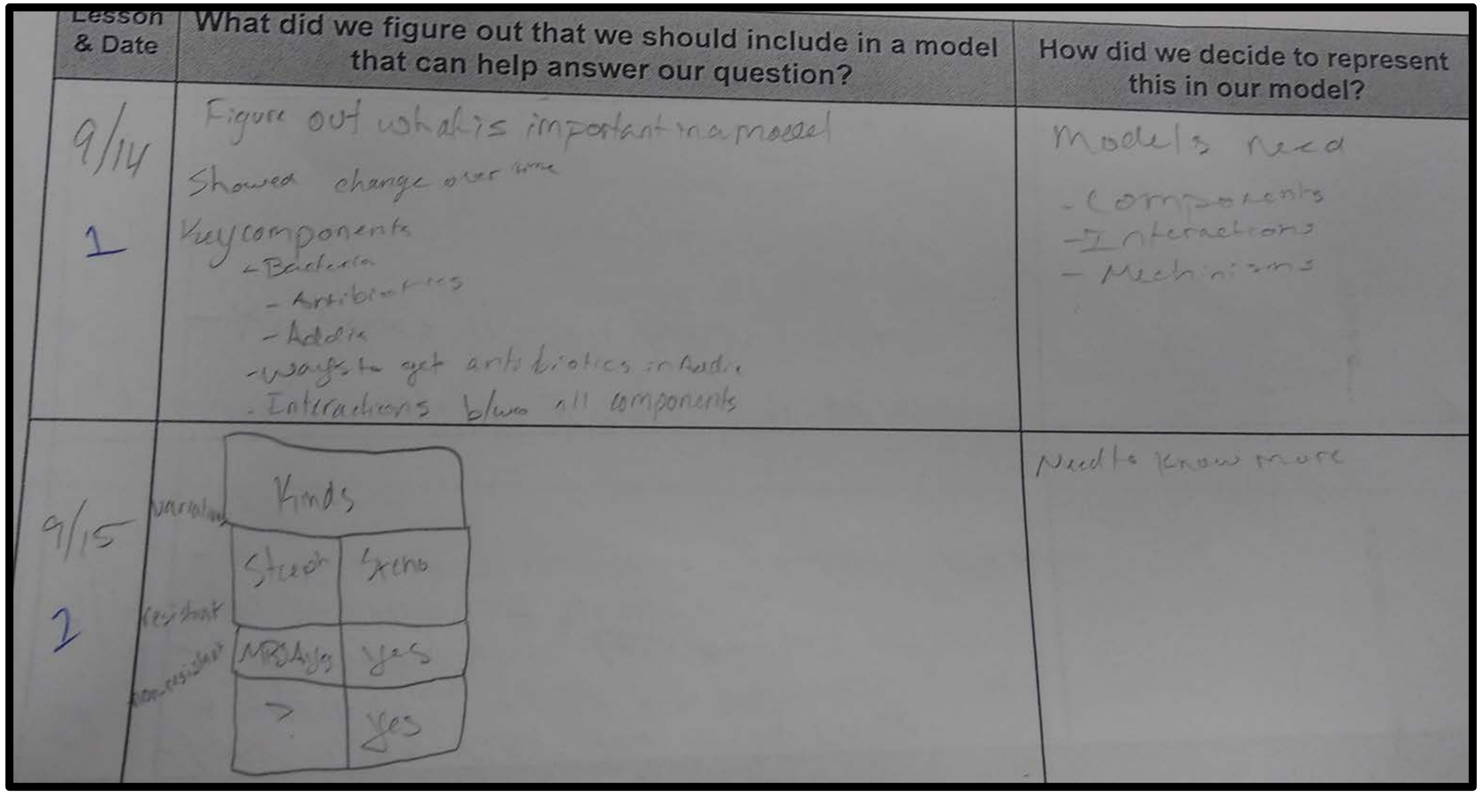
Making the invisible visible using Computer Simulations

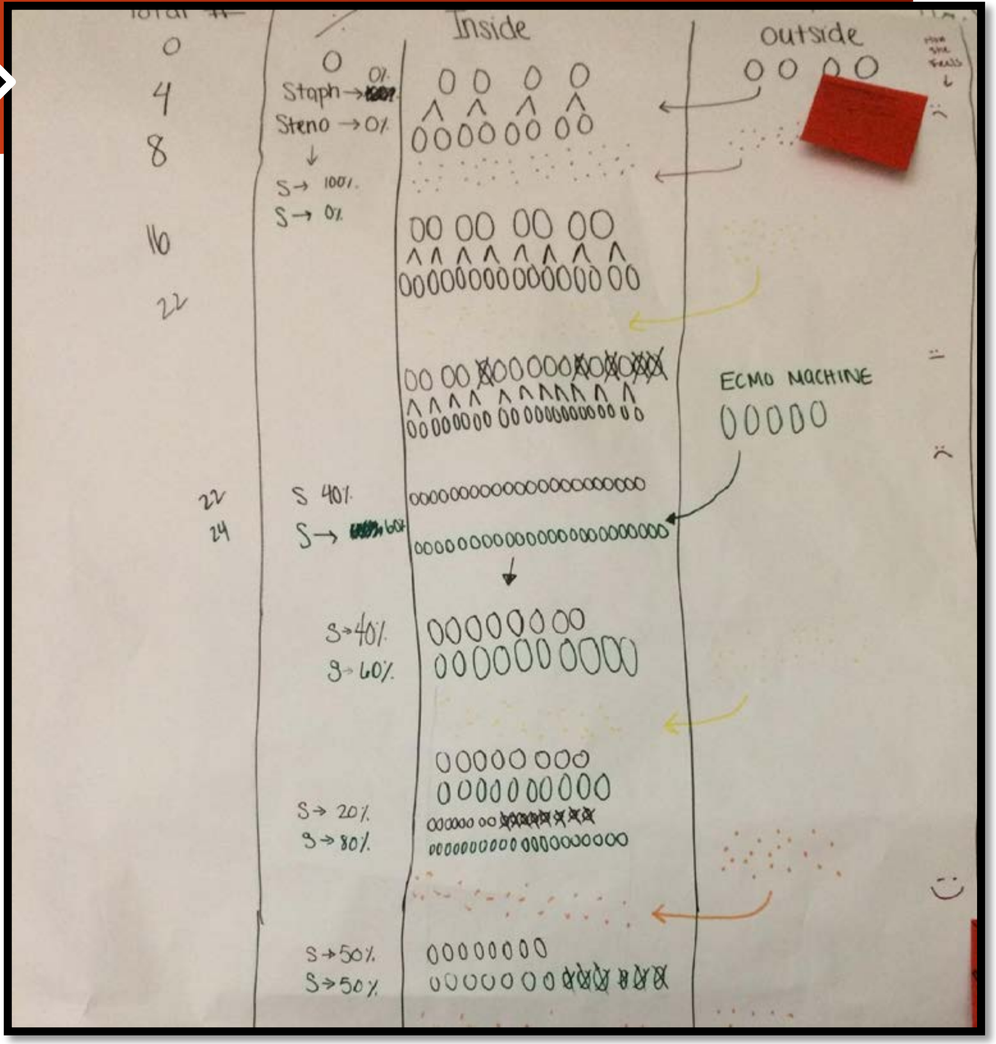




https://www.useloom.com/share/7c9a8ef7f3b241a19e8e5d27b384032f

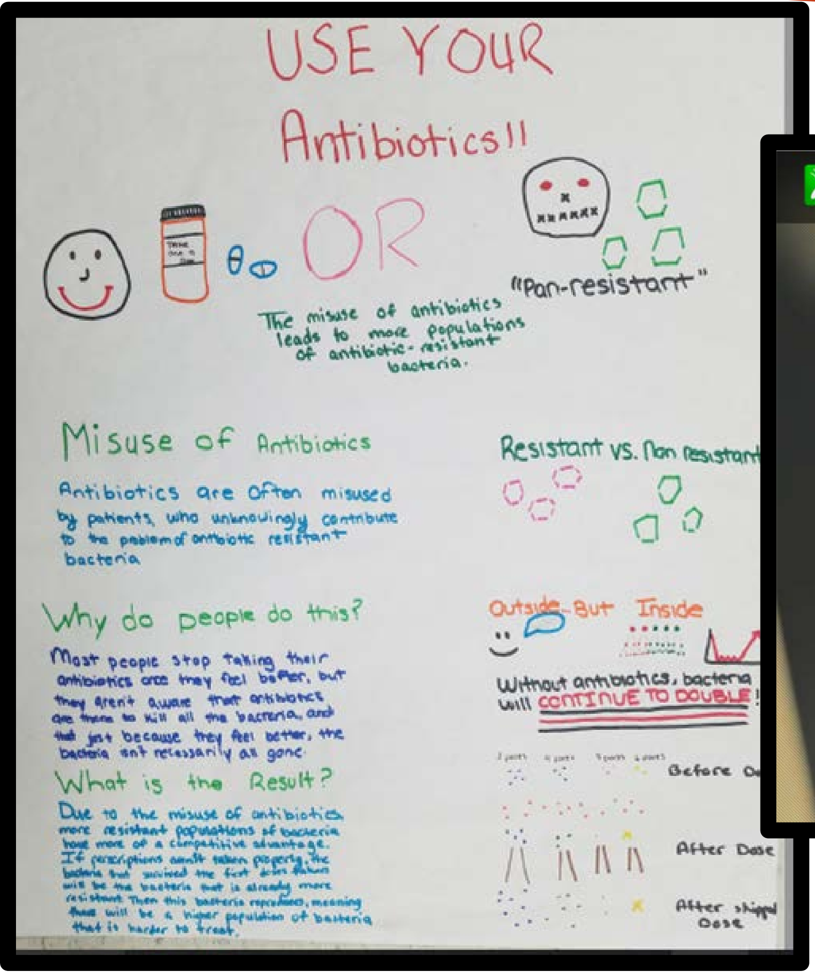
Keeping track of what we figured out and putting it all together





Final Models help students follow through on Mission

Infographic

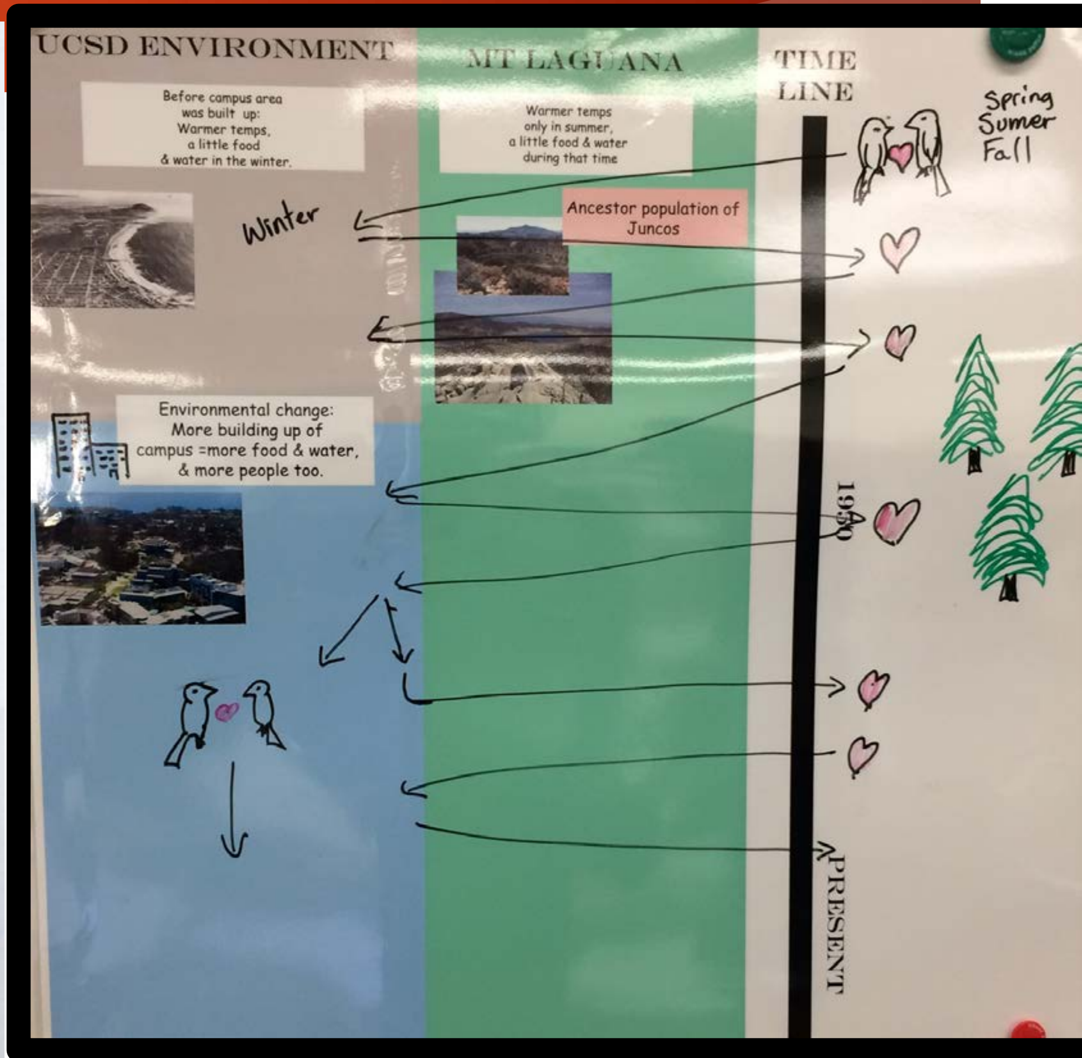


PSA Video

Return to DQB

Final Models help students follow through on Mission

Can we use our models to explain other traits in other organisms



Honors vs General Biology

Teacher teamwork is key!

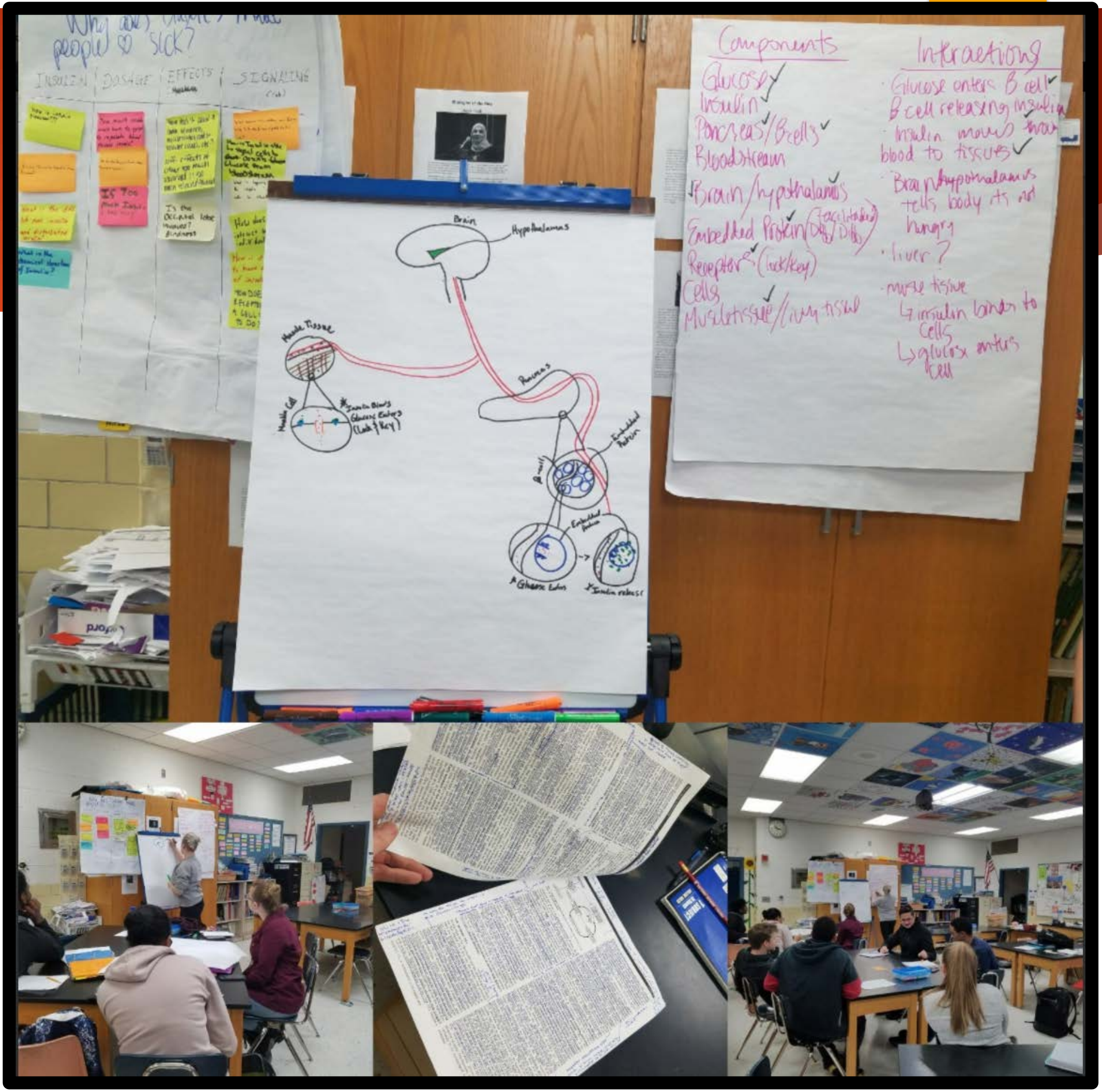
So Cohesive!!

Key to storyline columns:			
Lesson Question (time) *Building toward* ⬇ *NGSS PEs:*	**Phenomena**	**Lesson Performance Expectation(s):** • **Blue bold font: Science and Engineering Practice** • Regular font: Quoted from Appendix F Practices Matrix • *Italicized font: Specific storyline context (phenomena / question)* • Green font: Cross-cutting concept(s) • Orange font: Disciplinary Core Ideas (or pieces of these DCIs)	*What were we wondering* and **What Do We Think** **What We Figure Out** (CCCs & DCIs), *New Questions* and **Next Steps** • Yellow background font: What did we figure out, what were wondering and what do we need to do now? • Green font: Cross-cutting concept(s) • Orange font: Disciplinary Core Ideas (or pieces of these DCIs) • *Purple italicized font: New questions that we now have* • **Purple bold font: Our ideas for the next (or future) steps to pursue.**

This Lesson....What we are doing now: Students will be introduced to a new case study around a population of birds, the dark-eyed junco, that stopped migrating back and forth between the coast of Southern California and the mountains. The will gather information from a video about a founder population that was established on the campus of the University of California San Diego 60 years, and stayed. Students will figure out that there are differences in physical and behavioral traits between the mountain and city juncos.

Lesson Question	Phenomena	Lesson Performance Expectation(s)	What We Figure Out (CCCs & DCIs), *New Questions* and **Next Steps**
L15: What is happening in this new case of the UCSD juncos? 2 periods (60 min + 60 min) *Building toward* ⬇ *NGSS PEs:* *HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5*	A video clip (05:02-09:12) on juncos provides footage (and some descriptions) of them in an environment (a college campus in a city) that they stay in year-round now, but that they used to only visit in the winter in the past (and then would return to the mountains in the spring). A video clip (11:22-12:00) provides footage (and some descriptions) of the behavioral trait differences in the UCSD juncos compared to the mountain juncos: An image from the video summarizes some physical trait differences in the UCSD juncos compared to the mountain juncos:	**Ask questions about** how the population of juncos might be changing and whether those changes are the (effect) result of inheritance or learning (cause) and how this might be connected to the environment they live and reproduce in. **Develop models** to provide mechanistic account of phenomena *to explain what causes a behavioral trait difference and a physical trait difference in different juncos (effect) [UCSD juncos are bolder and have less white in their tail feathers than mountain juncos].*	Last time, we decided we needed to find a new case that we could apply our model of natural selection to. Our teacher found us a candidate case of a bird (junco) on a college campus in California, that met these criteria and introduced it to us through some video clips. From the first video clip (05:02-09:12), we noticed a lot of things that are happening with the Juncos shown there: • For a long time, dark-eyed juncos in California migrated between the mountains where they bred and the coast where they spent winters. • Some juncos that once migrated back and forth between mountains and the city stayed in the city and formed a small community that bred in the city rather than in the mountains. • These were first discovered in the early 1980s. • Now there are about 80 individuals in this campus community (UCSD), and it is a relatively stable population. • Mountain juncos spend summer in mountains and continue to spend winters on the coast and then migrate back in the summer. We organized this information in a timeline model to represent the features about the environments, populations, and time that we know. After organizing this information we were wondering: *What's changing here that might have led to this emergence of this new population of juncos?* **We decided to watch the video again. This time, we decide to pay attention to the mountain and city environments, and what's said about how they are different.** We noticed some new things about the two different environments and added them to our timeline: • The nests in an alpine forest in the mountains above 4,000', it snows in the mountains in the winter. • There are lots of people on campus, but not in the forest. • Water and food are abundant in city. • There are more nest predators (cats and crows) in the city. We gathered information a second video clip (11:22-12:00) and an image from the video that helped us identify an interesting behavioral and physical difference in the UCSD juncos: • The UCSD juncos are bolder than the mountain juncos. • They have less black in the feathers on their head and less white in their tails and they have shorter wings. **We developed two initial models:** • **One explains what causes a UCSD junco to be bolder than a mountain junco.** • **One explains what causes a UCSD junco to have less white in the tail feathers than a mountain junco.** We continued to investigate some the differences between the campus and mountain environments in our home learning (via street views on google maps). And we brainstormed how this might be related to these things:

AP Biology "Storyline"



We also added AP Environmental Science this year as well...

For more information….

NextGenStorylines website: http://www.nextgenstorylines.org/

Storyline Tools: http://www.nextgenstorylines.org/tools/

THE STORYLINES: http://www.nextgenstorylines.org/high-school/