Q2 2022 EDITION

THE PULSE

of Science Pathways

PASSAIC ACADEMY FOR SCIENCE AND ENGINEERING

BIOTECHNOLOGY LEARNING UPDATE

Many new skills were practiced during quarter 2 of Biotechnology Honors. One of the most important skill was time management. The students were given multiple lab assignments and a deadline to complete them all. It was up to the students to plan and arrange how everything would be completed (with some feedback and adjustments from the teacher as well). This skill is important to have in Biotechnology careers as well as in life in general.

Students also learned other lab skills, such as how to create agar plates, which were then used to grow and monitor bacteria such as E. Coli. They learned how to sterilize objects using a machine known as an Autoclave. They also learned and will continue to practice making dilutions and micropipetting skills... *(continued on page 2)*

WHAT'S NEW?

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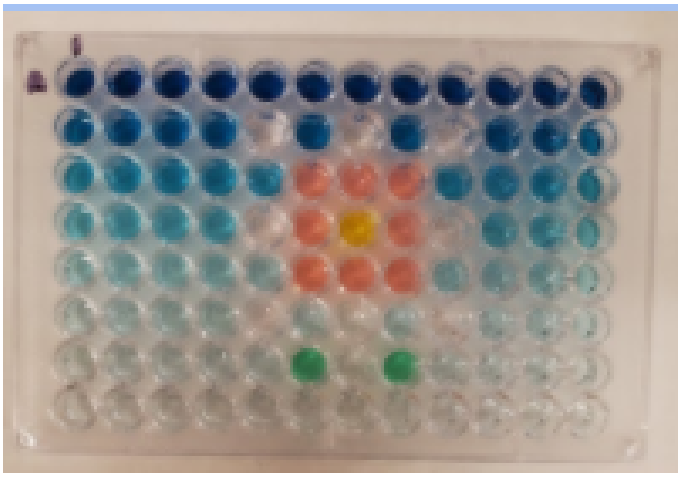
BIOTECHNOLOGY CONTINUED

Students also conducted research on the presence of bacteria within the school and presented their findings in a poster presentation to several Biology: Phenomenal Approach classes.



Students in the Organic and Biochemistry class (year 3) just completed their most exciting multi-procedure lab. They synthesized aspirin (acetylsalicylic acid) from two... reactants. During this laboratory students used techniques to isolate (vacuum filtration), recrystalize, purify, and confirm the identity (melting point analysis).

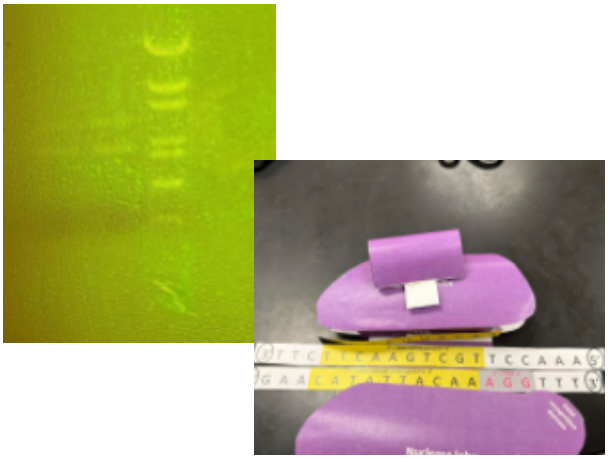
Students worked on building a model of the CRISPR-Cas 9 system and learned many things about the structure and use of it as well as DNA structure and Replication. It was beneficial as CRISPR is a technology that can be used to edit genes which will most likely change the world, and because of the exposure that they gained through the model, they will be better prepared for their upcoming lab research using CRISPR.

Students isolated genomic DNA using gel electrophoresis and used the Polymerase Chain Reaction (PCR) to amplify two separate regions of the mitochondrial genome. This was beneficial because they prepared many buffers and primers that give them exposure to what they may do in an actual lab.

They also conducted Gram staining to distinguish bacterial types, and determine the morphology of four different species of bacteria. Exposure to working with these bacteria helped them get an introduction to another important technique used in laboratories.

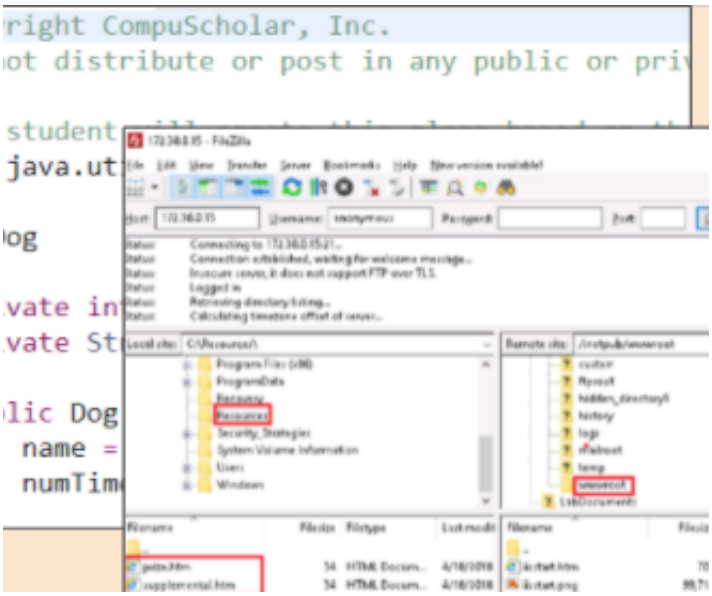
The Genetic Engineering students also examined the differences between spike proteins in alpha, beta and gamma

coronaviruses using DNA Subway and the NCBI database. They learned how to use FASTA formatting, complete alignments and create phylogenetic trees.

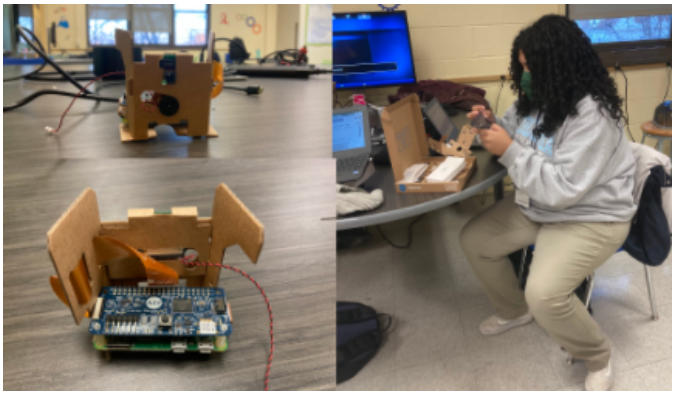


COMPUTER SCIENCE LEARNING UPDATE

Students in AP Computer Science are learning how to code classes in Java. They are using the new CompuScholar software to create, test, and debug their programs. Students will need to write their own original code as part of the AP exam process and are doing great on these practice assignments. In our Cybersecurity class, students are learning about server vulnerabilities and how to mitigate them. They are sharpening their hacking skills to learn how to protect our digital infrastructure. Our Intro to Computer Science students are completing their custom Scratch games and will soon be transitioning to their first coding labs in Python programming.



*Members of the **Girls Who Code** club have been building their own intelligent cameras that can recognize objects using machine learning. They have begun testing their AI Vision Kit Cameras on demos and AIY provided projects.*



DATA SCIENCE LEARNING UPDATE

*In **Intro to Data Science**, are continuing their study of introductory statistics and how we can use it to make inferences about issues. Our first project looked at how good students are at identifying how healthy their snacks are. Students were surprised to find out that most packaged snacks have about the same number of calories (150-200), but they can vary greatly in salt, sugar, fat, and total calories. They also realized that even though they might be low in calories, they might still have a high value of salt which can be unhealthy.*

For much of the remainder of the quarter students learned new skills in the R coding language. Students learned how to clean, transform, and subset data for later analysis. They also learned about creating and interpreting two-way frequency tables.

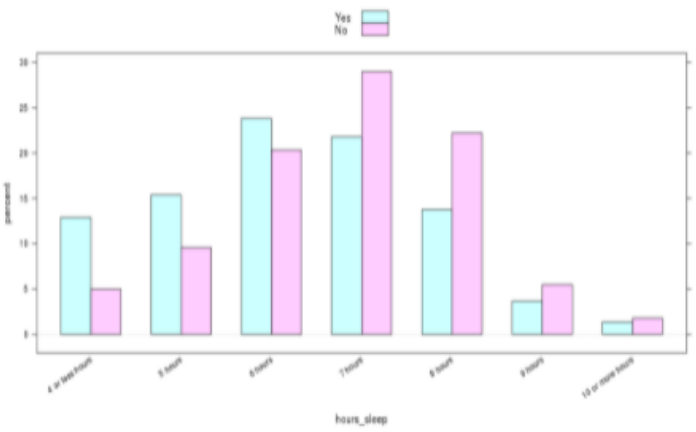
DATA SCIENCE CONTINUED

For example, we surveyed their class about soda and scary movie watching as an example of how we can relate two categorical variables.

They applied these new skills in their next project which delved into how teen depression might be correlated to a variety of other things in one's life. Students analyzed data from the CDC and presented their findings to the class. For example, students found that students that sleep less than 4 hours a night are more likely to be depressed. However, the disparity between those that are or aren't depressed is much weaker if you sleep more than 8 or 10 hours.

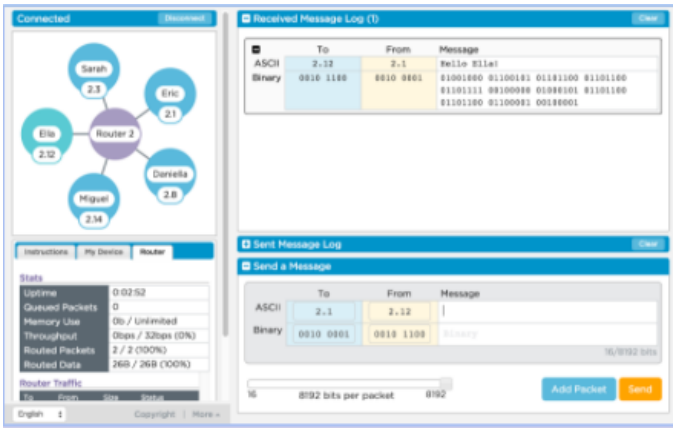
Lastly, PASE IDS students will be competing this winter and spring with Pittsburgh DataWork's DataJam Competition. Starting in January, our students are meeting twice per week with mentors from the University of Pittsburgh to assist them in conduction a data science project on the topic of their choice. Students have submitted their proposals and will begin their data-gathering, analysis, presentation and posters throughout quarter three. PASE and DataWorks are excited about this new pilot project and we can't wait to see what the students discover!.

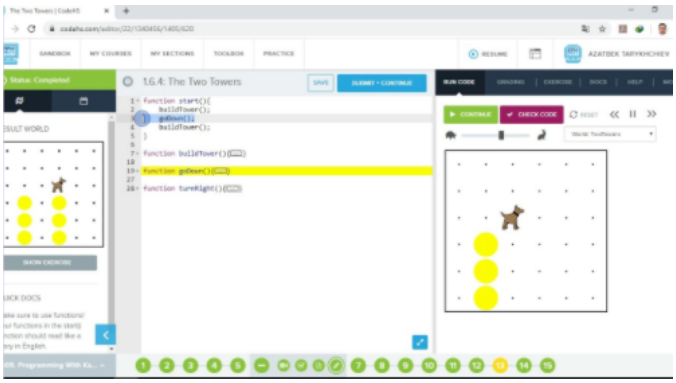
	Likes Scary Movies	Doesn't Like Scary Movies	Total
Drinks Soda	72.7%	13.6%	86.4%
Doesn't Drink Soda	13.6%	0.0%	13.6%
Total	86.4%	13.6%	100.0%



*In **AP Computer Science Principles**, students are learning about the internet. Students learn how the Internet works and discuss its impacts on politics, culture, and the economy. Throughout this unit, students use a digital tool called the Internet Simulator that simulates how different parts of the Internet work and forces students to grapple with and solve the problems each aspect of the Internet was designed to solve. At the conclusion of the unit, students investigate an "Internet Dilemma," both from the standpoint of its technical background and its impacts on different groups of people.*

Additionally, students have been learning how to program using Karel, a dog that only knows how to move, turn left, and place tennis balls in his world, to show students what it means to program, and allow students to focus on computational problem-solving. Students learn about the need for programming languages, the uses of programs, how to write programs to solve computational problems, how to design algorithms, how to analyze and compare potential solutions to programming problems, and learn the value and challenges involved in collaborating with others to solve programming problems.





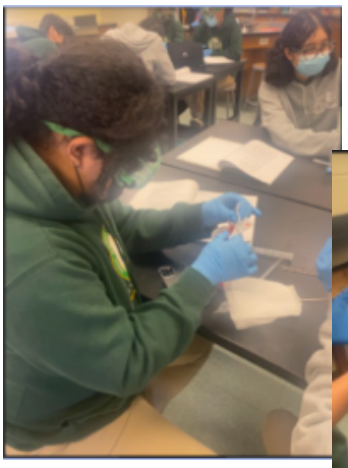
DATA SCIENCE CONTINUED

The Future Business Leaders of America enjoyed the virtual State Fall Leadership Conference so much that they are planning to attend the virtual Northern Region Summit as well! Students will be able to network, team-bond, foster leadership skills, and participate in workshops and activities with fellow Northern Region FBLA members.

Additionally, club members are excited to promote their winter/spring fundraiser - a customized decal sale! This experience will help students explore financial decision making while gathering and analyzing data from their school community.

BIOMEDICAL SCIENCE LEARNING UPDATE

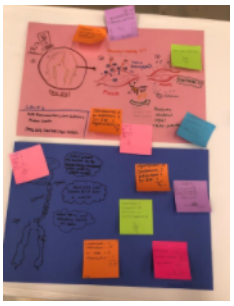
*In **Principles of Biomedical Science**, students are investigating the death of Anna Garcia. This quarter students studied blood to confirm the red liquid found at the crime scene was blood. We began by learning the different components of blood and their purpose. Students then performed the presumptive Kastle-Meyer test to confirm the red substance found at the scene was blood. After determining the red substance was blood, students blood typed each sample by comparing the agglutination of control samples. As a class, we narrowed down the blood sample owner using blood types so our next step was to analyze DNA. We used extracted DNA from strawberries to model the DNA extraction process for the cell. Students greatly enjoyed this process as seen in the pictures. Students also performed an investigation in which they tested how the height that the blood is dropped from affects the diameter of the blood splatters. They were able to use this information to analyze the blood splatter found at the crime scene.*



In the Human Anatomy Class, we have been learning about the Support Systems: Muscles and Bones.

From learning their different names and their molecular inner works to how we actually perform movement!

We like to work with models and get lots of interesting insights with the Anatomage



BIOMEDICAL SCIENCE CONTINUED

In Medical Intervention, students learnt about ELISA sample testing for bacterial meningitis, they learnt how to deal with outbreaks and measures to curtail the spread of infection. Students also learned about how bacteria exchange genetic materials like transformation, transduction and conduction. A stop motion project was assigned to everyone for a specific type of gene transfer. and how drug resistance work arises. The students also learnt how bacterial meningitis can cause hearing loss and how different hearing losses occur and interventions that can be done to help fix different types of hearing loss.

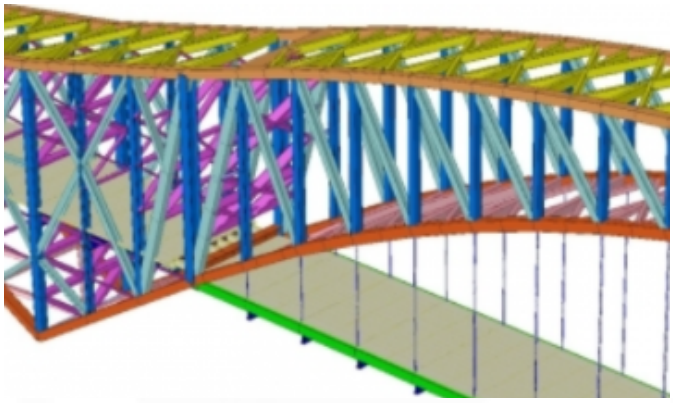
In Biomedical Innovation, students worked in investigating environmental health, they learnt how to identify causes for environmental concern, identified potentially hazardous materials in Passaic, learnt how to categorize and identify water pollutants. They also learnt how to create dose response curves to identify the threshold of common pollutants they identified in passaic using plants as their model. The students also worked on creating a community environmental profile and an action plan for the hazardous pollutants.

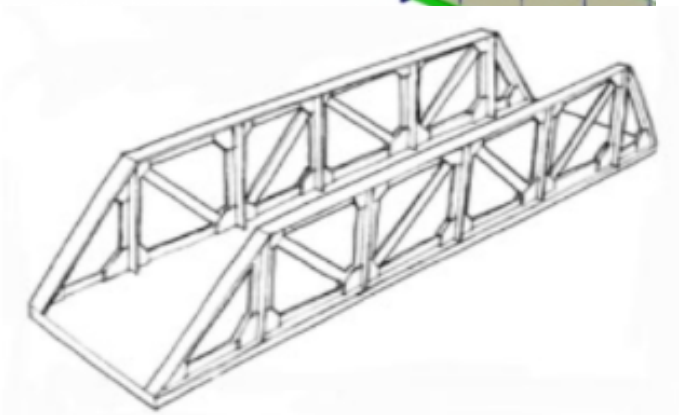
Over the course of quarter 2, 9 students attended the Phlebotomy program and now have their certification as of december 4th. Currently we have 9 students in the EKG program and are on track to graduate February 3 and the Medical Assisting program. Finally we have 3 students in the EMT program that we provide here as well and they will graduate in April. We are also in the process of enrolling more students for the Introduction to Patient Care at WPUNJ.

This quarter HOSA has been busy! In the winter, HOSA hosts a week of events for students to learn about health related topics and participate in fun activities. We kicked off HOSA week with an informative hands-only CPR event. Students were able to learn hands-only CPR on manikins provided by MedicZero Inc. During the week, students were also able to dissect a sheep brain. As seen in the photos, students greatly enjoyed learning the anatomy of the brain. Recently students have been learning about innovations in the medical field. HOSA president, Gabriela Bravo, presented to the group about dogs being trained to sniff out diseases such as COVID-19 or cancer. Gabriela led a group discuss to ask if students would trust a dog to sniff out a disease for them. To end the discuss she shared how scientists use biomimicry to create mechanical noses that may be able to sniff out diseases like dogs. This has been a productive quarter for HOSA.

ENGINEERING LEARNING UPDATE

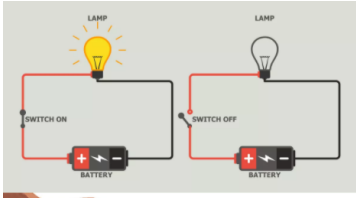
In quarter 2, students worked on the development of complex structures to compare material resistivity and effective design. During phase I, students designed and built up two different bridges; during phase II, students compare the structural effectiveness of the bridges by testing their strength (durability) under different weight load. Students are now working on the design of a model of their own houses.

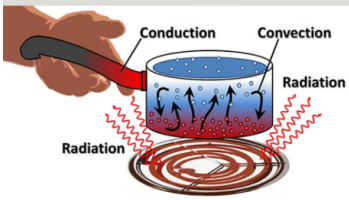




In quarter 2, students are learning about energy. We took a virtual field trip to a hydroelectric power plant, where students saw how the water in motion, moved turbines, which generated electricity. Students also learned how to build series and parallel circuits, their advantages and disadvantages. Finally, we also learned about thermodynamics or heat movement. This is an important topic in engineering, as the heat loss in a machine diminishes a system's efficiency.

In Aerospace Engineering students have been learning about the physics of flight. This marking period, students worked on two big projects: Gliders and Airfoils Students learned how to use the AERY Glider Design Software package for creating a glider design. The software package can perform the calculations required to predict the stability of flight for the designed glider and provide feedback on corrective actions to improve on this stability. Using this software, students designed their own gliders, built them out of balsa and spruce, and tested how far their glider could fly.

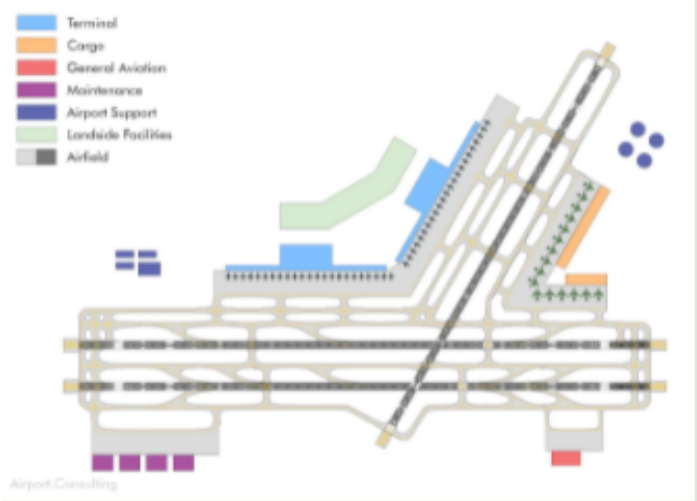


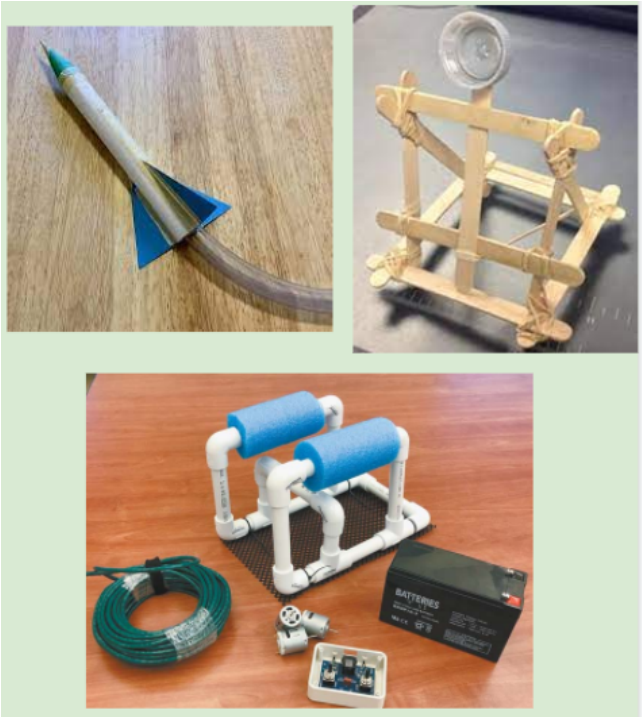


Students also learned how airfoils are used to convert motion through a fluid into lift. Using the Autodesk Fusion 360 software, students designed NACA airfoils, 3D printed them, and measured their lift at different angles of attack in our wind tunnel. With these measurements, students could calculate the airfoil Coefficient of Lift, identify its critical angle, and compare its performance to other students' airfoils.

In quarter 2, students covered airport operations, where we learned about the parts of the airport, runway nomenclature, and how pilots communicate with Air Traffic Controllers, using specific vocabulary to avoid miscommunication. We also learned about crew resource management and professionalism in the drone industry. These topics build the soft-skills that our students need to be successful as a part of large organization. Finally, we covered aeronautical decision-making, where we learned about the decision-making models that can help us make safe flying decisions. Specifically, we analyzed Captain Sully's landing on the Hudson river that saved hundreds of lives.

ENGINEERING LEARNING UPDATE





In quarter 2, students continued to challenge themselves and their peers with our mini-engineering challenges. Students competed against each other in designing a protective container that could help an egg survive a fall. They have also designed and built stemp rockets, catapults, and a boat. We are talks with members of the Navy for our members to learn how to build the underwater automatic vehicle 'SeaPerch.' Our students are very enthusiastic about the continuous opportunities to compete and apply the engineering design process.

THANK YOU

PASSAIC ACADEMY for SCIENCE & ENGINEERING
PASSAIC, NJ

SCIENCE

STUDENTS, STAFF, AND COMMUNITY!