UTeach Maker - Showcase Lesson Overview
Helena Castle (Spring 2020)

Submission Title	**Project Cell:** ***Bringing Cells To Life***
Name of UTeach AT	Helena Castle
Name of collaborator/s	Kira Lowery
School Name	**NYOS Charter School**
Subject and grade level	**7th Grade Life Science**
Website or Folder Link	**Showcase Lesson Link:** **https://castlehelena.wixsite.com/portfolio/showcase-lesson** **(*Visit this page to see pictures and additional reflections*)** **Links to Lesson Plans: Week 1 and Week 2** **Link to Project Journal**

Lesson Description:	The project being presented was a two week cell project with the following project launch: *"Project Cell is a non-profit organization that has noticed something: learning about cells can be challenging. Cells are responsible for making up all living things and they are what help us sustain life. Cells have small structures called organelles that have specific roles within the cell.* *When studying cells it is very helpful to look at models to see how these structures all fit together, BUT looking at models alone has its limitations in helping people learn how the organelles function and work together.* *Project Cell is launching a national contest for students like YOU to help them create interactive products that will help people learn about animal and plant cells, their organelles, and their role obtaining and utilizing energy for the organisms in which they create!* *Project Cell has seen many "typical" plant and animal cell models in their day, so be sure to develop a product that is creative and helps others learn about how the structures of the cell function and work together.* *Let's help Project Cell bring cells to life!"* This project had specific requirements for students that could be approached with freedom. The flexibility with the project promoted student engagement and interaction

	with the principles of making/the maker mindset. The lesson plans for the project can be found here: Week 1 and Week 2
Lesson Development:	The previous cell project that was implemented the year prior had a lot of strengths, but needed some updates and scaffolding to support student work over such a long period. The previous iteration had students develop museum models of cells, but we used the museum context in a new chemical bonds project earlier in the semester. In order to take a fresh outlook, we created a new launch to include the discussion of a non-profit launching a national contest to have students develop creative and innovative products to teach others about cells. Once the launch was developed, we tied back components of the development, reflection, and presentations to tie in with this story line. Next, we finalized all of the project requirements. With definite requirements that could be approached with freedom and creativity, we made sure to give students an open ended task to let them innovate. An essential component of the planning and implementation was the Project Journal. This journal was the home to all instructions, requirements, rubrics, and student work. Creating this journal helped organize the implementation of the project period and was a great resource for students, and an even better assessment tool that we could use to check in daily with students.
Connection to important concepts and skills within the discipline and/or across subject areas:	Before the cell unit, students studied the four major biomolecules: lipids, carbohydrates, nucleic acids, and proteins. Throughout this unit's investigations, we discussed the parts of the cell that were made with each of these biomolecules and the properties that each biomolecule had to carry out specific functions of the cell. Additionally, we studied and modeled the process of protein synthesis, talking about how DNA is transcribed into mRNA in the nucleus and then mRNA is translated into its corresponding amino acids and subsequent polypeptide chain at the ribosome. By discussing some of the organelles in the context of learning about how proteins are synthesized and reviewing the biomolecules and their properties, the cell unit content was scaffolded gradually. To learn more about the biomolecule lessons, please visit my Weekly Lesson Plans page. As we began the cell unit, many of these discussed connections were revisited and reminded students of what they already knew about cells. Before the project began, students learned about the history and tenets of the Cell Theory and reviewed each of the cell organelles with a candy cell activity. With the background knowledge and notes they needed to get started on the project, students launched into their project. Each workday had specific organelles that they reviewed and created in their project. Throughout the

	unit, students were reminded that organisms are made of one or more cell and told that we would be studying the tissues, organs, and organ systems that these cells create in our next human body systems unit. Understanding of the cell as the basic unit of life is integral to appreciating the complexity of the anatomy and physiology of the organ systems in the next unit. In addition to the science content, students were challenged to integrate technological components. Depending on the tech that they used, students connected their work to content like circuits and computer programming. This cross-curricular connection enhanced their projects and technology-related skills. <u>7th Grade TEKS:</u> (3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to: (B) use models to represent aspects of the natural world such as human body systems and plant and animal cells; (C) identify advantages and limitations of models such as size, scale, properties, and materials; and (12) Organisms and environments. The student knows that living systems at all levels of organization demonstrate the complementary nature of structure and function. The student is expected to: (D) differentiate between structure and function in plant and animal cell organelles, including cell membrane, cell wall, nucleus, cytoplasm, mitochondrion, chloroplast, and vacuole; (E) compare the functions of cell organelles to the functions of an organ system; and (F) recognize the components of cell theory. <u>9th Grade TEKS:</u> (4) Science concepts. The student knows that cells are the basic structures of all living

	things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to: (A) compare and contrast prokaryotic and eukaryotic cells, including their complexity, and compare and contrast scientific explanations for cellular complexity
Lesson Implementation:	This unit was designed for and implemented in all of the 7th grade life sciences classes at NYOS Charter School. Each of these class sizes ranged from 14-20 students and included inclusion classes with students who require modified curriculum. The majority of students are from low socioeconomic households and our student population represents many different cultural backgrounds.
	Students have had exposure to Making and technology, but before the experiences here many of their skills and mindsets were limited in these areas. The school as a whole allows freedoms to make projects like this possible, but as a whole, does not implement these ideals across the entirety of the educational institution. Ms. Lowery has done an exceptional job with teaching students about the maker mindset, and allowing them to create and iterate freely in her class to show and grow content knowledge. In general though, students do not experience these values across all of their classes and across all of their grade level experiences.

Reflection

Overall the project was successful in the eyes of both collaborators. Some of the strengths of the project include the engaging launch and storyline, the use of the project journal, and the freedom to let students create according to their interests while still meeting project requirements. Another key component of the project that set it apart from many traditional cell projects was the incorporation of technology as a requirement. Students had the choice in what technology they used, but were encouraged to use something that they had never used before-- like the micro:bits that they explored at the beginning of the project sequence. Students really rose to the occasion, creating products that were personalized, deeply rooted in the analogies that they created to teach others about cells, and showed a great deal of problem solving. Many students showed improvement in time management as compared to past projects because of the increased scaffolding of each day's work. The projects were used as a performance assessment and students also completed a Concept Check at the end of the unit. The Concept Check results showed strong student understanding across the standards of identifying prokaryotic/eukaryotic organisms and cell organelles. For example, 96.2% of the students could correctly identify which cells had nuclei, and ~88% of students could correctly identify all of the kingdoms and whether or not they were prokaryotic or eukaryotic. Additionally, 86% of students could correctly identify all components of the cell that were present in plant and not animal cells, and when asked about organelles and their functions, on average 80% of students correctly identified all of the functions of each organelle. This was a great performance for our students, especially with such a detailed Concept Check.

In order to dig deeper into content, and have students develop their ideas and iterate their products, the project timeline would need to include a few more days. Originally, this project was slated to be a little bit longer (3 days or so), and the shortened timeline did cause stress in some of our students as the project was wrapping up. At this point, students were highly invested in creating a great product and wanted more time in order to develop and execute their complex ideas. The students who wanted to go above and beyond worked hard to finish, but there were some groups who cut some of their ideas in order to create something to present. Another modification that we had to make for some groups was to abbreviate the involvement of technology in the final product. Instead of creating programs to run on micro:bit or integrating Makey Makey into their final product, some groups simply made a slideshow on Scratch to explain parts of their project. While this is not the ideal manifestation of the project requirements, it was a necessary move to keep some students' spirits high and the project goals attainable for them at that time. While some students were challenged by the technology, others pushed past their preconceived distaste for technology and showed great growth in their programming skills. One student in particular, decided that he was going to dive right into micro:bit and worked through his personal challenges with programming to create a beautiful controller that told his viewers about the functions of the organelles whenever the micro:bit was moved in certain directions. It was really exciting to see him buy into the project through this tech avenue, even though he expressed his aversion to programming in the past.

The final presentations, in the form of a "product pitch" to Project Cell were lively and playful. Students were excited to show off their products and sell the unique qualities that they had worked hard on throughout the project period. With more time, these presentations could be shown to communities outside the classroom, but the groups did a good job with summarizing their project experiences and reflecting on the creation of their products. In a perfect world, where time was in no way a factor, students could make commercials to show off their products and we could share them with the community.

At the end of the project, our (*imaginary*) non-profit, Project Cell, was very happy with the submissions they received and were excited students learned so much about cells and their organelles!

For additional reflections and pictures of student work, please visit my Showcase Lesson Page.