STEM SCHOOL CHATTANOOGA
Mini-PBL
Unit Plan Template

VR Cell Creation

Standards (Learning Targets)

LT 2 – Cellular Organelles & Functions
LT 4 – Cellular Transport & Homeostasis

Grade Level	11th	Unit Length	3 Weeks
Mini-PBL Overview	The purpose of this Mini-PBL is for students to learn Cellular Biology content while developing competence in Unity development and 21st Century skills such as innovation through technology expertise and time management. Via digital fabrication, students will create a Virtual Reality Cell product using Unity and Oculus Rift. During this process, students will participate in content tasks to expand on their prior knowledge. Unity tutorials and peer tutors will be in place to aid in the digital fabrication of VR projects.		
Mini-PBL Driving Question	How can we, as science consultants for Paramount Productions or Warner Brothers Pictures, create a Virtual Reality Cell experience that merges the content of cellular structure/function and cellular transport with Unity skill development in order to create a 4D Collaborative world that transforms learning into edutainment?		
Hook Event	Hook Part A: Students will view a video clip of a Willy Wonka and the Chocolate Factory or Charlie and the Chocolate Factory. After watching the clip students will participate in table talks and then whole class reflection of how the clip is analogous to cellular structure and function. This portion of the hook is necessary to activate and assess prior knowledge of the content. Hook Part B: Then, in stations, students will play the First Contact virtual experience using Oculus Rift and gaming hardware. This part of the hook ensures that all students have had a VR experience.		
Scaffolding Activities	**Class Activities** ● Hook Part A: Video Reflection (see description above) ● Practice: VR Cell Creation - Rubric Analysis - Students work in small groups to identify parts of the rubric that require clarification. Then all students participate in a whole class share-out. ● Practice: VR Cell Creation - Pacing Guide – VR Cell teams set times outside of class to work in order to meet Pacing Guide Requirements and then all students make additions to their Google Calendars and/or agendas accordingly. This is part of the gradual release model related the STEM School tenet of time management. ● Practice: STEM School Cell Analogy Reflection - Students will participate in a whole group discussion of information that was collected and recorded during the STEM School Cell Analogy station activity. ● Practice: STEM Harmony Activity - Students will create a STEM Harmony profile as their given cellular structure. After completing their profile requirements students will "speed date" in the persona of their cellular structures. While going through the rotations student will record information about each others' profiles and at the end of the activity the entire class will determine who was representing what cellular structure based on evidence gathered. ● Practice: Cell & Organelle Scenarios (links organelles to specific cells based on function) - Students are given descriptions of cells are designed to help them review the functions of some of the organelles		

and get the sense that cells are specifically designed to do a specific job(s) for the organism to which they belong.
- Practice: Cellular Transport Concept Mapping Activity - Student teams will have to research the following terms: active transport, passive transport, endocytosis, exocytosis, phagocytosis, pinocytosis, receptor-mediated transport and will have to conduct research as teams. They will need to know the definitions as a basic foundation but will they have to investigate further to find connections between the types of transport. Teams will then create a concept map of their findings that they will share with their classmates in a gallery walk fashion.

Station Activities
- Hook Part B: VR First Contact (see description above)
- Practice: STEM School Cell Analogy - Students will be given a Google Doc with one-sentence scenarios comparing cellular parts to people, places, or things inside of the STEM School (the cell). Then students are tasked to either agree or disagree with the given statement, provide justification/evidence to support their response. If students disagree with the initial scenario they are also required to provide a corrected statement.
- Practice: Cell and Cellular Transport Mini-PBL Google Slides (will finish outside of class) - Students are given a journey connected to Hook Part A in which they are asked to answer various questions about cells and cellular transport in order to activate prior knowledge and establish a foundation of knowledge. This practice assignment also serves the beginning phase of research for the VR Cell Creation summative assessment.

Workshops
- Unity Workshop (Peer-led) - Previous Biology students and/or Unity student experts will hold workshops during class and outside of class time in order to provide assistance to those with questions.
- Cellular Structure/Function Workshop (Peer-led) - Students that successfully completed their Cell and Cellular Transport Mini-PBL will be asked to lead a review of cellular structure/function using audio-visual supports.
- Cellular Transport Workshop (Peer-led) - Students that successfully completed their Cell and Cellular Transport Mini-PBL will be asked to lead a review of cellular transport using audio-visual supports.

Focus Groups
- Teacher/Team Conference - Student VR Cell Creation teams will meet with the teacher and be assessed formatively on their progress per the pacing guide and rubric.
- Remediation of Cellular Structure & Cellular Function (Teacher-led) - Students will be placed in this focus group based on data collected from their first submission of the Cell & Cellular Transport Mini-PBL responses and from their STEM Cell Analogy activity responses and reflection.

Team Time (Mini-PBL Teams)
- VR Cell Creation: Students will work in pairs that are chosen by the instructor. Students will submit a document that lists the work responsibilities of each student in the team. Each team member must be responsible for content and technology.
- Unscheduled Time: Students are not scheduled to have Biology classes on these days. Students are expected to be working on progress toward due dates including the Virtual Cell Creation Summative Assessment.

Activity Resources
- VR Cell Creation Lesson Supplements Google Drive Folder
- Unity Roll-A-Ball Tutorials (0-8)
- Unity Tutorial For Absolute Beginners 2018
- Official Unity Tutorials (1-30)
- First Contact Video of VR Experience

Digital Resources
- Unity 3D (https://unity3d.com/)
- Oculus Rift w/gaming computer/laptop
- Computers (will not work on Chromebooks or tablets)
- Technology for research

Calendar Overview					
	Monday	Tuesday (2hr)	Wednesday	Thursday (2hr)	Friday (1hr)
		Hook Event Part A: Video Clip w/Reflection CLASS ACTIVITY: Practice: VR Cell Creation - Rubric Analysis CLASS ACTIVITY: Practice: VR Cell Creation - Pacing Guide STATION: Practice: STEM School Cell Analogy STATION: Hook Part B: VR First Contact STATION: Practice: Cell and Cellular Transport Mini-PBL Google Slides	Unscheduled Time Practice: Cell and Cellular Transport Mini-PBL Google Slides TEAM TIME: VR Cell Creation	Complete STATION work as necessary from Tuesday CLASS ACTIVITY: Practice: STEM School Cell Analogy Reflection CLASS ACTIVITY: Practice: Cell & Organelle Scenarios WORKSHOP: Unity Workshop (Peer-led) TEAM TIME: VR Cell Creation	WORK SESSION DAY: FOCUS GROUP: Teacher/Team conference DUE TODAY: Practice: Cell and Cellular Transport Mini-PBL Google Slides WORKSHOP: Unity Workshop (Peer-led) TEAM TIME: VR Cell Creation
	Unscheduled Time TEAM TIME: VR Cell Creation	CLASS ACTIVITY: Reflection of Cell & Organelle Scenarios CLASS ACTIVITY: Practice: STEM Harmony Activity WORKSHOP: Cellular Structure/Function Workshop (Peer-led) TEAM TIME: VR Cell Creation	Unscheduled Time TEAM TIME: VR Cell Creation	CLASS ACTIVITY: Practice: Cellular Transport Concept Mapping Activity WORKSHOP: Unity Workshop (Peer-led) FOCUS GROUP: Remediation of Cellular Structure & Function (Teacher-led) TEAM TIME: VR Cell Creation	WORK SESSION DAY: FOCUS GROUP: Teacher/Team conference WORKSHOP: Unity Workshop (Peer-led) TEAM TIME: VR Cell Creation
	Unscheduled Time TEAM TIME: VR Cell Creation	WORKSHOP: Cellular Transport Workshop (Peer-led) TEAM TIME: VR Cell Creation	Unscheduled Time TEAM TIME: VR Cell Creation	TEAM TIME: VR Cell Creation	WORK SESSION DAY: FOCUS GROUP: Teacher/Team conference

					WORKSHOP: Unity Workshop (Peer-led) TEAM TIME: VR Cell Creation
	Unscheduled Time TEAM TIME: VR Cell Creation	Culminating Celebratory Showcase			

Culminating Event

Product

- VR Cell Creation Using Unity & Oculus Rift

Culminating Celebratory Showcase

- Students will play each others experiences and provide written feedback using the Mini-PBL rubric in Google Form format.

Common Assessment

Mini-PBL Rubric

	Advanced	Proficient
LT 2 – I can describe the connection between the structure and function of cellular organelles, intercellular relationships, and living systems.	❑ Allows the user to see a clear connection between the survival of a living system in relation to cellular components, functions, and transports.	❑ The VR experience is designed in such a way that the content is scientifically accurate ❑ Cell Membrane Structure: Includes accurate structural details of the cell membrane including the following: phospholipids, integral proteins, peripheral proteins, cholesterol
LT 4 – I can evaluate the types of cellular transport in relation to the structure and function of the plasma membrane, its macromolecule components, and the maintenance of homeostasis.	❑ Types of Solutions & Cellular Transport Involvement: Integration of hypotonic solution, hypertonic solution, and isotonic solution and the movement of molecules in relation to homeostasis	❑ Homeostasis Requirements: Evidence of how homeostasis is maintained in both the plant and animal cell in relation to structure and function ❑ Cellular Organelle Structures & Functions are scientifically accurate (see list in minimum requirements) ❑ Cellular Transport descriptions are scientifically accurate (see list in minimum requirements)
Process Skill #1 (21st Century Skill) Time Management	❑ VR product is submitted at least one day ahead of time (deadline is listed in Google Classroom) and teacher has been given all access permissions necessary to open any documents. If the assignment cannot be open it will be considered late	❑ VR product is submitted on time (deadline is listed in Google Classroom) and teacher has been given all access permissions necessary to open any documents. If the assignment cannot be open it will be considered late
Process Skill #2 (21st Century Skill) Technology Expertise	❑ Cellular Transport Involvement: The VR product allows the user to experience the types of cellular transport listed in the Minimum Requirement Section ❑ Movement in World & Triggers: User will be able to walk in the experience and use triggers on the handsets in interact with the science	❑ Polish Requirements: The VR product has intuitive interactions for the user ❑ Polish Requirements: The VR product has consistent visuals and operates smoothly ❑ Audio Requirements: Includes not only text but also audio as part of the user experience (science related) ❑ Visuals are of a clear, high quality

	Minimum Requirement Components: **Must be included to be graded.**	❑ Cellular Organelle Structure & Function: All of the following organelles are structurally represented and functions are described: nucleus, nucleolus, cell membrane, cytoplasm, mitochondria, vacuole, lysosome, ribosome, rough endoplasmic reticulum, smooth endoplasmic reticulum, Golgi apparatus, cytoskeleton, cell wall, chloroplast ❑ Cellular Transport Descriptions: The following cellular transport descriptions are present: active transport, passive transport, endocytosis, exocytosis, phagocytosis, pinocytosis, receptor-mediated transport ❑ VR Aspects = Includes a minimum of the following interactions (worlds, doors, stops, etc.) for the user: 1. Animal Cell 2. Plant Cell 3. Cellular Transport 4. What Cells in the Human Body Have More or Less of What Organelles: 1. #1 Analogy of what organelles are in more abundance in relation to selected theme (historical or fantasy/sci-fi) and the human body 2. #2 Analogy of what organelles are in more abundance in relation to selected theme (historical or fantasy/sci-fi) and the human body 3. #3 Analogy of what organelles are in more abundance in relation to selected theme (historical or fantasy/sci-fi) and the human body ❑ The Virtual Cell must be created using Unity and uploaded as a complete product ("game") to the shared Biology Fall 2018 Folder (LT2/LT4 VR Cell Subfolder) with the file name in the following format: Partners Last Names - VR Cell Fall 2018 (For example: Seigle, McCoy - VR Cell Fall Spring 2019)
	Grades	Students will earn two grades on this project (one for LT2, one for LT4, and two for Significant Process Skills) using the following scale; ● Missing (0): Did not meet minimum requirements ● Below Basic (50): Met minimum requirements but did not meet proficient requirements ● Proficient (85): Met minimum and proficiency requirements ● Advanced (100): Met minimum, proficiency and advanced requirements
Vocabulary		
	Science – Biology	1. Cell Types – prokaryotic, eukaryotic 2. Organelles – nucleus, nucleolus, cell membrane, cytoplasm, mitochondria, vacuole, lysosome, ribosome, rough endoplasmic reticulum, smooth endoplasmic reticulum, Golgi apparatus, cytoskeleton, cell wall, chloroplast 3. Cell Membrane Components – phospholipids, integral proteins, peripheral proteins, cholesterol 4. Cellular Transport - active transport, passive transport, endocytosis, exocytosis, phagocytosis, pinocytosis, receptor-mediated transport 5. Hypotonic Solution 6. Hypertonic Solution 7. Isotonic Solution 8. Homeostasis