Amp It Up! Engineering/Technology and Industry Lesson Extension



Teacher Name(s):	**Brianna Borek**
School and District:	**Hamilton-Wenham Regional HS**
Course:	**Anatomy & Physiology**

Abstract: In 200 words or less, please provide a summary of the goal for the lesson extension and its relationship between industry and academic topic.

A major theme of this course is the connection between structure and function. We dive deeper into this connection by studying homeostatic imbalances, and the potential medical interventions needed to bring the body back to its appropriate set points.

Today's cutting edge medical interventions address all body systems and some tools can be used to address multiple issues in the body. Medtronic produces a number of innovative products that can doctors can use to treat their patients.

In this lesson, students will explore the Medtronic website and identify a product and then design a case study around a patient that may benefit from having a doctor utilize that particular product. Students will present their patients to their classmates (modeling "rounds") and their classmates will need to identify a product that would be appropriate to use with the presented patient.

Engineering/Technology Link:

1. How did you *introduce* engineering/ technology concepts or the company/industry focus in your course? Check the appropriate box(es) or choose Other.

   ✓ Defined terms (science, engineering, technology)

   ☐ Described the engineering design process

   ☐ Engineering design challenge related to industry

   ✓ Overview of the company

   ✓ Challenge based on 'industry specific' area of focus (manufacturing process, quality control, measurement, development, teamwork etc.)

   ☐ Other: _____

Amp It Up! Engineering/Technology and Industry Lesson Extension

Level of Inquiry: Which of the following best describes the level of inquiry (adapted from Bell 2005) you used for this lesson/unit? Check the appropriate level.

☐ *Structured inquiry*: Instructor provides question and procedure. Students determine the results based on given procedures.
☐ *Guided inquiry*: Instructor provides question. Students design procedure and determine the results.
☒ *Open inquiry*: Students investigate their own research question. Students design procedures and implement the procedure on their own.

Lesson Extension Plan:

Title/Topic: Medtronic Case Study Design
Time (minutes): Two fifty-minute blocks (one for research/design, one for presentation)
Company Name and brief description: Medtronic, Danvers, MA
Overview of the Lesson: Students will review the many products available through Medtronic and will design a case study about a particular patient that might require the use of a particular device.
Standard(s)/Unit Goal(s) to be addressed in this lesson: HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis CCSS.ELA-LITERACY.W.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a selfgenerated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
Essential Question(s) addressed in this lesson: How do doctors use technology to help our bodies maintain homeostasis?
Objectives (academic and/or engineering/technology, career): 1. Identify various devices offered by Medtronic and determine their appropriate use 2. Research and determine homeostatic imbalances/disorders that require medical technology interventions that are produced by Medtronic 3. Design and present a case study to a small group of their peers
Link to Industry (how the lesson connects to the industry visited: Students will explore and become familiar with the devices produced by Medtronic
What students should know and be able to do before starting this lesson: - Students should be familiar with the design of a case study - Students should be able to use the internet to conduct research
Instructional Materials/Resources/Tools: Students will use their devices (we are a 1:1 school) to conduct research and design their case studies.

Amp It Up! Engineering/Technology and Industry Lesson Extension

Lesson Delivery

Lesson Opening

- Students will be shown the video *Meaningful Innovation* from the Medtronic YouTube page. Teacher will guide students to Medtronic website and give a brief "tour".

During the Lesson (activities/labs/challenges)

BLOCK ONE

- (~10 minutes) Students will work in groups of four students. They will first complete the *Technology Matching* worksheet to help them practice navigating the Medtronic website and will also give them some background on the medical devices

- (~40 minutes) Once that worksheet is complete, students will select one of the devices on the worksheet or an additional one they found interesting on the website. Students will be given the remainder of the block to design their case study.

BLOCK TWO

- (~5 minutes) Students will be given a short amount of time to check-in with their team to go over any last details of their case study presentation

- Groups will go up one by one and present their case studies. Non-presenting groups will be given a couple of minutes between each presentation to identify the appropriate device and will fill that in on the *Case Study Answer Sheet*.

Lesson Closing

- Students will share out the appropriate device for each case study and teams will check their answers.

Assessment

Student Assessment: Students will be assessed on the following:

- Their effectiveness and focus while working as a team during case study design
- Their case study presentation (rubric attached)

Delivery Assessment:

- Teacher will review initial Technology Matching worksheet
- Teacher will provide verbal feedback throughout research/design phase of block one

Additional resources and assessments: Attachments should include handouts, readings (with references), lab write-ups, rubrics, exams/quizzes, and/or other similar materials.

1. Technology Matching worksheet
2. Case study answer sheet
3. Criteria for Success - case study grading

TECHNOLOGY MATCHING WORKSHEET

PART ONE: Background
Visit www.medtronic.com

1. Click the "menu" button and select "about medtronic", then click "overview". Summarize the six major parts of the Medtronic Mission

PART TWO:
Visit http://bit.ly/medtronicproduct and/or http://bit.ly/medtronicinno to help you match the devices to their appropriate use and/or summary. Some terms may be used more than once.

_____	Micra transcatheter pacing system	a. Helps patients monitor and maintain blood sugar homeostasis
_____	MiniMed 670G	b. World's smallest implantable neurostimulator
_____	Intellis spinal cord stimulator	c. Gathers data on patient movement so that doctors can connect pain levels to action
_____	CoreValve Evolut TAVR System	d. Replaces a damaged and/or improperly working valve in the heart
_____	PillCam capsule endoscopy	e. Small electrode, typically implanted near the clavicle and connected to leads implanted in the brain
_____	Deep brain stimulation systems	f. Designed for diabetes patients
		g. Small device which produces clear images of the esophagus, stomach, and intestines
		h. Provides effective, long-term pain relief for patients; implanted in spinal cord
		i. Assists with maintaining cardiac rhythm
		j. Self-expandable valve inserted into the heart deployed through a minimally invasive procedure
		k. Used by physicials to detect gastrointestinal abnormalities, monitor disease actvitiy, and assess treatment efficacy
		l. World's first hybrid close-looped insulin delivery system
		m. World's smallest pacemaker
		n. Treats numerous neurological issues, including symptoms of Parkinsons disease

CASE STUDY ANSWER SHEET

After each presentation, your team will have 2 minutes to identify the medical device that you think would be most effective to provide to the presented patient. You can reference your *Technology Matching* worksheet if you need to! Each device will only be presented in one case study.

CASE STUDY ONE

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CASE STUDY TWO

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CASE STUDY THREE

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CASE STUDY FOUR

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CASE STUDY FIVE

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CASE STUDY SIX

Patient name:	Device:
Summary of case:	
Defend your device choice:	

CRITERIA FOR SUCCESS – CASE STUDY

Criterion	Present	Absent
Patient background – *provides adequate insights as to the patients condition* - Thorough, relevant, understandable patient demographics (age, gender, etc.) - Primary complaint(s) and any pertinent medical history		
Findings – *provides a temporal outline that details objective findings* - EX: swelling, tenderness, muscle function, special tests performed, referrals, diagnostic tests, etc. - Includes images (if relevant) of tests		
Diagnosis – *provides patient diagnosis*		
Disorder/imbalance background – *briefly summariezes the condition of interest* - General summary of disorder, causes, symptomology, impact on daily life, prognosis		
Collaboration – *team worked collaboratively and shared work equally*		
Presentation – *minimal reading from slides and/or notes, spoke clearly, eye contact*		
Creativity – *case study was creative and engaging*		
Citation – *appropriately cited sources*		