



# Using a Micro:bit to Solve Health Issues

*Grade 10th Grade*

*Subject Science Research*

*Ms. Goldstein, Brooklyn, New York*

## BIG IDEAS

1. How can technology be used to help solve real world health issues?
2. What health issues exist in the United States? What are some solutions to monitor these health issues?

## EDUCATION STANDARDS

*NGSS, Common Core, or related State standards. Write out (or copy and paste) standards completely. Please identify the point when each standard is addressed in the 5E template below.*

## NGSS Performance Expectation(s)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<p><b>Constructing Explanations and Designing Solutions</b>            Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.</p> <ul style="list-style-type: none"> <li>Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)</li> <li>Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)</li> </ul>	<p>HS-ETS1-2.            Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>HS-ETS1-3.            Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p>	<p>Influence of Science, Engineering, and Technology on Society and the Natural World</p> <ul style="list-style-type: none"> <li>New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HS-ETS1-3)</li> </ul>

**Common Core State Standards:** *Use your state standards if Common Core is not applicable in your state. You are encouraged to list the CCSS and your state standards.*

Math: *If applicable*

ELA: *If applicable*

ITEEA Standards *(If applicable)*

Other Standards *(as needed)*

**NYS Computer Science Standards:**

**9-12.CT.8** Develop a program that effectively uses control structures in order to create a computer program for practical intent, personal expression, or to address a societal issue.

**9-12.CT.9** Systematically test and refine programs using a range of test cases, based on anticipating common errors and user behavior.

**9-12.CT.10** Collaboratively design and develop a program or computational artifact for a specific audience and create documentation outlining implementation features to inform collaborators and users.

**9-12.NSD.1** Design a solution to a problem that utilizes embedded systems to automatically gather input from the environment.

## MEASURABLE STUDENT LEARNING OBJECTIVES

*Write the learning objectives as “students will be able to” statements. Be sure that your objectives are measurable and connect to the standards listed above.*

*You are encouraged to use Webb’s Depth of Knowledge to create action oriented objectives.*

SWBAT create a prototype of a device to solve a health care issue using a micro:bit device.

This is a unit aimed at integrating engineering/coding into the science research classroom. It is noted that most research track students will not be exposed to this throughout high school unless they take AP CS. Therefore, this 3 week unit gives them the opportunity to appreciate how engineering is integral in the study of a lot of science.

## STEM INTEGRATION

*Choose at least **TWO** of the following subject areas- Science, Technology, Engineering, or Math to address. Along with those subjects, please choose **at least one** other subject to integrate (any of the S- T- E -M- subjects, Art, Literacy, Social Studies, P.E., Music, etc.), for a total of **at least** three different subject areas. Please list them here.*

This project will integrate Science and and Technology and literacy.

*Clearly explain how each subject is integrated and how integration enhances students' understanding in each subject. Substantiate how practices will be developed within subjects. Why is the integration logical?*

Science and literacy need to be integrated as students will do research on a health care topic and will need to reach sources in order to understand the different facets of the issue. For example, students can do a project about how heart disease affects millions of Americans. They will read sources and create a presentation. They will then need to understand the science behind the issue. They will use technology to solve that problem.

## NATURE OF STEM

*Summarize how your lesson addresses the “nature of” science, technology, engineering, math, etc. as discussed in the Methods of STEM course.*

Students will need to iterate with their technology design. They will work on it, test it and repeat. This is the nature of science experiments don't usually work the first time around. Scientists need to learn from their mistakes, iterate and tweak their design.

## MATERIALS NEEDED

Micro:bit and computer that connects

## ENGAGING CONTEXT/PHENOMENON

*What are your engaging phenomena or your “hook” for the lesson? Be sure whatever you choose is appropriate for the subject area and grade level you are addressing. Several example phenomena are shared in course. Consider how observations of the natural world serve as phenomena to engage students in the content. You must utilize a*



*NASA resource in your lesson (please discuss with your instructors if you need assistance).*

*Students will use this video with accompanying questions to dive into how problems in space can affect human health and highlighting how NASA scientists use technology to help with biological health issues. This will then connect us back on Earth to connect how we can use technology to improve a human health issue.*

## DATA INTEGRATION

*What data is being used in this lesson? Are students analyzing or collecting data? What are they doing with the data? This would be a great place to include all the different NASA data made available to you. If NASA data is not appropriate for your lesson, speak to your course instructor to identify another source of data that is appropriate. It may be publicly available, collected by students, or accessible to you with permission through other projects.*

Students will collect data from their device to see how well it works in solving their health issue. They will continue to tweak their project until it works in the way that they intend. Note: this is a prototype so it will work the best of the ability for this project.

## TEACHER BACKGROUND KNOWLEDGE

*What background information does the teacher need to effectively teach this lesson? If you can provide links to resources, please do so.*

Teachers need to have a basic understanding of introductory coding structures such as iteration and selection and use of the of micro:bit.

## DIFFERENTIATION OF INSTRUCTION

*How can you adjust this lesson to meet the unique needs of students in your classes? What needs should be addressed? Think about and make these modifications PRIOR to the lesson so all students have the greatest ability to participate.*

1. Students will be given a pre unit survey to determine their *familiarity, experience and readiness* for coding. Students were then put into homogeneous groups based on these factors. This allows students who are more experienced to use more sophisticated coding structures while newer coders have the ability to get their feet wet with this new skill. (Seating arrangements attached).
2. Within the groupings for four individuals students were able to choose their partner based on what they were interested in.
3. Students were given the opportunity to use block coding or to *challenge themselves* to do the project using a text-based language.

4. For students who need extra scaffolding to help them get started on code, students will be reminded that they can refer back to videos with starter code for each sensor to get their design off the ground. More experienced coders will not necessarily need such support.

## REAL-WORLD CONNECTIONS FOR STUDENTS

*Is there a real-life connection to this lesson? If so, what is it? Is the lesson culturally responsive? What teaching practices do you suggest? How will students connect to the lesson in their everyday lives?*

Students will be thinking about real world health issues that probably have affected them or someone they know. This is a very relevant unit for students and their everyday lives.

## INTEGRATION POSSIBLE MISCONCEPTIONS

*Are there any previous ideas or thoughts you anticipate students having about this concept? List them here as it will help you consider ideas to include in your lesson.*

## LESSON PROCEDURE

*This is where you include each phase of the 5E. They should be extremely clear, well organized, and ready to be used by another educator. Be sure that each learning experience meets the guidelines for each “E”. The template below will help you.*

<b>5E</b>	<b>Details of 5E Lesson Implementation</b>
-----------	--

**Engage**

Procedure: Students will watch the video from NASA about bone health in space.

**Formative/Summative Assessments** *Students will answer questions about the connection between human health and technology and what this technology is solving for human health in space.*

**Resources** *(List all resources and materials used in this part of the lesson.)*



**Explore**

*Plan for students to engage in hands-on activities that are designed to facilitate conceptual*

<p>change.</p>	
<p>-</p> <p><b><u>Explain</u></b></p> <p><i>Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.</i></p>	<p><b><u>Preceding activities:</u></b> <i>students were exposed to basic coding structure such as selection and iteration. Students worked in groups to explore a specific sensor including writing basic code for that sensor, taking a video of how their code works on the micro:bit and researching real-world applications of the particular sensor. Students then did a jigsaw to present their sensor to other individuals in class.</i></p> <p><a href="https://docs.google.com/document/d/1_ih4cYu7TLfC1OpUNivN6i6YJksuLXFOX982asq07xU/edit?usp=sharing">https://docs.google.com/document/d/1_ih4cYu7TLfC1OpUNivN6i6YJksuLXFOX982asq07xU/edit?usp=sharing</a></p>
<p><b><u>Elaborate</u></b></p> <p><i>Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and</i></p>	<ol style="list-style-type: none"> <li>1. Research a health care issue that can be helped with a device with some sensors. ( For example, students could use the accelerometer to measure steps in order to combat obesity and other attendant health issues)</li> <li>2. Students will use their background research to design an algorithm to solve this issue       <ol style="list-style-type: none"> <li>1. First they will build the algorithm in words and describe what the device does step-by-step (pseudocode)</li> </ol> </li> </ol> <p><a href="https://docs.google.com/document/d/1-Xg724RYASKTKyQQgAPLjD6VFMknfsINQIRlcQzUjBQ/edit">https://docs.google.com/document/d/1-Xg724RYASKTKyQQgAPLjD6VFMknfsINQIRlcQzUjBQ/edit</a></p>

<i>skills.</i>	
<p>-</p> <p><b>Evaluate</b></p> <p><i>Assess students knowledge, skills and abilities.</i></p>	<ol style="list-style-type: none"> <li>1. Students will begin to design their code, making sure to “test early and often” in order to make sure it works.</li> <li>2. Students will iterate through this process a few times to make sure they come up with the best prototype in the time that is provided.</li> </ol> <p>Each day students will <a href="#"><u>reflect on their accomplishments and next steps using this google form.</u></a> (questions attached)</p>

## REFERENCES

If you borrowed ideas, give people and organizations the credit they deserve.

These activities are adapted from <https://microbit.org/> the micro:bit website which has a plethora of resources of integrating this work into K-12 classrooms.