

# Curricular Unit: Enhancing Health - Sensors in Wellness, Health, and Medicine

Contributed by: Kansas State University, Computing and Information Systems Department, National Science Foundation GK12 INSIGHT Program

Prepared for <http://www.teachengineering.org/>

**Grade:** 6 (5-7)

## Time Required

Please see individual lessons and activities.

## Summary

This health unit focuses on the many ways sensors are used to monitor, manage, and improve health and provides an opportunity to introduce a variety of science, biology, and programming lessons and activities. Students get to work with heart rate sensors, data loggers, measuring devices, and computer interfaces that can be used to enhance health and wellness. Students also get to learn about and interact with sensors and implantable devices used in medicine and animal health initiatives. Issues related to safety and security, as well as reliability are introduced along with a look at some of the current research areas active at K-State and in the greater academic community.

## Engineering Connection

Engineers are increasingly involved in many areas of health and medicine. Biomedical engineers develop devices and procedures to support a variety of health and medical objectives. Engineers design technologies that are being used to consistently and reliably monitor a wide range of body conditions, from blood glucose levels to internal temperatures as well as the devices used to treat significant illnesses. Engineers have developed and manufactured remote controlled devices that enhance the vision and precision of surgeons during operations and tools and technologies that enhance the targeted delivery of radiation, chemical, and other specialized treatments for better therapeutic effectiveness and reduced side-effects. Exciting research areas include nanotechnologies, robotics, and other areas.

## Engineering Category

1. Relating science and/or math concepts to engineering

## Subject Area(s)

Life Science, Computer Science, Biology, Science and Technology

**Keywords:** medicine, sensors, biomedical, robotics, remote-controlled, health, wellness, treatment, monitoring, wireless networks, farm animals, exercise, diabetes, implantable devices, rehabilitation, gaming, Kinect, Wii.

### **Educational Standards**

Shawnee School District Grade 6 (2010) from Kansas Science Standards -

- Objective 4006.01 - Identify a problem statement that can be answered through science investigation.
- Objective 4006.02 - Design and conduct investigations safely using appropriate tools, mathematics, technology, and techniques to gather, analyze and interpret data.
- Objective 4006.03 - Identify relationships between evidence and logical conclusions.
- Objective 4006.59 - Demonstrate comprehensive exercises which will promote health and well-being.

### **Related Lessons**

- Sensors in Health, Wellness, and Medicine (1)
- Advanced gaming interface devices in wellness and rehabilitation (5)

### **Related Activities**

- Assessing the Power of Exercises with Sensors (2, 3, 4)
- Using Sensors in Wellness Day (6)

### **Unit Overview (Return to Contents)**

Overview of topics: (1) Introduce sensors and their emerging applications in health, wellness, and medicine (2) Design an experiment to see how much activity is needed to reach and sustain our target heart rate (3) Calculate target heart rates for a student, a teacher, and a visiting engineer or graduate student. (4) Conduct the smart heart exercise experiment activity (5) Explore how innovative new gaming interface devices can be used in wellness and rehabilitation (6) Enjoy sensor-enhanced wellness activities.

### **5E Lesson for Health and Sensor Unit**

Engage: explain what will be done to hook students into the lesson. Will there be a video? if so, put the link in here.

Explore:*Fitness Inquiry Lab.* Students will explore the problem, “Which type of exercise will raise my heart rate the most?” They will start with observing and practicing the following exercises: jumping jacks, squats, jump rope, run, push ups, high knees, sit ups and isometric plank. Then students will formulate a hypothesis that predicts which exercise will have the greatest impact on heart rate. Next, students will work together to identify the independent variable, dependent variable and constant variables for the inquiry. Students will work with teams to conduct the experiment. They will use Garmin Heart Rate monitors to measure their heart rates during each exercise. Students will record this data and calculate the measure of center for each exercise. They will do this by finding the mean for the heart rates of each member of their group. Next students will graph the mean for each exercise on a bar graph. They will write a conclusion in which they interpret whether their hypothesis was supported by the results.

*6.SP.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.*

Explain:Denise can you explain what you will talk about here in regards to sensor technology and how it is used for health. Will you use power points, visual aids, video, etc?

Extend: Students will make a survey with five health related questions. For example, how many minutes do kids in our class exercise might be a question. Students will then administer this survey to the students in the class.

*6.SP.1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.*

Evaluate:Students will graph and interpret the results of the survey using power point or excel graphing software. Explain type of graph used here...

*6.SP.2. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.*

*6.SP.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.*

*6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and boxplots.*

## **Unit Schedule**

See individual lessons and activities.

## **Summary Assessment**

To evaluate the effectiveness of this unit, a pre-test is available that can be administered prior to beginning any of the activities or lessons. The same test can be taken as a post-test, after completion of the unit activities and lessons, and the results compared to assess the learning progress.

## **Attachments**

Pre-Unit Quiz

Post-Unit Quiz

## **Contributors**

Denise Case, Kansas State University, Lucas Shivers and Lindsey Burch, Bluejacket Flint Elementary.

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## **Supporting Program**

Kansas State University, Department of Computing and Information Sciences,  
National Science Foundation GK-12 INSIGHT Program

**Pre-Unit Quiz**  
**Post-Unit Quiz**

- 1. In your own words, what is a heart rate monitor?**
- 2. Explain the history of the heart rate monitor and how the idea was started?**
- 3. Why do you think it might be helpful to be able to measure heartrate?**

A **heart rate monitor** is a personal monitoring device which allows a subject to measure his or her [heart rate](#) in real time or record his or her heart rate for later study. Early models consisted of a monitoring box with a set of electrode leads which attached to the chest.

The first wireless [ECG](#) Heart rate monitor was invented in 1977 as a training aid for the Finnish National Cross Country Ski team and as 'intensity training' became a popular concept in athletic circles in the mid-80s, retail sales of wireless personal heart monitors started from 1983. [\[1\]](#)