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| **Title** | **Detecting Rise in Body Temperature in Human and Animals and its Effects on Health** |
| **Introduction** | Meteorologists often give heat advisories or warnings regarding exposure to the sun during the summer months. These warnings are issued to alert people about the dangers of being exposed to extreme heat and make people aware of the amount of time which they spend in the sun. Some dangers include edema (swelling), rashes, cramps, exhaustion, syncope (fainting) and stroke. The National Institute of Occupational Safety and Health (NIOSHA) has described these exposures to heat and provided measures to reduce the impact of these conditions to the body. Long-term body temperature increases can cause other effects as well. Some of these effects include heart, kidney and liver damage, chronic heat exhaustion, sleep disturbances, and susceptibility to minor injuries and sicknesses. Additional exposure of pregnant female animals to high temperatures has yielded embryos born with birth defects. (\*1)  In this Problem-Based Project unit, students will research normal temperature ranges and heat stroke ranges for the human body and that of an animal of their choice. Students will then locate and use a sensor that will monitor the temperature of the selected animal in its natural environment. (The choices include the TI Sensor Tag or the Arduino Lily Pad.)They will create a means for attachment and recharging of the device. Students will apply this information to the concept of the elderly monitoring their health with regards to excessive heat. The classroom time will be spent among the One Health Topic purpose, proper use and testing of the chosen sensor and /or programming. Brainstorming for attachment options, testing and analysis of data will be performed using the Engineering and Design Process. This lesson incorporates the use of the Arduino LilyPad into the weather unit as data is collected about body temperature to provide warnings for those at-risk of heat exhaustion and heat stroke. The Arduino LilyPad is programmed to display a blue color when the ambient temperature is less than or equivalent to the normal body temperature range of a person.  About the Arduino LilyPad Device. The Arduino LilyPad is a tiny computer which is designed to sense the environment and produce outputs that are easily observed. It can be programmed to measure temperature, light and motion (input) and produce either vibrations, flashing LED lights, blinking lights and sounds or any combination of these (output). This is made possible through the use of the computer language C++. For beginners, there are programs available on-line which can be copied and used by novice students or teachers. This interactive device can be sewn into any fabric with conductive thread as interactive garments (like shirts) or accessories (like earrings). A google image search of “Arduino LilyPad Projects” reveals so many creative ways to incorporate these devices into clothing or other items. \*3 For this reason it is considered a wearable device.  The culminating project of this unit is designed so that students take charge of their learning. In order to complete their project, they conduct research independently and collectively, brainstorm for possible solutions and choose their sensor(s) for the task, test their hypotheses and analyze their data collected from the experiment, modify procedures as needed and retest as needed. Students will also build a model, which may or may not work, but important to the engineering design process. Collaboration is involved in the many decisions that have to be made in completing this project. Students must come to agreements on the goal of the device, type of research of focus, the software programming needed, the procedural steps to create the wearable device and to test the device, the analysis of the data, the benefit of the project and its worth to the human or animal population or the environment, how to make the project into a wearable device and resolve all the problems incurred along the way. When students matriculate through these steps, they are practicing the habits of engineers. Teachers should be prepared to incorporate problem-solving and negotiation skills, encourage creativity and develop research skills along the way. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \*1 <http://www.ccohs.ca/oshanswers/phys_agents/heat_health.html>  \*2 <http://lilypadarduino.org/> (about the Lilypad and ordering link)  \*3 <http://tinyurl.com/j7rv22t> (ways to use lilypad)  **\***4 Getting Started with the Arduino Lilypad (very helpful for teacher and students) (<https://www.arduino.cc/en/Guide/LilyPadWindows> |
| **Real Science Application** | This unit contains science specific background information for the teacher related to this lesson, including the research program goals that this lesson incorporates and underlying scientific principles.  Heat advisories and heat warnings are issued to prevent the suffering of the effects of heat. In a heat advisory, the heat index remains at or above 100 ° F for a minimum of two hours. Excessive heat warnings include a heat index of 105 ° F or higher for a minimum of two hours. Heat advisory notifications trigger actions and regulations such as no evictions, no turning off power, outdoor activity restrictions, alerting hospitals to prepare for more heat-related injuries, checks on the elderly and homebound individuals and provide cooling devices to individuals who are in danger of heat-related effects. If we can detect and avoid temperature extremes, we can eliminate the associated (or accompanying) hazards such as heat exhaustion, heat stroke and seizures.  Animals can also suffer the dangers of heat effects if they are not cared for properly. When heat impacts animals, sickness or death can occur causing financial loss to those involved with their care, well-being, and management. If these animals are directly, or indirectly, involved with humans, disease transmission can occur to humans through environmental factors. The One Health Initiative vision is dedicated to improving the lives of all species—human and animal—through the integration of human medicine, veterinary medicine and environmental science.  The data that students collect will be used to identify dangerous warning temperatures and develop warning systems that allow them to self-monitor and adjust their temperature with actions that reduce their body temperature. This information will be transferred to an animal project to gather similar data that will help to monitor the health of the animal. *\*2* [*http://www.animalchange.eu/Docs/Budapest2014/S03.pdf*](http://www.animalchange.eu/Docs/Budapest2014/S03.pdf) |
| **Curriculum Alignment** | This section contains the curriculum alignment of the lesson to the North Carolina [NC Essential Standards](http://www.ncpublicschools.org/acre/standards/new-standards/) of Science or Math, and the [Next Generation Science Standards](http://www.nextgenscience.org/next-generation-science-standards) (NGSS) or [Common Core Math](http://www.corestandards.org/Math/).   |  |  |  |  | | --- | --- | --- | --- | | Content Area | Grade Level | NC Essential Standards | NGSS | | Human Body | 7th | 7.TT.1 Use technology and other resources for assigned tasks | MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society | |  |  | 7.RP.1 Apply a research process to complete tasks. | 3-5-ETS1-1. Define a simple design problem method reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.  3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.  3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. | |  |  | 7.E.1  Understand how the cycling of matter (water and gases) in and out of the atmosphere relates to Earth's atmosphere, weather and climate and the effects of the atmosphere on humans. | MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. | |  |  | 7.L.2  Understand the relationship of the mechanisms of cellular reproduction, patterns of inheritance and external factors to potential variation among offspring. | MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories | |
| **Learning Outcomes** | Students will explain how weather affects the human body temperature.  Students will demonstrate how temperature affects body functions (homeostasis).  Students will complete an experiment while incorporating technology in the Engineering Design Process. |
| **Time Required and Location** | 55 Minute Class Periods in the Classroom, Computer Lab and school grounds (data collections) |
| **Materials Needed** | Teacher List:   * [TI-Sensor Tags](http://www.ti.com/tool/cc2650stk) and extra coin batteries (Wal-mart is one battery resource.) * \* Teacher-created resources (see padlet @   <http://padlet.com/elampkin/nl05krqoapg0>)   * One Health Challenge Competition Rubric (Two teams from my school will enter this competition <http://assistonehealth.com/competition-overview/> * Projector for digital presentations & displaying any information for teaching purposes or student responses. * [Forehead Thermometer Strips](http://www.amazon.com/Handy-Child-Forehead-Thermometer-Temperature/dp/B00M1RFTFG/ref=pd_sim_sbs_75_1?ie=UTF8&dpID=41sY2NDw%2BWL&dpSrc=sims&preST=_AC_UL160_SR160%2C160_&refRID=10PD3SYNRDYJK1CB262Z), Amazon.com (2 per class) * Software needed for loading: * [TI-Sensor Tag](http://tinyurl.com/ngm4n2k) Simple Link Model App link (2 choices) * [TI-Sensor Tag Getting Started site](http://www.ti.com/ww/en/wireless_connectivity/sensortag2015/gettingStarted.html) Simple Link Model * \*[Arduino App](https://www.arduino.cc/en/Main/Software) for downloading * [Arduino LilyPad Download instructions](https://www.arduino.cc/en/Guide/LilyPadWindows#toc2) and operating instructions for students and teachers * \*Note: Teachers will need to request IT District Assistance to download the Arduino to desktops in advance of usage.   Arduino LilyPad Kits which includes the board, and the following**:** [Ordering info](https://www.sparkfun.com/products/11262)   * 2 x [Conductive Thread Bobbin](https://www.sparkfun.com/products/10867) * 1 x [Needle Set](https://www.sparkfun.com/products/10405) * 1 x [110mAh LiPo Battery](https://www.sparkfun.com/products/731) * Sparkfun USB Mini B Cable 6 foot (CAB-11301 [ROHS](https://www.sparkfun.com/static/rohs/)) [Ordering info](https://www.sparkfun.com/products/11301) separate from other parts. ( from Sparkfun.com)   **Documents:**   * Arduino LilyPad Device & software loaded on computers * Prepared sample data for teaching students, * Word cloud for student responses (prepared in advance) * Trello.com spreadsheet (organizing group member project responsibilities, optional. One drawback: all students need to create an individual account to use and share / collaborate.)   Student List:   * [Interactive Notebooks](http://everybodyisageniusblog.blogspot.com/p/interactive-notebooks.html) and writing utensils * Arduino LilyPads per group of 3 to 4 students * TI-Sensor Tag per group of 2 students * Electronic Devices for transmitting data (via word cloud), completing research & collecting data (phone, iPad, etc.) * Recording devices (computer, or notebook, pen / pencil, chart) * Lab (designed by students, including student-created data sheet) * [Trello.com](https://trello.com/)  (Digital Group Responsibility Charts) |
| **Safety** | Safety Rules and Precautions   1. Students will need to exercise caution anytime electricity is being used. 2. No foods or liquids are allowed in the science lab. 3. Students are expected to handle the equipment with care. 4. Do not put any part of the Arduino LilyPad in the mouth, (including the battery). 5. No horseplay is allowed in the lab setting. 6. Students are to maintain a reasonable amount of order at their lab station and place book bags in the storage area (away from the lab area) when completing labs. 7. Students should carry equipment properly when changing locations (scissors: sharp end down and away from self and others). 8. Students should maintain a sense of purpose (stay focused on the task at hand) and use appropriate voice levels when working in groups. 9. Students should remain with their group unless retrieving items. 10. Students should not visit other group for socialization purposes. |
| **Student Prior Knowledge** | These activities are created as part of the unit on weather. Students should be knowledgeable with safety rules (although they will reviewed again), the Engineer Design Process, weather vocabulary (precipitation, La Niña/El Niño, hemisphere, evaporation, temperature, thermometer, condensation, air pressure, barometer, fronts, Jet stream, anemometer, Gulf stream, latitude, wind vane, air mass, rain gauge, convection, conduction, radiation such as humidity, heat exhaustion, heat stroke) and processes (such as winds, clouds and precipitation), and weather patterns. |
| **Teacher Preparations** | * Prepare presentation media for lessons on use of Arduino with the objectives of the lessons * Set up an Arduino demo for the students to see. * Reserve the computer lab for these days * Get permission to load software on school computers; load with the media specialist in advance in classroom and or computer lab. * Remind students to bring their devices and connect to the school’s wi-fi prior to presentation day. * Assign students to heterogeneous groups; make sure someone has a device. (Students will define their roles / responsibilities in the group, using the Trello.com website.) * Assign computer lab seating chart. (Lab partners sit together and work quietly.) |
| Activities | Unit Overview  Students will use their knowledge of the One Health Concept, Engineering Design Process, TI-Sensor Tags and Arduino LilyPad devices to create their own project and display to their classmates using the included directions and rubric. (2 teams from my school will advance to the next level and enter the One Health Competition <http://assistonehealth.com/competition-overview/>  Day 1: One Health overview and reading assignment.  Objective for days 1-3: Students will:   1. 1. preview the One Health Introduction PPT 2. [http://padlet.com/elampkin/nl05krqoapg0/wish/97698993](http://padlet.com/elampkin/nl05krqoapg0/wish/97698993 ) 3. investigate the One Health Initiative <http://www.onehealthinitiative.com/> 4. read and summarize the mission statement to determine goals of the organization   <http://www.onehealthinitiative.com/mission.php>   1. Jigsaw Format: Students will be assigned a mission statement to analyze and clarify.   They will then rotate around the room and share their statement with  other classmates until all statements have been reviewed. More  information is available about Jigsaw at  <http://www.adlit.org/strategies/22371/>   1. Summarize & Review the One Health Initiative and Mission Statement with a paragraph in their journal.   Day 2: One Health Discussion and Summary   1. Review the One Health Concept with the Answer Garden Question responses <http://tinyurl.com/jcc5dea> 2. Analyze a One Health reading assignment for class discussion using the RUNNERS Strategy (<http://schools.cms.k12.nc.us/huntersvilleES/Documents/RUNNERS%20Strategy.pdf> )   GIDEON and One Health – Feb. 24, 2016 Original article link <http://www.onehealthinitiative.com/news.php>  Teacher modified Article: “Gideon and One Health” <http://tinyurl.com/jjsf5s3>    (NOTE: Teachers can go this site and choose a current article when presenting to students. This site is updated often. The questions are written to work with most science articles from this website.)  Day 3: One Health Discussion and Summary. Students will present their findings to the class in a discussion format (orally) and submit their written responses to teacher.  Day 4. Introduction to the Engineering Design Process  Objective for days 4-8. Students will:   1. discuss the characteristics of an engineer. 2. explore & share the individual blog of an engineer 3. investigate the habits of an engineer (Engineering Design Process)      1. Q&A: ([Gallery walk](http://www.theteachertoolkit.com/index.php/tool/gallery-walk): Students write their responses on post-it notes and place them on bulletin paper positioned around the room. The teacher discusses these responses with the class.   a. What is an engineer? (a person who designs, builds, or maintains  engines, machines, or public works) <http://tinyurl.com/z3596vd>  b. Describe the job of an engineer (accept responses that relate to  “problem-solvers”  c. What skills are needed by engineers to perform their jobs?  (technically minded, able to demonstrate numerical and scientific  ability and have problem solving skills)  <http://tinyurl.com/hvomrq2>  d. What technical skills would they need to use for their jobs? ( be  good at math, science, hands-on experiences, an understanding  of innovation principles, processes, design and society)  <http://tinyurl.com/jqrhe59>   1. [Engineering PPT](http://padlet.com/elampkin/nl05krqoapg0/wish/97705208) (this introductory information is useful although it is from the UK.) 2. Exploration Time: Allow students time to explore engineers’ blogs to understand their jobs.   <http://www.tomorrowsengineers.org.uk/blogs/>  Students will introduce their engineer to the group in a Powtoon\* Presentation with 6 slides (1. Name of the Engineer, picture and his/her job title, 2. Education Qualifications, 3. Employer & a brief summary of his / her job &4. Summary of his/her current project, Pictures of his/her worksite, 5. Hobbies, 6. Engineering advice to future engineers.  How to make a powtoon:  [http://www.powtoon.com/blog/how-to-](http://www.powtoon.com/blog/how-to-                  create-an-animated-presentation-in-5-easy-steps/)  [create-an-animated-presentation-in-5-easy-steps/](http://www.powtoon.com/blog/how-to-                  create-an-animated-presentation-in-5-easy-steps/)  To make your powtoon:  <https://www.powtoon.com/create/>  Day 5 Objective: Students will:  NOTE: \*Powtoon requires a free teacher account and log-in/password setup.  The teacher should create the account with a generic username and password to give to students. In this way all submissions are under the same account and can be accessed quickly for presentations.   1. complete the Powtoon 2. review the powtoon based on the criteria   Directions: Complete work on the Powtoon and post the assignment on the teacher-created Powtoon site. The teacher will create a padlet with each student’s name in a vertical row. The students will post the powtoon link to the right of their name.\* (Students do not have the editing rights to change the submissions from the teacher or other students.) Comments from other students will be placed to the right of the owner’s powtoon link.  Day 6 Objectives: Students will:   1. review their powtoon based on critera (if not done on day 5) 2. post their powtoon links beside their name on a teacher-designated padlet 3. examine & rate 5 projects from other students using the rubric and 4. post these comments beside the project owner’s link.   Day 7 Objectives: Students will:   1. read comments from their reviewers and make any corrections as needed to their presentations. 2. add any extras items which were discovered after reviewing other projects   Days 8 & 9 Objectives: Students will:   1. Respond to the [polleverywhere](https://www.polleverywhere.com/).com question, “What are some synonyms associated with the word engineer”? Possible answers include [originator](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+originator&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIHTAA), deviser, [designer](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+designer&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIHjAA), [architect](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+architect&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIHzAA), [inventor](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+inventor&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIIDAA), [developer](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+developer&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIITAA), [creator](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+creator&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIIjAA), [mastermind](https://www.google.com/search?safe=strict&rlz=1C1OPRA_enUS566US566&espv=2&biw=1242&bih=545&q=define+mastermind&sa=X&ved=0ahUKEwiFzIK5sZjLAhWK5yYKHSBcB-oQ_SoIJDAA) [(Sample: screenshot)](https://pollev.com/estalampkin921) 2. Perform the habits of engineers with a PPT that includes a simple lab procedure. Students will be guided through the Engineering Design Process in a simple set of procedures designed to simulate the process of an engineer down to creation of a prototype. This modeling will be the basis for which the real projects will be created. 3. [PPT The Engineering Design Process](http://padlet.com/elampkin/nl05krqoapg0/wish/97712083)   The teacher should allow students some planning time to write, discuss and make decisions as groups for slides # 8 -20.   1. [Teacher copy](http://padlet.com/elampkin/nl05krqoapg0/wish/97712092) 2. [Student copy](http://padlet.com/elampkin/nl05krqoapg0/wish/97712095) 3. [Engineering Design Poster](http://padlet.com/elampkin/nl05krqoapg0/wish/97712097) 4. [Lab Data Handout](http://padlet.com/elampkin/nl05krqoapg0/wish/97713923) (modify as needed)   Day 9 Objectives: Students will complete their lab procedures (to include  testing their rockets) and share their responses with the whole  group.  Day 10 Objectives: Students will:   1. review the 2nd Engineering PPT, “What is an Engineer?” 2. evaluate themselves against the slide, “What does it take to be an Engineer?” 3. place their responses on the designated padlet wall (<http://padlet.com/elampkin/6ossat669wi9>) 4. students can read the comments of other group members to determine how they can best work with each other.   Day 11. Objectives: Students with Smartphones will :   1. be issued a TI-Sensor Tag device 2. be directed and/or assisted to load the app onto the phone.   [TI Sensor Tag](http://makezine.com/2013/04/18/teardown-of-the-ti-sensortag/): An Overview, loading software onto personal  devices   1. open the app and explore the use of the program     \*Note: If more than one device is operated in close vicinity of others, users may see them all on their device screens. It may be necessary to put distance between the devices to connect to the correct one.  Day 12. Objectives: Students will:   1. practice the use of device while completing a lab. 2. acquaint themselves with the working the TI-Sensor Tag device their and cellular devices.   <http://processors.wiki.ti.com/index.php/SensorTag_User_Guide>   1. Pair TI-Sensor Tag with cellular devices 2. Complete [experiment](http://padlet.com/elampkin/nl05krqoapg0/wish/97723033) 3. Collect data according to the lab directions. 4. Analyze data 5. Discussion of results and presentation of lab to classmates.     Day 13 Objectives: Students will develop their One Health Project   1. Review the goals of One Health 2. What is the job of an engineer? 3. What problem can be solved by creating a device to measure/ monitor a person or animals’ vitals or the environment? 4. The Engineering Design Process begins \*   Students will:   * (Ask): make a list of problems which can be monitored by measuring the temperature.) * determine constraints (limitations) associated with solving these problems * (Imagine): brainstorm ideas to solve the problems * conduct research to determine which are valid problems. * research the number of individuals affected by its existence and the benefits of designing a device to correct this problem.  1. Students will share out their preliminary findings to the class   Day 14.   1. Students will modify their research problem and possible solution(s) as needed. 2. (Plan): Students will draw the prototype; make a list of needed supplies, write out procedures for designing and testing the prototype.   Day 15.   1. (Create) Students will follow their procedures for developing the prototype, test the prototype and collect data.   Day 16.   1. (Improve) Students will analyze their data, evaluate their prototype and discuss what improvements are necessary.   Days 17-19  Students will repeat the five steps to make any changes that will  improve the prototype.  \*Note: At any given time, students may be working through different steps concurrently. These days are estimates only. Students may need more or less time to matriculate through each step of the Engineering Design Process.  The Engineering Design Process will be repeated with the Arduino LilyPad Device.  Caution: The use of this device is a bit more challenging. It requires software to be downloaded on desktops or PCs. Students must follow directions from [Arduino LilyPad Download instructions](https://www.arduino.cc/en/Guide/LilyPadWindows#toc2). Students will need an introduction to writing C++ code (PPT) and learn how write and/or modify code researched from the internet.    Day 20  Objective: Students will integrate the Engineering Design Process into Arduino Lily Pad Device to create a second One Health Product. Students will benefit from repetition of the Engineer Design Process to promote critical thinking, collaboration, creativity and communication ([4Cs](http://www.nea.org/tools/52217.htm)).   1. Review the Engineering Design Process (EDP) Whole Group 2. Stand and Deliver Strategy (Students listen to partner recite steps; switch.) 3. Nanotechnology Mini-lesson (definition, benefits, applications) 4. Infographic Nanotechnology: definition, benefits, applications (Students begin this activity.)   Day 21  Objective: Student will illustrate their understanding of nanotechnology.   1. Completion of Infographic Nanotechnology: definition, benefits, applications 2. Nanotechnology News Articles: students locate their own resource or use “[Nanooze”,](file:///C:\\Users\\Esta\\Pictures\\Roblox\\New%20folder\\Kenan\\~$ta%20Lampkin%20(1)%20-%20Craigs%20Comments%20(1).docx) the kids nanotechnology magazine 3. Graphic Organizer from news article information   Day 22  Students will interview ASSIST Team Members, NCSU regarding their careers (on-line faculty website information and possibly by email.   1. Careers related to nanotechnology (Teacher provided / Student-researched) 2. ASSIST Center at NCSU website exploration: [introduction, mission and goals](https://assist.ncsu.edu/) 3. Interview an engineer from the [ASSIST Team member](https://assist.ncsu.edu/leadership/), NCSU [Research Assignment](http://padlet.com/elampkin/nl05krqoapg0/wish/97770435)   Day 23  Objective: Students will construct a general letter to ASSIST Faculty to learn about the career.   1. Letter to ASSIST Team Member, to gain knowledge for engineering prep and cutting- edge research and technology (Group construction for email) 2. Students will send these via their WCPSS emails 3. Stand up, hands up, pair up Activity to share 3 facts from the ASSIST Center Research Assignment.   Students are now ready to proceed to the Arduino Project in the Activities Section (See below.)  **Introduction for Teachers.** In this Problem-Based Project unit, students will identify normal temperature ranges and heat stroke ranges for the human body and that of an animal of their choice. Students will then locate and use a sensor that will monitor the temperature of the selected animal in its natural environment. (The choices include the TI Sensor Tag or the Arduino Lily Pad. This lesson is geared toward using the Arduino LilyPad). Students will create a means for attachment and recharging of the device. Students will apply this information to the concept of the elderly monitoring their health with regards to excessive heat. The classroom time will be spent among the One Health Topic purpose, proper use and testing of the chosen sensor and /or programming. Brainstorming for attachment options, testing and analysis of data will be performed using the Engineering Design Process.  Day 24 Project Selection, teacher approval of Arduino Project; work begins.   1. Engage: As students enter the room, ask them to respond to the board prompt, “Write down 7-10 things you know that occur during hot weather in your interactive student notebook.” A timer is projected on the screen and ticking quietly to keep students focused. (The teacher can use this time to check roll by seating chart and/or homework quickly.) When the timer goes off, the teacher asks students to choose a neighbor and exchange their ideas, selecting the top three ideas between them. Students will share these responses with the classroom until all groups have offered comments not presented by others. 2. Demonstration: The teacher asks two students to complete an activity with a forehead thermometer strip placed on their forehead. One walks around the room and one jogs in place. These questions are posed to the students while the two continue the activity:   a. What will happen to the students after 5 minutes? 10 minutes? 20 minutes?  b. What happens if we took this activity outside?  c. Is there a difference between the two individuals’ body temperatures?    3. After students respond, the teachers asks students to evaluate their list and  identify any dangers associated with hot weather. Students will discuss the  responses with the class. The class is split into four groups. Two groups  will google the normal body temperature range for humans (1) or animals  (2) and two groups will research the ranges for heat exhaustion (3) or heat  stroke (4) (using the class computers or their own devices).  4. Group Question: Why is this information about the body temperatures important?  Students record and share their responses.  Day 25  1. Review the information discovered from previous day’s research    2. Explore: Q: How would you use the Arduino LilyPad to prevent the dangers of heat stress (Heat exhaustion or heat stroke)?  (Students received Arduino instruction and practice on days 8 & 9. There  are two choices for Arduino links below.)  <https://us-mg6.mail.yahoo.com/neo/launch?.rand=9bqarfkbgib9r#5024552525>  or the overview programming lessons on the assistonehealth.com website  3. Students will work together in teams to brainstorm ideas to solve this  problem. They will use the Engineering Design Process to create their  experiment, list materials and procedures, collect and analyze data and  draw conclusions.  For assistance with the Engineering Design Process, use the link provided  for text & videos: <http://wwwtc.pbskids.org/designsquad/pdf/parentseducators/DS_TG_DesignProcess.pdf>  (I am also including a chart with sample outputs to consider for the Arduino novice teacher (see below.)  Sample Outputs that can be used with the Arduino LilyPad   |  |  |  | | --- | --- | --- | | Light Sensors | Sound Sensors | Vibration Sensors | | Color to indicate a safe temperature range | Sound to indicate a safe temperature range | Slow intermittent to indicate a safe temperature range  (Ex. 6 vibrations/ minute) | | Color to indicate a warning temperature range | Sound to indicate a warning temperature range | to indicate a warning temperature range(Ex. 12 vibrations / minute) | | Color to indicate a dangerous temperature range | Sound to indicate a dangerous temperature range | Fast to indicate a dangerous temperature range  (Ex. 20 vibrations/ minute) |   Day 26  1. The teacher polls each group, “Talk with your group members and  discuss what you learned from the experiment today.”  2. Students make notes in their journals.  3. Each group will share out in a brief discussion.  4. Students will reviewing programming with Arduino and practice  downloading samples to their Arduino.  Day 27 Project Drafts  1. Students write their draft for projects, get approval and begin working on their projects and procedures of the experiment. The goal is: How would you use the Arduino LilyPad to prevent the dangers of heat stress (Heat exhaustion or heat stroke)?  2. Review the Engineering Design Process overview programming lessons on the assistonehealth.com website or the <http://www-tc.pbskids.org/designsquad/pdf/parentseducators/DS_TG_DesignProcess.pdf>  Refer students to the website for videos to focus on errors in the students’ Engineering Design Process.  3. When students are finished with all parts of the engineering design, they may begin working on the One-Health site Q’ s after submission of their assignment on-line.  Day 28  .  1. Explain how this topic relates to the One-Health Initiative  This title is the goal for what follows. The students will summarize their  data and the relationship to the One Health Initiative.  2. Question: “How would you use the Arduino LilyPad to prevent the dangers of  heat stress?” (This is the problem that students will address in their  Engineering Design Process.)  Students will record these answers in their interactive student notebooks?  Q1: Are other organisms affected by heat? Explain.  Q2: Is there a way of determining their heat risks? Explain.  Q3: Explain the idea behind the One Health Initiative? Students will share their ideas. (Concept was already taught and discussed.)  Q4: Why should we be concerned about the health of animals?  (Include information based on the One Health Initiative.)  Q5: What benefits do animals provide for the planet? (Accept all responses  including food, fertilizer, clothing, protection, research & disease prevention,  disease awareness, etc.)  Individual & Group Brainstorming Questions posted on the board / screen.  Students will respond digitally in a poll format so that all students can see the results on the projector using their digital devices.  The teacher will accept close answers and facilitate students in their experimental design.  Q6: What products can we design to protect or monitor the health of animals?  Q7: What skills are needed to design and test products for health monitoring?  Day 29  Q8: What device can we create that will protect or monitor the health of animals?  Optional: Use Trello.com to organize your jobs to complete this assignment. [(Trello.com)](https://trello.com/) Trello is a free website that students can use to organize group project jobs within the assignment. Students can list their names, project responsibilities and due dates.   1. You will need to state the purpose of the device. 2. Explain how it is worn on the animal. 3. State why it is important    1. What benefit is it for the animal?    2. What benefit, if any, is it for humans? 4. Design an experiment to test your device. 5. Complete a model of your device for presentation. 6. Complete a digital presentation of your design process, include pictures.   A rubric is linked the Assessment Section.  Day30: Students complete their Digital Presentations  They have the option to use the Power Point template provided from the teacher. Students should allow for time for peer review after reviewing the rubric for their project.  Day 31 Group Presentations to the class. |
|  | A combined rubric will be used for assessing the question, “What device can we create that will protect or monitor the health of animals?” and the contents of that assignment (See numbers 1-6. above.) The rubric includes assessment for (1) the questions, (2) the experiment, (3) the model and the (4) digital presentatio  [Rubric](http://padlet.com/elampkin/nl05krqoapg0/wish/97745702) for the Arduino Project  Sources: These websites were used to consider designing another rubric:  http://www.biologycorner.com/worksheets/labreport\_rubric.html  <https://pastinnovationlab.org/wp-content/uploads/2015/01/Judging-Rubric-for-Digital-Presentation.pdf>  <https://sites.google.com/a/sandpointcharter.org/julie-williams-site/middle-school-physical-earth-science/invention-convention/model-grading-rubric>  http://www.uen.org/Rubric/rubric.cgi?rubric\_id=1219 |
| Extension Activities (Optional) | The Zoo Trip  While you are at the zoo, select an animal and interview a nearby zoo keeper:   * 1. Introduce yourself.   2. Ask questions to determine what type of sensor would be needed for an animal to assist in caring for that animal.   Once you determine a few options:   * 1. Ask the zookeeper what are concerns with the animal wearing this device?   2. What problems does she/he foresee in this?   3. What can you do to help solve this problem   4. Design a rough sketch while at the zoo   Back at the classroom or home:   * 1. Complete research regarding your device   2. Design your device   3. Write an explanation about its function and the problem you are solving for the animal.   4. Share it with the family members or friends to make changes or identify additional concerns   5. Write a feasibility statement and rough estimate cost of your device.   6. Besides zoo, what other market is there for your modified device?   7. Share it with classmates in a digital presentation   Career Focus for All students. Choose a related engineering career and describe the type of job performed, the education qualifications and job locations. |
| Modifica- tions | Modifications should include:   1. Paired with a buddy who can help with instructions, notes, assignments and keeping organized during class. 2. Google Translator or a dual-language app will be used where possible 3. Extra time to complete assignments or provided less items to complete 4. Modified or alternative assessments.   Classroom adaptations   1. Preferential seating to benefit the student, free from distractions. 2. Short breaks after completing tasks. 3. Squeeze balls or tools to help with fidgety students. 4. A quiet area free from distractions for testing or studying 5. Focus cues from the teacher 6. Teacher keeps a notebook for student organization 7. A student agenda for parents and students to initial daily. 8. Hand signals for comprehension check-ups during the lesson. 9. Computers to read aloud information to the students   Gifted students will be given enrichment activities |
| Alternative Assessments | * Students who have learning disabilities will complete a portion of the assignment. ELL students will have assessments sent to the ELL teacher or a representative who can speak their language. Gifted students will complete enrichment activities, questions or select options from a list. |
| References | References  Hot Environments <http://www.ccohs.ca/oshanswers/phys_agents/heat_health.html>  Heat Stress in animals <http://www.animalchange.eu/Docs/Budapest2014/S03.pdf>  Cmapp <http://cmapp.wcpss.net/>  Group digital organizer Trello.com  These websites were used to create the rubric:  http://www.biologycorner.com/worksheets/labreport\_rubric.html  <https://pastinnovationlab.org/wp-content/uploads/2015/01/Judging-Rubric-for-Digital-Presentation.pdf>  <https://sites.google.com/a/sandpointcharter.org/julie-williams-site/middle-school-physical-earth-science/invention-convention/model-grading-rubric>  http://www.uen.org/Rubric/rubric.cgi?rubric\_id=1219 |
| Supplement-al Information | Animal Heat Effects http://www.animalchange.eu/Docs/Budapest2014/S03.pdf  Solar Energy with kids <http://www.woodshop4kids.com/Hands_On_Books/diy_solar.html> |
| Comments | This plan was developed to include the One Health Concept and the Engineering Design Process. I have included the outline for the unit in the plan as well.   * Possible extensions or ways to shorten the plan: * The teacher can omit the teaching of the Engineering Design Process and the One Health Focus if it has been taught some other time. I plan to incorporate it through many of my lessons throughout the year. My goal is to develop independent thinkers and problem-solvers. * Reflections on the experience of teaching this lesson. This lesson has an estimated timeline before it has been taught. Feel free to modify the schedule as needed until the bugs are worked out. * Students’ comments or reactions will determine the teaching rate and how these lessons are taught. |
| Author Information | In this section, tell us about yourself and your mentor! Include the following:  Kenan Fellow:   * Zebulon Gifted and Magnet Middle School, Zebulon, NC * 7th Grade Science * Teaching since 1992 * elampkin@wcpss.net   Mentor: Dr. Jess Jur, Assistant Professor NC State   * Textile Engineering, Chemistry, and Science * ASSIST Center, NC   Post Doctoral Associate, Materials Science and Engineering, North Carolina State University, 2007-2008  Ph.D., Materials Science and Engineering, North Carolina State University, 2007  M.S., Chemical Engineering, The Johns Hopkins University, 2003  B.S., Chemical Engineering, The University of South Carolina, 2001  Email  [jsjur@ncsu.edu](mailto:jsjur@ncsu.edu)  Dr. Elena Veety, Education Director of the ASSIST Center |

This One Health Rubric (see below) is being used to judge my project’s final assignment, since students who advance to the One Health Competition will be judged by it.

One Health Challenge / Scoring Rubric

*Note: A score point of 0 is only awarded if the element is missing.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Product*** | ***Description*** | ***Highly Proficient*** | ***Proficient*** | ***Developing Proficiency*** |
| ***Research*** |  | ***3 points*** | ***2 point*** | ***1 points*** |
| **Problem Selection** | The problem your group selected is:   * relevant to today’s healthcare concerns * measureable * related to One Health | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Solution Research** | The solution:   * solves the problem that your group selected * the solution is created for a targeted audience * the solution is well researched and students can defend their design solution | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| ***Design*** |  |  |  |  |
| **Feasibility** | The product design works well:   * in the chosen environment * as a sensor on a wearable device * to transmit data (if necessary) in a manner conducive to the technological needs, existing infrastructure, and surroundings * \*\*\****High school only***\*\*\* as a proposed solution for your given problem. The product functions as intended and collects the necessary data to provide a solution to your chosen problem. | Contains exemplary work within the category.  Meets 3 or more bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Wearability** | The product is able to:   * withstand the movements, temperatures, and fluids found in the environment it is located * be made out of a material that is the least obtrusive for the highest percentage of people (i.e. it is not made out of a material that has many known allergens) * generally comfortable and not too bulky to wear | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Aesthetics** | The product designed considers:   * cultural sensitivity of the area in which the design will be distributed * stylish considerations including whether or not it is visually appealing * designs that reflect a target age and gender group OR are neutral (e.g. bright colors for children, one-size-fits-all sizes, etc.) | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Sensor placement** | The product designed= considers:   * Body location/s that would collect and transmit the most data (i.e. a hydration sensor would be placed on the inner arm) * Body location/s that maximize comfort and minimize discomfort for the wearer * Body location/s that are minimally invasive unless designed specifically for that location (e.g. a sensor in teeth). | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Power** | The product designed is powered by:   * an appropriate type of power (i.e. plutonium for a wearable sensor is too powerful and unsafe) * a power source/s is easily accessible in the selected location or desired market * a method that provides a lengthy lifespan for the product | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| ***Ad Campaign*** | ***Description*** | ***Highly Proficient*** | ***Proficient*** | ***Developing Proficiency*** |
| **Instructions** | The advertising campaign contains instructions that are:   * concise on how to use your device * written for the targeted audiences (consider literacy levels or age appropriate words and language) * graphics and designs that aid the user in understanding how to use and maintain the product | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Awareness** | The advertising campaign contains:   * specific information about how the product you designed will help prevent or monitor a specific health concern * information from vetted and reputable sources (CDC, WHO, University based research or journal articles) * a call to action that empowers the user in social responsibility and educating others | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Feasibility**  ­ | The advertising campaign :   * Is appropriate to reach the target audience/user * Includes advertising that is ecologically friendly and explains how the product is ecologically friendly * Includes planning that includes continued use of the product (e.g. longevity, training in the community) once the initial advertising campaign is complete | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| ***Poster*** | ***Description*** | ***Highly Proficient*** | ***Proficient*** | ***Developing Proficiency*** |
| **Instructions** | The poster contains instructions that are:   * concise on how to use the device * written for the targeted audiences (consider literacy levels or age appropriate words and language) * graphics and designs that aid the user in understanding how to use and maintain the product | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Target Population** | The poster explains:   * who the target population is (who is affected by this health issue?) * what percentage of this population will be helped by your design * how prevalent this issue is nationally, globally, etc * the need for the device | Contains exemplary work within the category.  Meets 3 or more bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |
| **Background Information** | The poster explains:   * how this health issue relates to One Health * how the device is powered and why this type was chosen * how to use the device and the lifespan of the device | Contains exemplary work within the category.  Meets 3 bulleted points well. | Contains good or average work within the category.  Meets 1 to 2 bulleted points well. | Contains below average work within the category.  Meets none of the bulleted points well. |