

5E Arts Integrated STEM Lesson Plan

Lesson Title: Interactions Using Coding

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Topic: Coding, Debugging, The Design Process, Algorithms and Flowcharts, Inputs & Outputs

Targeted Grade Level: 6th-8th Grade

Time Needed: 5-7 Class Periods (60 minutes)

Subject Integration: Technology, Engineering, Art

Justification:

Technology: Students will be coding while using micro:bits and the MakeCode block coding software. Students will be hands-on with the equipment.

Engineering: Students will collect and analyze algorithms. They will also learn how to correctly use banana plug wires and establishing good connection with them. Also, they will create their own device to help solve a real world problem.

Art: Students will be drawing out their wiring diagram, flow chart and a sketch of their teams design idea. They will be doing this via Google Draw or on a blank sheet of paper. They will also be creating their device with various types of items.

Standards:

PLTW Standard 1.6-8.H – Technology is closely linked to creativity, which has resulted in innovation.

Kentucky Technology Standard ID2 - Use a variety of technologies within a design process to create new, useful and imaginative solutions.

Kentucky Technology Standard CT1 - Develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

<u>NGSS Performance Expectations</u>		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.	MS-ETS1-1 Engineering Design MS-ETS1-2 Engineering Design MS-ETS1-3 Engineering Design MS-ETS1-4 Engineering Design	Influence of Science, Engineering, and Technology on Society and the Natural World The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)
Common Core State Standards:		
Kentucky Technology Standard ID2 - Use a variety of technologies within a design process to create new, useful and imaginative solutions.		
Kentucky Technology Standard CT1 - Develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.		
Other Standards		
PLTW Standard 1.6-8.H – Technology is closely linked to creativity, which has resulted in innovation.		

National Art Standards

VA:Cr2.3.6 - Design or redesign objects, places, or systems that meet the identified needs of diverse users

VA:Cr2.1.8a - Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms and meanings that emerge in the process of artmaking or designing.

Measurable Student Learning Objectives:

Students will be able to work together in teams to design a solution for a real-world problem.

Students will be able to complete the problem by designing and building the programs.

Students will be able to share their programs and design with their peers and provide other teams with feedback.

Nature of STEM: In this lesson/project, students will be using the Design Process in order to solve an authentic, real-world problem. They will be incorporating technology when coding, engineering for the design process, and art for the design and creation of the solution. At the beginning of the project, students will be drawing their algorithms and flowcharts by hand and then transferring them into a Google Drawing. Afterwards, students will continue to be working in teams to develop a code and to construct their hardware to work conjointly.

Engaging Context/Phenomena: To begin my lesson, we will start with a simple Think/Pair/Share about items that they interact daily with that makes life somewhat easier. Once students pair up, they will then break them down into different categories of interactions. After sharing, we will watch a quick video of how coding is the backbone to a lot of these interactions and the reason why they function the way they do.

Data Integration: Students will be collecting data for the inputs they will need for their code. Students will have to know the different types of data when dealing with the inputs and outputs devices when designing their product. Also, students will be collecting data on their peers project and sharing it with them.

Differentiation of Instruction: During the project, students will be working in teams (groups of 4) to complete it. These teams will be based off pre-assessment data as well as how skilled students are in coding and wiring from previous projects and summative

assessments. During teamwork, peers will take turns programming and debugging. Also, they will all help design the flowcharts and the hardware for the final product.

Real-life Connection: The objects that students use daily is because of inventions and innovations. Students will be able to work hands-on to create a product that could universally be used. This type of thinking and innovating will let the students see what goes on behind the scenes of how products are designed and programmed.

Possible Misconceptions: One of the biggest misconceptions the comes to mind is debugging a code that might be incorrect the first time they test the product. Coding can be tricky, especially at this age because students might not be able to solve the problem and get frustrated and end up not wanting to continue with the project. Another misconception would be building the design and properly wiring everything correctly. I think with both of these misconceptions, I will need to keep reminding the students that not everything will work out smoothly the first time and that's when you need to discuss it as a team (and myself if it gets to that point) to figure it out the problem.

Lesson Procedure:

5E Model	5E Objectives
<p>Engage</p> <p>Students will be introduced to interactions that they see or engage in daily. They will engage in a Think-Pair-Share over real-world example. Afterwards, they will be introduced to the guiding question for the project.</p>	<p>Procedure:</p> <ul style="list-style-type: none"> • Think/Pair/Share • Have students think about items they interact with that make their lives, or lives of someone they know, easier and write them down on post-it notes. • Student will then pair with a partner and discuss their post-it notes and will divide them into one of three groups: Environmental, mechanical, or both. • Students will then share their examples via Google Jamboard. <p>Modifications: Students will be placed in pairs based on their Kegan seating arrangement at that time. If lower level students are struggling to remain on task or keep up to speed, they will be placed in a group for extra modeling and a slower instructional pace.</p> <p>Standards Addressed</p> <p>PLTW Standard 1.6-8.H – Technology is closely linked to creativity, which has resulted in innovation.</p> <p>Kentucky Technology Standard ID2 - Use a variety of technologies within a design process to create new, useful, and imaginative solutions.</p> <p>Formative/Summative Assessments Formative assessment will be through whole class discussion, interaction with peers, and participation in the Jamboard.</p> <p>Resources</p> <p>Jamboard</p> <p>Post-it Notes (big & small)</p>

<p><u>Explore</u></p> <p>Students will be exploring different universal designs that they would like to create and start developing a plan for it.</p>	<p>Procedure:</p> <ul style="list-style-type: none"> • Students will be introduced to the project. Student will have to think of a physical computing device that will require a universal design. • Students will be placed into groups of 4. • Students will be reminded out the Design Process (Define Problem, Generate Concept, Design a Solution, Build & Test, Evaluate Solution, & Present Solution) <p>Modifications Collaboration between each team</p> <p>Standards Addressed</p> <p>VA:Cr2.3.6 - Design or redesign objects, places, or systems that meet the identified needs of diverse users</p> <p>Kentucky Technology Standard CT1 - Develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.</p> <p>Formative/Summative Assessments Starting to develop a plan for their design.</p> <p>Resources Google Draw or pencil and paper</p>
<p><u>Explain</u></p> <p>Students will be working on their flowcharts and algorithms to help jumpstart their design and code.</p>	<p>Procedure: After designing their product, students will then start to build an algorithm to help with their code.</p> <ul style="list-style-type: none"> • Students will work in their teams brainstorming how their design is going to function • Students will create a rough drawing of their algorithms on a piece of paper (flowchart) • Students will make their final flowchart on Google Drawing • Students will start working on their code for their design <p>Modifications Understanding MakeCode and each step their algorithm. Grouping students up for paired programming.</p> <p>Standards Addressed</p>

	<p>VA:Cr2.3.6 - Design or redesign objects, places, or systems that meet the identified needs of diverse users</p> <p>VA:Cr2.1.8a - Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms and meanings that emerge in the process of artmaking or designing.</p> <p>PLTW Standard 1.6-8.H – Technology is closely linked to creativity, which has resulted in innovation.</p> <p>Formative/Summative Assessments Rough draft of flowchart, Google Drawing of flowchart, MakeCode</p> <p>Resources MakeCode, micro:bit, Google Drawing</p>
<p><u>Elaborate</u></p> <p>Students will be working in teams to help design their product with the correct hardware. Afterwards, they will be presenting their work to their classmates.</p>	<p>Procedure:</p> <ul style="list-style-type: none"> • Students will be working using pair-programming to develop and finish their code. They will then start on their hardware. • Students will be wiring their design using banana wires, lights, timers, and other tools • Students will have to begin thinking about connections between their design and society • Once completed, students will work on presenting their design within their group to prepare for their class presentation. <p>Modifications Remember the connections with the hardware. Referring back to our inputs and outputs chart.</p> <p>Standards Addressed</p> <p>VA:Cr2.1.8a - Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms and meanings that emerge in the process of artmaking or designing.</p> <p>Kentucky Technology Standard CT1 - Develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.</p> <p>Formative/Summative Assessments Teacher observation via checking with each team on code and hardware/connections.</p> <p>Resources Micro:bit, MakeCode, Hardware for micro:bit</p>

<p><u>Evaluate</u></p> <p>After presenting to the class, students will be graded accordingly to the rubric. They will also complete a self-reflection over the project.</p>	<p>Procedure</p> <ul style="list-style-type: none"> • Students present their design to the class. • As they are presenting, students will write down and suggestions they have for their design to be improved. • Students will reflect on what worked well, what didn't work as planned, and what they could've been improved. <p>Modifications Students who excel in coding will help debug any code issues that their peers might have.</p> <p>Standards Addressed</p> <p>VA:Cr2.1.8a - Demonstrate willingness to experiment, innovate, and take risks to pursue ideas, forms and meanings that emerge in the process of artmaking or designing.</p> <p>Kentucky Technology Standard CT1 - Develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.</p> <p>Formative/Summative Assessments Finished product.</p> <p>Resources Rubric</p>
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Teacher Background: Before doing this lesson, prior knowledge of using MakeCode and micro:bits is a must. Also, it is recommended that one knows the basics of connecting wires to a battery device and the basic knowledge of inputs and outputs.