5E Integrated STEM Lesson Plan – Draft

Lesson Title: App Development

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Topic: Coding/Novel-based app development

Targeted Grade Level: Grades 6-8

Time Needed: 9-week rotation (approximately 40 days)

Subject Integration: Science, Technology, Math, ELA, Art

Justification: In these lessons, multiple subjects will be integrated; students will use problem-solving, logic, cause and effect, and computational thinking by completing the activities from Sprite Lab, Course F at code.org; create a Mars exploration game from Scratch and develop their own app or game through Scratch. The novel, *Click'd* by Tamara Stone Ireland is read in class during the first three weeks of the rotation with corresponding classroom activities prior to beginning discussions on apps, coding, and social media issues surrounding these topics.

Standards:

CCSS.ELA-LITERACY.RST.6-8.1

Cite specific textual evidence to support analysis of science and technical texts.

CCSS.ELA-LITERACY.RST.6-8.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating focused questions that allow for multiple avenues of exploration.

KDE - Visual Art/Multimedia

MA:Pr4.1.7 Integrate multiple contents and forms into unified media arts productions that convey consistent perspectives and narratives, such as an interactive video design.

CCSS.MATH.CONTENT.6.NS.C.5
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

CCSS.MATH.CONTENT.6.NS.C.6.C
Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

CSTA K-12: Algorithms and computing.

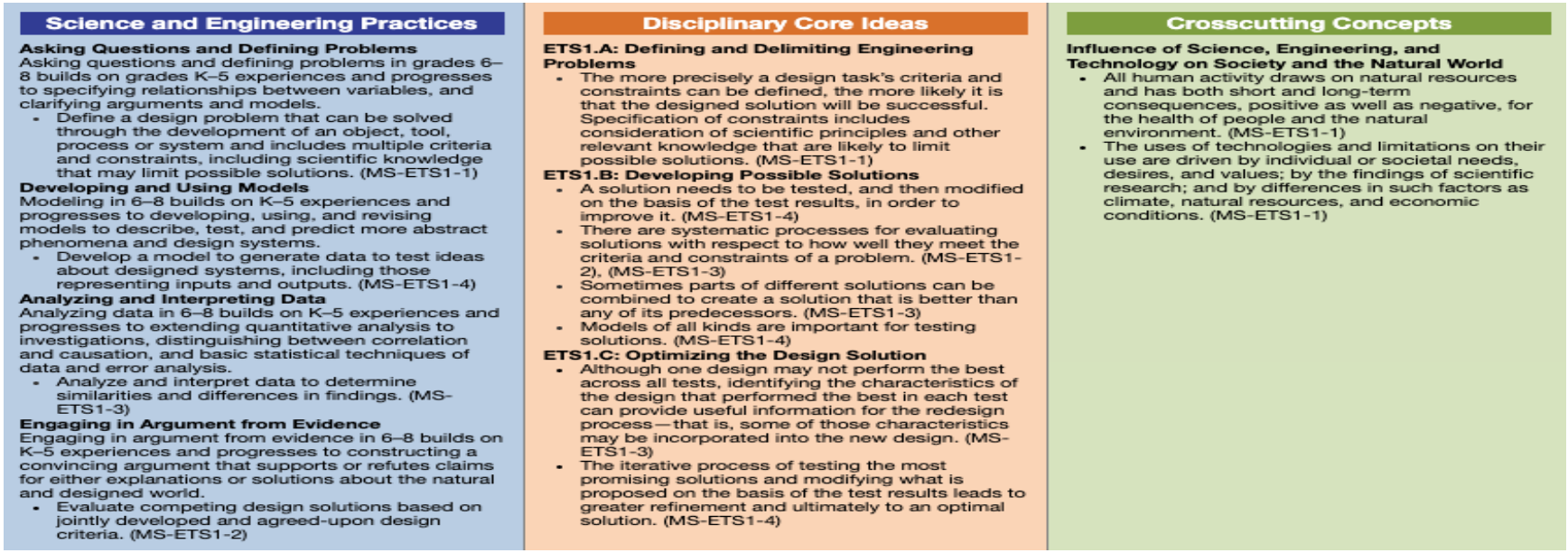
NGSS Performance Expectations

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.



Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.
- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Developing and Using Models
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.
- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Analyzing and Interpreting Data
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.
- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems
- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions
- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution
- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World
- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and 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)

Measurable Student Learning Objectives:

Students will be able to describe the importance of the user in the design process; identify sprites in a running computer program; create an animation using sprites; create an interactive animation using events, and develop programs that respond to user input.

Students will develop an idea and design their own app (based on the novel).

Students will design questions to gather information.

Students will design a logo for their app.

Nature of STEM: These lessons address NOSTEM through a variety of activities incorporating ELA and Art with science, technology and math using prior knowledge from activities, lessons and materials.

Engaging Context/Phenomena:

The first lesson will begin with a scenario activity called "Would you rather...?" thinking about each scenario provided and giving an explanation of each choice. We will use Four Corners (students align themselves into A, B, C, or D depending on the question) to determine commonalities for each student.

App/game development with Scratch

Data Integration: Students will collect data from quizzes they create to develop their own app. The personality quiz from *Click'd* will be used as an example as well as the activity from Would you rather?

Differentiation of Instruction: For group work - students will be placed into groups of three based on MAP data for reading (Lexile).

Real-life Connection: Coding is a critical career skill with a wide range of benefits such as earning potential from coding-related jobs and career flexibility. Gaming is a huge portion of many students' lives and learning how to develop these will pique interest in the subject. The number of social media apps students use is also an area to delve into.

Possible Misconceptions: Students typically believe that coding relies heavily on math abilities, when realistically - logic and problem-solving, and language abilities are far more valuable. Stereotypes surrounding coding careers as male tend to discourage women from pursuing these types of careers.

Lesson Procedure:

5E Model	Unit Overview
Engage Introduce the lesson with an anchoring phenomenon. Facilitate student questions, discussion, etc. as appropriate. Learn about what students already know and want to know.	**Procedure:** Prior knowledge of Allie's quiz questions for her app. Play - Would you rather? Reflection is important! Students will write the number of students with them in each corner for each question on a post-it note. **Modifications:** Address how it is okay to be by yourself when in your own corner because there aren't any correct answers. **Standards Addressed: WHST.6-8.7** **Formative/Summative Assessments:** Four corners **Resources** Would you rather?
Explore Plan for students to engage in hands-on activities that are designed to facilitate conceptual change.	**Procedure:** Sprite Lab; introduction to Sprite Lab video. Student as the user to sample programs. Making Sprites; Sprites in Action **Modifications:** Students are allowed a shoulder partner. **Standards Addressed:** MS-ETS1-1. CSTA K-12: Algorithms and computing. **Formative/Summative Assessments:** Exploring Apps worksheet; sprite lab documentation. **Resources:** Lessons from code.org

Explain Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts.	**Procedure:** Newsela article; favorites quiz; **Modifications:** assign article by Lexile to students; **Standards Addressed:** ELA/LIteracy **Formative/Summative Assessments:** Newsela/google form for app development **Resources:** Newsela; google form
Elaborate Provide applications of concepts and opportunities to challenge and deep ideas; build on or extend understanding and skills.	**Procedure:** Mars Exploration game with Scratch **Modifications:** Groups of 3 from pre-determined grouping **Standards Addressed:** Math/Science **Formative/Summative Assessments:** Coding rubric from Scratch; game design **Resources:** Scratch
Evaluate Assess students knowledge, skills and abilities.	**Procedure:** Create own app with Scratch; create a logo for app; present with poster or slideshow (include form sent to classroom students to collect data) **Modifications Standards Addressed** Math/Science/Writing/Art **Formative/Summative Assessments** Presentation of app; coding rubric from Scratch; **Resources:** Scratch

Teacher Background:

Click'd by Tamara Ireland Stone Teacher's Guide

Technology Term Journal

Would you rather?

Explore Mars Educator Guide

Mars Student Guide

Exploring Apps

Sprite Lab Documentation

Sprites in Action

The math behind bits and bytes

Favorites Quiz