Engineering Design Lesson Plan
E in STEM
Amanda Patterson
June 8, 2022

Lesson Title-AFter the Fall-Gravity
Topic-Gravity, Engineering Egg-Drop Project, Fractured Tales, Block Coding, Digital Artmaking
Targeted Grade Level-Third Grade
Duration-five days with 55 minute lessons

Standards:
5-PS2-1: Motion and Stability: Forces and Interactions-Support an argument that the gravitational force exerted by Earth on objects is directed down.
3-5-ETS1-1: Engineering Design: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
MA:Pr5.1.3.b: Exhibit basic creative skills to invent new content and solutions within and through media arts production.
3MA:Cr3.1.2.a: Construct and order various content into unified, purposeful media arts productions describing and applying a defined set of principles, such as movement and force.
C.3.3.b: Establish a situation, and introduce a narrator and/or characters; organize an event sequence that reflects linear, non-linear and/or circular structure.
C.3.3.c: Use dialogue and descriptions of actions, thoughts and feelings to develop experiences and events or show the response of characters to situations.

Content:
In this lesson, students will work in small groups to design and construct a project that will protect eggs from breaking after being dropped from 7 feet high. Students will learn about gravitational pull from videos and data from NASA JPL resource. Students will use library books and prior knowledge to discuss gravity. Students will discuss the reason that a feather and a pencil land on the ground at the same time upon release. Students will test their design to see if their project protected an egg from breaking during the egg-drop challenge. Students will reflect on the success of their project and will brainstorm other materials that could have been used to aid in their project. Students will use technology (Scratch, jr., or Scratch) to use block coding to animate their “egg” character to fall from a landing. Students will use digital artmaking in Scratch to create their own character and will code their character to emerge from the fallen egg.

Engaging Phenomena:
Students will view a short video to intrigue them to begin asking questions about gravity and its natural force.
3 Simple & amazing gravity experiments with explanation for science project

Data Integration:
View of Earth's Gravity Field using GRACE using gravity anomaly scale for discussion about our Earth's gravity. Data comes from NASA Jet Propulsion Laboratory.

Earth's Gravity Field

Differentiation of Instruction: In all lessons-Student needs depend on the given class. Student needs include any or all of the following depending on IEP: prompting/cueing, providing a reader, paraphrase, scribe, extended time for each assignment. Small groups will include a mixture of different leveled learning students to allow for peer learning to occur while students guide one another when one on one teacher assistance is needed.

Real-Life Connection: Students connect ot the lesson from their reflection to the story "After the Fall" by Dan Santat. Students discuss better packaging options for eggs that would prevent the eggs from breaking during transport and handling in grocery stores.

Possible Misconceptions:
-Engineering Misconception-
Some students thought that simply lining their cup with coffee filters would prevent their egg from breaking. Other students that crumpled their coffee filters were successful in preventing their egg from breaking.
-Heavier objects land faster than lighter objects falling such as a feather.
Technology Misconception-
While using Scratch some students simply made several scenes with their egg lower on each page rather than coding their egg to drop using block coding. Students reviewed codes to then have one page with the eg "falling" with the use of the correct codes.

Day 1

Procedure: Read aloud After the Fall, Humpty Dumpty discussion, take Reading Counts comprehension assessment. Watch gravity video Gravity Video in Google Classroom for Phenomena to begin discussion and prior knowledge. Intro Isaac Newton, prior knowledge about gravity.

Scrap Art Maker Space-Students create bird from the story
Modifications: Reader, Extended Time

Standards Addressed: C.3.3.b Establish a situation, and introduce a narrator and/or characters; organize an event sequence that reflects linear, non-linear and/or circular structure. **Formative/Summative Assessments**: Reading Counts online assessment to determine comprehension from read-aloud. Success-80% or above on assessment

Resources: Text for read aloud-"After the Fall" by Dan Santat, Chromebooks for students to take Reading Counts assessment. Google Classroom code with Gravity Video assigned in Classwork

Day 2–Challenge Information for Students

Procedure: Earth's Gravity Field Data Integration review and discuss data Earth's Gravity Field

Challenge-We need to protect Humpty when he has a great fall!

Egg Drop Challenge Design and Build using "Scrap Art" Maker Space materials

Students work in pairs or groups of 3 to work through the design process, (define problem, specify criteria and constraints for acceptable solutions, generate and evaluate multiple solutions, build and test projects, optimize a solution), and construct their project for the egg-drop challenge. Students must work with a limited selection of resources (Scrap Art Maker Space) to build and test their design without using an egg.

Modifications: Students paired in small groups with emotionally supportive students that will help quiet students to feel confident in sharing ideas.

Standards Addressed:

3-PS2-1 Motion and Stability: Forces and Interactions

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-5-ETS1-1 Engineering Design

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

5 MA:Pr5.1.3.a.-Exhibit developing ability in a variety of artistic, design, technical, and organizational roles, such as making compositional decisions, manipulating tools, and group planning in media arts productions.

Formative/Summative Assessments: Observation of projects built and discussion between group members about design features

Resources Project Resources-plastic cups, napkins, coffee filters, pieces of cardboard, straws, tape, string, popsicle sticks, plastic scrap pieces, paper cups, pieces of paper plates

Day 3

Procedure: Students perform egg-drop challenge with their own projects using real eggs. Students performed challenge in stairway seven feet high on the stairwell. After completing the challenge students used their Chromebooks to completed their reflection using the Google Form in their Google Classroom.

Reflection_Egg-Drop_Challenge

Modifications: Reader, Extended Time

Standards Addressed:

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.

3-5-ETS1-1 Engineering Design

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Formative/Summative Assessments: Google Form Reflection

Resources: Chromebooks, Google Form Reflection in Google Classroom

Day 4

Procedure: Students change the ending of the story, “After the Fall” by Dan Santat. Use Scratch, Jr. to program and create–Change the ending of the story-What comes from the egg “after the fall” besides Dan Santat’s idea of a beautiful bird? Students can not use a character from the Scratch database. They must animate their created egg as well as their own animated character “Humpty/egg” to fall from a landing to a surface below. Students will create their own character in Scratch, Jr. to emerge from the fallen egg and will code their character to rise up from the Humpty/Egg.

Modifications: reader, extended time

Standards Addressed:

5 MA:Pr5.1.3.a.-Exhibit developing ability in a variety of artistic, design, technical, and organizational roles, such as making compositional decisions, manipulating tools, and group planning in media arts productions.

MA:Pr5.1.3.b-Exhibit basic creative skills to invent new content and solutions within and through media arts production.

C.3.3.c Use dialogue and descriptions of actions, thoughts and feelings to develop experiences and events or show the response of characters to situations.

3 MA:Cr3.1.2.a-Construct and order various content into unified, purposeful media arts productions, describing and applying a defined set of principles, such as movement and force.

Formative/Summative Assessments: Exit ticket-Animated Humpty and their own Character

Resources: Chromebooks, Scratch program

Day 5

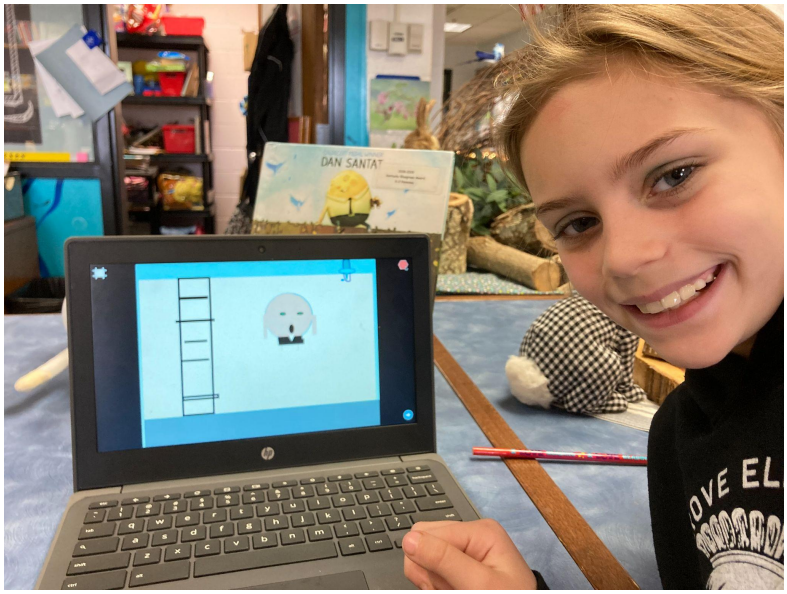
Procedure: Access prior knowledge and review block coding functions in Scratch, Jr. with students before technology project with their created character. Students will use block coding to animate their created character “Humpty/egg” to fall from a landing to a surface below. Students will code their character in Scratch to emerge from the fallen egg and will code their character to rise up from the Humpty/Egg.

Modifications: Extended Time, one on one assistance to struggling students

Standards Addressed: 5 MA:Pr5.1.3.a.-Exhibit developing ability in a variety of artistic, design, technical, and organizational roles, such as making compositional decisions, manipulating tools, and group planning in media arts productions.

Formative/Summative Assessments: Students present their created Scratch, Jr. page with their classmates.

Resources: Chromebooks, Scratch program



Assessment-Rubric

Challenge:_____
Student:_____ Date:_____

Participation	**Student fully participated in class discussions.**	**Student participated sometimes in class discussions.**	**Student did not participate in class discussions.**
Design for Challenge	**Student followed all instructions for challenge.**	**Student followed some instructions for challenge.**	**Student did not follow instructions for challenge.**
Build/Contruct	**Student used best effort and resources provided to build**	**Student used good effort and some of the resources**	**Student did not complete their build project due to not using**

	their design to complete the challenge.	**available to complete their challenge.**	**resources available and not using effort to overcome build challenge.**
Test and Modify	**Student showed accuracy in testing and modifying build design to complete the challenge if needed.**	**Student showed accuracy in testing but did not modify design to complete the challenge.**	**Student did not show accuracy in testing and chose not to modify the design challenge.**
Teamwork	**Student fully cooperated with group members and contributed fairly.**	**Student partially cooperated with group members and contributed fairly.**	**Student struggled to cooperate with group members and/or failed to contribute**
Points	**3**	**2**	**1**

Total Points for Project Challenge:_____