The Egg Drop

Pre-Teaching Mini Lesson:

Hey there!

We are so excited for you to start this lesson with your class. If this is your first ever STIIX lesson, make sure that your class clearly understands the Engineering Design Process we use at STIIX. This process can be found in the form of a flow chart included with your materials. Below is a quick mini lesson that can be done the day before you plan to start a STIIX lesson and can be revisited at any point in the future. Each lesson in the STIIX project kit follows this simple process and the goal is to explain exactly how engineers make cool things like rockets, bridges, and even water systems and how these things continue to get better over time. Feel free to make this your own but keep in mind that we want students internalizing this process as they continue with more STIIX projects in the future.

We hope you and your students love learning about the STEM concepts covered in your kits. And remember to refer to hellostiix.com for support in the process. **On each project page you will find a "*Teacher Tips*" section where our team shares some valuable insight to lead the at-hand activity**.

Thank you,
STIIX

Direct Instruction:

1. Display Engineering Design Process flow chart in your classroom.
2. Explicitly name and define each of the five steps in the process.
   #1 What's the Problem? Scientist don't typically wake up and say things like, "*I think cars are cool. Maybe I'll build one today!"* Usually there is a problem and engineers design and build things to solve that problem. A simple example of a problem is figuring out how to safely drop an egg. A more complex problem could be "which methods of protecting the egg are most effective?" **We want students to identify this problem and put it in the form of an Inquiry Question to be answered through the Engineering Design Process.**
   #2 Brainstorm! Now that we've identified the problem and posed our inquiry question, we now start thinking about ways to answer our question or solve our problem! Think of it as thinking time, talk to partners, ask questions, THINK BIG!
   #3 Get a Game Plan! Getting a game plan means putting those big ideas down on paper. Through this process you might already see that some of your big ideas simply couldn't work, or you might also find that you forgot to think about certain parts of the problem, that's okay! We are still planning here! The goal is just to get it down on paper now.
   #4 Create- Here is the fun part! Now we get to take those ideas and plans and bring them to life! Build what you've designed with your own two hands. Think about the logical steps we should take to build it and start building.
   #5 Test & Improve- Scientist never stop making their creations better and neither should we! In this step engineers test their creation to see 1.) if the creation solves the problem and 2.) how well it works. If it needs improvement we start back again at Step #1.

Optional:
Collaborative Instruction:

1. Stop and Think…class discussion.
   - Can you think of another process that this one is similar to? What parts are the same or different?
   - What types of things might this process be used to create and **why is it helpful?**

Independent Application:

1. Students write down the process in a notebook to refer to later. Be sure each students gives a short explanation for each step.

Standards:

Next Generation Science Standards

3-5 ETS1 Engineering Design:

3-5-ETS1-1.

Define a simple design problem 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 improve

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria

Planning and Carrying Out Investigations

- Plan and carry out investigations to answer questions or test solutions
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled

Constructing Explanations and Designing Solutions

- Construct explanations and design solutions to the use of evidence in constructing explanations
- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to success
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

ETS1.B Optimizing the Design Solution

- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints

***MS-PS2-1**

- Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- People's needs and wants change over time, as do their demands for new and improved technologies.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Motion and Stability: Forces and Interactions Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

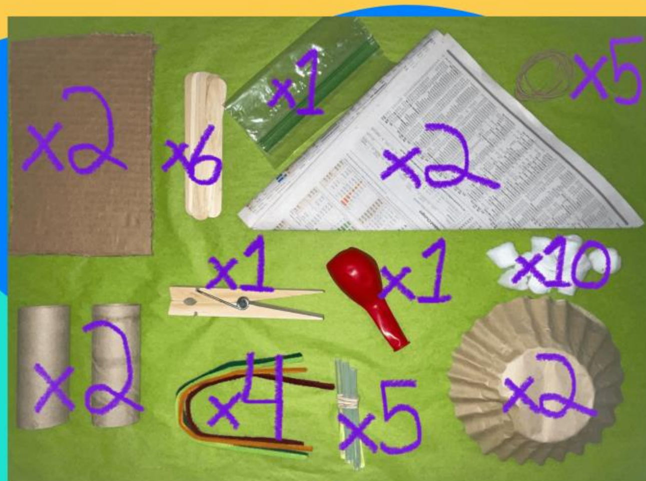
Arizona Academics Standards

W.5.8
Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and
MP.2
Reason abstractly and quantitatively.
MP.4
Model with mathematics.
MP.5
Use appropriate tools strategically.
3-5.OA
Operations and Algebraic Thinking

21st Century Skills

Learning Skills
Critical Thinking, Creativity, Collaboration and Communication
Literacy Skills
Information, Media, and Technology
Life Skills
Flexibility, Productivity and Social Skills

Materials:



Individual

- **X3 Cardboard sheets**
- **x2 Newspaper sheets**
- **x2 Cardboard Tubes**
- **x4 Pipe Cleaners**
- **x4 Jumbo Pop. Sticks**
- **x8 Lg. Pop. Sticks**
- **x8 Straws**
- **x1 Balloon**
- **x1 Resealable bag**
- **Cotton balls**
  - **Small handful**
- **X2 Coffee Filters**
- **X5 Rubber bands**

Group

- **Lg. Clothespin**
- **Eggs / Gift Card**
- **Glue**

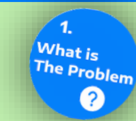
Objective

Students are to design and build Students will be able to design and build a case/shell for a real egg with the intention of helping it survive from as far of a fall possible. This simulates safely dropping a supply crate into a flooded city for the town of STIIX-ville.

Key Vocabulary

Force, Potential Energy, Kinetic Energy, Impulse, Air Resistance, Gravity

Day 1 – Inquiry Development (10-15 mins.)



1. Watch the Intro Video as whole group or individually at https://www.hellostiix.com/projects/eggdrop
2. Pause, think aloud, and discuss when prompted.
3. At the conclusion of the video, guide students to develop a question that they would like to answer relating to the project- this will serve as the "problem" or the inquiry question.

Students and teacher write out the inquiry question at the top of a planning sheet(scratch paper) that will be used later. **Depending on student ability level the question can be created as a whole group with ample teacher support, or it can be done on an individual student basis.

How to support students in creating an inquiry question:

- Avoid factual questions with simple answers(factual questions usually begin with "who/what" or "do/does").
- Supply students with the choice of using "why…" or "how…" to begin their question.

Ex: "Ask a question that begins with How or Why about what you learned about the project in the video."

Possible Desired Outcomes:

How can we best use the materials to protect the egg?

Is one way of protecting it more effective than the other? (cushioning vs. slowing down)

Why do you think we include the materials that we do for this project?

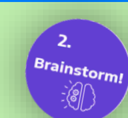
How can we make sure our projects stay sturdy for multiple drops?

Day 1: Direct Instruction (15 minutes):

1. Watch the Academic Video with the whole group or individually
2. Optional: Pause video as you see Key Vocabulary. Record the words and their definitions and examples on the graphic organizer provided.
3. Pause and think when prompted. Allow students to verbally share their thinking with partners or whole class

Day 1 & 2: Collaborative Instruction (40 minutes):

*Teacher supports students by guiding on a group or individual level.



BRAINSTORM!

1. Watch the How-To Video as whole group or individually
2. Verbalize the general steps from the video.
3. Teacher displays or recaps project rules/specifications (located in videos and on main portion of project page)
4. Students brainstorm(talk with group or a partner explaining ideas).
   **Teacher meets with individuals or small group to support the process.

GET A GAME PLAN!

1. Decide which option or OPTIONS you would like to use to protect your egg and how you think you can make it unique, work the best, etc.
2. Teacher must sign off/green light the design before actually building

CREATE!

- See steps in Video 3 (How-To video)
- Pass out Step-By-Step sheets to students
- **Use cation while using the glue gun. Unplug immediately after use to prevent the gun from overheating. Have students do any gluing wearing gloves and also over newspaper sheets.
- WE RECOMMEND NOT PASSING OUT EGGS UNTIL STUDENTS ARE READY TO INSERT THEM IN THEIR PROJECT
- Remember students must be able to check the egg after each test

TEST & IMPROVE

- See steps in Video 4 (Testing & Evaluation)
- Decide where your egg drop area will be
- Host a competition with the class
  -Use the clip to drop the egg- go higher and higher
- Optional: Go back inside and let them make adjustments based on project's performance
- Film project runs

Day 2: Independent Application(30minutes)

The type and number of Independent application actives should be determined by the students' individual ability levels.

2. Students write a 3-5 sentence paragraph answering their inquiry question as evidenced by their work. The height their egg survived should be a part of their answer.

AND/OR

3. Students complete Reflection Questions / 'Quiz' from the provided worksheet.

Extension Activities

- Watch the bonus video from an engineering professional from the industry (Video 5)
- Decorate the designs!
- Build a second design to compare to the original. Can you make this one ore durable and drop it from a different height? Maybe with even less materials?
- Film the test in slow motion to more closely analyze the car's performance.
- Email info@hellostiix.com to view more videos on this topic or to provide constructive feedback.