**Lesson Number 1: Space Junk Game Maker**

**Problem statement:** Students will conceptualize the problems space junk creates by viewing the Gravity movie clip, and creating and playing an interactive “Space Junk” obstacle game in a team setting.

Note: This unit contains an engineering design challenge beginning in Lesson 5 where students will design and build a spacecraft model to solve the space junk problem.

**Learning objectives:**

Students will understand that space junk exists, and that it is a problem through the creation and game-play of an interactive “Space Junk” obstacle game. This game will be played using common coding language to help students understand programming skills computer game makers use at a very basic level.

The students will understand that navigating around this space junk is necessary for the safety of manned and unmanned spacecraft.

**Lesson standards (NGSS, CCSS, CTE):**

**NGSS:**

|  |  |
| --- | --- |
| 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. |

**CCSS:**

ELA:

SL.5.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

Math:

[4.NBT.B.4](http://www.corestandards.org/Math/Content/4/NBT/B/4/)

Fluently add and subtract multi-digit whole numbers using the standard algorithm.

5.G.A.1

Graph points on the coordinate plane to solve real world and mathematical problems.

**Computer Science:**

1B-A-3-7 Construct and execute an algorithm (set of step-by-step instructions) that includes sequencing, loops, and conditionals to accomplish a task, both independently and collaboratively, with or without a computing device.

**Soft skills:**

Creativity and innovation:

* *Creative Thinking*
* *Collaboration with others*
* *Adaptability*

**Locally and/or personally relevant for students:**

The clip from Gravity depicts a woman in space (underrepresented in the industry), and students will engineer possible solutions during a simulation to address problems associated with space junk. More specifically, students will team to create their own game that will enable them to physically model the environment in which space junk exists, understand how it is problematic and how to find a solution to navigating around it. Students will be able to transpose a phenomenon occurring in space, into a game that takes place in a classroom. Hopefully the protection of earth and its atmosphere will be the shared goal among students that is both locally and personally relevant!

**Connections to career and educational pathways:**

This unit lesson most relates to computer programming, in which students will be developing a map using coordinates for how to navigate around space junk. Students will also define the goal of their space junk game. This results to computer programming in that the programmer defines the inputs and parameters in order to produce an output that accomplishes the programs objective. Refer to the Career Connections section of the Space Cadet Guidebook for real life examples of people that are in this field.

**Materials:**

* Access to movie clip from Gravity or WallE clip \*see online resources
* Space Book Intro video <https://vimeo.com/124972284>
* Space Book website <http://apps.agi.com/satelliteviewer/>
* Group Consensus protocol
* Discussion Diamond Documents
* Space Cadet Academy Guidebook
* Space junk obstacle course game materials: print 1 set per team:
  + Space Junk Game Objectives, Roles, and Planning doc
  + Role Cards for space junk game \*\* It is very useful to laminate a set of these for each team
  + Space Junk Game Rules for Students
  + Space Junk Game Materials List
  + Space Junk Game Grid
  + Classroom manipulatives of some type, game piece or pawn
  + Game Maker Scoresheet
  + 2 large black poster papers taped at the short end seam, with coordinate grids drawn on by the teacher 1 per team, or a few sets per class
  + Color printed, laminated if possible and placed on blocks 1 ISS, and 2 satellites images
  + 1 per student: Space Junk Navigator worksheet

**Lesson preparation:**

Familiarize yourself with the video clip from Gravity, be aware some students may be scared by this clip, in which case you can use the clip from Wall E as an alternative.

Students should be familiar with using coordinate planes before doing this lesson.

Make the numerous copies needed for this multiple day lesson, and prepare copies of the guidebook which will be used throughout the unit.

Familiar yourself with the Space Book resource online.

Prepare the packets each team will need for game design and play.

Prepare the large scale game board with coordinate grids (13x18), and ISS + satellites images

**Time required:**

2-4 - 1 hour sessions approximately, more if needed

**Grouping of students for instruction:**

Students should be in 4-5 member equal random groups. These same groups will be used throughout the unit, with modification by the teacher if needed.

For the Space Junk game students will have a given role that is randomly assigned: materials manager and time keeper (1), scorekeeper/referee (1-2), navigator (1), player (1). Adequate time must be provided to allow for rotation of game roles for all team members. Brief descriptions of each role will be provided.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

In this first lesson students are understanding and exploring the space junk problem.

**Understanding the Problem**

|  |  |
| --- | --- |
| **Teacher** | **Student** |
| Give each group of students the “What do you know about space junk? discussion diamond graphic organizer” (approx. 5 minutes or until most student conversations are concluded) | Write what they know about space junk on graphic organizer. |
| Introduce the problem launch using a video clip from the movie Gravity: [Gravity Clip](https://www.youtube.com/watch?v=vKW-Gd_S_xc) or [WallE](https://www.youtube.com/watch?v=RmG5tUCrrsA)  (approx.1.5 - 3 mins) | Students will watch the clip. |
| “Now that you have seen a fictionalized version of this problem, here is resource showing some actual satellite space debris.”: [Space Book](http://apps.agi.com/satelliteviewer/)  Teacher demo of this resource only. (1-2 mins) | Students will only view the Space Book resource. |
| Hands out Post-its to each student to add to the discussion diamond. (2-5 minutes) | Write new understanding on post-it and place over previous understanding. |
| Facilitate a quick discussion to solidify the space junk problem they saw in the video, and on space book. (1-2 mins) | Share out new information or new questions from their team discussions. |
| Introduce the group consensus protocol. (1 min) | Ask questions for clarification if needed. |
| “Now that we know a little about this problem, we’re going to engineer a game as a group to model the challenges of travelling in space.”  Hand out 1 packet to each team with:  ~ Role Cards for Space Junk Game  ~ Space Junk Objectives, Roles, and Planning  ~ Space Junk Game Materials List  ~ Space Junk Game Grid  ~ Space Junk Game Rules  Note: rules are not expectations such as “Don’t cheat”  (2 mins) | In groups students will read the Space Junk Game Objectives, Roles, and Planning doc in order to create their version of the space junk coding game using the space junk game grid. |
| Monitor game development, answer clarifying question on rules and setup etc. | Materials manager will get game materials and students will use materials to practice set up and finalize their game play rules. |
| Gives groups approval for their final game design.  (20-40 mins) | Students will get approval from teacher before creating their version of the game on the large game board.Once they have teacher approval students will work to create the large version of their game. |
| DAY 2:  Reintroduce group consensus protocol, and quickly establish basic group norms. Norms might include: Be respectful  Take turns  Teams may also discuss a team name, a name that they might use in later lessons for their company name  (2-4 mins) | Have students write their team name and 3 or so “norms” on an index card to use throughout this unit.  Students will complete their large game board and get ready to play. |
| Teacher will monitor final game play on the giant coordinate grid for groups ready to play, and help support groups that are still finalizing and getting approval for their plan.  Each person on the team will need a:  ~ Space Junk Game Navigator Worksheet  Each team will need 1:  ~ SJ Game Maker Scoresheet  (20-30 mins) | Students will rotate roles in their game play, keeping score on their team scoresheet. |
| Teacher will facilitate a gallery walk, “stay and stray” style. The final “scorekeeper” stays behind to explain the team’s version of the game, while the remaining team members rotate to the other stations.  (5-10 mins) | The scorekeeper explains the team’s version of the game to the other groups. The rest of the team does a gallery walk around the room. Students will report to the scorekeeper on how other teams played. |
| Teacher facilitates a final discussion on how the games were played, what worked, what could be improved and how the game models the real space junk problem.  (5 mins) | Students will participate in the discussion on how the games went, what worked, what could be improved, how it models the real problem. |
| Teacher will present each student with the “Space Cadet Academy Guidebook” and upon completion of their exit ticket responses: their first “Game Maker Badge”:Today your exit ticket is to answer at least one of the following questions:   1. How did you fulfill your role for the space junk game? 2. What do you understand now about space junk? 3. How do you think they track space junk? 4. How is space junk a problem?   “Congratulations and Welcome to Space Cadet Academy!”  (5-10 mins) | Students will document their understanding of the space junk problem and their reflections in their new “Space Cadet Academy Guidebook”. |

**Accommodations:** Highly Capable: you could use all four quadrants of the coordinate planes for the game grid instead of just using quadrant 1. The discussion diamond task is a SIOP tool, and is meant to allow for all students to show understanding. Students who are challenged in this lesson can work alongside peers for support.

Adjust reflection exit ticket questions in the guidebook dependent upon student ability.

**Extensions:** Add in facts about space junk into the game by making certain space junk items unlock specific information.

**Assessment:**

Formative Assessment in the Lessons:

1. The group discussion diamonds will serve as a baseline of understanding to assess from.
2. Completed design of the game including how it's scored and anecdotal notes from the teacher’s observations of game play can be used as needed.
3. The “Space Cadet Academy Guidebook” reflection questions provide formative assessment information.

**References/Resources:**

**For Class:**

* [Gravity Video Clip](https://www.youtube.com/watch?v=vKW-Gd_S_xc)
* [Wall-E Video Clip](https://www.youtube.com/watch?v=RmG5tUCrrsA)
* [Space Book Intro Video](https://vimeo.com/124972284)
* [Space Book Website](http://apps.agi.com/satelliteviewer/)

**For Guidebook:**

* <https://www.yoyogames.com/get>
* <https://unity3d.com/unity>
* <http://www.rpgmakerweb.com/>
* <https://scratch.mit.edu/projects/18641/>
* <https://www.tynker.com/>