BeeBots, Coding, and a new game about Mining in Space

Share a hands-on, fun STEM game incorporating coding, resource management, and game design. Lesson alignment with NGSS Engineering Design and ISTE standards will be discussed. There will also be time for participants to experience the game (play).

GAME INSTRUCTIONS AT END OF SLIDES

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ALIGNMENT - IOWA CORE

- **21.3-5.TL.3** (Technology Literacy, 21st Century Skills)
  - Utilize digital tools and resources to investigate real-world issues, answer questions, or solve problems.

- **21.3-5.TL.4**
  - Use technological resources to develop and refine questions for investigation.
ALIGNMENT - ISTE

Computational Thinker

a. formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

d. understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.
ALIGNMENT - NGSS

- 3-5 Engineering Design  3-5.ETS.1-1
  - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on material, time, or cost.

- Crosscutting Concepts
  - People’s needs and wants change over time. Engineers improve existing technologies or develop new ones to … meet societal demands.
INTEGRATING BEE BOT

Bee Bot

simple coding structures that allow students to concentrate on the development of strategy rather than the complexity of programming.
THE FIRST GAME (MY GAME) (EVALUATING PREVIOUS SKILLS)

- The lessons started with a mission goal (get water, energy, etc) and record the amount of material.

sequential process
step-programming
collaboration
communication
The game was appropriate for evaluation of coding skills

ISTE 5.C-D, 1.C-D
NGSS 3-5.Eng. Design
1-2, 1-3
Iowa Core
Technology 21.3-5.TL.3&4
The apparent chaos going on in the game actually shows four teams working independently of each other. The discussions going on include:

“who will program next?”
“what square should we get?”
“how do we code the program?”
“should we have a second option?”
HOW CAN WE MAKE THIS GAME BETTER?

Every time we played I asked,  
“**How can we make this game better?**”

They answered:

“If you want us to build things you need to put more stuff out.”

“How many points are these all worth?”

“Maybe there should be things to avoid.”

*Together, we reached the current version of the game.*
THE ITERATIONS - OVERVIEW

- **ONE (My Game)**
  stapler, tape roll, water cup
  RECORD what you reach

- **TWO (Their game)**
  Use Pattern Blocks to pick represent what we need, points structure

- **THREE (Their game)**
  Using resources required to launch rover (BeeBot) out to mine,
  1 water + 1 energy

- **FOUR (Their game)**
  Make it a space station and BUILD STRUCTURES (awesome)
ASTRO-MINE

developed by Aaron AB and 160 of his favorite students

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SET UP

- **30cm x 30cm grid**
  (total size varies with space available)

- **2 Bee Bots, 4 teams**
  (the downtime is important)

- **Pattern Blocks**
  - blue rhombus (water) x24
  - red tetrahedron (energy) x24
  - yellow hexagon (construction) x12

- **Obstacles (4x)**
SET UP

1. Each team gets
   * One obstacle to place on field
   * 3 water tiles, 3 energy tiles
   * One base

2. Each team places their obstacle anywhere on the field

3. Each team places their base anywhere on the row closest to them

4. Finally, the resources are distributed to the field.
   - 12 yellow (construction)
   - 12 blue (water)
   - 12 red (energy)

The resource distribution is random and some cells will contain more resources than others. (students will immediately start planning)
GAME PLAY

1. Bee Bots start on opposite sides of the field. Bots always take off from the center of their base.

2. Teams select a destination and program the Bee Bot. Teams must ‘pay’ one blue and one red to launch a Bee Bot.

3. If the Bee Bot stops entirely inside a cell that team collects the resources.

4. After an attempt, BeeBots move to the team to the left (clockwise).

Water (blue) keeps the rover driver safe
Energy (red) powers the rover

If you don’t have a water and an energy unit, your BeeBot cannot go mining.
GAME PLAY

1. Players can trade in construction pieces if necessary
   one yellow => three blue
   one yellow => two red

2. Players can construct water towers and power stations
   two yellow + one red = power station
   two yellow + one blue = water tower

3. When a water or energy Bee Bot comes to your team and you own that tower, you receive one of that energy type
END GAME

- Towers worth 15 points
  Yellow is worth 5 points
  Red energy is worth 3 points
  Blue water is worth 3 points

- We all agreed that points only indicate how well a team performed. Points do not determine a winner. Teams can celebrate their own achievement and we often discuss the results (if needed, i.e. hurt feelings)

60 Points!!