Connect Stars

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11.127/11.252 - Designing and Developing Games for Learning
April 6, 2017

Game Setting & Objectives

Humanity has at last mastered interstellar travel, and is starting to explore the galaxy in search of resources. Four countries are at the forefront of the new space race. The US and Canada have allied themselves as the North American Countries for Space Exploration (NACSE), squaring off against the Asian Alliance for Interstellar Exploration (AAIE), led by South Korea and India.

The space race has caused a resource shortage on earth in four key elements, Carbon, Iron, Helium, and Hydrogen, and NACSE and AAIE are searching for more. Each country is sending out a ship to collect enough resources to build more ships and dominate the space race.

Working with your allied country, you are captaining a ship to collect resources and bring them back home before the other alliance can do the same--luckily, since you're a team, you can divide and conquer the board, and each focus on collecting half of the resources. Each time you plot a course to a new star, you must take account of where you are and calculate a new trajectory in your search for resources. Once your team has collectively acquired 10 metric tons of each element, you have won and can return home.

How to Play

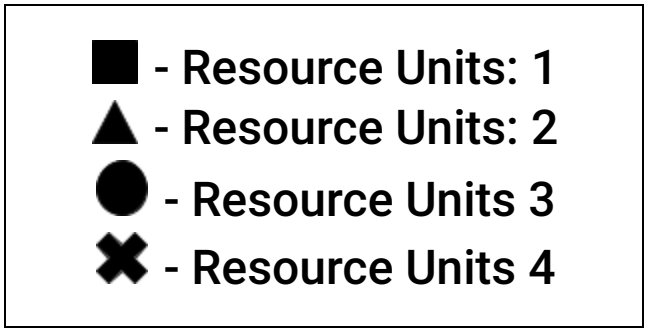
Resources

Game board
Travel cards
Dry-erase markers
Dry-eraser eraser
Elemental Tokens
Dice: 1 red die, 1 white die

Rules & Gameplay

Game Set Up

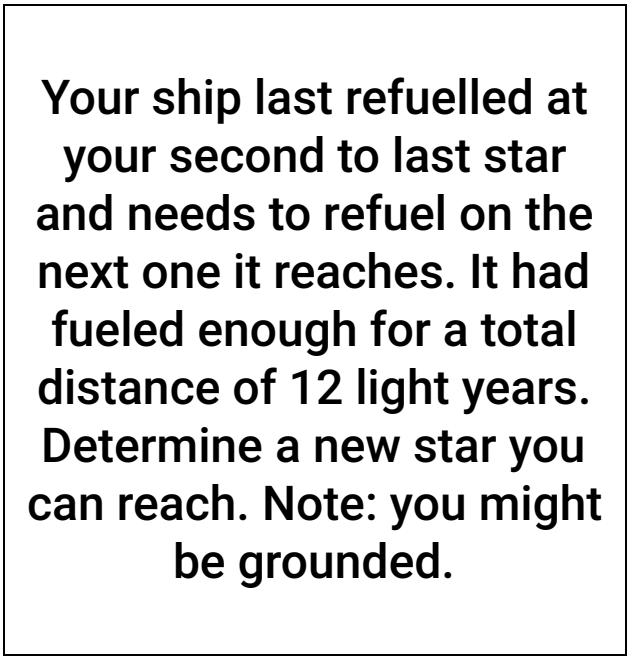
Each player selects one of the four element quadrants (hydrogen, helium, carbon, iron) to begin. The player's goal is to focus on collecting this element, as well as the element in the opposite quadrant; their teammate will be collecting the other two elements. The players then divide into two teams, and decide who goes first. Players determine their first three stars in their corresponding quadrants by rolling two die. The coordinates of these stars within the quadrants is determined by the outcome of the roll, where the red and white die respectively dictate the *x*- and *y*-coordinates of the stars in the corresponding quadrants. For example, if a player rolls red-2 and white-3 and selected the Iron (Fe) quadrant, then they will mark a star at (2,3) in the Iron quadrant. All three initial stars are to be connected and may be marked to remember the order in which the stars were obtained. Each star is marked with a simple shape which dictates how many resource points they are to receive, tabulated below. Resources are distributed in the form of resource tokens held by each player.



Resource reference card

Typical Turn

Each turn begins when a player turns over a Travel card which all players can read. These cards, listed in Appendix A, pertain to the geometry-related Common Core standards for 6th-8th grade. Upon turning over the card, the player begins to solve the problem with the assistance of his/her teammate. Problems are generally constrained by the placement of the last two or three stars, and are solved by the placement of a single new star. These problems are designed to be mostly conceptual and exhibit multiple solutions to allow for flexibility in placing stars. In some cases, the player may be unable to place a star because the solution exists outside the board; in this case, the player would flip over a new Travel card and begin solving that. Only when the card explicitly states that they might be "grounded" (see sample card below) will gameplay proceed to the next player without placing a star. Upon completion of the problem, the player marks and connects their existing network with this new star. Should a player land exactly on the axis between two element quadrants, they are to receive one resource point for each of the two elements bordering the axis.



Sample question card

While the player solves the problem, the opposing team monitors the work of the player and may challenge their solution when they place their new star. Once challenged, all players will begin discussing the problem and present why they believe the placement is correct or incorrect, requesting the help of the overseeing teacher if necessary. When the challengers are correct, the solving player forfeits the ability to mark a star on the current turn and play proceeds to the next player. Should the challenger be incorrect, they forfeit their next turn. After a player's turn is

completed, play progresses to the opposing player of the opposite team, moving clockwise around the board while alternating between the teams.

End of Game

When a particular team accumulates the requisite resource points to return to Earth, they must spend additional resources to return to Earth. For example, if a player ultimately ends up in the carbon quadrant at the (3,4) location, they would need an additional 3 + 4 = 7 iron resources to return to earth. Note that players must still *return* to Earth with the necessary resource points and must plan their paths accordingly by accounting for the checkerboard distance they must travel back to Earth. Both players of a team must return to Earth before winning the game.

Common Core Standards

Connect Stars meets the following Common Core standards:

Standards for Mathematical Practice:

CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.
CCSS.MATH.PRACTICE.MP2 Reason abstractly and quantitatively.
CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others.
CCSS.MATH.PRACTICE.MP4 Model with mathematics.
CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.
CCSS.MATH.PRACTICE.MP6 Attend to precision.
CCSS.MATH.PRACTICE.MP7 Look for and make use of structure.
CCSS.MATH.PRACTICE.MP8 Look for and express regularity in repeated reasoning.

Content Standards:

Grade 6

Solve real-world and mathematical problems involving area, surface area, and volume.

CCSS.MATH.CONTENT.6.G.A.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
CCSS.MATH.CONTENT.6.G.A.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

Grade 7

Draw construct, and describe geometrical figures and describe the relationships between them.

CCSS.MATH.CONTENT.7.G.A.2 Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

CCSS.MATH.CONTENT.7.G.B.6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Grade 8

Understand congruence and similarity using physical models, transparencies, or geometry software.

CCSS.MATH.CONTENT.8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations:

- CCSS.MATH.CONTENT.8.G.A.1.A Lines are taken to lines, and line segments to line segments of the same length.
- CCSS.MATH.CONTENT.8.G.A.1.B Angles are taken to angles of the same measure.
- CCSS.MATH.CONTENT.8.G.A.1.C Parallel lines are taken to parallel lines.

CCSS.MATH.CONTENT.8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

Understand and apply the Pythagorean Theorem.

CCSS.MATH.CONTENT.8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

CCSS.MATH.CONTENT.8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.