Strategic Games to Promote Reasoning, Discourse and Motivation

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What do we mean by Strategic?

▸ These types of games have been part of human culture for millennia

  ▸ Scholars have traced the first games of chance to 3000 BCE

  ▸ This fact is interesting (hopefully) but also important

    ▸ Games are part of who we are as people!

▸ What are some of your favorites?

Reasoning, Discourse, Motivation

‣ Three essential constructs to support students' mathematics learning

‣ As a math teacher I know each of these aspects of student activity are vital since …

‣ The experts confirm our practice-validated knowledge

  ‣ The Process Standards (NCTM, 2000),

  ‣ Mathematical Proficiency (NRC, 2001)

  ‣ Standards for Mathematical Practice (CCSS-M)

Games can support student learning?!

▸ Let's examine what it means to PLAY!

▸ Play is a powerful orientation to activity. It allows for:

  ▸ A focus on process more than product

  ▸ Opportunities to experience '*flow*'

  ▸ Low risk of failure

▸ Particularly important here, play is confined by rules, but the players may agree to manipulate these rules.

Here's a quick example

▸ Who has played the card game Go Fish?

▸ This game has variations including when sets are displayed, capturing others cards, and keeping score.

 ▸ Students could try to earn more points than the other player OR

 ▸ Students could collaborate to get one score for the game

▸ More important for our discussion is "How can the rules be manipulated to foster reasoning, discourse, and motivation?"

Go Fish

- Keep in mind that an ideal adapting of rules moves student activity through a progression from Concrete to Representational to Abstract

- Early in the progression each card is worth it's value and all cards are simply added, but by what method?

- Next, playing all 4 of a number earns double points

- Later, totals are determined by raising the value of the card to a power, i.e. playing three 7's earns 7^3 points

Now it's your turn!

▸ We want you to get to play three games and discuss the strategies inherent to the game AND how the rules may be altered to promote reasoning, discourse, and motivation

▸ The first game initially incorporates Natural #'s, the second positive fractions, and the third decimal representations.

▸ We will begin with Pathways!

Pathways Game Rules

▸ Materials Need: Green Tiles, Game Boards & Dry Erase Markers

Player X places two green tiles over factors, and draws an X on the product.

Player O checks that the product is correct. Both players write the equation.

Player O places a green tile over one new factor, and draws a 0 on the product. Player X checks the product, and both players write the equation.

▸ The winner is the first player to complete a path from top to bottom or from side to side of the game board.

Pathways

▸ What reasoning strategies did you purposefully use while playing?

▸ As a teacher, how would you pose questions for students while they are playing to elicit their thinking about the game play?

▸ What alterations to the game seem valuable?

▸ Our wish is for students to build their own boards to play and incorporate N, Z, Q^+, and Q

Uncover Game Rules

- Materials Needed: Fraction Strips (1, ½, ¼, 1/8, and 1/16), red fraction cube
- Each player covers his or her whole strip with two ½ pieces.
- Each turn has four steps. You may not exchange and remove the pieces in the same turn.

1

Roll the fraction cube.

2

You have three choices:

- Remove the piece shown on the fraction cube.

$\frac{1}{2}$ $\frac{1}{2}$

- Exchange one of the pieces for equivalent pieces.

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{8}$

- Do nothing.

3

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{8}$ ✓

Your partner checks to be sure he or she agrees with what you did.

4

When you finish your turn, say "Done" and hand the cube to your partner.

- The winner is the first player to uncover a whole strip by rolling a fraction that exactly matches the last piece on the strip.

Uncover

▸ Uncover can be used to enable students to move along the C-R-A progression.

▸ As you play Uncover…

   ▸ What are key strategies for the game play?

   ▸ How can the game be altered/extended?

   ▸ What values can not be included with the number generators we have provided?

A progression for abstracting

‣ As presented, Uncover is rather concrete

‣ Extensions include:

    ‣ Using more fraction strips

    ‣ Rolling a 'multiplier' number generator

    ‣ Incorporating additional fractions (which ones?)

    ‣ Transitioning to drawn representations of fraction strips

    ‣ Playing the entire game symbolically

Decimal Dare Game Rules

▸ Materials Needed: 0-9 Decahedron, Game Sheet

▸ Step 1: Roll the decahedron, decide if you want to make the number a tenth or hundredth.

▸ Step 2: The number must be added to your previous roll. Use the chart to guide you and circle your last move.

▸ Step 3: Hand the decahedron to your partner. Repeat this 6 times. Every player must have six turns.

▸ The Winner is the player to gets closest to 1 without going out.

Decimals Dare

▸ The rules establish the goal of reaching a prescribed endpoint with a small set of possible moves.

▸ For this game, we want to highlight the potential to talk your moves

▸ How might this game be altered/extended?

Adjusting the Board

▸ The Decimal Dare board is printed with specific start and end points.

  ▸ What other values are reasonable?

  ▸ We support students efforts to abstract by enabling their understanding of

   ▸ sliding the board along the number line or

   ▸ zooming the board in to include more decimal places

  ▸ Easy access to a board generator

   ▸ http://www.helpingwithmath.com/printables/tables_charts/1nbt1-numbers-chart01.htm

Bringing it all together

- We have focused on altering rules to extend the game and thus extend the reasoning that students will do about the mathematics

- The opportunity to alter the rules of the game allows the student to make the game her own thus promoting motivation

- There are multiple occasions to talk during the game, but the greatest opportunities for discourse occur in the negotiation of the rules and particularly when students respond to teachers questions about how new rules will impact their strategies!

Thank You

- Questions?

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