M2C3 MATH MODELING LESSON OVERVIEW

LESSON TITLE: PRIZE SPINNER

STANDARDS ALIGNMENT:

GRADE 3	GRADE 4	GRADE 5
3.NF.A.1 Understand a fraction (1/*b*) as the quantity formed by one part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by *a* parts of size 1/*b* **3.NF.A.2** Understand a fraction 1/*b* as a special type of fraction that can be referred to as a unit fraction (e.g. 1/2, 1/4). **3.NF.A.3** Understand two fractions as equivalent if they have the same relative size compared to 1 whole.	**4.NF.B.3** Understand a fraction *a/b* with *a* > 1 as a sum of unit fractions (1/*b*).a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. **4.NF.B.3, 4.NF.B.4** Build fractions from unit fractions. Use this understanding to multiply a whole number by a fraction (n x a/b). Solve word problems involving multiplication of a whole number by a fraction.	**5.NF.A.2** Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators by using a variety of representations, equations, and visual models to represent the problem. **5.NF.B.4** Apply and extend previous understandings of multiplication to multiply a fraction by a whole number and a fraction by a fraction.
MP: 1 Make sense of problem and persevere in solving them. **MP: 3** Construct viable arguments and critique the reasoning of others. **MP: 4** Model with Mathematics	**MP: 1** Make sense of problem and persevere in solving them. **MP: 3** Construct viable arguments and critique the reasoning of others. **MP: 4** Model with Mathematics	**MP: 1** Make sense of problem and persevere in solving them. **MP: 3** Construct viable arguments and critique the reasoning of others. **MP: 4** Model with Mathematics

CONNECTIONS (Consider while planning):

• Previous Math Knowledge: *What prior math knowledge and experiences does this lesson consider and/or build on?*

Fractions are parts of a whole. They always refer to something (like a whole day or a full circle).

• Cultural/Community/Family Connections: *How does the lesson connect to, or build on the*

knowledge, practices, or experiences of children and families? On community contexts??

Students may have experiences using spinners in board games, spinning prize spinners at carnivals, and playing spinner games at local arcades and similar places, etc. They may have intuitive understandings about the relationships between the size of the region assigned to a given prize and the likelihood of earning that prize.

Spinners must be made up of whole circle.

TASK VARIATIONS:

Routine 1: Mathematizing World - Open Ended (10 minute) - [Introduce Prize Spinner Task : Ask students if they have used spinners in games.] Use initial slides to connect to students' experiences with spinners.

- What do you notice? What does this picture make you wonder about? Brief class discussion.
- For students who have limited experience with parts of wholes using fraction circles, use fraction circles pieces to explore different ways to make one-whole from different sets of fraction circle pieces. Examples (½ + ½ = 1 , ¼ + ¼ + ½ = 1, ½ + 1/3 + 1/6 = 1, etc)

Routine 2: Mathematizing World - Specific Questions (20 minute) Sensemaking and assumption building. Show the side with 4 different spinners.

- What questions do you have that you could use mathematics to answer?
- What information do you need to find out to answer those questions?
- What assumptions could you make? What assumptions are reasonable?
- Elicit ideas related to the different size partitions of the four spinners. Here students should notice that the spinners are partitioned in different ways, and that the size of the region relates to how likely it is for the spinner to "land" on that space. Students should notice that some spinners are divided equally – into 4ths, into 8ths, and that other spinners are NOT divided equally – one shows ½, 1/3 and 1/6 for example.

Routine 3: Full Modeling Task (60-90 minute) Students participate in entire modeling cycle

In this task students will create their own spinner. They will use their understanding of fractional parts of wholes to create the spinners.

The final slide asks for students to brainstorm important considerations if they were to make their own spinner – this brainstorm is relevant to all three versions of the task that follow (3rd, 4th and 5th). Students may note considerations such as: how many different prizes there will be, whether the prizes should be equally likely, or whether it should be easier to win some prizes and more difficult to win others, etc..

Version A: **Design your own spinner (Grade 3).**

Students will design their own spinner.

- Design your own spinner prize wheel using fraction circles.

- Give examples of spinners that form a whole circle and those that do not.
- Develop a method that your class can use to create a spinner with any number of prizes.

Students can trace their designs or use the blank fraction circles to replicate the designs they made.

They could also take pictures of their designs and present them electronically.

Version B: Class / School Reward (Grade 4)

Reward systems are a great way to recognize kindness, helpfulness, responsibility and other positive contributions to our school. Show video of school that uses reward systems.

Student discussion: What would you like to encourage at your school? Design a reward system that uses a spinner to give out prizes for positive contributions to your school.

In your groups:

- Determine what you would like to encourage at the school
- Design a spinner for the rewards (prizes) using fraction circles
- Determine rewards that you would give and what portion/fraction of the spinner you want for each reward
- Write a proposal to your teacher or principal describing how you determined the behaviors, rewards and spinner
- Encourage students to justify/explain how they know that the regions on their spinner total exactly one whole.
- Adaptations: require students to create a spinner that has at least ____ different prizes (4? 5? 6?) This will invite students to move beyond 3rd and 4ths into other fractional parts.
- Adaptations: require students to create a spinner where some prizes or rewards are more likely than others. This will invite students to compose a whole using different unit fractions.

VERSION A AND B TASKS

ANTICIPATED STUDENT ASSUMPTIONS

- All prizes be equally likely to win
- Some prizes be harder/easier to win
- Not all spins will result in a prize, one result could be spin again or spin twice for two possible prizes.
- Spinners must be created with diameters. Thus, opposite sectors have equal areas and equal likelihood of the spinner pointing to those sectors.
- Spinners can be made of all different size sectors.

ANTICIPATED STUDENT STRATEGIES for MAKING THE SPINNER

- Students may compose a spinner using equal size pieces (four ¼ pieces, three 1/3 pieces, etc.)
- Students may also explore ways to compose a whole using different fractions (1/2, 1/3 and 1/6 for example).
- Students should justify why each prize is aligned with each region on the spinner- i.e., do they want it to be easier or harder to win the prize or reward. Students should also be encouraged to describe their spinner in fractional terms – ¼ of the spinner has no prize, ¼ of the spinner you get to spin again, ¼ of the spinner is for X prize, and ¼ of the spinner is for Y prize or reward, etc
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VERSION C TASK: Creating a Carnival Prize Wheel Game Spinner

At the spring carnival, there will be a prize wheel game. Students can buy tickets to spin the wheel and win prizes. Our class gets to design the prize wheel game. The game should help raise money for the school, and it should be fun to play.

In your groups:

- Design a spinner for the game using fraction circles
- Determine prizes for the game and decide what portion/fraction of the wheel you want for each prize
- Consider the number of people that might play the game, and estimate the number of each prize needed
- Extension: Find a fair number of tickets students should pay to play*
- Extension: Estimate how much money the game will raise*

ANTICIPATED STUDENT ASSUMPTIONS

- Number of people that will attend the carnival
- Number of people that will play the spinner prize wheel game
- Number of times the wheel will be spun (i.e. you are given two spins/ticket)
- Will all prizes be equally likely to win, or will some prizes be harder/easier to win
  Will all spins result in a prize, will some spins result in no prize, or a 'spin again' option?

ANTICIPATED STUDENT STRATEGIES for ESTIMATING NUMBER OF PRIZES

- Students will use similar strategies to those described above to design the spinner.
- To estimate the number of each prize that will be needed, students will need to make assumptions about the number of people that will play the game (which might require estimating the number of people that will attend the event/carnival), Then based on this assumption, they can use the portion of the spinner devoted to a given prize to estimate the number of that prize that will be needed. For example, if 100 people play the game, and ¼ of the prize spinner says “win a lollipop” then approximately ¼ of the people that play will land on that spot, and ¼ x 100 is 25, so you will need about 25 lollipops. Estimating the amount of each prize that is needed will require multiplying a unit fraction by a whole number.

MATERIALS NEEDED:

Prize Spinner_Lesson Slides

Prize Spinner_Student Task

Fraction circles pieces – Version A

Blank Circles

Optional : Materials to create a prize spinner.

Cardboard, colored paper, attachable spinner.

- Extension require the further development of materials by a teacher.