M2C3 MATH MODELING LESSON OVERVIEW

LESSON TITLE: Nana's Birthday

STANDARDS ALIGNMENT:

GRADE 3	GRADE 4	GRADE 5
3.OA: Represent and solve problems involving multiplication and division. **3.OA 3**: Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.	**4.OA:** Use the four operations with whole numbers to solve problems. Gain familiarity with factors and multiples. **4.OA 3:** Solve multistep word problems posed with whole numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted...Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	**5.OA:** Write and interpret numerical expressions. **5.OA 1**: Us parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. **5.OA 2:** Write simple expressions that record calculations with numbers… **5.NBT:** Perform operations with multi-digit whole numbers and with decimals to hundredths. **5.NBT 6**: Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays and/or area models.
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:**

- Four operations (addition, subtraction, multiplication and division) using numbers between 0-1000.
- Fair shares (division); equal groups (multiplication);
    - *In this instance fair sharing may mean that shares are proportional to earnings/savings rather than equal*

- Partitioning
- Equivalent fractions
- Representing math ideas with pictures, symbols, and words.

• **Cultural/Community/Family Connections**:
- Sharing
- Fairness/unfairness
- Experiences with honoring grandparents/elders in the community (birthdays, anniversaries)
- Sharing costs to buy something
- Pooling money (putting money together to buy something)
- Saving/earning money

Language Considerations: specialized terms: *Nana (cultural name for grandmother)*

TASK Variations:

Level 3: **Full Modeling Task (60-90 minute) Students participate in entire modeling cycle**
In this task, students must determine how four grandchildren should combine their money to purchase a gift (art supplies) for their Nana/grandma. The grandchildren in the story are different ages and have different amounts of money they earn or already have. One of the grandchildren suggests that they should split the cost among them and each pay the same amount. Another grandchild says that would not be fair and says they should pay different amounts. The students must come up with a recommendation about how to share the cost of the present. The plan must be fair and usable in other similar situations. Students are asked to report out their plan with a group poster and whole class discussion.

Launch: Fair Share Discussion
Building background knowledge and connecting to funds of knowledge. Show scenario slide: FAIR SHARING:
What does it mean to share something fairly? Can you think of a situation in which you had to share something fairly with your friends or family? What made the situation fair? How did you know it was fair? What would be a situation in which it was unfair?

Give students time to talk with their table mates about what a fair share is.

Version A: Nana's Birthday (easier number choices)

It is Nana Rosa's 65th Birthday.
Her five grandchildren want to buy a special gift. She is a painter.
At the art store they found a professional paint set that comes with lots of paint colors and different size canvases and brushes. The paint set is on sale for $200.00

- Maya, a 11th grader earns $60 each week from her book store job.
- Andrea, a 9th grader, earns $30 each week from babysitting jobs.
- Gabe, a 6th grader, earns $10 each week taking care of his neighbor's pets.
- Elisa, 4th grader, earn $5 each week watering plants for the family garden.
- Joaquín, a 2nd grader, has no weekly job but has saved $8 in his piggy bank.

One of the grandchildren says that they should split the cost of the paint set among them and each pay the same amount. Another sibling says that it is not fair and they should each pay different amounts.

What do you think? What is *fair* in this situation?

TASK:

- Help the grandchildren make a plan to share costs in a fair way to buy the gift.
- Use mathematics to justify your conclusions.
- Your plan should work in other situations where family members want to share costs fairly.

Version B: Nana's Birthday (harder number choices, range)

It is Nana Rosa's 65th Birthday
5 of her grandchildren want to buy a special gift. She is a painter.
At the art store they found a professional paint set that comes with lots of paint colors and different size canvases and brushes. The paint set is on sale for $199.00

- Maya, a 11th grader earns $60 per week from her book store job.
- Andrea, a 9th grader, earns between $20-30 each week from babysitting jobs.
- Gabe, a 6th grader, earns $10 each week taking care of a neighbor's pets.
- Elisa, a 4th grader, earns about $5 each week watering plants for the family garden.
- Joaquín, a 2nd grader, has no weekly job but has saved $8 in his piggy bank.

One of the siblings says that they should split the cost of the paint set among them and each pay the same amount. Another sibling says that it is not fair and they should each pay different amounts.

What do you think? What is *fair* in this situation?

TASK:

- Help the grandchildren make a plan to share costs in a fair way to buy the gift.
- Use mathematics to justify your conclusions.
- Your plan should work in other situations where family members want to share costs fairly.

ANTICIPATED STUDENT ASSUMPTIONS:

In this task, students will have to make many decisions based on assumptions. For example, they will need to make assumptions/decisions about:

Who will pay for the gift: Will all the grandchildren pay for the gift? Will some of the grandchildren pay for the gift? What about the youngest child?

How much will each grandchild contribute: Some children make different amounts for different types of work. One child only has a fixed amount (piggy bank). Some students might assume a grandchild has savings to draw upon.

How long it will take to get enough money to buy the gift:

How their plan is fair: In our plan, each granchild pays …. This plan is fair because…

ANTICIPATED STUDENT STRATEGIES:

Strategies for Task Versions A & B

Equal pay Model

• divide $200 by 5. Each grandchild pays $40. And then figure out how long it would take earn $40. This often pushes a conversation about Joaquín's contribution of $8.00.

• divide $200 by 4. (four siblings have jobs and will split cost evenly $50.00). Joaquín will make up the difference or pay the "tax". Could Joaquin pay the tax in on $200.00?

Proportional Model:

• The amount each grandchild pays is proportional to their earning power. Maya would pay the most because of being the oldest sibling and makes 2 to 12 times as much as the other grandchildren. Andrea would pay more than Gabe, who would pay more than Elisa. Joaquín might contribute some amount but not all of his $8.00.

Version B:

Make numbers friendly: Students might round up $199.00 to $200.00 to make it a friendlier number to work with.

Address the range: Some students might select an endpoint of the range ($20 or $30) to make numbers easier to work with. Some may attempt to take an "average" or the midpoint ($25) in between as an assumption for their model.

Conceptual confusions/misconceptions

• What to do with Joaquín's contribution (youngest grandchild). Static amount $8.00
• Divide the art supplies price by 5 and think they are done with the problem.
• Add the time (weeks) it would take each sibling to come up with each share, rather than consider that the children would be earning the amount concurrently.

MATERIALS:

Nana's Birthday_Lesson Slides

Nana's Birthday_Student Task