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| **TEAM Lesson Plan Template** | |
| Teacher: Dr. Amanda Niedzialomski | |
| Subject/Grade: Mathematics (Fractions) / 4th Grade | |
| Lesson Title: Kool-Aid Oobleck Recipe | |
| **STANDARDS** | **Identify what you intend to teach.** State, Common Core, ACT College Readiness Standards and/or State Competencies; Enduring Understandings and Essential Questions. |
| **MP4. Model with mathematics**  **MP5. Use appropriate tools strategically**  **MP6. Attend to precision**  **4.NF.B.3** Understand a fraction a/b with a > 1 as a sum of fractions 1/b. For example, 4/5 = 1/5 +1/5 + 1/5 + 1/5.  a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.  b. Decompose a fraction into a sum of fractions with the same denominator in more than one way (e.g., 3/8 = 1/8 + 1/8 +1/8; 3/8 = 1/8 + 2/8; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8) recording each decomposition by an equation. Justify decompositions using a visual fraction model.  c. Add and subtract mixed numbers with like denominators by replacing each mixed number with an equivalent fraction and/or by using properties of operations and the relationship between addition and subtraction.  d. Solve contextual problems involving addition and subtraction of fractions referring to the same whole and having like denominators. | |
| **OBJECTIVE(s)/Sub-Objectives** | **Connect prior learning to new learning.** Clear, Specific, Observable, Demanding, High Quality, Measurable, Aligned to Standard(s), and Integrated with other subjects, build on prior student knowledge  Student-Friendly (I Can Statement) |
| I can measure accurately with a measuring cup.  I can decompose a mixed fraction into a sum of fractions with the same denominator.  I can add fractions with the same denominator. | |
| **MATERIALS AND RESOURCES** | **Content-related:** Clearly supports lesson objective(s); rigorous & relevant; Incorporates multimedia & resources beyond the textbook. |
| **Materials**  Mixing bowls and spoons, one pair per group (or one large mixing bowl for the whole class)  Measuring cups and measuring spoons (each group needs a 1/3 cup and a 1/4 cup measuring cup)  Cornstarch in plastic containers (each group needs a container with at least 3 cups of cornstarch)  Water (a 16.9 fl oz bottled water for each group works well)  Kool-Aid (unsweetened) in plastic containers (each group needs a container with at least 1/4 cup of Kool-Aid)  Craft sticks or plastic knives for leveling (one per group)  Clear, disposable plastic cups, some marked with 1/3 cup increments (at least 8 cups per group), some marked with 1/4 cup increments (at least 8 cups per group)  Paper or notebook for notetaking and recording results  **What if the technology is not working?** This is a low-tech activity.  **Routine for distributing materials:** Place the following materials on each table where the students will work in a group:  1/3 cup measuring cup\*  8 plastic cups with 1/3 cup increment markings\*  container of cornstarch\*  craft stick\*  \*these items should be placed together, on one desk or side of the table  1/4 cup measuring cup\*\*  8 plastic cups with 1/4 cup increment markings\*\*  bottled water\*\*  \*\*these items should be placed together, on a separate desk or the opposite side of the table  Each student also needs their notebook, or a separate sheet of paper can be passed out to each student.  Later in the activity, the remaining materials will be distributed to the groups: each group will receive a mixing bowl, a mixing spoon, a measuring spoon, and a container of Kool-Aid. | |
| **ACCOMMODATIONS/ADAPTATIONS** | **Learning styles and interests.** Anticipate learning difficulties, regularly incorporate student interests & cultural heritage; differentiate instructional methods. |
| **Modifications/Plans for Diverse Learners**  **Differentiation**  **\_\_x\_\_ Content:** The recipe can be changed to 2 cup cornstarch + 1 cup water + 2 tsp Kool-Aid and the measuring cup/spoon size can also be changed to decrease the number of possible decompositions. The number of required decompositions for each group to find can be changed.  **\_\_x\_\_ Process:** Some students, including those with touch sensitivity, may not want to measure the ingredients or touch the Oobleck. Instead, these students can be the recorders of the team, while other teammates do the measuring. Clean spoons or craft sticks can be provided so students who would prefer not to touch the Oobleck can still interact with it. The teacher can demonstrate some of the properties of Oobleck at the front of the class, so students who do not wish to interact with the substance can observe some of its properties.  **\_\_x\_\_ Product:** For some students, it may be helpful to tell the teacher their decompositions orally, rather than writing them on paper.  **Accommodations**  The Kool-Aid can be omitted for students with allergies or food-coloring sensitivities.  The same mathematical skills of decomposing fractions and adding fractions with common denominators can be done completely on paper (without measuring ingredients or creating the Oobleck), which may be helpful for some students.  **Early Finishers:** Early finishers can find more decompositions than the required number. They can attempt to find all of the decompositions with their given measuring cup, and argue why they have found them all. They can be given a second measuring cup of a different size, and explore new decompositions using the pair of measuring cups. | |

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| **MOTIVATING STUDENTS/ANTICIPATORY SET** | **“Hook”: Engage students’ attention and focus on learning.** Personally meaningful and relevant. |
| Look at videos or pictures of fun cakes or other pastry items. Ask if anyone likes to bake. Discuss the precision one needs to bake items such as these.  <https://www.instagram.com/kids_cakes/?hl=en>  Then watch a video on measuring ingredients.  [How to Measure Dry Ingredients Like a Pro | Food Network](https://youtu.be/XlV8h3LJNj4)  <https://youtu.be/XlV8h3LJNj4> | |
| **INSTRUCTIONAL PROCEDURES** | **Step-by-Step Procedures-Lesson Sequence: Basic to Complex.** Lesson includes visuals, modeling, logical sequencing and segmenting (beginning, middle, ending); essential information; concise communication; grouping strategies; differentiated instructional strategies to provide intervention & extension; seamless routines; varied instructional strategies; key concepts & ideas highlighted regularly. |
| ***Introductio*n** Today will make our own recipe – but not to eat, to play with! We are going to be making a very cool substance called *Oobleck.* You will get to see why it is so cool once we’ve made it. Through the process of making it, we are going to learn about fractions, because we will be using measuring cups and spoons to measure our ingredients. We will practice decomposing a fraction into a sum of fractions.  Each small group is divided into two teams: Team C (for cornstarch) and Team W (for water). Team C moves to the desk/side of the table with the cornstarch and 1/3 cup measures, and Team W moves to the side with the bottled water and 1/4 cup measures.  Model measuring a level measuring cup of cornstarch and a full measuring cup of water (or a plastic cup of water filled to the mark).  **Part 1** Before we begin making our recipe, task the students with verifying the following equations:  *Team C:* Students on these teams will use their 1/3 cup measuring cup and one of their plastic cups to verify:  2/3 = 1/3 + 1/3  3/3 = 1/3 + 1/3 +1/3  4/3 = 1/3 + 1/3 +1/3 + 1/3  They will do this by measuring 1/3 cup of cornstarch at a time and adding it to the plastic cup; then they will do their best to level the cornstarch in the cup and observe the amount of cornstarch, based on the 1/3 cup increment markings.  *Team W:* Students on these teams will use their 1/4 cup measuring cup and one of their plastic cups to verify:  2/4 = 1/4 + 1/4  3/4 = 1/4 + 1/4 + 1/4  4/4 = 1/4 + 1/4 + 1/4 + 1/4  They will do this by measuring 1/4 cup of water at a time and adding it to the plastic cup; then they will observe the amount of water, based on the 1/4 cup increment markings. (If this is too difficult to do with the measuring cup, students may use a plastic cup marked with a 1/4 cup mark instead.)  Remind students that precision is important with measurement (cornstarch should be level in the plastic cup, water should fill the measuring cup, etc). Observe the groups and provide reinforcement as needed. Early finishers can find more decompositions, using more cups if necessary. (I.e., 7/3 = 1/3 + 1/3 + 1/3 +1/3 + 1/3 + 1/3 + 1/3.) Once all groups have finished this task, regain the attention of the whole class for a discussion. *Was every group able to accurately replicate the equations by measuring? Did anyone have error in their measurements? Why do you think error may have occurred? Can we extend our observations to understand numerical questions (without measuring)? What is 1/8 + 1/8 +1/8? What is 1/4 + 1/4 + 1/4 +1/4 + 1/4? How can we decompose 5/12? How can we decompose 7/5?*  **Part 2** Team C is tasked with measuring 2 ⅔ cup cornstarch, and Team W is tasked with measuring 1 ¼ cup water to contribute to the Oobleck recipe, but first they must find as many decompositions of these amounts as they can, using their available fraction/measuring cup. They may experiment by using the clear plastic cups. For example, 2 ⅔ = 3/3 + 3/3 + 2/3. They should write this equation down, and can also (optionally) demonstrate the decomposition by measuring 3/3 into one cup, 3/3 into a second cup, and 2/3 into a third cup. Each team should find at least three decompositions to write down. Early finishers can find as many decompositions as they can. For example:   |  |  | | --- | --- | | Team C (Cornstarch) | Team W (Water) | | 2 ⅔ = 3/3 + 3/3 + 2/3 | 1 ¼ = 4/4 + 1/4 | | 2 ⅔ = 1/3 + 3/3 + 4/3 | 1 ¼ = 2/4 + 2/4 + 1/4 | | 2 ⅔ = 2/3 + 2/3 + 2/3 + 2/3 | 1 ¼ = 1/4 + 1/4 + 1/4 + 1/4 + 1/4 | | 2 ⅔ = 5/3 + 3/3 | 1 ¼ = 3/4 + 2/4 | | And so on… | And so on… |   Once all groups have finished this task, regain the attention of the whole class for a discussion. Taking turns amongst the groups, have the students share with the class the different decompositions they found. Record the different results on the board. *How many different decompositions did we find for 2 ⅔? How many did we find for 1 ¼? Do you think we found them all? How many do you think are possible?* (These last two questions are difficult for a 4th grader to answer but good to think about; they can be treated as good things to ponder.)  Now the teams will choose one of their decompositions and model it by measuring their ingredient into the appropriate number of cups. For example, if Team C chooses the decomposition 2 ⅔ = 3/3 + 3/3 + 2/3, then they will measure 3/3 into one cup, 3/3 into a second cup, and 2/3 into a third cup.  Once the groups have these decompositions measured, the remaining materials are distributed: each group will receive a mixing bowl, a mixing spoon, a measuring spoon, and a container of Kool-Aid. Team C and Team W will now come together and work as one group.  Step 1: The cornstarch is added carefully to the mixing bowl. The recipe calls for 2 ⅔ cups of cornstarch.  Step 2: The recipe calls for between 2 and 3 tsp of Kool-Aid. The groups are tasked with finding a sum of unit fractions that is between 2 and 3, using the measuring spoon the group received. They should write the sum they find on their paper. For example, if the group received the 1/2 tsp spoon, any of the following answers would be correct:  1/2 + 1/2 + 1/2 + 1/2 = 4/2 = 2  1/2 + 1/2 + 1/2 + 1/2 + 1/2 = 5/2  1/2 + 1/2 + 1/2 + 1/2 + 1/2 +1/2 = 6/2 = 3  Each group should confirm with the teacher that their sum is between 2 and 3. Then they use the sum they found to measure an appropriate amount of Kool-Aid and add it to the mixing bowl with the cornstarch.  Step 3: The water is now poured slowly into the mixing bowl, and the contents are carefully mixed by the students (or teacher).  Once thoroughly mixed, students get to appreciate their recipe and touch the Oobleck.  *Note: Instead of each group making their own Oobleck, the groups can measure their ingredients as described, but then all groups add their ingredients into one large mixing bowl, so only one large batch of Oobleck is made.*  **End/Closure:**  Regain the attention of the whole class. *What makes this substance interesting? Do you think this is a solid? Do you think this is a liquid? It’s kind of both. It’s called a non-Newtonian fluid. Does anyone know what viscosity means? Viscosity is a measure of how thick and sticky a fluid is. So water has a low viscosity. It is thin, and not sticky, and it pours quickly and easily. Does anyone have an example of a fluid with a higher viscosity? Oil, dish soap, white glue, syrup, and honey are examples. In non-Newtonian fluids, the viscosity changes depending on how much pressure is applied. Isn’t that what we notice with Oobleck? What happens if you take a handful of Oobleck and squeeze it in your hand, applying pressure? What happens when you relax your hand and stop applying pressure? Do you think our decompositions and precise measurements helped to create this result? What do you think would happen if too much cornstarch had been used? Or too much water?*  **Motivating Students**  \_x\_ Verbal Reinforcement: The teacher will monitor students’ work throughout the activity to provide reinforcement.  \_x\_ Relate to Real World: Some students are familiar with cooking and baking and the idea of measuring ingredients to follow a recipe.  \_x\_ Other: Many students will be motivated by the opportunity to make a slime-like substance to play with.  **Presenting Instructional Content**  \_x\_ Hands-On: Students are holding the objects for measuring and mixing the ingredients, and they get to feel and play with the resulting Oobleck.  \_x\_ Discussion: The class discusses the various fraction decompositions found by the groups, and considers some larger questions (like *is there a limit to the number of decompositions?* and *how many decompositions are possible?*).  \_x\_ Modeling: Students model the decomposition of fractions by measuring the ingredients using measuring cups and spoons.  ***Instructional strategies:***  **Modeling and Guided Practice *-*** The teacher will model measuring a level measuring cup of cornstarch and water. The teacher will monitor students’ work and ask questions to prompt them if they are stuck.  **Check for Understanding (CFU) –**  ***What am I doing for students that progress at different rates?***  Encourage students to help each other. Ensure that each student gets to participate and contribute to the team. If teams finish early, have them find more of the possible decompositions.  ***What do I do if they get it?***  Discuss why we are limited to one measuring cup per decomposition. Could that happen in a real-world problem? What would happen if we allowed more measuring cups? What would happen if we excluded the measuring cup we started with? Explain that the recipe for Oobleck only requires that the amount of cornstarch is approximately twice the amount of water; with this knowledge, task the students with creating a new recipe for Oobleck, and decomposing these new amounts.  ***What do I do if they don’t get it?***  Change the recipe to 2 cup cornstarch + 1 cup water + 2 tsp Kool-Aid. Change the measuring cup for Team C to 1/2 cup and the measuring cup for Team W to 1/3 cup to reduce the number of possible decompositions. Concentrate on each team finding one decomposition, not multiple; then collect the decompositions during the whole-class discussion and note their differences and similarities. | |
| **QUESTIONING/THINKING/PROBLEM SOLVING (embedded throughout)** | **Balanced mix of question types.** Utilizes Blooms Taxonomy/Webb’s Depth of Knowledge; high frequency; purposeful & coherent; require active responses; balance based on volunteers/non-volunteers, ability, & gender; lead to further inquiry & self-directed learning.  **Implement four types of thinking (Analytical, Practical, Creative, & Research-based) & Teach/Reinforce problem-solving types**. Provide opportunities for students to generate ideas & alternatives; analyze, evaluate & explain information from multiple perspectives& viewpoints. |
| **Questioning**  **Knowledge:**  What is a unit fraction?  What is a mixed fraction?  What does it mean to decompose a number into a sum?  How do we add two fractions when they have the same denominator?  How much does this measuring cup hold?  Can you give an example of a solid?  Can you give an example of a fluid?  What does viscosity mean?  **Comprehension:**  What is 1/8 + 1/8 +1/8?  What is 1/4 + 1/4 + 1/4 +1/4 + 1/4?  How can we decompose 5/12?  How can we decompose 7/5?  How many different decompositions did we find for 2 ⅔?  What makes Oobleck interesting?  **Application:**  Why is accuracy in measuring ingredients important?  How can we apply these skills to making a recipe at home?  Did anyone have error in their measurements?  **Analysis:**  Why do you think error may have occurred?  What would happen if we allowed more measuring cups?  Can you find two decompositions for 1 ¼ using the 1/2 cup and 1/4 cup measuring cups?  **Synthesis:**  Is there a limit to the number of decompositions of 1 ¼ (using a ¼ increment)?  What would happen if we excluded the measuring cup we started with?  Can you find a decomposition of 1 ¼ using the 1/3 cup and 1/4 cup measuring cups? Are there others?  How many decompositions of 1 ¼ do you think are possible?  **Evaluation:**  What do you think would happen if we had used too much cornstarch? Or too much water?  **Thinking**    \_x\_ **Practical** – Skills practiced in this lesson are used on a regular basis by many people for a variety of reasons: cooking, baking, balancing the chemicals in a fish tank, and creating a glaze for ceramics are some examples.  \_x\_ **Creative**– Students can decompose the given fractions in a variety of ways. Students can choose to discover these decompositions experimentally by measuring, or by using their knowledge of fraction operations. Students create the Oobleck in the final part of the lesson.  \_x\_ **Analytical** – Students compare mathematical equations to measured results. Students explain the potential for error in their measurements. Students analyze a given fraction to find different decompositions.  \_x\_ **Research-based** – Students confirm mathematical equations experimentally using measurement. Students model fraction decomposition.  **Problem Solving**  **\_\_x\_\_ Drawing conclusions/Justifying Solutions:** Students can justify their numerical decomposition: 1 ¼ = 1/2 + 1/2 + 1/4 (for example) by measuring 1/2 cup water in one cup, 1/2 cup water in a second cup, and 1/4 cup water in a third cup, then combining them and observing the measurement of all the water to be 1 ¼ cup.  **\_\_x\_\_ Predicting Outcomes:** Students predict how the Oobleck will react to different scenarios.  **\_\_x\_\_ Observing and Experimenting:** Students experiment with measuring their ingredient in different decompositions, and observe the resulting numerical fraction decomposition.  **\_\_x\_\_ Generating Ideas:** Students are challenged with combinatorics questions like, “*How many decompositions are possible?”,* and, *“How can we tell if these are all the decompositions?”.* Students must generate ideas for questions that are difficult to answer.  **\_\_x\_\_ Creating and Designing:** Students can create a different recipe for Oobleck, using the rule that the amount of cornstarch should be approximately twice the amount of water. | |

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| **GROUPING** | **Maximize student understanding & learning** Varied group composition (race, gender, ability, & age); clearly understood roles, responsibilities & group work expectations; accountability for group & individual work; student opportunities for goal setting, reflection & evaluation of learning. |
| * Heterogeneous groups of 4-6 * The groups will be divided into two teams: Team C and Team W * Product. Students will participate in the class discussions, create the Oobleck, and record their work on paper. | |
| **ASSESSMENT** | **Formative and/or summative assessment.** A variety of assessments, including rubrics, measure achievement of objectives and informs instruction. |
| **Assessments:**  **\_\_x\_\_ Teacher Made Test** In a future assessment the teacher can ask the students to decompose a fraction into a sum of fractions with the same denominator.  **\_\_x\_\_ Project \_\_x\_\_ Group Assignment \_\_x\_\_Teacher Observation \_\_x\_\_ Solution to Real World Problem:**  This lesson is a group project that solves the real-world problem of using a measuring cup to follow a recipe. The teacher will directly observe the students’ success with this. The groups produce written equations throughout the lesson, which are also used for assessment.  *\****Students should achieve \_\_\_\_\_% mastery of this objective: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | |
| **CLOSURE** | **Reflection/Wrap Up.** Summarizing, reminding, reflecting, restarting, connecting. |
| ***During the conclusion part of creating an effective lesson plan teachers must sum up the ideas learned from the lesson. A teacher should also relate this information to future and past coursework to provide students with a broad understanding of the ideas learned. It is important to allow students enough time to ask questions, assert assumptions, and summarize the lesson during this part of the lesson plan.***   * ***Review/Summary: wrap up what has been learned and accomplished in the lesson (even if they are in the middle of an exercise, it is still important to summarize to the point where they are now). Ideally involve students in this synthesis.*** * ***Preview for next lesson: link what they did today with where they are going next.*** * ***Upcoming assignments: remind them of any upcoming assignments.***   ***Today we…. Turn to your partner and…. Let’s review our I Can statements……***  ***Here is your exit ticket for today…..***  **Follow-up Activities/Extension *These may be designed to create a longer or more intense lesson. For example, if the class is able to cover the material in a lesson much faster than expected, extensions may prove helpful. Extensions may also be useful in various parts of a lesson where the teacher (and class) decides they should spend more time on a skill or topic.***  ***Reflection: You must reflect on every lesson you teach.*** | |

**NOTES:**

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