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| **TEAM Lesson Plan Template** | |
| Teacher: Dr. Amanda Niedzialomski | |
| Subject/Grade: Mathematics (Fractions) / 5th 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**  **5.NF.A.1** Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent  sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12 or 3/5 + 7/10 = 6/10 + 7/10 = 13/10.  **5.NF.A.2** Solve contextual problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2. | |
| **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.  I can add fractions with unlike denominators. | |
| **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 tablespoon, a teaspoon, a 1/2 teaspoon, a 1/4 teaspoon, and measuring cups of sizes 1, 1/2, 1/3, and 1/4 cup)\*  \*Alternatively, groups can share the measuring cups  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 various measurements (each group needs several unmarked cups, a cup with a 1 cup mark, a cup with a 1/2 cup mark, a cup with a 1/3 cup mark, and a cup with a 1/4 cup mark).  Sharpie  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:  measuring cups of all sizes, a tablespoon, and a teaspoon  clear plastic cups with the measurement markings  container of cornstarch  craft stick  bottled water  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, the remaining measuring spoons, 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:** For some students, it may be helpful to review the 4th-grade standard of decomposition into fractions with like denominators; in this case, limit the summands of the decomposition to fractions with the same denominator. The recipe can be changed to 2 cup cornstarch + 1 cup water + 2 tsp Kool-Aid to simplify the sum and 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 challenge themselves to include different denominators. *Is it possible to find a decomposition that uses all of the available denominators?* They can attempt to find as many of the decompositions as they can, and consider how one would know if they have found them all. They can add more denominators into the possibilities and use them to explore more decompositions. | |

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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.  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). Explain that there are 16 tablespoons in a cup. *Then a tablespoon is what fraction of a cup? 1/16.* Explain that there are 3 teaspoons in a tablespoon. *Then how many teaspoons are in a cup? 48. And a teaspoon is what fraction of a cup? 1/48.*  **Part 1** Tell the students that the recipe for Oobleck calls for 1 ¼ cup water. Task the groups with decomposing 1 ¼ into sums of fractions, using the denominators from the measuring cups and spoons, and recording their decompositions on paper. (So the available denominators are 1, 2, 3, 4, 16, and 48.) Some of the decompositions must use unlike denominators. Students can then compare some of their numerical decompositions to their measured findings. First, students carefully measure the water using a decomposition students are confident is correct, like 1 ¼ = 1 + ¼, and add the water to an unmarked cup. (I.e., students measure 1 cup of water and add it to the unmarked cup, and then measure 1/4 cup of water and add it to the same cup.) This cup now contains 1 ¼ cup of water. Carefully mark the water level on the cup with a Sharpie. Now students have a 1 ¼ cup measuring cup. They can use a similar process to measure their other decompositions, and add them to this plastic cup to confirm the total amount of water is 1 ¼ cup. Here are some decompositions students could have:  1 ¼ = 1/4 + 1/4 + 1/4 + 1/4 + 1/4  1 ¼ = 1/2 + 1/2 + 1/16 + 1/16 + 1/16 + 1/16  1 ¼ = 1/3 + 1/3 + 1/3 + 1/4  1 ¼ = 1/2 + 1/3 + 1/4 + 1/16 + 1/16 + 1/48 + 1/48  Students should find as many decompositions as they can in the time available; every group should have at least three decompositions with unlike denominators.  Once each group has at least three decompositions with unlike denominators, regain the attention of the whole class. Have the groups take turns sharing some of their decompositions, and record these on the board. Check together that they all have a sum of 1 ¼. Discuss using the measuring to verify their decompositions. *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?*  **Part 2** Tell the students that the recipe for Oobleck also calls for 2 ⅔ cup cornstarch. Task the groups with decomposing 2 ⅔ into sums of fractions, using the denominators from the measuring cups and spoons, and recording their decompositions on paper. (So the available denominators are 1, 2, 3, 4, 16, and 48.) At least three of the decompositions must use unlike denominators. For this part, the students can work purely numerically. If students prefer to use measurement to find/verify decompositions, they will have to problem solve, as the plastic cups are not large enough to hold 2 ⅔ cup. Once all groups have found at least three decompositions with unlike denominators, regain the attention of the whole class. Repeat the sharing process, and record the different decompositions on the board. Discuss the different decompositions. *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?* *Is the number of decompositions using these denominators limited or unlimited?* (These last three questions are difficult for a 5th grader to answer but good to think about; they can be treated as good things to ponder.)  **Part 3** Now we get to make the recipe! The remaining materials are distributed: each group will receive a mixing bowl, a mixing spoon, a 1/4 tsp measuring spoon, and a container of Kool-Aid. Have the groups choose one of their decompositions of 2 ⅔ to measure the cornstarch, and add 2 ⅔ cup cornstarch to the mixing bowl. Tell the students the next ingredient of Oobleck: 2 ¼ tsp Kool-Aid. Using their sharpened decomposing skills, the groups choose a decomposition of 2 ¼ with unlike denominators, record it on their papers, and use it to measure 2 ¼ tsp Kool-Aid into the bowl with the cornstarch. Finally, have the groups choose one of their decompositions of 1 ¼ to use to measure the water and pour it into a plastic cup. 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, or work on decompositions of other numbers.  ***What do I do if they get it?***  Discuss variations on the task. *What if we excluded one of the measuring tools – are decompositions for all three numbers still possible? What if we excluded two measuring tools? Does the answer depend on the number we are decomposing? Does the answer depend on which tools are excluded?* 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. | |
| **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 does it mean to decompose a number into a sum?  How do we add two fractions when they have the same denominator?  How do we add fractions when they have different denominators?  How much does this measuring cup hold?  How many tablespoons are in a cup?  Can you give an example of a solid?  Can you give an example of a fluid?  What does viscosity mean?  **Comprehension:**  How can we decompose 2 ¼?  How many different decompositions did we find for 2 ⅔?  What makes Oobleck interesting?  If a tablespoon equals three teaspoons, then a teaspoon is what fraction of a cup?  **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?  Can you find a decomposition for 1 ¼ if we exclude the denominators 4 and 16?  Can you find a decomposition for 2 ⅔ if we exclude the denominators 3 and 48?  Can you find a decomposition of 1 ¼ that uses all the denominators (1, 2, 3, 4, 16, and 48)?  **Synthesis:**  Is there a limit to the number of decompositions of 1 ¼ (using denominators 1, 2, 3, 4, 16, and 48)?  How many decompositions of 1 ¼ do you think are possible?  What if we excluded one of the measuring tools – are decompositions for all three numbers still possible?  What if we excluded two measuring tools?  Does the answer depend on the number we are decomposing?  Does the answer depend on which tools are excluded?  What if we could only use one tool? Which one can measure all the quantities we need?  **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 the water 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 3-4 * 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 unlike denominators.  **\_\_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 measuring cups and spoons 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 to day 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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