Understanding Decimals

Summary

These games and activities help students investigate the relationship between fractions and decimals, focusing on equivalence.

Main Core Tie

Mathematics Grade 6

Strand: RATIOS AND PROPORTIONAL RELATIONSHIPS (6.RP) Standard 6.RP.3

Group Size

Small Groups

Materials

- *The Tile Center Sheet*
- *Custom Tiles Sheet*

Blank 10x10 Grid Sheet
Index Cards
Paper
Dice
Calculators

Background for Teachers

Students should use models and other strategies to represent and study decimal numbers. Fractions and decimals both represent parts of a whole, and both can represent numbers greater than one. Learners need to investigate the relationship between fractions and decimals, focusing on equivalence. Any fraction can be rewritten as an equivalent decimal and any decimal can be rewritten as an equivalent fraction. Help them understand that a fraction such as 12 is equivalent to 5/10 and that is has a decimal representation of (0.5). After developing and understanding of equivalent fraction and decimal forms, students need to recall fluently the decimal equivalents for common fractions such as 14= 0.25, 12= 0.5 and 34= 0.75. For other fractions divide the numerator by the denominator. It is important for students to understand the traditional algorithm, but also be able to use a calculator to convert fractions to decimals. In addition, students can examine that some fractions are terminating decimals and others are not.
Decimals are part of our every day life. We see them in the amount of rainfall in weather reports, sports statistics (e.g. batting averages), and stock market reports. It is important to connect fractions to decimals by numerous conceptual experiences, rather than just memorizing the algorithm.

Intended Learning Outcomes

1. Develop a positive learning attitude toward mathematics.
6. Represent mathematical ideas in a variety of ways.

Instructional Procedures

Invitation to Learn
Demolition Decimals
Ask students if they have ever created new words by taking a word and rearranging its letters. Explain that they are going to do a similar activity only using numbers. Have the students cut three

index cards in half the wide way. Then, have students label the card as follows: 7, 5, 4, 0, and a decimal point. Tell the students you are going to ask them to make numbers that will fit a specific rule. Remind students that each number and the decimal must be used for each problem. Have students work in small groups and discuss their findings and discoveries. Start giving rules such as: "Build a number that is greater than 750", "Build a number that is less than 5", "Build a number that is between 70 and 70.5", etc.

Instructional Procedures

Part One: Rolling For One

Tell the students they are going to play a game to investigate decimals in more depth. They will be looking at the whole, which is one, 1, and/or 1.0, and exploring adding tenths and hundredths. Students will create a written accounting of all addition of decimals.

Model the game as a whole class the first time. To play the game, have students set up a T-chart like this by folding a blank piece of copy paper in half and labeling it as shown:

Play the game with the class using the following rules:

Each player must roll the die 7 times.

After each roll of the die the player will decide whether it should be tenths or hundredths. (e.g. a roll of 3 could be 0.3 or .03)

A running total is kept of all seven rolls.

To win the game, students must get as close to one without going over 1 whole.

If you have a class that is struggling with this concept, show the tenths and hundredths in money form. For example, six hundredths is $0.06 and six tenths is $0.60. Students are trying to reach $1.00. This is great for understanding, but students need to be able to remove the dollar sign and the zeros and still realize that $0.06 is equal to .06 and $0.60 is equal to 0.6. Students will make this transfer quickly if they can clearly see the connections between representations.

An example of play: One player rolls a six, they must decide whether it is six tenths or six hundredths. Player two repeats the process with his/her own roll. Player one rolls again and adds the roll to the previous total. For example, player one had six tenths and rolled a six again, the player can not make that into six tenths because it will go over one whole after only two rolls, so the players must make it six hundredths. So, 0.6 + .06= .66. Play continues with each player adding to his previous sum. After seven rolls, the player closest to 1 (without going over) is the winner.

Practice the game as a class.

Check for understanding of the game. If students are still a little confused have them play the game partners against partners. Circulate questioning the students during the game. If students grasp the idea, play in partner groupings. As you circulate, continue asking questions to see if students can see any patterns that will help them win the game.

After everyone has had a chance to play, have the students examine their results. Have students discuss in small groups how numbers were recorded. Did it matter if a student didn't put the zero after a number? (i.e. 0.6 instead of .60), How did each student keep track of their score, etc.

Students will record in their math journals their responses to the journal prompt "My strategy for playing Rolling One is..."

Part Two: Get the Hint?

Explain to the students they are going to explore decimals using a calculator. Many times when students use calculators they get an answer with many digits after the decimal point; students find it difficult to deal with all those decimals. Teachers hear questions like What do the decimals mean?, and What's the real answer?, stated in the classroom. This activity is a simple engaging way to look at decimals. Before starting, be sure to have the students create a recording sheet by folding a regular sheet of 812" x 11" copy paper into thirds and labeling each column as

shown here(information in parentheses is for teacher help, do not have students write it on their page).

For the whole class modeling use an overhead calculator. The first couple of times you model this activity show students the secret number.

The goal is to figure out the secret number. (Note: When playing with a partner and not the class as a whole, be sure to remind students to keep the calculators hidden so their partner can not see the secret number.)

The rules of the game are as follows:

a. Partner A will choose a secret number between 1-100.

b. Partner B will try to figure out what partner A's secret number is by guessing a number.

c. Partner A will take partner B's guess and divide it by the secret number.

d. Partner A records the decimal on the Record Sheet.

e. Partner B finds the decimal point and draws a box around the 3 numbers on the right side. Then, determines the approximate percentage of the decimal.

Reminders:

If it has a 1 to the left of the decimal point= 1.34567877679. This means that your guess is greater than the secret number= 135%.

If it has does not have a 1= 0.67895546565. Box 0.67895546565. This means that your guess is less than the secret number. It is only approximately 68% of the number.

f. With your new information, make another guess.

g. Try to guess the secret number in less than 5 guesses.

After modeling and checking for understanding, students will play several games in partners, recording their work on their self-made record sheet.

Part Three: The Tile Company

Students are going to look at decimals using a model, the 10-by- 10 grid. Discuss how many squares make up a 10-by-10-square grid. Remind the students that one grid represents 1 whole that has been divided into 100 equal parts.

Using the Blank 10x10 Grid Sheet, have the student shade in three tenths of grid #1. Have students compare their shading to their partners. Discuss the written notation for this picture in fraction form, decimal form, and as a percent. If needed, have a mini-lesson on how to figure out each one of these notations and how it relates to the illustration.

Continue giving the students other numbers to represent in picture and written notation: .25, .4 .66 and so forth until you are confident that the students understand.

Inform the students that they have just been hired by the Tile Center Company as financial consultants. Tell them they will be examining different kitchen tile patterns which the Tile Center Company sells. All tiles are 10 inches by 10 inches and sell for $1.60. The company is losing money and needs the students' assistance in determining which tiles need to be changed to have the company make more money, but are still pleasing to the eye. All the white squares are one cent. The shaded squares are twice as expensive.

The task: In small groups, "Consultants" (students) will create a presentation to the President of the Tile Center Company.

1. Students need to determine the fraction, percent, and decimal form of each The Tile Center tiles.

2. Determine the cost of each tile.

3. Make a recommendation about which of existing tiles should continue to be manufactured (provide profit) and which should be eliminated and why.

4. Create six unique grid patterns that will make the company money. State the cost of each tile and the fraction, decimal, and percent shaded for each tile.

5. Finally suggest a new price that would make the tile company at least $0.05 profit per tile.

6. Write a one page letter to the President discussing #2, #3, #4, and #5.

Extensions

Curriculum Extensions/Adaptations/ Integration

The Tile Company is wanting to release a new line of tiles that are 20 x 20. Suggest to the company a tile price and 6 different tile designs that would make the company money on every sale.

Play *I Have, Who Has?* Commercial sets are available for purchase, or a Google search of "I Have, Who Has" will return many pre-made sets you can print and use.

Family Connections

Have the students play *Get the Hint?* with a family member.

Have the students find batting averages for 10 different baseball players in the newspaper. Record the players names and rank order the players from the best batting average to the worst.

Watch the nightly news or read a newspaper to find the Dow Jones rate 10 days. Find the difference each day in the decimals. Record and chart.

Log on the www.weatherbug.com and create a bar graph of the rainfall for two different regions.

Assessment Plan

Have students write in their math journals about how decimals relate to fractions and percents.

Have students self assess how well their presentation met the criteria on a student created rubric.

Complete the tile company activity with accuracy. During the activity, ask the students to explain the steps they are taking. Check for accurate expression of fractions, decimals and percents, both in written form and in conversation.

Bibliography

Research Basis

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA.

Teaching and learning mathematics is a complex, active, and social activity. The research on problem solving and mathematical reasoning clearly states the great need to create mathematically rich environments for students to deepen their understanding of mathematics. The instructional strategies chosen should match the varied learning needs of students. Effective instruction occurs when teachers choreograph the learning experience by carefully choosing select problems, standard-based materials, and conducting formal and informal assessments. The end goal is to empower students in problem solving by blending conceptual, procedural, and factual knowledge into a powerful learning package.

Van de Walle, J. A. (2001). *Elementary and middle school mathematics: Teaching developmentally* (4th ed.). New York: Addison Wesley Longman.

Van de Walle clearly states the importance of constructivism. "Constructivism provides us with insights concerning how children learn mathematics and guides us to use instructional strategies that begin with children rather than ourselves" (2001, p. 26). The whole learning process focuses on learning the concept, instead of the small pieces or procedural parts in the learning process. Effective teachers know their students' strengths and weaknesses and plan instruction to challenge all learners to meet high standards. To do this, teachers must find ways to learn students' prior mathematics knowledge and misunderstandings so that knowledge gaps can be addressed, inconsistencies resolved, and understanding deepened.

Authors

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