Teacher Notebook:

Save Patch

National Center for Research
on Evaluation, Standards, & Student Testing

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Overview of the Notebook

The goal of this notebook is to provide you with the necessary information to use this game with your students. In this notebook, you will find:

1) **Overview of the Game**: This section provides a brief introduction about the game including how to play and the math topics covered by the game.

2) **The Screen**: This section of the notebook shows an example of a typical screen and points out elements of the game that will help your students play such as help menus, game resources, and screen features that may be important to know about as your students play the game.

3) **Suggested Topics for Classroom Instruction**: This list provides an overview of the math topics related to this game. Depending on your purpose for using the game (e.g., review, introduction, etc.), the math topics can be used as preview topics to the game or something to go over with students after they have played the game. You might teach the lesson to the whole class, a small group, or an individual student who is having difficulty.

4) **Common Errors Students Might Make in the Game**: This is a list of the most common errors students might make in this game. Review this list and watch carefully for these errors in the game. In many cases, the mistakes students make in the game provide hints to you about their deeper understanding and misconceptions about fractions.

5) **Sample Lesson Plan**: This section provides a sample lesson that could be used as a guide for classroom instruction.

6) **FAQ**: This section provides you with frequently asked questions about this game.

7) **Standards Addressed**: This list provides an overview of the Common Core State Standards for Mathematics addressed in this game. Both middle school and elementary school standards may be listed.

Overview of the Game

Topics covered in the game: the whole unit, numerator, denominator, adding fractions, and converting fractions.

The goal of this game is to reach a cat statue across an archeological dig site. The challenge lies in only being able to travel on a one- or two-dimensional grid along a rope path, where the player must determine the correct length of rope to be strung between posts. In addition, on some levels, the player is required to stop at prescribed points (denoted by gold signposts).

Players are given a set number of rope pieces to build the rope path; rope pieces are added to signposts to prescribe the distance the character will walk. For example, if you add a one-unit rope piece to a signpost, the character will walk exactly one unit. In *Save Patch*, one whole unit is always the distance between two round gray posts.

Rope pieces can be added to a signpost to increase the distance the character will walk; however, only identical rope pieces can be added together. While any size rope piece can be placed on the signpost initially, subsequent rope pieces can only be added to the signpost if they are the same size. Whole unit (integer) rope pieces are also added one at a time to signposts, reinforcing the meaning of addition with integers.

Levels 01-03: Whole units and learning game play

Levels 04-15: Identifying correct denominator

Levels 16-28: Adding fractions

Levels 29-41: Converting fractions

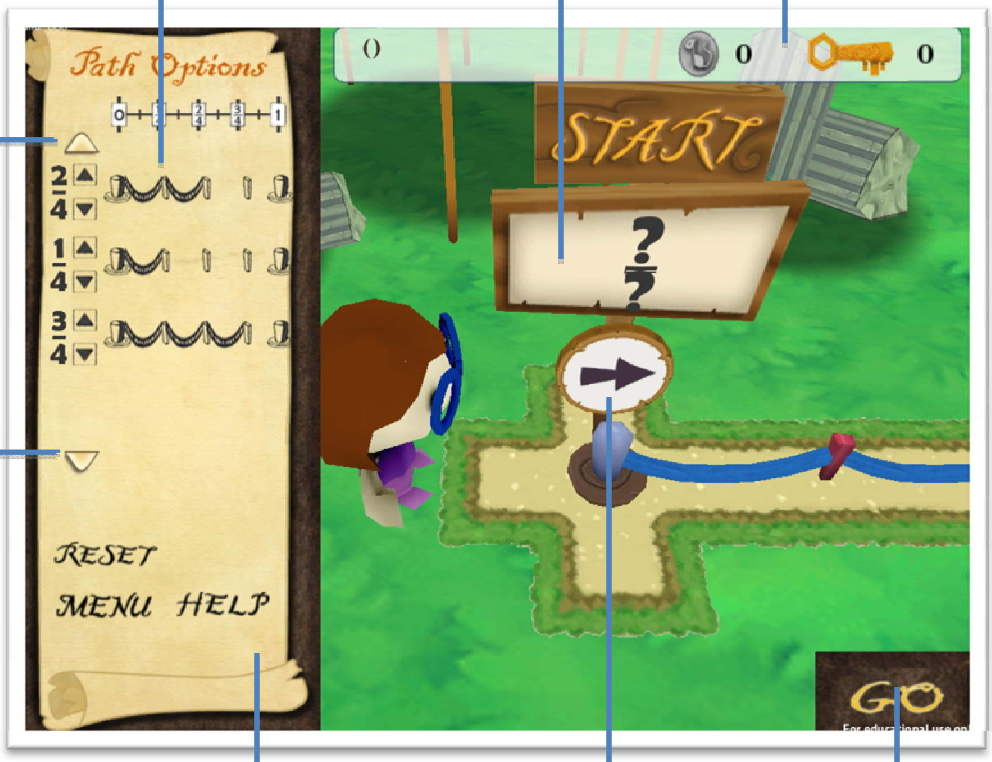
Levels 42-56: Converting fractions (challenge levels)

The Screen

These are your resources. Change the size of the pieces by clicking up or down on the arrows to the left.

Drag the resources here. Remember that only like fractions can be added together.

The number of silver coins and gold keys you've collected in the level will show up here.



Sometimes there will be more resources than shown. Click on these arrows to scroll up and down to see all of your resources.

Click here to reset the level, open the help or go to the level menu.

Click on the arrow to change the direction. The arrow must be pointing in the direction you want to walk.

Click here when you are ready to see if you have the correct answer.

Suggested Topics for Classroom Instruction

Below are the topics associated with this game. If students are having a particular type of trouble with a game, you might want to address that topic with the whole class or individual students.

Unit

One whole unit is always the distance between paths that are worn into the grass field. The unit is marked by the round gray posts. Many students mistakenly believe that the whole screen is always the whole unit. Emphasize that they must identify the whole before they decide what rope(s) to use.

Denominator

In the game, the denominator is represented by spaces between the posts, as the small red posts divide the unit into fractions. Many students mistakenly figure out the denominator by counting the posts instead of the spaces between the posts. Emphasize that they figure out the denominator by counting the spaces or the loops of rope along the edge of the paths for each whole unit. Students should understand that the denominator tells you the number of pieces of rope that would make one whole unit of rope.

Numerator

As its name suggests, the numerator represents the number of a specific size of rope pieces a student has. So the three in ¾ just means that they have three pieces of rope, each one fourth of a whole rope in length. Students should understand that, even though both the numerator and denominator are integers, they represent very different things. The denominator tells us about the size of the unit and the numerator tells us how many of those size pieces we have.

Adding Fractions

Adding allows us to combine two things into a single sum; however, to do so, the two things must be identical. You can add miles to miles and yards to yards, but you can't add miles to yards unless you make the units identical. In the same way, you can't add fourths to thirds. To add fractions with different denominators, we have to make equivalent fractions with a common denominator (see converting fractions below). Then we add numerators and keep (write) the common denominator. Ask students WHY the denominators don't change when adding (or subtracting) fractions with common denominators. They should be able to tell you that, just like adding seven ones

and two ones make nine ones, or adding 3 tenths and 4 tenths would be 7 tenths, the units don't change, so in adding fractions, the units don't change.

Converting Fractions

In *Save Patch*, it is not important for students to understand equivalent fractions or the math behind equivalent fractions. It is important that they see a pattern in converting from a rope piece of one size to another. For example, when one half of a rope is cut into half (i.e., two equal pieces), each piece is now a fourth (because it would take four of these pieces to make a whole) AND that there are two of these in one half (because you cut the half rope into two equal pieces). This will help them determine common multiples (denominators), and will provide a conceptual base for understanding multiplication / division of fractions in future games. We hope that such an understanding also helps them begin to understand why multiplication of fractions does change the denominator.

The Importance of WHY!

Students often have trouble connecting the symbolism of fractions to their use in the world. While the game is one means to help them do so, it is vital that they begin to understand why fractions behave like they do and their similarities to integers. An appropriate question to ask in instruction and when helping them in game play is "Why?" For example, why don't denominators change when you add fractions or why must denominators be the same when adding two fractions?

Common Errors
Students Might Make In the Game

Ignoring the unit markers (round gray posts)
If you see students using denominators of multiples of what is actually needed, they make be making this common error.

Counting posts instead of spaces
Inclusive of end posts: If you see students using fractions with larger denominators than what is actually needed, they make be making this common error. This typically happens with fractions above 1/3. Help students understand the need to count the number of spaces between posts to determine the denominator.

Exclusive of end posts: If you see students using fractions with denominators that are smaller than what they need (especially one smaller than what they need), they may be counting the number of red posts between the round gray unit posts. This typically happens with fractions that are larger than 1/3. Show students how to count the spaces between posts to determine the denominator.

Adding fractions with unlike denominators
Often students will ask why they can't get the ropes to "stick" on a signpost. Generally this is because they are trying to add ropes of different sizes to the same signpost. While you are likely to see this with fractions (like thirds and halves), realize that most students will experience this when they try to add wholes and halves on a level. The game won't do the math for you (including interpreting mixed numbers) so students must do all the adding and represent a single sum to the game.

Signposts pointing in the wrong direction
Sometimes, students will forget to turn the arrows on the signposts to the direction they want to walk. To turn the arrows on the signposts, have students click on the arrow until it turns in the correct direction.

Running out of rope
The arrows at the bottom of the rope bin (both up and down) allow students to access additional pieces of rope on many levels.

Using ropes in order
Students sometimes think that they must use the ropes in the order they are listed. Explain to the students that they can click the down arrow (on the

bottom of the rope bin) to see more rope and that the ropes can be used in any order. Generally, as students get farther into the game, this becomes less of a problem. You may want to demonstrate how to access other ropes with your class as a whole before allowing students to play the game on their own.

Placing rope pieces on only one signpost

In levels with a gold signpost, students must stop at the gold signpost to acquire the key needed to pass the level. This means the student must place a rope piece(s) on the signpost that reaches to the gold signpost instead of bypassing it. To ensure they will stop at the gold signpost, they should be encouraged to put on each signpost enough rope pieces to get to the next signpost.

Using the cat statue as the end unit marker

Students may use the cat statue to determine the end of the unit rather than the round gray posts. For example, if the cat statue is placed at the 4/5 mark, students may mistakenly divide the whole unit rope into fourths rather than fifths.

Clicking Go before all rope pieces are placed

Often, when students are replaying levels, they may change the number of rope pieces on only one signpost. They must replace the rope pieces on all the other signposts as well before clicking Go.

Clicking Undo to “create” more pieces of rope

Students sometimes click the Undo button because it looks like more rope pieces are being created in the resource section, as they may not notice that the rope pieces are being moved off of signposts and back into the resource section. Students should divide as many whole pieces of rope as they need to complete the task. Students are not limited to just dividing one whole unit rope. The Undo button will not give students extra pieces of rope but will only put the last rope piece that they placed on the signpost back into the rope resource section.

Sample Lesson Plan

When using *Save Patch* with your students, the focus of your lesson could vary depending on if you wanted to use the game for review or initial instruction. Below is a sample lesson plan intended for students who have previously learned about fractions and are now using *Save Patch* as practice of the concepts.

The lessons below can be done on consecutive days or spaced further apart as necessary. Lessons can also be combined depending on how fast students play each level and/or how proficient students are with each topic.

Lesson 1: Quick review of the unit, numerator, denominator (list from Math Topics section); introduce game to students at front of class (play first few levels together).

Lesson 2: Students play levels 1-15 on individual computers.

Lesson 3: Quick review adding fractions; students play levels 16-28.

Lesson 4: Quick review of converting fractions; students play levels 29-41. Students who finish early should move on to the challenge levels 42- 56. After students have completed all levels, review the topics of the game and make explicit the connection between the mathematics from the game and the mathematics learned in the classroom.

Save Patch FAQs

Can students skip levels?

No. Students are only allowed to play the level after the last completed level. However, students can return to previously completed levels if they want to replay a level.

Can I help students while they play the game?

Yes.

We have found that students seem to learn best when they make sense of the math in the game on their own in order to succeed at each level.

That said, you are probably in the best position to determine how to help. If students are getting frustrated or unmotivated to play, it may be best to help them through one or more levels until they better understand the goal, mechanics, and math of the game.

How do students unlock the "better" avatars?

The most popular avatars can be purchased for coins the students unearth at the silver signposts. The cost of these avatars is stated on the avatar menu. When a student has accumulated enough coins, they can select newly unlocked avatars and then click "Begin." The student can then return to the last incomplete level or any level they completed.

Standards Addressed in the Game

Common Core State Standards

Mathematics (2010)

Grade 1

Measurement and Data

1.MD.2: Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*

Grade 3

Number and Operations—Fractions

3.NF.A: Develop understanding of fractions as numbers.

3.NF.A.1: Understand a fraction 1/*b* as the quantity formed by 1 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.3b: Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.

3.NF.A.3c: Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.*

Grade 4

Number and Operations—Fractions

4.NF.B: Build fractions from unit fractions.

4.NF.B.3b: Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 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*.