

Teacher Notebook: Wiki Jones



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

UCLA | Graduate School of Education & Information Studies

National Center for Research on Evaluation, Standards, and Student Testing
(CRESST)
Center for the Study of Evaluation (CSE)
Graduate School of Education & Information Studies
University of California, Los Angeles
300 Charles E. Young Drive North
GSE&IS Bldg., Box 951522
Los Angeles, CA 90095-1522
(310) 206-1532

Document No. 2014-02-04-RN6.1

Copyright © 2014 The Regents of the University of California

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305C080015 to the National Center for Research on Evaluation, Standards, and Student Testing (CRESST). The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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 screens in each stage of the game and points out elements of the game that will help your students play such as help menus 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: fractions, whole units as fractions, locating numbers on a number line, naming numbers on a number line.

Wiki Jones is a game focused on the number line and identifying fractions on the number line. The game addresses the concepts of the whole unit and the numerator and denominator of a fraction.

In the narrative, a detective named Wiki Jones is investigating a mystery in the school cafeteria. Players help Wiki Jones find the perpetrator by performing actions on the number line. The narrative is split into five scenes, with each scene requiring the player to perform a different task that builds towards writing the fraction represented by the number line. In the first scene, the player must identify the whole unit by bagging each unit of evidence. In the second scene, the player must use a laser to cut each unit of evidence into equal pieces (the denominator) for analysis. In the third scene, the player must follow a recipe that requires a certain number of equal pieces (the numerator). In the fourth scene, the player has tracked down the crooks and found they have placed firecrackers in the sprinkler pipes and must therefore locate and defuse the firecrackers given a fraction. In the fifth scene, the crooks are hiding in a library so the player must input a fraction that matches the shaded portion of the number line, so a crane can locate and capture each crook to be apprehended.

In the first scene, the player only needs to identify the whole unit. In later scenes, the task order is adapted to the player's performance. If players are having trouble with dividing the whole unit or locating the fraction, they are directed to identify each whole unit on the number line first, and then continue with the task in the scene.

Scene 1: [Identify the whole unit](#)

Scene 2: [Divide each whole unit into equal parts](#)

Scene 3: [Locate the number of equal pieces in the fraction](#)

Scene 4: [Locate fractions on a number line](#)

Scene 5: [Write the fraction represented on the number line](#)

Scene 1: Identify each whole unit

In this scene, players must identify each whole unit by clicking and dragging the black-and-yellow wrapper located at zero. Players must drag all the way to the end of a whole unit and release the mouse—if they stop and start midway through a unit, or double click at the whole unit, they should press the Undo button or Reset button and drag the wrapper again.

The screenshot shows a game interface with a kitchen background. A number line is displayed on a table with a red and yellow wavy pattern. A black and yellow wrapper is positioned at the '0' mark. A yellow banner at the bottom reads 'Drag the wrapper to bag each whole unit of evidence!'. A control panel on the right contains buttons for 'WHOLE UNIT', '?', 'UNDO', 'RESET', 'HOME', and 'DONE'. A 'TOP SECRET' sign is visible on a box. A yellow 'DO NOT CROSS' sign is also present.

Click and drag the wrapper to the end of each whole unit.

The Help Button displays screens with instructions on finding the whole unit. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line.

Press this button to undo the last action.

Identify each whole unit.
Click on the green button to start.

Drag the wrapper to bag each whole unit of evidence!

Press this button to return to the Start screen.

Press this button to submit an answer.

Press this button to reset the level.

Scene 2: Divide each whole unit (denominator)

In this scene, players draw vertical lines to slice the bacon into equal pieces. If the pieces are not equally sized, they will be asked to redraw the lines.

The Help Button displays screens with instructions on finding the denominator. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line. The player is required to identify the whole unit after repeated incorrect responses.

The Divide button must be pressed before the player can begin drawing lines on the bacon.

Press this button to undo the last action.

Divide each whole unit into 4 equal pieces. Click the Divide button to start.

0 1 2

Press this button to return to the Start screen.

Press this button to submit an answer.

Press this button to reset the level.

For educational use only

Scene 3: Count number of pieces (numerator)

In this scene, players drag the handle of the machine to the location specified. Each whole unit is correctly divided for the player; this scene provides practice on the meaning of the numerator.

The Help Button displays screens with instructions on finding the numerator. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line. The player is required to identify the whole unit after repeated incorrect responses.

The Locate button must be pressed before the player can drag the handle to the correct location.

Press this button to undo the last action.

Drag the handle!

LOCATE

WHOLE UNIT

?

UNDO

HOME

RESET

DONE

0 1 2

Locate $\frac{5}{4}$ on the number line. Click the Locate button to start.

Press this button to return to the Start screen.

Press this button to submit an answer.

Press this button to reset the level.

Scene 4: Locate the fraction

In this scene, players must perform two actions: first divide each whole unit, and then drag the handle of the defuser to the location specified.

The Help Button displays screens with instructions on the meaning of the numerator and the denominator. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line. The player is required to identify the whole unit after repeated incorrect responses.

The Divide button must be pressed before the player can begin drawing lines.

Press this button to undo the last action.

First divide each unit, and then locate $5/4$.

Draw lines over the pipe!
Make sure it crosses the number line!

Press this button to return to the Start screen.

Press this button to submit an answer.

Press this button to reset the level.

Scene 4 (continued): Locate the fraction

After the units have been correctly divided, the player must drag the handle of the defuser to the specified location.

The Help Button displays screens with instructions on the meaning of the numerator and the denominator. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line. The player is required to identify the whole unit after repeated incorrect responses.

The Locate button must be pressed before the player can drag the handle to the correct location.

Press this button to undo the last action.

First divide each unit, and then locate $5/4$.

Drag the handle to the firecracker!

Press this button to return to the Start screen.

Press this button to submit an answer.

Press this button to reset the level.

Scene 5: Identify the fraction

In this scene, players must enter the fraction depicted by the highlighted part of the number line. The crane moves to whatever fraction the player has entered and attempts to grab the crook. Players must enter the fraction exactly as depicted in the number line, and not an equivalent fraction (e.g., must enter $\frac{4}{6}$ instead of $\frac{2}{3}$).

Press this button to return to the Start screen.

The Help Button displays screens with instructions on finding the fraction. The Help Button also flashes if a player has repeatedly responded incorrectly to a problem.

The Whole Unit Button displays the black-and-yellow wrapper shown at the "0" mark on the number line.

Press this button to undo the last action.

Write the fraction represented by the red highlight.

Click the arrows to select values for the numerator and denominator.

Press this button to submit an answer.

Press this button to reset the level.

For educational use only

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.

Fractions

This game uses the idea of fractions as measures or lengths. Divisions of the number line are used to emphasize that a point on a number line is named for its distance from zero measured in units. For instance, the number “2” is located 2 units from zero, and $\frac{1}{3}$ is located $\frac{1}{3}$ of 1 unit from zero. The big idea here is that students must understand what one whole unit is before they understand how each of these whole units is divided up.

Whole Units as Fractions

When identifying a fraction greater than or equal to a whole unit, the whole unit means that the number of equal pieces shaded, by definition, matches the number of equal pieces in the unit. For example, the whole unit 1 is equivalent to $\frac{4}{4}$ because if the denominator indicates that each whole unit is divided into four equal pieces and the numerator indicates there are four of these pieces, then that must be equivalent to one whole unit. Each of the integers can be written in exactly the same way.

Locating Numbers

When locating a number on a number line, students must use the length from 0 to 1 to identify the length of one unit. In early levels, the number 1 is shown; in later levels it is implied. When locating a fraction, divide each unit into the number of equal segments denoted by the denominator. For example, a denominator of 3 means to divide each whole unit into 3 equal segments. Each of the segments is a length of $\frac{1}{3}$ of the whole unit, and there are three of them in each whole unit. Note that the only point named $\frac{1}{3}$ is the point that is this length from 0. After dividing the unit appropriately, look at the numerator to know how many of these segments to include in the length from 0. For instance, to locate $\frac{2}{3}$, we need to start at 0 and move to the right by 2 of the $\frac{1}{3}$ segments. If the number line displays more than one whole unit, the denominator applies to each unit on the number line. For example, a number line that displays 4 units with a denominator of 3 will have 12 equal $\frac{1}{3}$ segments.

Naming Numbers

When using a number line it is important to notice which numbers are already labeled. If 0 and 1 are labeled and the point to be named is located between them, look at the number of equal-sized segments between 0 and 1. The name of the point is based on how many segments the unit has been divided into (the denominator) and how many of those segments are included in the length (the numerator) from 0 to the particular point. Sometimes more equal divisions need to be created in order to determine the name of the point. Note that it is not necessary for 0 and 1 to be labeled (any two numbers could be labeled), but it is important for students to be able to identify what one whole unit is in order to correctly identify fractional pieces on any number line.

Common Errors

Students Might Make in the Game

Counting lines instead of spaces

When asked how many equal parts there are in the whole unit, students count the number of lines rather than the number of spaces between the lines. Similarly, when asked to divide the number line or unit into, for example, seven equal parts, students will draw seven lines rather than six lines. Alternatively, students may count the first and last division marks rather than spaces when dividing up the number line. For example, students are asked to divide a unit into fifths and they draw only three lines because they count the first and last lines as part of the five specified in the denominator. In both cases, it is imperative that students understand that the denominator specifies the number of pieces each whole unit is broken into, not the number of lines that are drawn.

Identifying the entire number line as one unit

When given a number line of more than 1 unit, students count the entire number line as one whole unit. Similarly, when asked how many equal parts divide *each* whole unit, students count the number of equal parts in the entire number line. The early levels of the game are aimed directly at this misconception and in later levels, students may be asked to identify each whole unit if the game detects this misconception. Work with students to identify each whole unit when there are multiple units represented on the screen.

Finding the fraction of the number line rather than the unit

Students may find the fraction of the entire number line rather than the fraction of the unit. For example, on a 3-unit number line, students may identify the number 2 as the $\frac{2}{3}$ mark rather than correctly identifying $\frac{2}{3}$ of one unit. Work with students to show each whole unit and, once they demonstrate an understanding of each whole unit, work with them to understand that the denominator specifies how many equal pieces **each one of these whole units** is divided into.

Switching the meaning of numerator and denominator

Students often write the number of equal parts as the numerator and the number of highlighted parts as the denominator. Help students understand that the denominator specifies the type of unit (e.g., “thirds,” “fifths,” etc.) so we can look at that first to see the type of unit we are working with. Students sometimes get confused because, although the game talks about it before addressing the numerator, it is written below the numerator in a fraction.

Believing the numerator can't be larger than the denominator

Research suggests that, because the “pie” model of fractions is often used to represent fractions and only one unit is shown at a time, many students erroneously believe that you cannot have more pieces than one whole. This error also can be seen when students mistakenly believe one cannot ever have more than 100%. It is critical that students understand that the denominator represents how many pieces **each** whole unit is divided into and that the numerator specifies how many **of those sized pieces** one has. Consequently it is possible to have more pieces than the number of pieces in one whole unit. This may be easier to illustrate with money. A dollar can be divided into four equal parts (quarters), which means that there are four quarters in one dollar. It is, however, possible to have more than four quarters and that would mean you have more than one whole dollar.

Difficulty working with denominators other than 2 or 4

Because most students are often exposed to halves and fourths, they can often recall how to manipulate these fractions. *Wiki Jones*, therefore, tries to connect understanding to these familiar denominators and asks students to practice with denominators that they may not have a lot of experience working with. It is important to focus on student understanding of what the denominator means in these familiar fractions before attempting to understand fractions that are less familiar.

Circling, dividing, etc. past the number line

If students continue a task past the end point of the number line, the program will read their actions as incorrect, and they will have to replay the level.

Starting another task before finishing the first task

For example, on levels where the students are required to divide the number line into equal-sized pieces, several incorrect attempts will then force students to start the level by bagging each whole unit. Students must then complete the task of bagging each whole unit by clicking on the “whole unit” button. After students complete that task, they may then click on the “divide” button.

Not clicking the “Done” button before moving onto a different task

In order for the task to register as complete, students must click the “Done” button. For example, if a student must bag the whole unit as well as divide the whole unit, students must click the “Done” button after he or she has finished bagging the whole unit in order to move onto the next task.

Sample Lesson Plan

When using *Wiki Jones* 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 *Wiki Jones* 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 fractions, whole units as fractions, locating numbers on a number line, naming numbers on a number line (list from Math Topics section); introduce game to students at the front of class (play first few levels together).

Lesson 2: Have students play the game on individual computers. At the end of class debrief student difficulties and successes.

Lesson 3: Review student difficulties and successes from the day before. Allow students to continue to play the game. 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.

Wiki Jones FAQs

Can students skip levels?

No. Students must play the levels in the order they are given. They can replay levels they have already completed, but they must complete each level in order.

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.

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.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.2a: Represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $1/b$ and that the endpoint of the part based at 0 locates the number $1/b$ on the number line.

3.NF.A.2b: Represent a fraction a/b on a number line diagram by marking off a lengths $1/b$ from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.

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.*