Instructional Design: Fractions Subunit

Created and Developed by Eric Payne

March 18, 2012

Findlay City Schools



Rationale

This instructional subunit is geared to providing all students with the opportunity to experience math lesson with a contextualized, practical, real-world emphasis. Providing students with a sense of applying the concept to their lives and future is critical in persuading the students to the material’s relevance to them. This subunit’s focus of fractions lends itself nicely to real world applications. According to The Center for Occupational Research and Development (CORD), “students have a difficult time understanding academic concepts (such as math concepts) as they are commonly taught (that is, using an abstract, lecture method), but they desperately need to understand the concepts as they relate to the workplace and to the larger society in which they will live and work.” Therefore, I will provide students with various opportunities for discussion, examples, and applications that link the various fraction learning outcomes to real life.

 I will be developing this Instructional Design by applying the Basic Lesson Plan Model and also through the constructivist approach toward teaching and learning (Chiarelott, 2006). I will be presenting this lesson through various methods such as direct instruction, group work, and differentiated lessons based on formative assessments. This allows me to attempt to reach all students through varying tasks and materials for independent students or groups, as well as allowing students to draw on personal experiences that may relate to the application of fractions and share those experiences with classmates. By utilizing these methods I hope to better present materials in a more logical order for students. This is a problem that the current curriculum used by my school presents. The current curriculum spreads parts and pieces of the fraction materials that students are required to learn across four separate chapters. This does not present the greatest opportunity for students to master all of the skills needed on this particular topic. The materials for the subunit from the current curriculum are adequate, but used in an order that does not flow well and does not allow for students to practice skills that are closely related before moving on to new, unrelated topics.

 I will also need to apply some Behaviorist approaches to my instruction when presenting some of the new content for the first time. But, I plan to incorporate as much contextual teaching and learning as possible because “contextual teaching and learning provides a means for developing career-related and academic competencies at a high level (Berns & Erickson, 2001). By introducing students to a variety of forms of fractions and applications of fractions and how they may be used in the real world I hope to use the benefits of contextual teaching. Representing fractions in a variety of ways, applying operations such as addition, subtraction, and multiplication of fractions, converting fractions among other forms of fractions, and ordering and comparing fractions can be a difficult concept master, and if I am able to incorporate these skills into real-life situations then students are more likely to retain the information.

 By utilizing formative assessments and a summative assessment at the end of the subunit I will be able to monitor student achievement and understanding which will allow me to alter lessons and materials as needed to best fit the needs of students who require additional interventions or need extensions past the planned curriculum. With the combination of a better sequencing of the content, a focus on Constructivist methodology mixed with some Behaviorist practices, and a target of applying contextual teaching this subunit should better teach and guide students in their ability to work with fractions.

References

Berns, R. G., & Erickson, P. M. (2001). Contextual teaching and learning: Preparing students for the new economy. The Highlight Zone, 5, 1-8.

Chiarelott, L. (2006). *Curriculum in context*. Belmont, CA: Thomson Wadsworth.

The Center for Occupational Research and Development. (2012). What is contextual learning?. Retrieved from <http://www.cord.org/contextual-learning-definition/>

**Learning Outcomes**

My Curriculum Design project dealt with fractions and decimals, but for the purpose of this Instructional Design I have chosen to focus on only the fractions subunit.

**Lesson One: Representing Fractions as Mixed Numbers and Improper Fractions**

* Students will develop a list of when they see or use any representations of fractions in real life situations. (Bloom’s: knowledge, application)
* Students will represent fractions in as mixed numbers. (Bloom’s: knowledge, apply, comprehend)
* Students will represent fractions as improper fractions. (Bloom’s: knowledge, apply, comprehend)

**Lesson Two: Comparing and Ordering Fractions**

* Students will compare fractions to other fractions to determine which is greater, less than the other, or if they are equal. (Bloom’s: analyze)
* Students will order a set of fractions from greatest to least or least to greatest. (Bloom’s: knowledge, analyze, synthesize)

**Lesson Three: Computing with Fractions - Part I (Addition and Subtraction)**

* Students will create a list of occupations that would require the ability to add and subtract fractions. (Bloom’s: knowledge, application, synthesis)
* Students will solve fraction addition problems. (Bloom’s: apply, evaluate)
* Students will solve fraction subtraction problems. (Bloom’s: apply, evaluate)

**Lesson Four: Computing with Fractions – Part II (Multiplication and Division)**

* Students will continue/add to their list of occupations that would require the ability to add and subtract fractions. (Bloom’s: knowledge, application, synthesis)
* Students will solve fraction multiplication problems. (Bloom’s: apply, evaluate)
* Students will solve fraction division problems. (Bloom’s: apply, evaluate)

**Lesson 5: Summative Assessment (partial day lesson)**

* Students will demonstrate their comprehensive knowledge of fractions.

**Fractions Pre-Assessment**

**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SCORE \_\_\_\_\_\_\_\_\_\_**

1. Represent $\frac{25}{4}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Represent $\frac{9}{2}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Represent $\frac{16}{4}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Represent 3 $\frac{3}{4}$ as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Represent 2 $\frac{5}{7}$as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Represent 5 $\frac{2}{3}$ as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Compare the following fractions using $<, >, or =$.

1. $\frac{2}{3}$ $\frac{3}{4}$ 8. $\frac{1}{2}$ $\frac{8}{16}$ 9. $\frac{7}{8}$ $\frac{5}{6}$

Order the following fractions from ***least to greatest***.

 $\frac{3}{5}$ , $ \frac{1}{2}$ , $ \frac{2}{3}$ , $\frac{3}{8}$ , $\frac{1}{3}$

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Complete the operations. Simplify all fractions to their simplest form.

11. $\frac{3}{8}$ + $\frac{5}{8}$ = 12. $\frac{3}{5}$ + $\frac{7}{10}$ = 13. $\frac{1}{2}$ + $\frac{3}{4}$ =

14. $\frac{3}{5}$ - $\frac{2}{5}$ = 15. $\frac{2}{3}$ - $\frac{4}{9}$ = 16. $\frac{11}{12}$ - $\frac{1}{4}$ =

17. $\frac{2}{3}$ x $\frac{1}{2}$ = 18. $\frac{7}{8}$ x $\frac{2}{5}$ = 19. $\frac{4}{6}$ x $\frac{1}{2}$ =

20. $\frac{1}{2}$ $÷$ $\frac{1}{4}$ = 21. $\frac{3}{5}$ $÷$ $\frac{1}{8}$ = 22. $\frac{6}{7}$ $÷$ $\frac{1}{2}$

**Lesson One: Representing Fractions as Mixed Numbers and Improper Fractions**

***AUDIENCE:***

6th Grade math students (regular education and special education students)

***CONCEPT:***

Representing Fractions

***LESSON OBJECTIVES:***

* Students will develop a list of when they see or use any representations of fractions in real life situations. (Bloom’s: knowledge, application)
* Students will represent fractions in as mixed numbers. (Bloom’s: knowledge, apply, comprehend)
* Students will represent fractions as improper fractions. (Bloom’s: knowledge, apply, comprehend)

***PROCEDURES:***

1. Introductory Activity: (10 min)
* Ask students to raise their hands if they have experience working with fractions. Then ask for a volunteer to write an example of a fraction on the board. Then, ask if any students know of any other ways that fractions are used and written. Accept volunteers to write their ideas on the board. Now ask if they know of any real life situations in which these fractions might be used in.
* Tell students that there are several ways that fractions can be written and today we will be practicing with and writing *mixed numbers* and *improper fractions*. You will also learn how to change these fractions to and from each other.
* Tell the students that they are now going to watch a *Brainpop* video about mixed numbers and improper fractions. (Show the video)
1. Developmental Activity: (20 min.)
* Tell the students to open their Math Journals and head the paper.
* Write the improper fraction $\frac{9}{2}$ on the board and instruct them to do the same in their journals. Explain that this is an improper fraction because the *numerator is larger than the denominator*. Also explain that sometime when working with fractions we need to use improper fractions, but most of the time we need to change them to a mixed number.
* Write the mixed number 4$\frac{1}{2}$ on the board and instruct them to do the same in their journals and explain that this is the same as out improper fraction and it is a mixed number because it contains a whole number and a fraction.
* Demonstrate on the board that to turn the improper fraction into a mixed number you simply divide the numerator by the denominator. Ask students to check your work with their scientific calculators by typing 9 A b/c 2 =. (This is the acceptable method on the OAA)
* Now demonstrate to students how to change a mixed number into an improper fraction. Tell them we call it the “Banana Method”. Use the mixed number written on the board an in their journals. Put a banana looking loop around the whole number and the denominator. Tell the students that to switch the mixed number into an improper fraction they need to **multiply** the numbers in the loop and **add** the numerator. This answer will be the new numerator and the denominator remains the same as the original fraction.
* Demonstrate several more examples of each form of fractions and changing between the two on the board as students do the same in their journals.
1. Concluding Activity: (20 min.)
* Group students into groups of three based on pre-assessment data and provide each student with the activity sheet.
* Explain to them that each person in their group is in charge of developing 10 problems similar to the ones we practiced together. 5 mixed numbers and 5 improper fractions. After each member has developed their own problems they trade within their groups and solve the problems developed by the group member.
* After they solve each problem they bring them to me so I can use them as a quick formative assessment for the lesson. If they show understanding, they receive their HW and begin working. If they need intervention they receive assistance and then receive their HW.

***ASSESSMENT***

* Formative assessment is the classroom group activity as previously explained in the procedures.

***MATERIALS/RESOURCES***

* Laptop and projector/Brainpop Video - http://www.brainpop.com/math/numbersandoperations/mixednumbers/
* Math journals
* Group activity sheet
* Practice WS p. 232 (homework)

**Group Activity**

**Mixed Number and Improper Fraction**

**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Create 5 improper fractions.**

1. 2.

3. 4.

5.

**Create 5 mixed numbers.**

1. 2.

3. 4.

5.



**Lesson Two: Comparing and Ordering Fractions**

***AUIDENCE:***

6th Grade math students (regular education and special education students)

***CONCEPT:***

Comparing and Ordering Fractions

***OBJECTIVES:***

* Students will compare fractions to other fractions to determine which is greater, less than the other, or if they are equal. (Bloom’s: analyze)
* Students will order a set of fractions from greatest to least or least to greatest. (Bloom’s: knowledge, analyze, synthesize)

***PROCEDURES:***

1. Introduction: (10 min.)
* Begin by asking each student to come to the board and write any proper fraction they want on the board.
* Look at all of the fractions and ask if anyone could pick out the smallest fraction, or the largest fraction. Accept volunteers to try, but do not reveal any answers yet.
* Explain that in many jobs, people need to be able to determine between fractions that are greater than or less than other fractions. Jobs such as bakers, designers, engineers, architects, and doctors. Then tell the class that jobs such as construction workers and carpenters need to be able to put fractions in order to make accurate measurements. Ask if anyone would like to have one of these jobs someday, ask for other jobs that may need these skills and create a list on the board.
* Tell the students that this is what they will be learning today; how to compare and order fractions.
1. Developmental Activity: (25 min.)
* Tell the students that if they apply their knowledge of decimals they will be able to easily determine the greater fraction between two or more fractions even if they have unlike denominators by turning each fraction into a decimal. (Students will also use the *fraction to decimal* function on their calculators for this step.)
* Display several fractions on the whiteboard. Show students that by dividing the numerator by the denominator it will turn a fraction into a decimal. If we turn all of the fractions into decimals it will allow us to compare and order the fractions. Tell the students that since using a scientific calculator is an expectation in 6th grade, we are also able to change a fraction into a decimal by entering the fraction into the calculator and using the *fraction to decimal key.* Have students copy the fractions into the math journals and work through changing each into a decimal.
* Have students volunteer to share what order they believe the fractions should be in to make the least to greatest. Students record answers in their journals.
* Display an unmarked number line on the Smartboard that is surrounded by familiar fractions that are currently not in the correct order. I will use the class roster name cards to randomly select volunteers to go to the board to help order fractions. Each student will go to the board. This will serve as a formative assessment.
1. Concluding Activity: (25 min)
* Students compare given fractions using greater than, less than, and equal to signs.
* Students order fractions.
* Students bring activity to be checked, intervention is used for students still lacking the skill.

***ASSESSMENT:***
 The concluding activity will serve as a formative evaluation, and there will be no home assignment for this lesson.

***MATERIALS/RESOURCES:***

Smartboard, Math Journals, classwork activity WS, whiteboard, calculators





**Lesson Three: Computing with Fractions - Part I (Addition and Subtraction)**

***AUDIENCE:***

6th Grade math students (regular education and special education students)

***CONCEPT:***

Completing mathematical calculations with fractions – addition and subtraction

***LESSON OBJECTIVES:***

* Students will create a list of occupations that would require the ability to add and subtract fractions. (Bloom’s: knowledge, application, synthesis)
* Students will solve fraction addition problems. (Bloom’s: apply, evaluate)
* Students will solve fraction subtraction problems. (Bloom’s: apply, evaluate)

***PROCEDURES:***

1. Introduction (15 min.)
	* Review the work that we have already done with fractions so far (mixed numbers, improper fractions, comparing and ordering fractions) by completing examples of each together.
	* Tell students that we are going to continue our work with fractions for two more lessons and then take a final assessment to see what they have learned. The final fraction lessons will be learning how to add, subtract, multiply, and divide fractions. Today we will learn how to add and subtract fractions.
	* Ask students to open their journals and take 5 minutes to continue their lists of jobs that might need to use math operations with fractions.
2. Developmental Activity (25 min.)
	* Show *Brainpop: Adding and Subtracting Fractions*
	* Each student gets a mini-whiteboard, dry erase marker, and tissue.
	* Write two basic fractions (i.e. $\frac{3}{4}$ and $\frac{1}{4}$) on the board and have students write the same on their boards. Explain that when denominators are alike you simply add or subtract the numerators and place the sum over the same denominator. Provide several examples for students to do, when the finish a problem the raise their board to be checked (formative assessment).
	* Continue with the boards, but now try some with unlike denominators. Tell students they need to use their GCF skills previously learned to find a denominator that would be common for both, and then add or subtract. Do several examples with unlike denominators.
	* Students will be able to add and subtract fraction with like and unlike denominators by hand, and also by using the fraction function on their calculators.
3. Concluding Activity: (25 min.)
	* Students will complete StudyIsland assignment for adding and subtracting fractions in the computer lab. Assignments will be graded and have been modified specific to pre-assessment results and IEP needs.

***CLOSURE/ASSESSMENT: (5 min)***

1. Closure: (3 min)
	* Students do a “3 minute write” in their journals and write everything they know about fractions and how they are used in real life.
2. Assessment: (2 min)
	* Students will complete homework assignment practice the addition and subtraction skills learned in the lesson. The assignment will be reviewed to begin the next lesson and check for understanding. Students may use calculators to check their answers, but must show work on all problems.

***MATERIALS/RESOURCES:***

Math Journals, laptop and projector/Brainpop video, mini-whiteboards, dry erase markers, tissues, calculator, computer lab reservations, HW assignment

**Lesson Four: Computing with Fractions – Part II (Multiplication and Division)**

***AUDIENCE:***

6th grade math class including regular education on special education students

***CONCEPT:***

Completing mathematical calculations with fractions – multiplication and division

***LESSON OBJECTIVES:***

* Students will continue/add to their list of occupations that would require the ability to use math operations with fractions. (Bloom’s: knowledge, application, synthesis)
* Students will solve fraction multiplication problems. (Bloom’s: apply, evaluate)
* Students will solve fraction division problems. (Bloom’s: apply, evaluate)

***PROCEDURES:***

1. Introduction (10 min.)
	* Have students close their eyes and pretend they are working as a carpenter that is building a large table. Tell them that they know that each board for the table is 1 ¾ inches wide and the whole table needs to be 42 ½ inches wide. Ask the students “What would you do to figure out how many boards you need to build the table without buying too many boards?” Give them time to think with their eyes closed (approx.. 3 min) then tell them to open their journals and write down how they would solve the problem. Students share their ideas.
2. Procedures (15 min.)
	* Use the example used in the visualization exercise to demonstrate to students how multiplying and dividing fractions could be needed in real life. Show the students how the problem could be solved using division.
	* At the board, show students that when multiplying fractions you just multiply straight across the fractions numerators and denominators to create the new fraction. Do several examples.
	* At the board, show students that when dividing fractions you must first use the *reciprocal* (flip the fractions numerator and denominator) of the second fraction and then multiply straight across the fractions numerators and denominators to create the new fraction. Do several examples.
	* Practice multiplying and dividing some examples with calculator using the fraction function.
3. Concluding Activity (30 min.)
	* Allow students to choose their own teams of two. Instruct the teams that they will be creating their own word problems for other teams to solve. Pass out the *Word Problem Requirements* page and go over the requirements with the class.
	* Allow 20 minutes for teams to create at least 5 word problems and answer keys, and then tell groups to trade with another group and work to solve their problems.
	* After the team has solved all of the problems they take the answer key to check their work.

***CLOSURE/ASSESMENT:***

1. Closure/Assessment (5 min):
* Students write on an exit slip 3 things they learned, 2 things that they are still confused about; and 1 thing that they would like to learn about fractions.

***MATERIALS/RESOURCES:***

Math Journal, calculator, *Word Problem Requirements* page, paper, scrap paper for exit slip

**Team Activity – Fraction Word Problems**

**WORD PROBLEM GUIDELINES**

* All word problems must relate to a real life situation where fractions may be used.
* Each team must create at least **5** word problems.
* Each operation (add, subtract, multiply, and divide) must be used at least once.
* All word problems must contain at least ONE fraction.
* All word problems must contain a clear question.
* All problems must be written neatly!

**Day 5: Summative Assessment (partial day lesson)**

* Students will take the post-assessment which is a summative assessment of all material presented in the four lessons. The summative assessment is the exact same assessment as given for the pre-assessment and can be seen above. Summative assessment results will be used to determine if re-teaching is needed or if students are prepared to move ahead in the curriculum.

**Fractions Post-Assessment**

**NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SCORE \_\_\_\_\_\_\_\_\_\_**

1. Represent $\frac{25}{4}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Represent $\frac{9}{2}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Represent $\frac{16}{4}$ as a mixed number. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Represent 3 $\frac{3}{4}$ as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Represent 2 $\frac{5}{7}$as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Represent 5 $\frac{2}{3}$ as an improper fraction. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Compare the following fractions using $<, >, or =$.

1. $\frac{2}{3}$ $\frac{3}{4}$ 8. $\frac{1}{2}$ $\frac{8}{16}$ 9. $\frac{7}{8}$ $\frac{5}{6}$

Order the following fractions from ***least to greatest***.

 $\frac{3}{5}$ , $ \frac{1}{2}$ , $ \frac{2}{3}$ , $\frac{3}{8}$ , $\frac{1}{3}$

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Complete the operations. Simplify all fractions to their simplest form.

11. $\frac{3}{8}$ + $\frac{5}{8}$ = 12. $\frac{3}{5}$ + $\frac{7}{10}$ = 13. $\frac{1}{2}$ + $\frac{3}{4}$ =

14. $\frac{3}{5}$ - $\frac{2}{5}$ = 15. $\frac{2}{3}$ - $\frac{4}{9}$ = 16. $\frac{11}{12}$ - $\frac{1}{4}$ =

17. $\frac{2}{3}$ x $\frac{1}{2}$ = 18. $\frac{7}{8}$ x $\frac{2}{5}$ = 19. $\frac{4}{6}$ x $\frac{1}{2}$ =

20. $\frac{1}{2}$ $÷$ $\frac{1}{4}$ = 21. $\frac{3}{5}$ $÷$ $\frac{1}{8}$ = 22. $\frac{6}{7}$ $÷$ $\frac{1}{2}$