How to introduce fraction procedures in 5th grade

I taught all levels of math from 7th through 12th grade in my teaching career. After teaching for many years, I realized that there were some topics in each math class that were important for the students to learn in order to proceed in their math career and often these topics were often complicated topics for the students to master. I tried to identify the 5-8 most important topics that the students needed to master in my class to be prepared for the math classes they were going to enter in the next 3 or 4 years. In order to give the students extended time to learn these eight topics in each class, I started to use short 2-3 minute introductory lessons in my teaching routine 2 or 3 times per week about 6-10 weeks prior to actually assigning a homework assignment dedicated to the topic I was teaching that day.

Sometimes I would use the introductory lesson at the beginning of a class and sometimes I would use the introductory lesson at the end of the class period. I would always have a 2-3 minute introductory lesson prepared for each class every day. Often, I did not have enough time to discuss the introductory lesson that I had prepared for that day, but it was not a problem I could use the same introductory lesson the next day.

In order for you to understand what I mean by short 2-3 minute introductory lessons, there are 10 short 2-3 minute example lessons that I would write as addendums in my daily lesson plans if I was teaching fractions in 5th grade. The 10 lessons were written so that I would have them prepared if I had the time to present these topics. The daily lesson plans focused on the topic for today which usually was not directly linked to the short lesson notes.

By using these short teaching sessions over a one or two month period, prior to the actual day that I was going to focus on the topic and assign homework, the students already knew how to solve the problems using the correct procedures. I thought if students were exposed to solving different problems for several weeks and the problems were presented as fun topics in small increments, the students would feel confident when they were actually required to solve the problems on their own. The results seemed to be that the students knew how to do the homework problems on the day the topic was the main focus point and they used the right procedures immediately.

In the 10 example lessons (notes) are mainly focused on adding and subtracting fractions. Keep in mind prior to the students solving problems from the chapter focusing on fractions I had already introduced the students to the following procedures: 1. Finding LCDs using mental multiplication and division, 2. Finding LCDs using factor trees, 3. Reducing fractions using mental multiplication and division skills and using factor trees, 4. Multiplying fractions (using illustrations and rules – repeatedly emphasizing the difference rules used to multiply and divide fractions versus adding and subtracting fractions), 5. Two or 3 short lessons where the students solved both addition and subtraction fractions and two or three multiplication problems, 6. Solve problems involving division, 7. I would interleave all types of problems in my short 2-3 minute lessons to make sure the students would differentiate the different problems and use the correct rules for the different problems.

I did not want the students to only know the rules for adding fractions on the first day I assigned homework from the book. I wanted the students to know how to solve the simple addition problems in

the book, but they already knew that there were going to be more challenging problems that involved different rules.

Here are some thoughts I had prior to attempting to plan my short 2-3 minute mini lessons.

The initial step is to decide what the step by step procedures you want the students to begin to understand prior to getting to the chapter focused on fractions. 1. Adding and subtracting fractions with identical denominators. (Concepts and Procedures) 2. Why do these fractions equal one: "$\frac{2}{2}, \frac{8}{8}, \frac{5}{5}, etc.$". 3. Why do the following fractions equal zero: "$\frac{0}{2}, \frac{0}{6}, \frac{0}{11}, etc.$". 4. Explain that a fraction is a division problem. Simplify the following fractions: "$\frac{11}{11}, \frac{10}{5}, \frac{16}{4}, etc.$". 5. Finding equivalent fractions by multiplying by the number one, a fraction like: "$\frac{2}{2}, \frac{3}{3}, \frac{5}{5}, etc.$". This is actually, "Young's Conversion Theorem", but it is not necessary to refer to the theorem by name. Explain (emphasize) that the rule for multiplying fractions is not the same rule used to add and subtract fractions. 6. Find the biggest number that divides into two different numbers. 7. Reducing fractions by dividing both the numerator and the denominator by the biggest number that divides into both the numbers. 8. Find an equivalent fraction to a given fraction when the denominator of the second fraction is given. 9. 10. Etc.

There are so many little steps that students must be familiar with when simplifying fractions, it is unrealistic for average students to be able to learn and remember all the little steps if they are supposed to learn the steps in a week, a month or even two months. I believe it takes two years for average and below average students to all the rules necessary to solve fraction problems.

Start early in September to introduce basic fraction procedures that you want the students to master in November or December. Use short 2-3 minute introductory lessons 2 or 3 times per week either to begin a class or end a class.

The following are short comments that I put in my daily lesson plans to help be remember what I already introduced and focus on my objectives in November or December.

Some days I would put comments in my lesson plans and find that I did not have enough time to discuss the introduction comment today, but I kept the comment in lesson plan to discuss tomorrow or the next day.

Day 1: I assume that previous teachers already illustrated how to solve these problems using graphs, geometric shapes, line segments, computer simulations.

1. $\frac{2}{5}+\frac{1}{5}$ Use a picture to illustrate the answer and then discuss the rule. Answer equals, "$\frac{3}{5}$".
2. $\frac{3}{7}+\frac{2}{7}$ Use an illustration and discuss the rule. Answer is "$\frac{5}{7}$".
3. $\frac{3}{7}+\frac{2}{7}-\frac{1}{7}$ Use the rules Answer is "$\frac{4}{7}$".
4. $\frac{3}{8}+\frac{5}{8}$ Use the rules Answer is "$\frac{8}{8}$". What does the answer, "$\frac{8}{8}$", mean?

Day 2 (Which might be 2, 3, or 4 days after the first introduction)

1. $\frac{3}{9}-\frac{1}{9}+\frac{2}{9}$ Use a picture to illustrate the answer and then discuss the rule again. Answer equals, "$\frac{4}{9}$".
2. $\frac{3}{5}-\frac{1}{5}=\frac{2}{5}$ Emphasize the identical denominator rule when adding and subtracting fractions.
3. $\frac{3}{5}+\frac{2}{5}=\frac{5}{5}$ A short discussion is important.
4. $\frac{7}{11}-\frac{2}{11}+\frac{4}{11}-\frac{1}{11}$ If time discuss this problem.

Day 3 Introduction

1. $\frac{3}{8}+\frac{3}{8}-\frac{1}{8}=\frac{5}{8}$ Notice none of the answers will reduce except the answers that equal one.
2. $\frac{2}{7}+\frac{1}{7}+\frac{0}{7}+\frac{4}{7}=\frac{7}{7}=1$ Emphasize the rules and discuss the value of the fraction, "$\frac{0}{7}$".
3. $\frac{3}{5}+\frac{4}{5}+\frac{3}{5}=\frac{10}{5}=2$ This will require some discussion.

Day 4 Introduce Equivalent Fractions

1. $\frac{2}{3}=\frac{4}{6}$ Using Pictures Think about what I did to both the number "2" and the number "3" to get the new numbers "4" and "6".
2. $\frac{1}{2}=\frac{2}{4}$ Use pictures to illustrate. Again what did I do to both the first two numbers to get the second 2 numbers?
3. $\frac{1}{2}=\frac{5}{10}$ Use pictures to illustrate. What did I do to the first two numbers this time to get the last two numbers?
4. $\frac{1}{3}=\frac{6}{18}$ Just tell me what I did to the two numbers "1" and "3" to get "6" and "18"?
5. Solve the following problem: $\frac{5}{6}=\frac{5}{6}\times 1=\frac{5}{6}\times\frac{2}{2}=\frac{10}{12}$" Use a pie chart to illustrate but do not spend a lot of time explaining the process to day. Wait until the next introduction day.

Day 5 Introduction Discuss the multiplication property for the number "1". "$6\times 1=6$", "$11\times 1=11$", "$1\times 4=4$ etc. "$a\times 1=a$" This last equation simply indicates that no matter what number you replace the letter "a" with you get an equal or equivalent answer. Find equivalent fractions by multiplying by one. This is the first time the students will encounter, "Young's Conversion Theorem". I would not mention the name of the theorem, but I would emphasize that when you multiply a fraction by any fraction equal to one, you get an equivalent fraction, that may look different but when you place a point representing the fraction on a number line the two fractions are the same point, therefore equal.

1. $\frac{1}{2}=\frac{1}{2}\times 1=\frac{1}{2}\times\frac{2}{2}=\frac{2}{4}\quad\therefore\ \frac{1}{2}=\frac{2}{4}$
2. $\frac{2}{3}=\frac{2}{3}\times 1=\frac{2}{3}\times\frac{4}{4}=\frac{8}{12}\quad\therefore\ \frac{2}{3}=\frac{8}{12}$
3. $\frac{5}{6}=\frac{5}{6}\times 1=\frac{5}{6}\times---$ The students can find different fractions equal to, "$\frac{5}{6}$".

Day 6 is review day of the first five introduction questions. Give a 2-3 minute quiz as bonus points for the students to solve the following questions.

1. $\frac{2}{7}+\frac{4}{7}=$
2. $\frac{3}{5}+\frac{3}{5}-\frac{2}{5}=$
3. $\frac{7}{10}+\frac{3}{10}=$
4. $\frac{7}{8}+\frac{5}{8}+\frac{5}{8}-\frac{1}{8}=$ This problem is really hard. I will be amazed if you get the right answer.
5. Fine the equal fraction to "$\frac{3}{5}$" by multiplying by the fraction, "$\frac{4}{4}$". Remember, "$\frac{4}{4}=1$".