Developing Students’ Understanding of Decimal Numeration in Grade 5

Lindsay Gordon, Felicia De Peña & Faculty Mentor Dr. Claudia Burgess

Introduction:

Many misconceptions exist in the realm of decimal numeration (Melus, 2014, University of Melbourne, 2015). Teachers and students alike struggle with the notion that: 

- Decimal numeration can be broken down into whole and fractional parts. 
- Decimal numeration is a continuous representation of numbers. 
- Decimal numeration is a different system of base-ten numeration. 

Conventional teaching strategies often fail to help students overcome these misconceptions. Selwyn (2001) found that even pre-service teachers did not have a well-integrated knowledge of decimal numeration. Underdeveloped content and pedagogical knowledge often leads to teaching misconceptions, some of which are common. For instance, teachers often refer to decimals as an error in counting or as a correction to an error in counting. Another misconception is that decimals are fractions with a denominator of ten. This is not always the case, and teachers often refer to decimals as being placed in the numerator of a fraction. This is also not always the case. As a result, it is important for teachers to understand the common misconceptions that students may have when learning about decimal numeration.

Theoretical framework:

- We conceptualized our study using the CCSS in Mathematics (2010) for grade five. These strands are:
  - The student learns the importance of understanding the place-value structure of multi-digit numbers. In the base-ten system, the value of each place is 10 times the value of the place to its right. Multi-digit multiplication and division is a good example. In the base-ten system, the value of each place is 10 times the value of the place to its right. Multi-digit multiplication and division is a good example.
  - The students understand the base-ten system to decimals to the thousandths place. Multiplying by 10 changes the value of each digit. Dividing by 10 changes the value of each digit.

Methodology: Participants and procedure

In this study, four students getting ready to enter fifth grade were chosen from local elementary schools. The students, Jane, Adam, and Mark (pseudonyms) were brought to us for a four week tutoring and interview before beginning the tutoring process. The tutoring sessions were held for one hour per week for a total of 12 sessions. The study was administered and collapsed into the following clusters:

- Instructional Cluster 1: A focus on the place value of numbers to the right of the decimal point. The students were introduced to the concept of place value and how it applies to decimals. The students were given examples of how to identify the place value of decimal numbers. They were also given examples of how to compare and order decimal numbers. 
- Instructional Cluster 2: A focus on the addition and subtraction of decimal numbers. The students were given examples of how to add and subtract decimal numbers. They were also given examples of how to compare and order decimal numbers. 
- Instructional Cluster 3: A focus on the multiplication and division of decimal numbers. The students were given examples of how to multiply and divide decimal numbers. They were also given examples of how to compare and order decimal numbers.

Methodology: Data gathering and analysis

For the initial sessions, each student was required to take a written assessment and an interview with the researchers—a total of 12 sessions. The written assessment consisted of 20 multiple choice questions on decimals ranging from place value to the multiplication and division of decimals. During the second session, each student answered a series of questions regarding decimals. The interview was composed of 12 open ended questions designed to test multiple operations. The researchers recorded the interview and took notes on questions and answers to give the level of student understanding.

Empirical Teaching and Learning Trajectory:

Initial Assessment Results

During the initial assessment and interview, one of the class members was struggling with the basic concept of understanding decimal numeration. Even with the introduction of the concept, the student was struggles with the idea of understanding the place value of numbers to the right of the decimal point. The student was unable to understand the concept of understanding the place value of numbers to the right of the decimal point.

Instructional cluster 1

When the students started drawing on a long list of decimal numeration, we noticed an increased understanding of place value. The students were introduced to the concept of place value and how it applies to decimals. The students were given examples of how to identify the place value of decimal numbers. They were also given examples of how to compare and order decimal numbers.

Instructional cluster 2

The students started drawing on a long list of decimal numeration, we noticed an increased understanding of place value. The students were introduced to the concept of place value and how it applies to decimals. The students were given examples of how to identify the place value of decimal numbers. They were also given examples of how to compare and order decimal numbers.

Instructional cluster 3

In the final weeks of the course, students added and subtracted decimal numbers. Students were given a problem card to represent a situation that requires them to solve a problem. The students were given a problem card to represent a situation that requires them to solve a problem. They were also given examples of how to compare and order decimal numbers.

Post-Assessment Results

After completing the system, the students were asked to solve a real-world problem. The students were presented with a real-world problem and were required to solve it on their own. The students were then asked to explain their solution to the researchers. The students were given examples of how to compare and order decimal numbers.

Reflection and discussion:

In this study, the students were introduced to the concept of understanding the place value of numbers to the right of the decimal point. The students were given examples of how to identify the place value of decimal numbers. They were also given examples of how to compare and order decimal numbers. The students were then asked to explain their solution to the researchers. The students were given examples of how to compare and order decimal numbers.

References:

- B.S., Mathematics (2015). Preservice and in-service teachers’ understanding of decimals. Developing Students’ Understanding of Decimal Numeration in Grade 5, Teachers and students alike struggle with the notions of place and not beyond (e.g., students who think 0.65 has more digits, students who think 0.065 has more digits)
- Familiarity with a particular digit is ten times smaller than the place to its left. (CCSS.Math.Content.5.NBT.4)
- Compose, read, and write decimals using base ten numerals, expanded form, area models, or fractions. (CCSS.Math.Content.5.NBT.3.b)
- Add and subtract decimals of different sizes using drawings and other manipulatives. (CCSS.Math.Content.5.NBT.7)
- Developing Students’ Understanding of Decimal Numeration in Grade 5, Martinie (2014). Teachers and students alike struggle with the notion of place and not beyond (e.g., students who think 0.65 has more digits, students who think 0.065 has more digits). The following session focused on word problems. Students had to add, subtract and compare decimals to hundredths, using concrete models or drawings and strategies based on place value. In the first lesson, we focused on the place value of numbers to the right of the decimal point. For this standard, not only includes all four operations, but it includes the connection to a written method as well. That is obvious when students are asked to add two decimals together. Students had to add two decimals together. Students had to add two decimals together. Students had to add two decimals together.

The graphic below shows how students learn to subtract whole numbers with regrouping. The standard algorithm does not dictate how students should think about the sizes of numbers. In the first lesson, we focused on the place value of numbers to the right of the decimal point. For this standard, not only includes all four operations, but it includes the connection to a written method as well. That is obvious when students are asked to add two decimals together. Students had to add two decimals together. Students had to add two decimals together. Students had to add two decimals together.