Developing Fraction Proficiency in Fourth Grade Mathematics

Synopsis

Reflection and Discussion

CCSS.MATH.CONTENT.3.NF.A.2 states [Students should]
Understand a fraction as a number on the number line; represent fractions on a number line diagram. In our experience over the course of this project, students had the most trouble with this particular standard.

Key Points to Remember:
- The idea of having the same whole
- Maintaining student interest
- Visual models
  - relativity
  - equal parts

Empirical Teaching and Learning Trajectory

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Mentor: Jathan Austin, Salisbury University
Development Fraction Proficiency in Fourth Grade Mathematics

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Developing Fraction Instruction for Fourth Grade Mathematics
Introduction

Research confirms that third grade students in the United States have difficulty with multiple mathematical topics they are expected to know upon entering the fourth grade.

The Common Core State Standards report that by the end of third grade students should have a strong foundation of:
- fraction representation
- inequalities and equivalency
- fraction proximity of a whole and half a unit

The purpose of this study was to explore and develop four rising fourth grade students’ thinking about fractions. The specific research questions were:

1. What difficulties do the students have with fractions concepts prescribed by the Common Core?

2. What types of representations and teaching strategies are effective in helping the students develop mathematical proficiency with fractions?
**Theoretical Framework**

The Five Strands of Mathematical Proficiency:
- Conceptual Understanding
- Procedural Fluency
- Strategic Competence
- Adaptive Reasoning
- Productive Disposition

Key points from this learning progression:
- Unit fractions
- Equivalent fractions
- Comparing fractions with the same denominator
- Comparing fractions with the same numerator
Methodology
Participants and Procedure

Each student came in to our classroom once a week for seven one-hour sessions plus the introductory and concluding interviews.

Daisy (female)
Jordan (female)
Jay (male)
Nick (male)
PATHWAYS Cycle of Integrated Teaching and Research

- Analyze student assessment data
- Establish student learning goals
- Pose selected tasks to group of four students
- Select tasks to move students' thinking forward

Gather written and video recorded data from interaction with students
Methodology

Data Gathering and Analysis

The students were given both a written and a verbal interview style pre-assessment so that we could gauge their level of comprehension. After seven weeks of instructional sessions, students were given a post-assessment that consisted of the same set of interview and written questions.

Data gathering and analysis procedures followed:
- filmed sessions
- Collection of student work samples
- Watched video and transcribed verbatim.
- Reviewed transcript and coded segments using the 5 Strands of Mathematical Proficiency
- Summarized students’ attainment and made data-based conjectures about how to enhance students’ thinking
- Created a design of the next lesson
Fraction Proficiency in Grade Mathematics

Empirical Teaching and Learning Trajectory

Section and Discussion

CT3.NF.A.2 states: [Students should] understand a fraction as a number on the number line; represent fractions on a number line diagram. In our study, over the course of this project, students had the opportunity to work with this particular standard.

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Instructional Sessions (Weeks 2-3)

Fraction Art

Instructional Sessions (Weeks 1-6)

Fractions on the Number Line

Instructional Sessions (Weeks 7-9)

Post Assessment Results

The mathematics framework on the right-hand side of the page includes information about the assessment results and the impact of instructional strategies.
**Initial Assessment Results**

The results from the completed initial assessment were overall very inconsistent. This example shows the weakness in strategic competence that this student initially had:

![Example of fractions](image)

Aside from weaknesses, it was also apparent that the students had some combined strengths. Pictured below is a question that all students mastered:

![Fraction question](image)
**Instructional Sessions (Weeks 2-3)**

"Fraction Art"

The students designed a shape that fit into specific guidelines we provided.

"Fraction Wall"

When asked to, the students were able to make a fraction equivalent to \( \frac{1}{4} \) using their fraction walls.

Strategic competence and adaptive reasoning was shown in each activity by having the students solve these problems and explain their reasoning. They also helped students develop a productive disposition toward mathematics.
Instructional Sessions (Weeks 4–6)

We incorporated dice activities to add the element of random selection. The intent of this activity was to get the children thinking more about equivalency more quickly and thus exhibiting procedural fluency while completing this task.

The children exercised skills in strategic competence during our “pizza-fractions” lesson. By moving away from fraction bars, the student’s had to convert their thinking to represent these proportions in a more complex way.
Instructional Sessions (Weeks 7–8)

The final two weeks of instruction focused on a more in-depth exploration of fractions and all of their components. This was a way for the students to employ adaptive reasoning. The clothespin-fractions activity we conducted is shown below.

In another lesson entitled “Fraction Avenue,” we witnessed the students displaying a productive disposition toward their work.

The children demonstrated strategic competence by solving these problems and creating the correct fractions to represent the amount of driveway paved.
Post Assessment Results

One weakness that was consistent for all four students was the ability to interpret number line representations of fractions.

Students generally performed better, however, on post-assessment problems requiring the comparison of fractions in inequality statements. Below is a bar graph showing the percentage of correct responses given for each of the four inequality items.
Reflection and Discussion

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THANK YOU!

References


