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## **Students' Common Misconceptions on Basic Mathematics Skills**

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# Students' Misconceptions on Basic Math Skills

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## Research Questions

- What are students' common misconceptions on basic math skills?
- How do these misconceptions impact their understanding of higher-level mathematics concepts?

## Literature Review

- Denmark and Kepner, Jr. (1980) presented the results of a survey about basic skills as viewed by elementary and secondary mathematics educators, which formed a basic outline of which skills were considered basic for mathematics.
- Reys and Yang (1998) found strong evidence in their study that even if students have strong written computational skills, they lack the number sense behind the skills.
- Hudson, Kadan, Lavin, and Vasquez (2010) "discovered that all students could benefit from reinforcement and re-teaching of essential topics, including, but not limited to fractions, percentages, and decimals" (p. 51) at every grade level.

## Methodology

- 37 mostly junior students from an urban public high school in Northern Illinois were the participants of the study.
- Mastery quizzes, teacher journals, and student work were collected during student teaching.
- Data analysis was conducted based on content analysis (Neuendorf, 2002).

### 1: Fractions

Teacher: \_\_\_\_\_ Period: \_\_\_\_\_

Time Limit: 5 minutes. No calculators are allowed on this exam. Write fractions in lowest terms.

1. Reduce  $\frac{63}{77}$  to lowest terms.

4. Simplify:  $\frac{7}{2} - \frac{11}{10}$

2. Simplify:  $\frac{4}{15} + \frac{8}{9}$

5. Simplify:  $\frac{4}{15} + \frac{2}{5}$

3. Simplify:  $\frac{8}{5} \cdot \frac{4}{5}$

6. Simplify:  $\frac{5}{6} \div \frac{5}{4}$

**Figure 1.** An example of a mastery quiz.

## Common Misconceptions

### Fractions

*Lack of Knowledge of Common Denominators while Adding or Subtracting (17% of Incorrect Answers)*

$$\frac{7}{8} - \frac{1}{7} = \frac{6}{1}$$

### Decimals

*Misjudging Decimal Place with Multiplication Answers (18.2% of Incorrect Answers)*

$$0.014 \times 0.3 = 0.042$$

### Percentages

*Setting Up Proportion Incorrectly (9.9% of Incorrect Answers)*  
150 is what percentage of 500?

$$\frac{x}{500} = \frac{150}{100}$$

### Integers

*Forgetting Negative Sign in Final Answer (17.3% of Incorrect Answers)*

$$-53 + 50 = 3$$

### Scientific Notation

*Lack of Knowledge of Only One Digit on Left of Decimal (27.5% of Incorrect Answers)*

Write 0.000000021656 in scientific notation.  
21656

**Figure 2.** Most common misconception for each type of mastery quiz.

## Results

**Mastery Quizzes:** There are four or five significant misconceptions for each section of mastery quizzes: fractions, decimals, percentages, integers, and scientific notation. The percentages are based off the number of answers that display that misconception out of total incorrect answers (excluding blank answers).

**Teacher Journals:** Findings from teacher journals were consistent with the misconceptions identified from the mastery quizzes. These were based on what topics student struggled with in class and results of discussions with other teachers.

**Student Work:** There was less significant finding from the analysis of student work over the course of an Algebra unit, but that could be due to any number of outside factors, including lack of pre-planning to consciously include similar questions in the unit materials, and more frequent access to calculators.

## Conclusion

- There are several misconceptions evident in basic math skills without the use of calculator. However, findings were less conclusive within student work, where basic skills were needed to complete other computations and students were allowed to use calculators.
- If given more time, this study could focus more on development and use of specific materials which assess misconceptions.
- There is lack of research on basic skills and misconceptions among high school students who struggle through secondary mathematics. The common misconceptions identified in this study could be explored within higher level contexts in future research.