VARIATIONS IN SECOND-GRADE STUDENTS’ NUMBER SYSTEM KNOWLEDGE OUTCOMES
PRESENTATION FOR 2018 USU RESEARCH WEEK

Jessica King, Monika Burnside, & Felicia Messervy
Members of the Early Mathematics Research Group (EMRG)
Mentor: Jessica F. Shumway, Ph.D
• Number system knowledge is the ability to relate quantities to their respective numerical representations, understand relations among those numbers, and use that knowledge to manipulate quantities through operations (Geary et al., 2013).
NUMBER SYSTEM KNOWLEDGE

- a < b
- Three blue circles equal 3
- Symbols for addition (+), subtraction (-), and division (÷)
LITERATURE REVIEW

• Early NSK is a predictor of adolescent functional numeracy (Geary et al., 2013).
• Current research focuses on preschool and kindergarten number sense instructional interventions (e.g., Jordan et al., 2012).
• There is a need for further research on interventions in primary elementary grades (K-2).
The long-term goal of our study is to help improve instructional methods for developing number sense.

The focus of today’s presentation is on one aspect of our larger project: the initial quantitative analysis on test scores.

RQ: What are the variations in students’ Number System Knowledge outcomes after they participate in the instructional treatment?
Participants
- 5 second-grade classes from the Intermountain West area
- 75 participants
- 2 cases per class (11 case studies)

Setting
- Regular mathematics instruction in second-grade classrooms
- Intervention took place at meeting area or at desks as the warm-up activity to the mathematics lesson

Methods
- Pretest – Instructional Treatment - Posttest
- Mixed methods study (collected quant & qual data)
MIXED METHODS STUDY OF A CLASSROOM-BASED INSTRUCTIONAL TREATMENT

Pretests and Interviews Before

NSK Instructional Treatment

Interviews and Observation During

Posttests and Interviews After

Creswell & Plano Clark, 2011
MIXED METHODS STUDY OF A CLASSROOM-BASED INSTRUCTIONAL TREATMENT

Test Scores (Quantitative Data) → Interviews and Observations (Qualitative Data)
NINE- WEEK INSTRUCTIONAL TREATMENT

Show Quick Image
Pair-Share Discussion
Whole-Class Discussion
EXAMPLES OF INSTRUCTIONAL TREATMENT TEACHING EPISODES

Week 1

Week 4

Week 8
DATA SOURCE: NSK PRETEST AND POSTTEST

Number Sets Test

Number Line Estimation

Computational Fluency
DATA ANALYSIS

Descriptive Statistics → Paired-Samples t test → Visual Analysis
RESULTS
The $t$ test results showed a significant gain from pretest to posttest, $t(74) = 18.21$, $p < .001$ with a large effect size of 2.10.
RESULTS: DESCRIPTIVE STATISTICS BY CLASS

TABLE 1

*Mean Score on Number System Knowledge Test (NSK) and Standard Deviation for Five Second Grade Classes*

<table>
<thead>
<tr>
<th>Class</th>
<th>NSK Pretest</th>
<th>NSK Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>34</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>44</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>19</td>
</tr>
</tbody>
</table>
RESULTS: VISUAL ANALYSIS BY CLASS
RESULTS: VISUAL ANALYSIS FOR CLASS 1

Figure A. Pre and Posttest scores of Class 1
RESULTS: VISUAL ANALYSIS OF CASES

Figure K. Class 1: Target students’ pre and posttest Number System Knowledge Test scores compared to the class average.
CONCLUSIONS

• Students made significant growth in their NSK learning outcomes. However, we cannot parse out what factors caused this growth.

• Our next step is to analyze the qualitative data to better understand how and why learning occurred.

• The goal of our results is to help improve instructional methods for developing number sense.
THANK YOU FOR ATTENDING!

- Questions?

- References:

We are members of the Early Mathematics Research Group
Dr. Jessica Shumway (jessica.shumway@usu.edu)