Students’ Understanding of Equality & the Equal Sign
Laura Ramm, Benedictine College, REU 2013
Mentor Dr. Magiera

Background Information
• Understanding of equality influences students’ success in Algebra
• The equal sign is introduced in Elementary grades with little attention in Middle School and High School
• Elementary students have a weak concept of equality

Research Question
• How do Middle and High School students interpret the equal sign and equality in written task solutions?

Conceptual Foundation
• Map of Knowledge of the equal sign (Matthews et al., 2012)
  • Level 4 Comparative Relational
  • Level 3 Comparative Computational
  • Level 2 Flexible Operational
  • Level 1 Rigid Operational

Methodology/Data Analysis
• Written survey (10 questions)
  • 607 Students
  • 248 Middle School
  • 359 High School
  • Developed task specific rubric (0-4 scale)
  • Coded interpretations of equal sign in students’ written solutions

Selected Results

<table>
<thead>
<tr>
<th>Interpreting the Equal Sign</th>
<th>Comparing Quantities</th>
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<tbody>
<tr>
<td></td>
<td>Defining</td>
</tr>
<tr>
<td>Unclear</td>
<td>58.14%</td>
</tr>
<tr>
<td>Operational</td>
<td>36.05%</td>
</tr>
<tr>
<td>Comparative</td>
<td>26.89%</td>
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<td></td>
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</table>

- 58% of students had difficulty articulating the meaning of the equal sign
- Students predominantly define, and interpret the equal sign in context operationally
- Significantly more students interpreted the equal sign comparatively in context than defined it comparatively ($z=10.26$, $p<0.05$)
- Significantly fewer students interpreted the equal sign comparatively in the algebraic context than arithmetic context ($z=7.79$, $p<0.05$)

Conclusion
• Students have limited understanding of the equal sign and the concept of equality
• Both Middle and High School teachers should foster students’ understanding of the equal sign and equality

References