Technology’s Impact on Fraction Learning:
An experimental comparison of virtual and physical manipulatives

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Fractions
Manipulatives
Virtual Manipulatives
Previous Literature
Previous Literature
Research Questions

I. Knowledge of fractions

I. Time-efficiency
Hypotheses

I. Knowledge of fractions
   A. Virtual > Physical

II. Time-efficiency
   A. Virtual > Physical
Research Setting

- 1\textsuperscript{st} year, urban charter school
- 67 5th grade students
- 62% of students below grade-level
- 10 days of instruction using instructional scripts
- Within-class random assignment
<table>
<thead>
<tr>
<th>Physical</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys Physical</td>
<td></td>
<td>Girls Physical</td>
</tr>
<tr>
<td>Virtual</td>
<td>Boys Virtual</td>
<td>Girls Virtual</td>
</tr>
</tbody>
</table>
Methodology
Methodology
Data

• Assessments
  – Fractions Probe
  – Day 5
  – Day 10

• Practice Logs
  – Practice Exercises
  – Games

• ANCOVA Models
Research Question #1

<table>
<thead>
<tr>
<th></th>
<th>Day 0</th>
<th>Day 5</th>
<th>Day 10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td>6.93</td>
<td>6.82</td>
<td>12.72</td>
</tr>
<tr>
<td><strong>Virtual</strong></td>
<td>7.11</td>
<td>7.47</td>
<td>14.5</td>
</tr>
</tbody>
</table>

- The chart shows the comparison between Physical and Virtual conditions over three days: Day 0, Day 5, and Day 10.
- Physical conditions are represented by light blue bars, while Virtual conditions are represented by dark blue bars.
- The data indicates a slight increase in both conditions from Day 0 to Day 10, with the Virtual condition showing a more significant increase compared to Physical conditions.
Research Question #2
Practice Exercises

<table>
<thead>
<tr>
<th></th>
<th>Physical</th>
<th>Week 1</th>
<th>Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>53.9</td>
<td>24.61</td>
<td>28.58</td>
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<tr>
<td></td>
<td>77.67</td>
<td>24.47</td>
<td>51.34</td>
</tr>
</tbody>
</table>

Legend:
- Physical
- Virtual
Research Question #2
Games

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Week 1</th>
<th>Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>20.62</td>
<td>6.53</td>
<td>12.48</td>
</tr>
<tr>
<td>Virtual</td>
<td>23.25</td>
<td>6.03</td>
<td>17.16</td>
</tr>
</tbody>
</table>
Interpretation of Results

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Limitations

• Generalizability
• Possibility of differences between treatment conditions
• Nesting
• Not a fully-powered study
Directions for Future Research
Directions for Future Research
Questions?

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