A Modified Cover, Copy and Compare Math Fact Fluency Intervention

Megan E. Johnson
RaeLynn J. Lamminen, M.S.
Carlos J. Panahon, Ph.D.
Shawna Petersen-Brown, Ph.D.

School Psychology Doctoral Program
Agenda

• Introduction
• Method
• Interventions
• Results
• Discussion
Introduction
What can iPads bring to the classroom?

• Individualized instruction
  • (Draper-Rodriguez, Strnadova, & Cumming, 2014; Hutchison, Beschorner, & Schmidt-Crawford, 2012; International Reading Association, 2009; Larson, 2010; Shank, 2005)

• Interactive instruction
  • (Larson, 2010; Marsh, 2010; Mayer, 2005; Shank, 2005)

• Increased participation and engagement
  • (Avila, Biner, Bink, & Dean, 1995; Cumming & Draper-Rodriguez, 2013; Larson, 2010; Mayer, 2005; Means, Toyama, Murphy, Bakia, & Jones, 2010; Messinger-Willman & Marino, 2010)
Have iPads been used as an Evidence-Based Practice?

• Educational improvement due to the increased participation and engagement rather than the use of the iPad
  • (Hutchison et al., 2012; Means et al., 2010; Messinger-Willman & Marino, 2010;)

• Classroom Goals get lost in the hype of new technology
  • (Hutchison et al., 2012; Karsenti & Fievez, 2013)

• Barriers could outweigh benefits
  • (Falloon, 2013; Means et al., 2010; Messinger-Willman & Marino, 2010)

• Survey of teachers k-12 found that teachers thought iPads were most beneficial for use in math
  • (Ray & Panahon, 2015)

• Math fact fluency iPad intervention in comparison with Cover, Copy and Compare intervention was more effective
  • (Haydon et. al., 2012)
Cover, Copy and Compare

- An effective intervention for math fact fluency
  - It is a test-study method
  - Found to be productive for grades 1-12 in all educational settings
  - Effective in math fluency problems (Kitchens, 2012)
    - Maintenance of findings

- Could this intervention be electronic?
Purpose of the Study

• Extend the work of Haydon and colleagues
• Evaluate the effects of iPads on math fact fluency
• Evaluate the acceptability of iPad math fact fluency intervention and cover-copy-compare worksheets as reported by students.
Research Questions

• Were the interventions effective for increasing math fact fluency?

• Was iPad condition growth significantly greater than the CCC worksheet condition growth?

• Was one intervention more acceptable to students than the other?
Method
Project Design

• Counterbalanced within-subjects design
  • 20 fourth graders
  • Randomly assigned into 2 equal groups
    • Group 1: iPad then Cover-Copy-Compare
    • Group 2: Cover-Copy-Compare then iPad

• 8 weeks
  • 4, 10-minute sessions per week
  • 4 weeks of each intervention
    • Worksheet intervention: Cover-Copy-Compare
    • iPad intervention: Flashcards Deluxe
Timeline

• Pre-test

• Weeks 1-4
  • Group 1: iPad intervention
  • Group 2: Worksheet intervention

• Mid-test & Kids Intervention Profile (KIP) 1 (Eckert, Codding, Hier, Sullivan, & Malandrino, 2014)

• Weeks 5-8
  • Group 1: Worksheet intervention
  • Group 2: iPad intervention

• Post-test & Kids Intervention Profile 2 (Eckert, Codding, Hier, Sullivan, & Malandrino, 2014)
Fidelity Results

• Fidelity
  • 4 sessions (25%) during weeks 1-4
  • 5 sessions (25%) during weeks 5-8
  • IOA was 100% for both interventions

• Inter-scorer agreement
  • 20% of the sessions during weeks 1-4
  • 20% of the sessions during weeks 5-8
  • ISA was 100% for both interventions
Interventions
Cover, Copy, and Compare

- Randomized multiplication fact lists were created
  - 0s – 12s
  - Task interspersal
  - 15 total problems on each worksheet

- Test-study method
  - Modeling, practice, corrective feedback

- Shown to be effective at increasing math performance
  - (Joseph, Konrad, Cates, Vajcner, Eveleigh & Fishly, 2012; Skinner, McLaughlin, & Logan, 1997)
<table>
<thead>
<tr>
<th></th>
<th>a.</th>
<th>b.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6x9=54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12x6=72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1x12=12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5x12=60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5x4=20</td>
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<td></td>
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<tr>
<td>2x9=18</td>
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<td></td>
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<tr>
<td>3x9=27</td>
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</tr>
<tr>
<td>7x9=63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8x1=8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4x5=20</td>
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</tr>
<tr>
<td>11x10=110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x8=0</td>
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</tr>
<tr>
<td>1x9=9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8x6=48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4x1=4</td>
<td></td>
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</table>
iPad Intervention

• Flashcards Deluxe App
  • Imported math fact lists used on worksheets
  • Changed so that students had to enter the text rather than just flip the virtual flashcard
  • Required a correct answer to be provided before moving on to next problem
  • Changed settings to provide immediate feedback
6x9 = 54

12x6 = 72

Score:
11 of 15 = 73%
(tap to continue)

Time Studied: 4 min
Correct %: 73% (11 of 15)
Kids Intervention Profile (KIP)

How much do you like [insert specifics of intervention]?

- Not at all
- A little bit
- Some
- A lot
- Very, very much
Results
Was one intervention more acceptable to students than the other?

<table>
<thead>
<tr>
<th>Question</th>
<th>iPads</th>
<th>CCC</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you like practicing math facts?</td>
<td>3.2</td>
<td>3.15</td>
<td>0.87</td>
</tr>
<tr>
<td>How much do you like practicing math facts on the __________?</td>
<td>3.4</td>
<td>3.1</td>
<td>0.27</td>
</tr>
<tr>
<td>Were there times when you didn’t want to practice math facts on the ________?</td>
<td>2.47</td>
<td>2.47</td>
<td>1.00</td>
</tr>
<tr>
<td>Were there any times when you wished you could work on the ________ more?</td>
<td>2.47</td>
<td>2.42</td>
<td>0.91</td>
</tr>
<tr>
<td>How much do you like using __________?</td>
<td>3.32</td>
<td>3.21</td>
<td>0.80</td>
</tr>
<tr>
<td>How much do you think the __________ helped you practice math facts?</td>
<td>3.28</td>
<td>3.44</td>
<td>0.64</td>
</tr>
<tr>
<td>Do you think your math fact skills have improved by practicing on the _______?</td>
<td>3.22</td>
<td>3.00</td>
<td>0.61</td>
</tr>
<tr>
<td>Do you think your math fact skills have gotten worse from practicing on the _______?</td>
<td>1.05</td>
<td>1.05</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Were the interventions effective for increasing math fact fluency?

Yes, $p = .003$, $d = .31$

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>30.43</td>
<td>16.93</td>
</tr>
<tr>
<td>Posttest</td>
<td>35.62</td>
<td>16.55</td>
</tr>
</tbody>
</table>
Growth and Interventions

• Was iPad growth significantly greater than Cover-Copy-Compare worksheet growth?
  • Ruling out order effect:
    • Did order have an effect on growth during either of the iPad or CCC worksheet conditions? No, $p=0.62$ and $p=0.63$, respectively.
    • Did order have an effect on students’ posttest scores? No, $p=0.66$. 
Growth and Interventions

• Was iPad growth significantly greater than the Cover-Copy-Compare worksheet growth?

No, $p,.94$

<table>
<thead>
<tr>
<th></th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPad Growth</td>
<td>2.70</td>
<td>6.32</td>
</tr>
<tr>
<td>Worksheet Growth</td>
<td>2.50</td>
<td>7.80</td>
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</table>
Discussion
Summary

• Both interventions resulted in growth
• iPad growth was not significantly greater than worksheet growth
• Student acceptability
  • No statistically significant difference
Limitations

• Only 4 weeks of data for each intervention
• Small, specific sample
• Large standard deviation
• Relied on self-reporting for daily session results
  • Worksheet – relied on students to cover while copying
  • iPad – relied on students to copy score correctly
The Flashcards Deluxe app on iPads was as effective as the cover-copy-compare worksheet intervention for increasing math fact fluency.
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• Participants
Questions

• Please contact
  • Megan Johnson
    • Megan.johnson-5@mnsu.edu
  • RaeLynn Lamminen
    • Raelynn.lamminen@mnsu.edu

• List of references also available from first and second author.