Effectiveness of iPad Apps on Visual-Motor Skills Among Children with Special Needs Between 4y0m-7y11m: A Pilot Study

INTRODUCTION
Visual motor integration (VMI) is the skill that measures the efficiency of one's eye-hand coordination in combination with visual perceptual skills. The underlying skills (motor control, visual perception and motor accuracy) significantly affect a child's performance at school. Occupational therapy (OT) can target visual motor integration difficulties in children. In fact, weekly OT has been shown to significantly improve VMI in pre-school students with developmental delay (Cass-Smith, 2002; Danks et al., 2003).

Over the last decade there has been a dramatic increase in research examining the use of various technological devices as intervention techniques for various populations. However, no studies have yet focused on the use of iPads in the development of VMI.

The benefit of the iPad as a therapeutic tool is that it is user-friendly and is a non-stigmatizing technology that is easily transportable for students and therapists, which allows for versatility in the learning environment (Wiley et al., 2014).

METHOD
Design: 1) Experimental 2) Pilot RCT 3) Pre-post intervention

Participants: Clients of the MAB-Mackay Rehabilitation Centre were recruited by 2 pediatric OTs working at the centre. Consent from parents and assent from children age 7+ were collected.

Inclusion Criteria:
- Age: 4y0m to 7y11m prior to July 2014
- Special needs diagnosis
- Client of MAB-Mackay Rehabilitation Centre
- Currently enrolled in academic environment
- Below average score or lower on Beery-Buktenica Developmental Test of Visual Motor Integration 5th edition (Beery VMI)
- Normal hearing or with or without correction
- Ability to sit for 45 min and engage in the session

Exclusion Criteria:
- Visual acuity below 20/200 after correction
- Diagnosis of cognitive impairment

Measures:
1. Beery VMI (VMI subscale)
2. Miller Function & participation scales (visual motor subscale)
3. Intervention Appreciation Scale

Intervention Phase:
- Two 40 minute 1-on-1 sessions per week for 10 weeks
- Occupational therapy student researchers provided the intervention sessions
- Minimum attendance 8, maximum 12 (including evaluations)

DISCUSSION
Positive clinical findings:
- Both traditional OT and iPad intervention have shown gains in VMI skills
- User-friendliness and intuitiveness of the iPad
- Increased engagement and sustained attention throughout the iPad sessions
- Less therapist preparation time needed for iPad sessions
- Portability and mobility of the iPad

Negative clinical findings:
- Decreased social interaction between the child and the student researchers during iPad sessions
- Difficulty in grading the iPad apps compared to activities in traditional OT sessions
- Only paper and pencil assessments were used to evaluate both groups (control and experimental)

RESULTS

Figure 2: Flow diagram of phases of the study

Table 1: Characteristics of participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Median (IQ)</td>
<td>Median (IQ)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Boys (girls)</td>
<td>Boys (girls)</td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>French (English)</td>
<td>French (English)</td>
<td></td>
</tr>
<tr>
<td>Visual motor integration</td>
<td>Exclusion (inclusion)</td>
<td>Exclusion (inclusion)</td>
<td></td>
</tr>
<tr>
<td>iPad</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>OT sessions during study week</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>VMI</td>
<td>Normal</td>
<td>Normal</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Result of the two-way mixed design ANOVA comparing the effects of experimental group vs. control group on the scores of the VMI and M-FUN at baseline and follow-up

<table>
<thead>
<tr>
<th>VMI</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-FUN total</td>
<td>6.603</td>
<td>6.358</td>
<td>0.042</td>
</tr>
<tr>
<td>Amazing maze</td>
<td>12.720</td>
<td>11.480</td>
<td>0.008</td>
</tr>
<tr>
<td>Draw-a-car</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
<tr>
<td>Find the alphabet</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
<tr>
<td>Draw a stick</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
<tr>
<td>Writing</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
<tr>
<td>Go Fishing</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
<tr>
<td>Behave</td>
<td>12.480</td>
<td>11.360</td>
<td>0.018</td>
</tr>
</tbody>
</table>

Table 3: Main effect of time on outcomes measures scores

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experimental Group</th>
<th>Control Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMI</td>
<td>0.070</td>
<td>0.082</td>
<td>0.642</td>
</tr>
<tr>
<td>M-FUN total</td>
<td>6.603</td>
<td>6.358</td>
<td>0.042</td>
</tr>
<tr>
<td>Amazing maze</td>
<td>12.720</td>
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Strengths:
- First study of its kind
- Use of two measures
- Inter-rated all pre and post assessments and all chosen apps

Weaknesses:
- Small sample size for an RCT
- Short intervention phase
- OT students implementing the interventions
- Co-morbidities (e.g. language delays)
- All apps are in English
- No control of external variables

CONCLUSION

Future Directions:
- Larger sample size
- Increased duration and number of intervention sessions
- Stylist
- Effective quantitative and qualitative measures for motivation
- Grading of the apps based on challenge (task analysis)

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- McGill University
- Centre de Recherche en Santé des Populations
- Centre de Recherche en Santé Mentale et Sociale

Significant main effect of time for both control and experimental groups on the development of VMI skills.
- This study supports the need for further research into the use of iPads for the development of VMI skills in the pediatric population.