A Pilot Study Exploring the Potential of the Wii Fit to Improve Motor Skills in Children with Developmental Coordination Disorder

James Hammond, Victoria Jones, Dido Green, Elisabeth Hill, Ian Male
What is Developmental Coordination Disorder (DCD)?

- Marked impairment in motor control
- Not caused by low IQ or a medical condition

Who does DCD affect?

- 2-10% of children between the age of 5-11 years

Why is it important?

- Functional impairment of everyday activities
- Has damaging secondary effects

1 American Psychiatric Association. (1994) Diagnostic and Statistical Manual of Mental Disorders, Category 315.40 Developmental Coordination Disorder (53-55), Washington, DC.
Why is DCD a problem?

1. School
   Poorer academic performance

   *Worse long-term outcome*

2. Home

3. Play

4. Perception of motor ability

5. Attention & psychiatric problems

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Why is DCD a problem?

1. School
2. Home
   - Less Independence
3. Play
4. Perception of motor ability
5. Attention & psychiatric problems

Background
What was this research trying to add?
Method
Results
Conclusions

Why is DCD a problem?

1. School
2. Home
3. Play
   - Isolated
   - Poor peer relations
4. Perception of motor ability
5. Attention & psychiatric problems

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Why is DCD a problem?

1. School
2. Home
3. Play
4. Perception of motor ability
   - Worse than peers
   - Reinforced by societal demands
5. Attention & psychiatric problems

Why is DCD a problem?

1. School
2. Home
3. Play
4. Perception of motor ability
5. Attention & psychiatric problems
   - Lower self-esteem
   - Greater anxiety
   - ADHD more likely
   - Worse outcome

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Existing Interventions:

- Specialist run
- School run
  - Jump Ahead

What is wrong with existing interventions?

- Most interventions have not been formally investigated\textsuperscript{10}
- Professional resources are scarce \textsuperscript{16}
- Waiting lists are long \textsuperscript{16}


\textsuperscript{16} Kirby A(2004) Is dyspraxia a medical condition or a social disorder? The British Journal of General Practice: the journal of the Royal College of General Practitioners, 54, 6-8.
The Wii Fit

- Demonstrated in:
  - Cerebral palsy 17
  - Stroke 18

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Aims:

1. To determine whether regular use of the Nintendo Wii Fit improves **motor proficiency** in children with DCD

2. To determine whether regular use of the Nintendo Wii Fit improves **psychosocial wellbeing** in children with DCD

3. To determine if this intervention is **feasible** in a school environment
Design: cross-over

Approval: IRAS + R & D

Power analysis: 22 participants
**Participants:**
- Children recruited from two Mid-Sussex schools
- Identified as being at risk of functional movement problems
- Between the age of 6-10
- Had to fulfil an inclusion / exclusion criteria
**Screening:**
- 52 children identified
- Teachers completed the DCD-Q
- 15 item screening tool
- 20 children invited to take part
**Background**

What was this research trying to add?

**Method**

Identification of children at risk of DCD

**Screening phase**

Allocation into Group A or B

**Intervention group:**

10 minutes, x3/week, for 4 weeks

**Control group:**

1 hour, x1/week, ongoing

**Method**

Wii Fit (Group A, n=10)

Jump Ahead (Group B, n=9)

**Results**

Pre-trial measures recorded

Measures recorded after Leg 1

Measures recorded after Leg 2
**Background**

What was this research trying to add?

**Method**

**Results**

**Conclusions**

<table>
<thead>
<tr>
<th><strong>Intervention group:</strong></th>
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### Identification of children at risk of DCD

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<th><strong>Screening phase</strong></th>
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</table>

- Pre-trial measures recorded
- Measures recorded after Leg 1
- Measures recorded after Leg 2
Measures:

i) BOT-2 (SF)

ii) CSQ

iii) SDQ
<table>
<thead>
<tr>
<th>Motor Area Composites</th>
<th>Item Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine Motor Precision</td>
<td>Drawing Lines through paths</td>
</tr>
<tr>
<td></td>
<td>Folding paper</td>
</tr>
<tr>
<td>Fine Motor Integration</td>
<td>Copying shapes (square and star)</td>
</tr>
<tr>
<td>Manual Dexterity</td>
<td>Transferring pennies (Number in 15 seconds)</td>
</tr>
<tr>
<td>Bilateral Co-ordination</td>
<td>Jumping in same place</td>
</tr>
<tr>
<td></td>
<td>Tapping feet and fingers</td>
</tr>
<tr>
<td>Balance</td>
<td>Walking forward on a line</td>
</tr>
<tr>
<td></td>
<td>Balancing on a beam (Up to 10 secs)</td>
</tr>
<tr>
<td>Running Speed and Agility</td>
<td>Stationary Hop (number in 15 secs)</td>
</tr>
<tr>
<td>Upper-limb Coordination</td>
<td>Dropping and catching a ball with both hands</td>
</tr>
<tr>
<td></td>
<td>Dribbling a ball</td>
</tr>
<tr>
<td>Strength</td>
<td>Knee push-ups (30 seconds)</td>
</tr>
<tr>
<td></td>
<td>Sit-ups (30 seconds)</td>
</tr>
</tbody>
</table>

**Table 1:** Illustrating the various composites of the BOT-2 Short Form, with examples of each section
Measures:

i) BOT-2 (SF)

ii) CSQ

iii) SDQ

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Ability</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tying shoelaces</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2. Using a knife and fork during mealtimes</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3. Managing paper when using the toilet</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>4. Catching and throwing a tennis ball and kicking a football</td>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

Identification of children at risk of DCD

Screening phase

Allocation into Group A or B

Wii Fit (Group A, n=10)

Jump Ahead (Group B, n=9)

Wii Fit (Group B, n=9)

Jump Ahead (Group A, n=10)

Pre-trial measures recorded

Measures recorded after Leg 1

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Background What was this research trying to add?

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Identification of children at risk of DCD

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Results

Measures:

i) BOT-2 (SF)

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iii) SDQ

Conclusions

Pre-trial measures recorded

Measures recorded after Leg 1

Measures recorded after Leg 2
Background

What was this research trying to add?

Method

Results

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**Statistical analysis:**

1. Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) = *t*-tests
2. Coordination Skills Questionnaire = *t*-tests
3. Strength & Difficulties Questionnaire = *Mann Whitney U Test*

- Identification of children at risk of DCD
- Screening phase
- Allocation into Group A or B
  - Wii Fit (Group A, n=10)
  - Jump Ahead (Group B, n=9)
  - Jump Ahead (Group A, n=10)
- Pre-trial measures recorded
- Measures recorded after Leg 1
- Measures recorded after Leg 2
Demographic results:

- Average age of just over 9 years
- More boys than girls
- The majority of BOT-2’s and CSQ’s were available for analysis
- There was a poor return of SDQ’s

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>M:F</th>
<th>Mean Age</th>
<th>BOT-2</th>
<th>CSQ</th>
<th>SDQ:LEG 1</th>
<th>SQD:LEG 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>10</td>
<td>8:2</td>
<td>8.5</td>
<td>10</td>
<td>10</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Group B</td>
<td>9</td>
<td>6:3</td>
<td>9.7</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>14:5</td>
<td>9.08</td>
<td>18</td>
<td>18</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>
Use of the Wii Fit was associated with a statistically significant improvement in motor proficiency.
Change in motor proficiency (BOT-2 SF)

Comparison of mean scores of each motor area composite at different stages of the study

- FMP = Fine Motor Precision
- FMI = Fine Motor Integration
- MD = Manual Dexterity
- BC = Bilateral Coordination
- B = Balance
- RS&A = Running, Speed and Agility
- ULC = Upper Limb Co-ordination
- S = Strength
Change in self-perceived ability in motor tasks (CSQ)

**Results**

- **Group A**
  - $p = 0.01$

- **Group B**
  - $p = 0.08$

- **Difference across groups**
  - $p = 0.29$
Change in self-perceived satisfaction in motor tasks

A comparison of self-perceived satisfaction at different time points in Group A

A comparison of self-perceived satisfaction at different time points in Group B

p = 0.01 Group A

p = 0.32 Group B

p = 0.75 (Difference across groups)
Change in parental assessment of emotions / behaviour

- Improvement in emotional symptoms, conduct problems, hyperactivity, peer relations and pro-social behaviour

- Differences between groups after Leg 1 of the study: $p=0.06$
Key message:
- The Wii Fit is likely to be an effective intervention tool for improving motor proficiency and wellbeing in children with DCD

Limitations:
- Study design
- Data analysis
- Measures

Future directions:
- Confirming results with a bigger study
- Obtaining funding for a larger study (RfPB bid)
- Development of measurement tools