Number Race as an intensified instruction for low performing children in mathematics in grade one

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Finnish context

- Two official languages in Finland, Finnish (93%) and Swedish (6%)
- Childhood and basic education
  - 0-6 Early childhood education/kindergarten, voluntary
  - 6-7 One year pre-primary education, curriculum, voluntary (96% of children)
  - 7-16 Basic education (primary school, comprehensive school)
- Nearly all children complete the basic education
- Most children attend the public school nearest their home
- Only children with severe special needs attend special classes
Mathematically low performing children in grade one

- The difference between children’s knowledge and skills are wide, already in first grade (Dyson, Jordan, & Glutting, 2011)
- The gap between well and weak-performing children tends to grow wider across the school years (Aunola et al, 2004; Jordan et al, 2007)
- Low-performing children seem to benefit less from the ordinary pre-primary school education than the typically performing children (Aunola et al, 2004)
Computer Aided Instruction (CAI)

- Adaptive computer games and computer aided instruction (CAI) have been used successfully for training mathematical skills (Räsänen, Salminen, Wilson, Aunio, & Dehaene, 2009).

- Computer games generally motivate children and provides intensive training in an entertaining context (Kroesbergen & Van Luit, 2003; Dowker, 2005; Wilson, Dehaene, Pinel, Revkin, Cohen, & Cohen, 2006).

- Compared to teaching by teachers, computer games have shown to be less effective than traditional teaching (Chute & Miksad, 1997; Din & Calao, 2001; Kroesbergen & Van Luit, 2003).
Number Race

- Developed by Anna Wilson and Stanislas Dehaene (2004), originally named *La Course aux Nombres*
- Children play with different number representations, and train basic concepts of numbers and arithmetics
- The game is based on four instructional principles relevant to the remediation of developmental dyscalculia (Wilson, Dehaene, et al, 2006).
- The game is adaptive and varies in three different ways: distance between the numerical representations, speed and response deadline, and the conceptual complexity (Wilson, Dehaene, et al, 2006).
Tal i farten

www.lukimat.fi -> Tal i farten

http://www.thenumberrace.com
Aim of the study

- How does the game Number Race affect low performing children’s mathematical skills?

  - Can Number Race as an intensified instruction increase the mathematical skills of low performing children?

  - How do children receiving intensified instruction develop in their mathematical skills compared to children in the comparison groups?
Method

- **Participants**
  - 321 children in grade one (162 girls, 159 boys)
  - 25 classes, 19 schools from all parts of Swedish-speaking Finland
  - Children’s mean age at autumn assessment were 86.46 months \((SD = 3.89)\)
  - Swedish as native language (82 %) or other (18%) (mainly Finnish)
Procedure

- **Measurement**
  - LukiMat-assessment tool for screening and identifying children at risk in mathematics (available at www.lukimat.fi)
  - An individual paper and pen test, carried out in groups
  - Three measurement points during the school year: autumn, winter and spring
  - Test reliability (Cronbach’s alpha) from .92 (autumn) .95 (winter) to .97 (spring). Alpha > .80 at all measurement points indicating a good reliability
### Areas in the assessment tool LukiMat and number of items

<table>
<thead>
<tr>
<th>Areas in the assessment tool LukiMat and number of items</th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td><strong>Counting Skills</strong></td>
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<tr>
<td>Counting up or back, skip</td>
<td>9</td>
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<td>Number identification, recognition and writing (1 and 2 more/less)</td>
<td>4</td>
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<td>Counting numerosity of a set (Counting part of a whole)</td>
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<td><strong>Basic Arithmetical Skills</strong></td>
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<td>Addition</td>
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<tr>
<td>verbally in a context,</td>
<td>8</td>
<td>12</td>
<td>10</td>
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<td>with symbols</td>
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<td>Subtraction</td>
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<tr>
<td>verbally in a context,</td>
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<td>12</td>
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<td>with symbols</td>
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<td><strong>Mathematical Relational Skills</strong></td>
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<tr>
<td>Seriation, comparison, classification, one-to-one correspondence</td>
<td>16</td>
<td>6</td>
<td>6</td>
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<td>Basic arithmetic principles: additive composition, commutativity, associativity, inversion</td>
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<tr>
<td>Understanding mathematical symbols</td>
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<tr>
<td>Understanding place-value and base-ten system</td>
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<td><strong>Number Sense</strong></td>
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<tr>
<td>Comparing amounts</td>
<td>12</td>
<td>6</td>
<td>6</td>
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<tr>
<td><strong>Applying understanding place-value and base-ten system in counting</strong></td>
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<tr>
<td>Counting sums of money</td>
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<td>6</td>
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</tbody>
</table>

*More than one area in focus

The number mean the number of items

*Note.*
Procedure

- Intensified instruction
  - Number Race (Tal i farten)
  - Conducted individually in school setting by the children's ordinary classroom teacher or special education teacher
  - 3-4 times per week, 15 minutes at a time, and during a period of four weeks (recommendation)
  - During the intervention the teacher was asked to fill in a logbook (date, minutes of playing, notes)
Conclusion of preliminary results

- Number Race as an intensified instruction did not increase the mathematical skills of the children in the instruction group, more than the low performing children not receiving the instruction.
- The game Number Race did not have a significant effect at the instruction groups’ mathematical skills.
- All low performing children improved their skills, but did not close the gap to the well-performing children.

Thank you!
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