Numerical Knowledge of Low- Versus Higher-Income Bilingual Preschoolers

Meghan C. Goldman, James Negen, Tanya D. Anaya, & Barbara W. Sarnecka

Department of Cognitive Sciences, University of California, Irvine

Introduction

• The numerical knowledge that children acquire before kindergarten is the single best predictor of later academic achievement (e.g., Duncan et al., 2007).
• Low-income children enter kindergarten far behind their higher-income peers on a wide range of foundational math tasks (e.g., Jordan, Huttenlocher, & Levine, 1992).
• The number of people who speak a language other than English at home make up 20% of the U.S. population and 43% in California (Shin & Kominski, 2010). However, research on early mathematical learning has not kept up with these changing demographics.
• We compared the numerical knowledge of low-versus higher-income bilingual preschoolers on a variety of math tasks. Higher-income bilinguals were tested in English; low-income bilinguals were tested in Spanish and English (highest score used in analysis).

Participants

Demographic Characteristics

<table>
<thead>
<tr>
<th>Low-Income Group</th>
<th>Higher-Income Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 75</td>
<td>n = 45</td>
</tr>
</tbody>
</table>

- Mean age at first session (yrs; mos): 4.6
- Age range (yrs; mos): 3.5 – 5.6
- Language other than English exposed to at home: Spanish (all), Bulgarian (1), Chinese (24), Farsi (2), French (2), Greek (1), Indian (7), Japanese (1), Korean (4), Ukranian (1), Vietnamese (2)
- Mean percent of time exposed to that language at home: 77% versus 39%
- Income:
  - Under $10,000: 23%
  - $10 – $15,000: 27%
  - $15 – $20,000: 25%
  - $20 – $30,000: 20%
  - $30 – $40,000: 5%
  - $75,000 +: 100%
- Parent Education:
  - Less than H.S. diploma: 56%
  - H.S. diploma / G.E.D.: 24%
  - Technical / Trade school: 4%
  - Some college: 8%
  - College degree: 1%
  - Post-college education: 16%
- No response: 7%

Method

- **Counting Out Loud**: “Lets count to ten. Ready? One, two, three... Now it’s your turn, you count.”
- **Counting Objects**: “Can you show me how you count these?”
- **Give-A-Number**: “Can you give Mr. Leopard three oranges?”
- **Numeral Identification**: “Can you find the number one and put it in its home?”
- **Scaffolded Number Line**: “I’ll give you a number and you put it in its place on the number line.”

Results

- **Counting Out Loud**: 77% versus 100% correctly counted to ten ($\chi^2 (1) = 11.883, p < .001$).
- **Counting Objects**: 87% versus 100% correctly counted the six objects ($\chi^2 (1) = 6.545, p < .05$).
- **Give-A-Number**: 27% versus 84% understood the cardinality principle ($\chi^2 (1) = 37.597, p < .001$).
- **Numeral Identification**: 11% versus 76% correctly identified the written numerals one through ten ($\chi^2 (1) = 69.054, p < .001$).
- **Scaffolded Number Line**: 5% versus 55% correctly placed the numbers one through nine (excluding five) on the number line ($\chi^2 (1) = 37.326, p < .001$).

Discussion

• While the majority of the higher-income bilinguals performed at ceiling on each of the tasks, the performance of the low-income bilinguals varied widely within and between each task.
• Similar to previous studies comparing low-versus higher-income children’s math knowledge (e.g., Jordan, Huttenlocher, & Levine, 1992), low-income bilinguals lagged significantly behind higher-income bilinguals on all of the tasks.
• These findings suggest that income level, more so than language status, affects early math skills. Therefore, low-income bilinguals tend to be behind in early math because they are low-income, not because they are bilingual.

References


Acknowledgments

This material is based upon work supported by the National Science Foundation under DRL 0953521 to Dr. Barbara Sarnecka. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors, and do not necessarily reflect the views of the National Science Foundation.