Using Mathematics Think Alouds: A Field-Identified Teaching Strategy for English Language Learners with Disabilities

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National Center on Educational Outcomes
Welcome and Introduction

Martha Thurlow, Director
National Center on Educational Outcomes
What Do We Know About ELLs with Disabilities?

- An estimated 357,325 students K-12 in 2001-2002
- 9% of all ELLs have disabilities
- Roughly 80% identified with a learning disability or a speech language impairment
- Spanish language speakers highly represented
States Reporting Reading Test Participation and Performance on Regular Assessments

2006-2007

- No data
- Has participation and performance
  (Does not include accommodated data for regular assessment or other language versions)
## One State’s Performance Data

### Students Proficient on Regular Reading Assessment

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade 4</th>
<th>Grade 8</th>
<th>Grade 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td></td>
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</tbody>
</table>
| ELLs with Disabilities | 12%  
(N=585) | 7%  
(N=402) | 2%  
(N=268) |
| All students with disabilities | 42%  
(N=8015) | 22%  
(N=7470) | 18%  
(N=7057) |
| All ELLs | 31%  
(N=5162) | 26%  
(N=3875) | 18%  
(N=3796) |
| All students | 71%  
(N=57,891) | 63%  
(62,927) | 62%  
(N=65,396) |
Kristi Liu
National Center on Educational Outcomes
Our projects funded by the Office of Special Education Programs

Study 1: LEP/IEP Instruction Project (Grant #H324D010023)
- Investigate instructional strategy use for ELLs with disabilities by middle school teachers in one state
- Conduct research on top-weighted strategies in reading and math

Study 2: LEP/IEP Strategies Project (#H324C040171)
- Follow up on results of LEP/IEP instruction project with successful middle school teachers and principals nationwide
Identifying strategies to improve mathematics achievement for ELLs with disabilities
Top weighted strategies according to teachers in one Midwestern state...

<table>
<thead>
<tr>
<th>Content</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math</td>
<td>Tactile, concrete experiences of mathematics</td>
</tr>
<tr>
<td></td>
<td>Daily re-looping of previously learned material</td>
</tr>
<tr>
<td></td>
<td>Problem solving instruction and task analysis strategies</td>
</tr>
<tr>
<td></td>
<td>Teacher “think-alouds”</td>
</tr>
<tr>
<td></td>
<td>Student “think-alouds”</td>
</tr>
<tr>
<td>Reading</td>
<td>Teaching pre-, during-, and post-reading strategies</td>
</tr>
<tr>
<td></td>
<td>Fluency building (high frequency words)</td>
</tr>
<tr>
<td></td>
<td>Direct teaching vocabulary through listening, seeing, reading, and writing in short time segments</td>
</tr>
<tr>
<td></td>
<td>Relating reading to student experiences</td>
</tr>
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<td></td>
<td>Chunking and questioning aloud (reading mastery)</td>
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</tbody>
</table>
Think-alouds

Explaining and teaching the steps of problem solving through self-reflection and review; that is, demonstrating how to say aloud the steps used in problem solving.
Related Research

- Single-subject research with general think aloud procedures for students with disabilities in mathematics (Braten & Throndsen, 1998; Case, Harris, & Graham, 1992; Davis & Hajicek, 1985; Leon & Pepe, 1983;)

- Research on “Self-instructional strategy development” (SI) or “self-regulated learning” (SRL) (Leon and Pepe, 1983; Moore, Reith, & Ebeling, 1993)
# Students in Math Think Aloud Study

<table>
<thead>
<tr>
<th>Student</th>
<th>Grade</th>
<th>Age</th>
<th>Ethnicity/Language</th>
<th>Oral English Proficiency</th>
<th>Reading Level</th>
<th>Math Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>8</td>
<td>15</td>
<td>Hmong</td>
<td>Intermediate</td>
<td>2.5</td>
<td>Low</td>
</tr>
<tr>
<td>T1</td>
<td>6</td>
<td>13</td>
<td>Mexican-American/Spanish</td>
<td>Proficient</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>T2</td>
<td>6</td>
<td>13</td>
<td>Mexican-American/Spanish</td>
<td>Proficient</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>T3</td>
<td>6</td>
<td>12</td>
<td>Mexican-American/Spanish</td>
<td>Beginning</td>
<td>Did not meet standard</td>
<td>Did not meet standard</td>
</tr>
</tbody>
</table>
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Metropolitan State University
Mathematics Think-Aloud Strategy

- Teacher determines the standards-based mathematics concept or skill to learn:
  - Example: representing fractions and their equivalents
- Determine Pre-requisite skills
  - Example: student recognizes part-to-whole relationships, understands key vocabulary terms (numerator, denominator, digit, single digit, two-digit) and symbols (=, /)
  - Conduct Pre-requisite skill assessment (CBM & CBA to verify PrS)
- Teacher modeling of strategy (I do it)
  - Example: “first, I need to [factor the numerator with the denominator to the lowest number, next, I need to [verify that both fractions are equal], finally, I need to [start the next fraction and complete the steps]"
- Teacher and Student use the Mathematics Prompt Sheet to teach/learn the strategy (we do it)
- Student Guided and Independent Practice (You do it)
Monitor and Evaluate Strategy Use, Progress, and Student Check-in

- Use of systematic teaching process
  - Explain what will be done and why
  - Determine and verify vocabulary needed
  - Describe strategy steps
  - Modeling and Prompting of steps
  - Provide exemplars & visuals

- Collect strategy and achievement during instruction & practice

- Provide student opportunities to verify comprehension of strategy and process (student check-in)

- See http://cehd.umn.edu/NCEO/OnlinePubs/ELLsDis16/default.html for published descriptions
Model for Progress Monitoring
(cf. Salvia & Hughes, 1990)

Prepare
• What will you assess?
• How will you assess?

Collect Data
Summarize Data
Organize Data
Display Data
Interpret Data

Make Decisions
Applications for ELLs with disabilities in Group and ESL Settings

- Evidence for use of think-alouds with ELLs in ESL settings
  - Use in conjunction with the CALLA (Chamot, Dale, O’Malley, & Spanos, 1992)
  - A think-aloud procedure was used as a step in preparing for understanding the problem-solving steps, as a guide during problem solving and as a reflective (“retrospective”) process after solving the problem
  - Students with language and mathematics ability challenges (“low ability”) had more difficulty and could benefit from procedures used in our study (cf. Liu, Barrera, & Thurlow, 2009)
References


For additional NCEO research reports on strategies for ELLs with Disabilities, please visit our website: http://www.nceo.info
Go to “publications” and look for “ELLs with Disabilities” series