

The discourse of mathematics assessments

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Overview

- Background
 - Mathematical language and the discourse of mathematics
 - ELLs and mathematical language
 - The discourse of testing
- Methods
 - 107 released 4th and 8th grade mathematics items
 - Analyzed *task demand*
- Findings
 - Endophoric references
- Implications
 - Testing discourse (referential structure)
 - Cognitive lab protocol
- Conclusion

Mathematical language and ELLs

- Mathematical language
 - Halliday (1975)– mathematics as a register
 - Pimm (1987)– mathematics and metaphor
 - O’Halloran (1999)– mathematics as a multisemiotic subject
 - Schleppegrell (2007)– mathematics and language (things vs processes)
- ELLs and Mathematical language
 - Mathematized language (Dominguez, 2008; Irujo, 2007; Ron, 1999)
 - *begins with everyday language, which is acquired naturally through social interaction. Mathematized language is similar to everyday language, but makes the mathematical concepts that are present in the everyday language explicit*
 - Language as *action*

The discourse of testing

- O'Connor (2006)– testing as a communicative situation
- Schiffrin (1987)– *coherence* as emergent
- Eco (1979)– the model reader
- Bauman (2009)—functional item classification

Functional organization of an item

On Saturday 789 people went to the zoo. On Sunday 983 people went to the zoo. How many more people went to the zoo on Sunday than on Saturday?

- A) 194
- B) 204
- C) 206
- D) 1,772

Domain: Arithmetic Subtraction

Item Perspective: contrast between two numbers in respect to their difference in value

Situation: Attendance at zoo on two successive days

Item Demand: “How many more...?”

Response Space: multiple-choice

Response: calculated value

ELLs and the discourse of testing

- *Celedon-Pattichis (1999)—some successful students ignored words irrelevant to the task demand; less successful students attempted to “figure out” such words (difficulty: unsupported key words impede accessibility to the task demand – in example “zoo” is irrelevant)*
- *Lager (2004)—English learners often misinterpret what a task is asking and set about trying to solve the wrong problem (difficulty: item likely does not provide sufficient support for building the item perspective – likely problem would be the phrase “How many more”, which cues a positive difference & implies a subtraction)*
- *Schleppegrell (2007) —students may have difficulty identifying what the problem is about before they even begin to attempt calculations (difficulty: contextual situation does not facilitate identification of the item construct/perspective—in example situation does not cue the requested subtraction)*
- *de Oliveira and Buckley (2007)—ELLs can experience difficulty with low level cognitive items because of linguistic complexity (difficulty: key vocabulary is not within ELLs background knowledge and item provides lack of contextual support for task demand—in example, the syntax of task demand likely impedes access; could be restated as “More people went to the zoo on Sunday than on Saturday. How many more went on Sunday?)*

Methods: Analysis of mathematics test items

- 107 released mathematics items
- 4th and 8th grade tests (NAEP 2007)
- Analyzed discourse *task demand* using Atlas.ti
- Considered both text and graphic components as referential sources of information
- Looked specifically at endophoric references to the task demand:
 - Anaphoric references—precede task demand
 - Cataphoric references—follow task demand
 - Dual references—both precede and follow
 - Embedded—referent and co-referent both in task demand

Results

- 128 demands in 107 items
 - Syntactic types of task demands
 - 77% interrogative
 - 22% imperatives
 - 1% incomplete statements
 - Endophoric references
 - Anaphoric (50%)
 - Cataphoric (13%)
 - Dual (10%)
 - Embedded (5%)
- Laura, does this not add to 100% because some items don't have any co-referent?

Implications for cognitive lab protocol

■ Language of mathematization

- Think aloud protocol to investigate students' language **processing** and reasoning strategies in solving mathematics problems
- Compare students' language **register confusions** (everyday vs. mathematical)
- Compare students' problem solving strategies (translation, skipping words, etc.)

■ Discourse components

- **choose items based on discourse structure**
- Ask students to identify *discourse components* of items (task demand, domain, situation, response)
- Compare students' identification of *discourse components* in **ONPAR** vs. traditional forms

Laura, How does the planning for new cl's tie to the previous analysis?

Laura, Having trouble with 1st point. Also you haven't mentioned ONPAR in the ppt so far.

Conclusion: Promising directions

- Results from ONPAR science cognitive labs
- ELLs and traditional items
- ELLs and ONPAR items