

Diversity and Equity: Assessment Challenges and Examples for English Learners

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Assessing Content Mastery of English Learners in Mathematics: Basic Claim

Excessive linguistic complexity in mathematics word problems functions as a threat to the validity of test scores for ELs, therefore as a potential source of bias (August & Hakuta, 1997; Abedi & Lord, 2001, Martiniello, 2007, 2008).

Research on Text Complexity, Differential Item Functioning (DIF) and Think-Alouds

- What are the linguistic (syntactic and lexical) features of items showing large difficulty differences favoring non-ELs over ELs with equivalent mathematics proficiency?
- What comprehension challenges do these linguistic features pose to ELs with different levels of English Language Proficiency?

Linguistic Features of DIF Items

SYNTACTIC

- Complex **multi-clausal** sentences
- Long noun phrases

LEXICAL

- **Unfamiliar** words and phrases (non-mathematical)
- **Polysemy** (words with different meanings)
- **Home-related vs. School-related** words
 - words or particular meanings of words not likely to be learned by ELs in their schooling in **English** (Martiniello, 2007, 2008, Martiniello & Wolf, 2010)

Features of DIF items

CONTEXT

- **Cultural references** and background knowledge

NON-LINGUISTIC

- Item layout
- Absence of non-linguistic **schematic representations**

(Martiniello, 2008, 2009)

Examples from State Assessments

Unfamiliar Vocabulary (School-related vs. Home-related words)

Source: Massachusetts Department of Education (2003) MCAS Test Grade 4 (items 8 and 30)

30

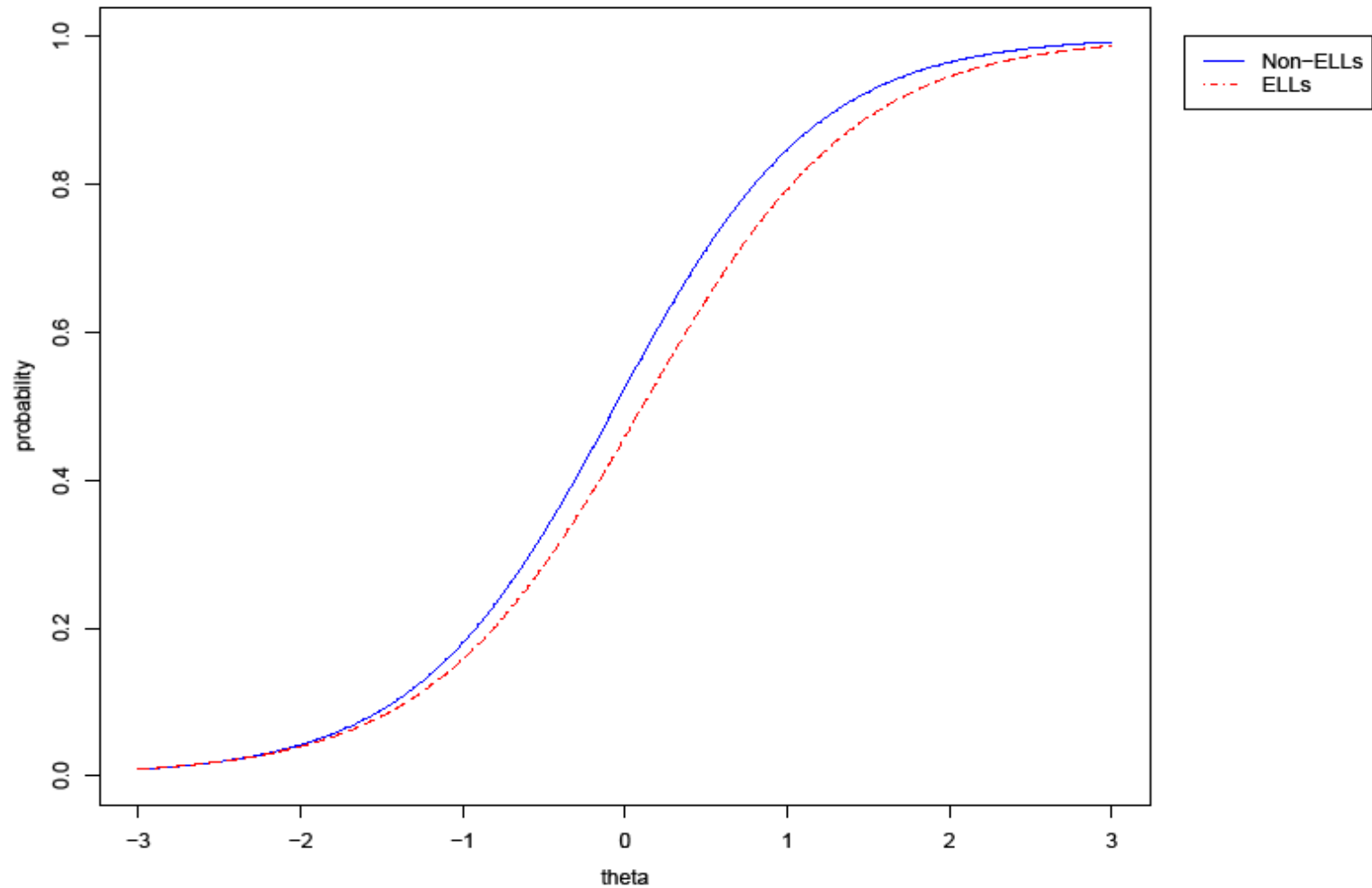
Mr. Garcia gave each of his students a notepad, a pencil, and a ruler on the first day of school. The chart below shows the different colors of the notepads, pencils, and rulers.

Colors of Notepads, Pencils, and Rulers

Notepads	Pencils	Rulers
Yellow	Red	Green
White	Blue	Purple
	Orange	

How many different combinations of 1 notepad, 1 pencil, and 1 ruler can Mr. Garcia make?

Item Characteristic Curve Item 30 ICC



8

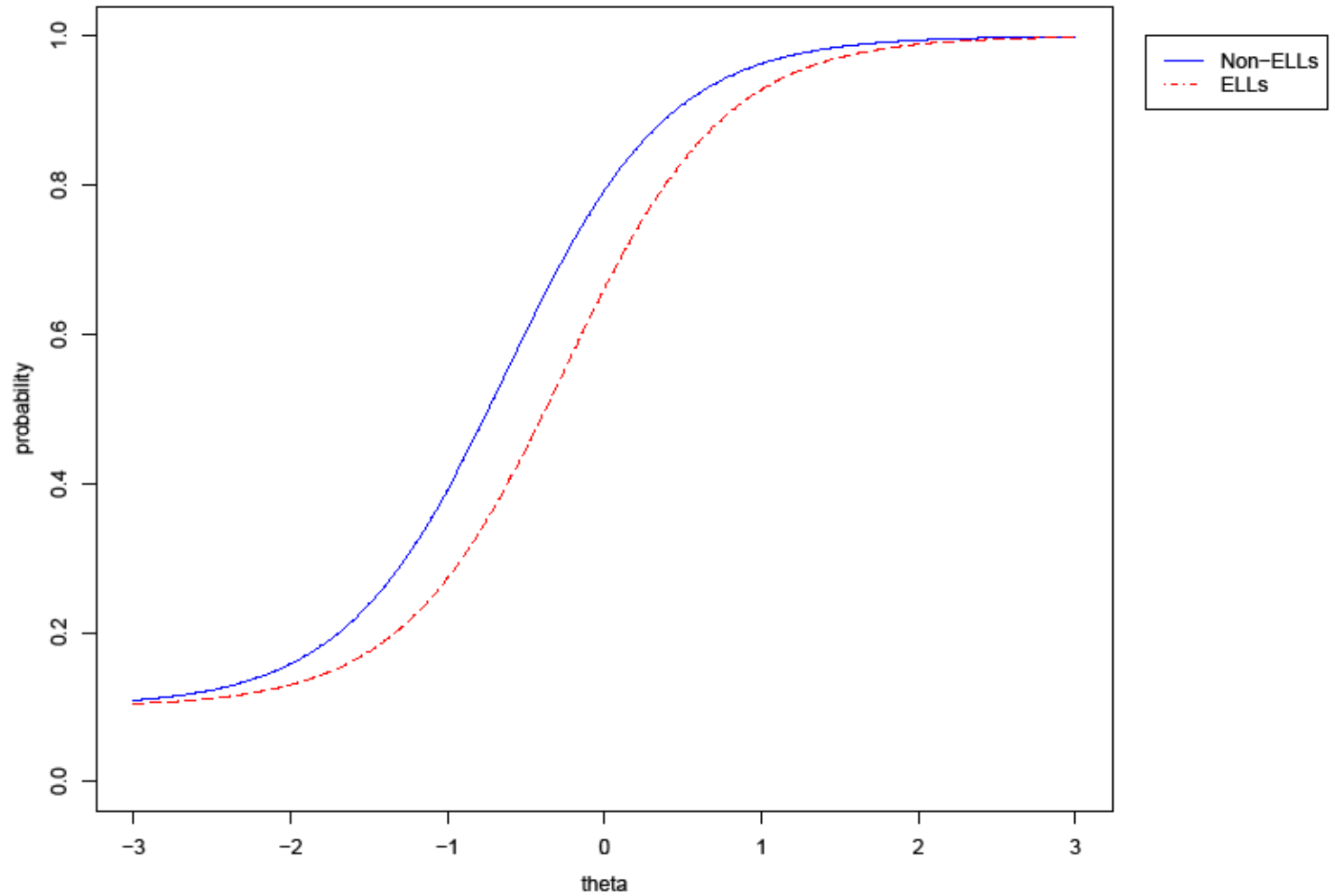
Every Saturday in the fall, Martin has to do 1 inside chore and 1 outside chore. The chores are listed below.

Inside Chores	Outside Chores
vacuum	rake
wash dishes	weed
dust	

How many different combinations of 1 inside chore and 1 outside chore can Martin make?

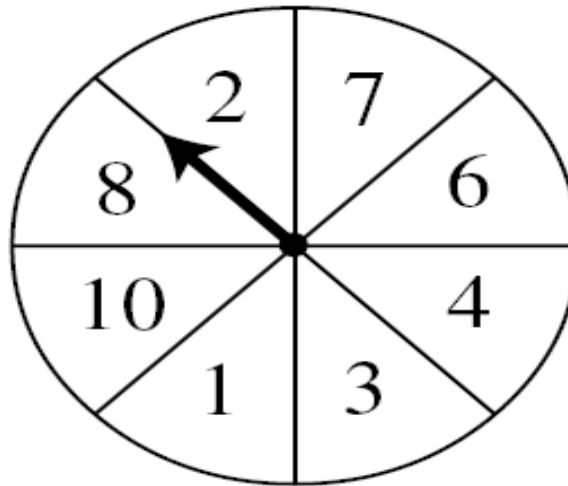
- A. 3
- B. 5
- C. 6
- D. 9

Item Characteristic Curve Item 8 ICC



2

To win a game, Tamika must spin an even number on a spinner identical to the one shown below.



Are Tamika's chances of spinning an even number certain, likely, unlikely, or impossible?

- A. certain
- B. likely
- C. unlikely
- D. impossible

Polysemy and Syntactic Ambiguity

Polysemy:

The word *ONE* has different meanings depending on context

spinner identical to the one shown below

Here ONE is a **pronoun** replacing the word SPINNER

spinner identical to the spinner shown below

But, ONE also means the **numeral 1**

In think-aloud interviews, most ELs interpret ONE as the #1

Item Layout and Syntactic Relationships

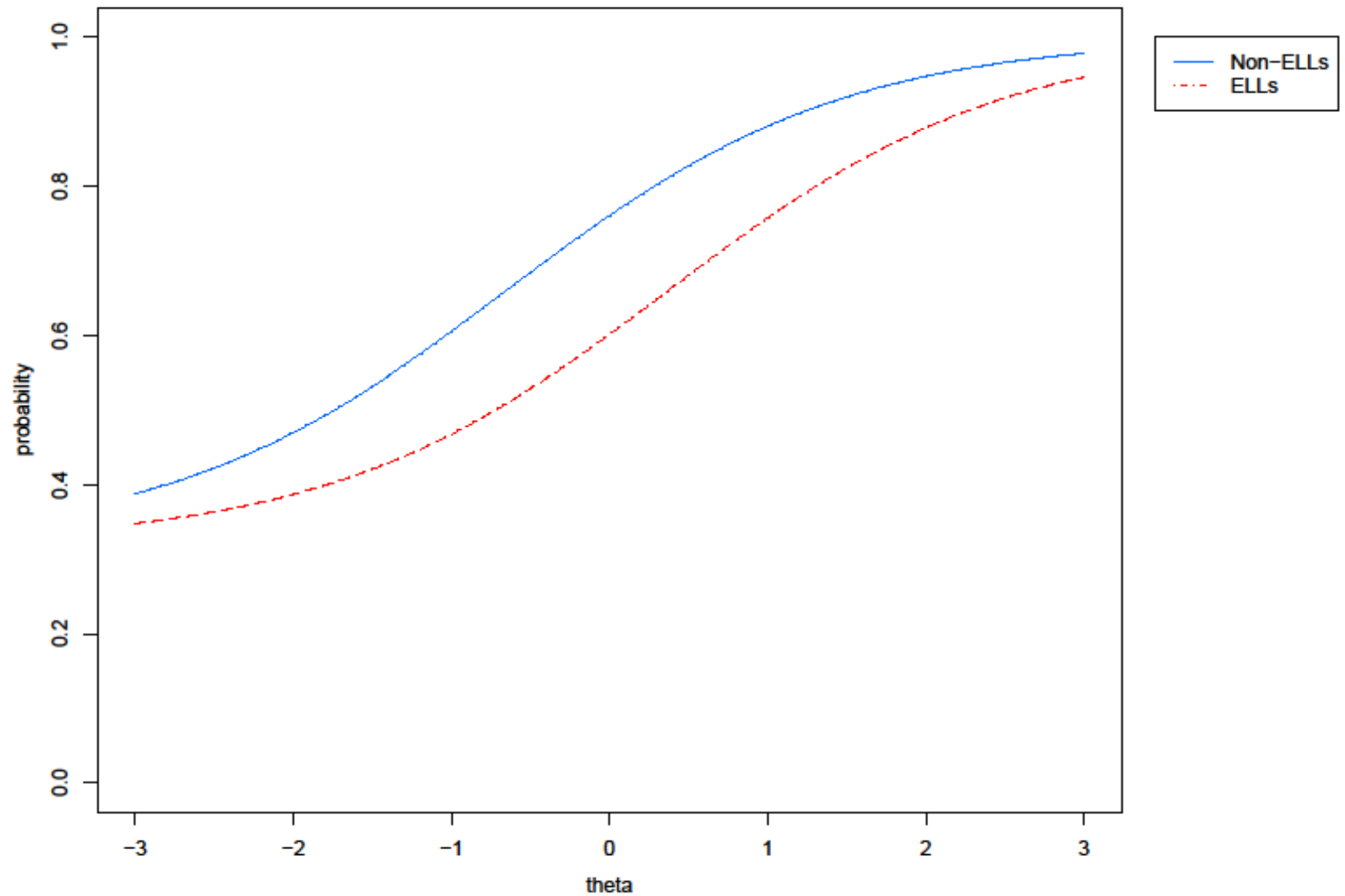
Actual Item Layout

To win a game, Tamika must spin an even number on a spinner identical to the one shown below

This is clearer

To win a game,
Tamika must spin an even number
on a spinner identical to the one shown below

Item Characteristic Curve Item 2 ICC



Examples from State Assessments

Cultural References and Background Knowledge (COUPON, RAISED)

Source: Massachusetts Department of Education (2003) MCAS

Coupon for \$1.00 off

► **5** Miguel wants to buy 3 bags of potato chips. Each bag of potato chips costs \$2.69. If he uses a coupon for \$1.00 off the price of one bag, how much will Miguel owe for the 3 bags of potato chips?

A. \$1.69

B. \$3.72

C. \$7.07

D. \$8.07

Polysemy: Raised for a shelter

- 18** The pictograph below shows the amount of money each fourth-grade class raised for an animal shelter.

Amount Raised by Each Class

Class	Amount Raised
Ms. Smith	
Mr. Powell	
Ms. Carly	
Mr. Roper	

If Mr. Powell's class raised \$20 and Mr. Roper's class raised \$30, how much money does one  represent?

- A. \$1
- B. \$4
- C. \$5
- D. \$20

Implications for Testing

- **Test construction**

- Avoid unnecessary linguistic complexity not relevant to mathematics
- Refine linguistic complexity measures to include issues particular to ELs
(e.g. school vs. home vocab, polysemy, familiarity vs. frequency)
- Thorough item review by EL experts

- **Test analysis/validation**

- Differential Item Functioning DIF studies for ELs
- Routine use of Think-aloud protocols
 - Further validity research

References

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