English Language Learners, Large Scale Assessment and Mathematics: A Literature Review

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TESL Ontario Conference
Oct. 29th 2011
Outline for the Presentation

~ Short Activity to get to know Each Other
~ What are the Teacher Candidates saying?
~ What are the Curriculum Documents are saying?
~ What are the Researchers are saying?
~ Math time!
~ What are your Pet Peeves when Teaching Math to English Language Learners?
~ What can we do as teachers?
~ For Teachers who are going through the EQAO…
Just To Learn More About You...

Stand up if...

1) You work with English Language Learners
2) You work with English Language Learners in Ontario Public or Private Schools.
3) You help English Language Learners with Math.
4) You love Math.
5) You get frustrated with the Math while helping the English Language Learner.
Advantages
~ ELL’s learn to adapt in the mainstream schooling in Canada
~ They are generally “pretty smart” in Math
~ Mathematics is easy for ELL’s to express themselves since Mathematical Language is very simple

Disadvantages
~ Mathematics teachers are the first mainstream teachers ELL’s meet.
~ There is still a language barrier with teacher, students and ELL that are below level 3.
~ Hard to identify other learning disabilities
According to NCTM 1994…
(Position Statement on Language Minority Students)
“Cultural background and language must not be a barrier to full participation in mathematics programs preparing student for a full range of careers. All students regardless of their language or cultural background must study a core curriculum in mathematics based on the NCTM standards”
Teachers of mathematics must incorporate appropriate strategies for instruction and assessment to facilitate the success of the ESL and ELD students in their classrooms. These strategies include:

- **modification** of some or all of the course expectations, based on the student’s level of English proficiency;

- **use of a variety of instructional strategies** (e.g., extensive use of visual cues, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions; modelling of preferred ways of working in mathematics; previewing of textbooks; pre-teaching of key specialized vocabulary; encouragement of peer tutoring and class discussion; strategic use of students’ first languages);

- **use of a variety of learning resources** (e.g., visual material, simplified text, bilingual dictionaries, culturally diverse materials);

- **use of assessment accommodations** (e.g., granting of extra time; use of alternative forms of assessment, such as oral interviews, learning logs, or portfolios; simplification of language used in problems and instructions).
Students who are no longer taking ESL or ELD courses may still need program adaptations to be successful. If a student requires modified expectations or accommodations in a mathematics course, a checkmark must be placed in the ESL/ELD box on the student’s report card (see Guide to the Provincial Report Card, Grades 9–12, 1999).
Mathematics is a technical subject that contains unique patterns of vocabulary and grammar; it contains technical (mathematical) vocabulary such as difference, fractions, and derivatives.

However, a mathematical problems may contain words that have different meanings within the context of mathematics such as place, product and significance.

Educators may recognize technical vocabulary but may be unaware of grammatical patterns that construct complex relations and may confuse ELLs (Schleppegrell, 2007) (for example, the different meaning of significance and statistical significance).
According to theories and practice in linguistics, *language register* defines meanings of words and sentences that serve a particular function in language.

Cuevas (1984) defined *mathematics register* as the specific meanings that belong to the mathematical language. Mathematics register is more precise than the natural English language, and uses grammatical structures and styles to convey concise mathematical knowledge.
What are the Researchers saying?

There is a common misconception that mathematical language is a universal language due to the use of numbers and symbols. (Wright & Li, 2008)

The literature suggests that when ELLs are first learning mathematics, the mathematical vocabulary used can create difficulties as the ELLs’ second language learning is still slowly developing. This suggests that ELLs are learning two languages simultaneously: mathematical language alongside with English language (Cuveas, 1984).
Barwell, Leung, Morgan and Street (2002) noted that there are differences between taught and written mathematical language in the context of the classroom. This suggested that oral mathematics instruction does not lead to a full understanding of written mathematics.

Mathematics teachers are not expected to act as ESL teachers, but rather as teachers of the language of mathematical concepts and skills. As a result, it has been suggested that the academic language used in materials and discussions in mathematics classrooms work to increase the difficulty ELLs have learning mathematics (Cuevas, 1984).
Aiken (1970) argued that measures of students’ perceptions, attitudes and beliefs about mathematics have been difficult to develop and may not be valid. Aiken (1970) reviewed a series of articles and concluded that there are many influencing factors that may affect a students’ perception of mathematics such as: (a) age, (b) sex, (c) achievement, (d) ethnic background, (e) personality, (f) parental influences, (g) social factors, (h) gendered differences in interests, (i) anxiety, and (j) intellectual factors.

Cultural differences may also influence perceptions of education for students from different ethnic backgrounds (Stigler & Hiebert, 1999)
Write these mathematical expressions into sentences:

1) $x > 15$

2) $f(x) = x^2 + 2x + 1$

(Wright & Li, 2008)
Welcome to grade 5 KSL (Korean as Second Language) math class!

문제:
1. 사각형의 가로가 오센티이고 세로가 사센티일때 사각형의 넓이를 구하시오.
2. 삼각형의 가로가 팔센티이고 높이가 육센티일때 삼각형의 넓이를 구하시오.

(Lee, 2010)
What if the questions were..

From
문제:
1. 사각형의 가로가 오센티이고 세로가 사센티일때 사각형의 넓이를 구하시오.
2. 삼각형의 가로가 팔센티이고 높이가 육센티일때 삼각형의 넓이를 구하시오.

To
문제:
1. Rectangle의 가로가 5cm이고 세로가 4cm일때 사각형의 area를 구하시오.
2. Triangle의 가로가 8cm이고 높이가 6cm일때 삼각형의 area를 구하시오.

(Lee, 2010)
And the concepts were...

정리:
• 사각형의 area는 length와 width의 곱과 같다
• 삼각형의 area는 base와 height를 곱한 다음 2으로 나눈 값과 같다.

답: 1.                                    2.

(Lee, 2010)
Or even better...

1. 4cm  
   5cm  
   Area?

2. 6cm  
   8cm  
   Area?

(Lee, 2010)
Because of a lack of familiarity with test format, ELLs may need additional time to become familiar with the test format before they are able to understand the test given (Solano-Flores, 2006).

The wording of items in mathematics has a major influence on ELLs’ comprehension and ability to perform well on those mathematics tests (Staub & Reusser, 1995).
What are your Pet Peeves about teaching Mathematics to English Language Learners?
Other Modification and Accommodations...

~ Reword Your Questions,
   - Instead of Enclosing -> Use Surrounding
~ Word Walls in Your Mathematics Classroom
~ Put brackets for Keywords in Math Notes, giving definition or space for your ELL to write it in your language
   - Let your ELL’s share how to say it!
   (Many Roots, Many Voices, Ontario Ministry of Education 2004)
~ Write Word Problems that might related to ELL’s
~ Use a variety of assessment
In Ontario, large-scale assessments are administered by the Education Quality and Accountability Office (EQAO) to test students at different ages on skills of numeracy and literacy, as well as to document and track the achievements of students over time.

These provincial assessments include Grades 3 and Grade 6 reading, writing and mathematics, Grade 9 mathematics, and the Ontario Secondary School Literacy Test (OSSLT) in Grade 10.
Performance gaps between ELL and non-ELL students are apparent from previous documented results of the EQAO mathematics tests for all grades and in the Ontario Secondary School Literacy Test (OSSLT) (Cheng et al., 2007).

For the Grade 9 Mathematics test, level 2 is equivalent to a minimum pass in the Ontario mathematics curriculum.
Abedi, Leon, and Mirocha (2003a) compared internal consistency coefficients (Cronbach’s alpha) of ELLs and non-ELLs in the Stanford 9 (formerly known as the SAT 9) test data. The results indicated a gap in the reliability and validity coefficients between the two groups, which decreased as the level of language demands of the assessment were reduced. The average Cronbach’s alpha for the listed subject disciplines were .808 for non-ELLs and .603 for ELLs (Abedi et al., 2003a). The alpha values were .898 for non-ELLs compared to .802 for ELLs in mathematics assessments. The differences in internal consistency indicate that language factors may be a source of measurement error hindering the performance of ELL students (Abedi et al., 2003a).
Let’s try simplifying some math questions....
Some Hints/Suggestion from the Literature…(Abedi, 2006)

1. Word Frequency and Familiarity
2. Word Length
3. Sentence Length
4. Voice of Verb Phrase
5. Length of Nominals
6. Complex Question Phrases
7. Comparative Structures
8. Prepositional Phrases
9. Sentence and Discourse Structure
10. Subordinate Clauses
11. Conditional Clauses
12. Relative Clauses
13. Concrete vs. Abstract or Impersonal Presentations
14. Negation
References


Thank You For Your Afternoon!

Questions?