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Teaching and Learning of Word Problems in Beginning Algebra

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Teaching and Learning of Word Problems in Beginning Algebra

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NIGERIA: Where we are

- Challenges in Education:
  Regional gaps; large population; multi-language; basic education

- Mathematics education: Core subject; students’ poor performance and negative attitude; large classes; heavy teacher workload
• Algebra: 'Gateway' and 'Language' of higher mathematics (Kieran, 1992; Fearnley-Sanders, 2000)
• Introductory aspects: Variables; Expressions; Equality; Functions; Graphs
• Difficulty in transition from arithmetic (Goldin, 2008; Herscovics & Linchevski, 1994)
• Misconceptions & Errors (Clement, 1982; Stacey & Macgregor, 1997; Reed, 1999)
Beginning Algebra

- **Algebra misconceptions**
  - Letter, especially as a word or object
  - Confusing products and sums
  - Equality

- **Newman language-based error analysis**
  - Read aloud the question
  - Understand specific terms and general meaning
  - Transform words to suitable representation
  - Process representation mathematically
  - Write the answer
Purpose and Research Questions

- The study describes how word problems are taught in beginning algebra and the difficulties experienced by Year 7 students. It also examines the impact of a teacher professional learning intervention on classroom practices and students’ success in solving algebraic word problems.

1. How are word problems in Year 7 Beginning Algebra class taught in public schools?

2. What difficulties do students in Year 7 experience in solving beginning algebraic word problems and are they different from difficulties teachers perceive students would have?

3. How does a teacher professional learning intervention programme impact on Year 7 classroom teachers’ beliefs, knowledge and practice?

4. How does the teacher professional learning intervention programme impact on students’ difficulties and success in solving algebraic word problems?
Significance

- New knowledge about the adaptation of Newman procedure for general use in classroom.

- Identification of language process errors in solving algebraic problems in a West African country - Nigeria.

- Filling the gap of limited literature about professional learning focused on teacher’s knowledge of students’ thinking and misconceptions in beginning algebra.

- Findings will inform stakeholders for a better preparation of pre-service mathematics teachers and provide a platform for teacher professional learning.
Conceptual Framework

Professional learning

- Teachers’ PCK
- Teachers’ beliefs

Teachers’ Practice

- Students’ engagement in learning

- Students’ knowledge of algebra and its representational forms

Successful algebra problem solving

- Students’ beliefs
Stages of data collection

- **Pre intervention**
  - Pilot study
  - General survey (n=30)
  - 4 Case Studies: Observations, Pre-test, Interviews

- **Professional learning Intervention program**
  - Rating of students’ algebra questions (n=12)
  - Students’ beginning algebra misconceptions
  - Language-based approaches

- **Post intervention**
  - 4 case studies: Observations, Post-test, Interviews
  - Focus group interview, debriefing session (n=12)
### Initial Findings: Professional Learning

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<thead>
<tr>
<th>Rating of algebra questions</th>
<th>Mathematics-Algebra</th>
<th>Language –based approaches</th>
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<tr>
<td>All symbolic questions were rated easier than word problems and the most difficult symbolic questions were equations with inverse</td>
<td>Most teachers had wrong solutions to the two word problems resulting from misconceptions about the letter and reversal error</td>
<td>Newman language-process error analysis procedure reported to be the most successful approach</td>
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<td>The most difficult word problem involved only knowledge of the letter as a quantity</td>
<td>Unaware of some misconceptions initially but during PL, they corrected their errors on the word problems</td>
<td>Use of simple language, familiar words and revoicing were other reported successful approaches</td>
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<td>Word problems with two variables were mainly rated as adequate</td>
<td>Students’ difficulty perceived to mainly relate to their inability to interpret the word problem</td>
<td>Use of group-work and wait time were difficult due to class size</td>
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Thank you for listening