Mathematics Education and Language Diversity: From Language-as-Problem to Language-as-Resource

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Why is language important for Mathematics teaching and learning?

Poor performance by multilingual learners cannot be solely attributed to the learners’ limited proficiency in the language of teaching and learning (suggesting that fluency in the LoLT will solve all problems) in isolation from the pedagogic issues specific to mathematics as well as the wider social, cultural and political factors that infuse schooling. (Setati, 2012)
Central to research in this area of study is a need to address the uneven distribution of knowledge and success in mathematics.
A Country of Eleven Official languages

- It encourages and recognises multilingualism as a resource
- Learners (i.e. their parents) are to choose their preferred language of learning upon admission to a school.
- Where a certain language is not available, a request for the provision of instruction in the chosen language can be made to the provincial education department
- Schools also have to choose a language of learning and teaching mathematics
- School Governing Bodies are required to state explicitly their plan to promote multilingualism
Multilingualism is not a disadvantage

- Multilingualism does not impede mathematics learning (e.g. Clarkson, 1992, 2007; Dawe, 1993; Zepp, 1982)
- Learners’ home language(s) are a resource for learning mathematics (e.g. Adler, 2001; Khisty, 1995; Moschkovich, 1999, 2005; Setati, 1998, 2005)
- Children in multilingual education tend to develop better thinking skills compared to their monolingual peers (e.g., Bialystok, 2001; Cummins, 2000; King & Mackey, 2007).
- All these studies were framed by a conception of language as a tool for thinking and communication.
But language is political

• Language was central to the ideology of apartheid in South Africa
  – It was used to classify, segregate, and polarize South Africans
• The deliberate underdevelopment of the African languages during apartheid was part of the larger social-engineering project
• The language of learning and teaching issue was a dominating factor in opposition to the apartheid system of Bantu Education
The political role of language

• Language has implications for how ‘social goods’ are or ought to be distributed (Gee, 1999).
  – Social goods’ are anything that a group of people believes to be a source of power, status or worth. e.g. mathematics and English.

• When people speak or write they create a ‘political’ perspective
  – they use language to project themselves as certain kinds of people engaged in certain kinds of activity (Gee, 1999).

Decisions about which language to use, how, and for what in multilingual mathematics classrooms are not just pedagogic but also political (Setati, 2008)
Research shows that despite what policy says,...

• Teachers in black African schools in SA prefer to teach mathematics in English (Setati, 2008)

• Learners in black African schools in SA prefer to be taught mathematics in English, a language that they are still learning, despite their limited fluency in it
  – They want access to social goods such as jobs, higher education, etc. (Setati, 2008)

• Debates on language and mathematics teaching and learning tend to create dichotomies that are not helpful.
Why the seeming disconnection between research and practice?

• Research on language and learning is framed by a cognitive perspective
• Language preferences of teachers and learners in black African schools who prefer English are informed by the socio-political realities of their context

Language is not benign it is a product and carrier of power. (Bourdieu and Wacquant, 1992)
Multilingual Policy and Monolingual Practice

- Not all languages are equally “powerful”
  - The hegemony of English is an international phenomenon
- Enforcing purist home language or English only monolingual teaching at any level of education is not consistent with multilingual policy and can be seen as discriminatory
  - In the case of home language monolingual teaching, it suggests that if you have money then you can buy access to English
  - Access to English means access to social goods such as higher education, jobs, international opportunities, status, etc.
  - In the case of English only monolingual teaching, it suggests that African learners are not allowed to be who they are.
Language as a problem creates dichotomies

• Debates on language and mathematics teaching and learning tend to create dichotomies:
  – Teaching in English versus teaching in the learners’ home languages;
  – Focusing on developing learners’ fluency in English versus on their mathematics proficiency;
  – Seeing the use of the learners’ home languages during teaching and learning as a commitment to the development of African languages and the use of English as being against the development of African languages.
    – Seeing the use of the learners’ home languages during teaching and learning as deolonisation and the use of English as being colonised.
• These dichotomies create an impression that the use of the learners’ home languages and the use of English are or must be in opposition.
A multilingual policy calls for a holistic view of multilingual learners

• A multilingual is not a sum of two or more complete or incomplete monolinguals.

• A multilingual is like a high hurdler who blends two types of competencies: that of high jumping and that of sprinting.

• The coexistence and constant interaction of the many languages in the multilingual has produced a different but complete language system.
A Case for a Multilingual Approach to Mathematics Teaching and Learning

• Given the hegemony of English,
  – How can we teach mathematics in multilingual classrooms to ensure that learners are sufficiently challenged mathematically & interested in learning mathematics?
  – How can we draw on the learners’ home languages to ensure a focus on developing mathematical proficiency while learners are still developing fluency in English
  – How can we draw on the diversity of languages present in our classrooms (English and the learners’ home languages) to provide the language support that learners need?
Theoretical underpinnings

• A holistic view of multilingual learners, which is different from a monolingual view which regards multilingual learners as a sum of two or more complete or incomplete monolinguals.

• An understanding of language as a resource
  – For a resource to be useful it needs to be both visible and invisible (Lave and Wenger, 1991).
    • **Visibility** is in its presence and the form of extended access to mathematics it provides
    • **Invisibility** is in the form of unproblematic interpretation and integration of language(s) used
    • For e.g., the use of technology in mathematics teaching and learning.
Principles that should guide a multilingual approach to mathematics education

1. The deliberate, strategic and proactive use of the learners’ home languages.
   – unlike code-switching, which is spontaneous and reactive.
   – English and the learners’ home languages operating together and not in opposition.
   – All written texts are given to learners in two languages (home language and English).
   – learners are explicitly encouraged to interact in any language they feel comfortable with.

2. The use of interesting and challenging mathematical tasks,
   – Through this, learners would develop a different orientation towards mathematics and would be more motivated to study and use it.
What this multilingual approach is NOT about

• Developing mathematics terminology in African languages
  – While the development of mathematics terminology in African languages is important, teaching should not be used for that.
  – It is about using language as a transparent resource to make mathematics accessible to multilingual learners
  – It attends to the challenge of comprehension rather than of terminology.

• Developing learners’ fluency in English or their home languages
  – While fluency in both languages may develop, that is not the goal
  – It is about developing the learners’ mathematical understanding and proficiency

• Teaching solely in African languages
  – While this is desirable it is not feasible at this stage given the hegemony of English and the low socio-cultural capital associated with African languages.
How it works

• All written texts are in both English and the learners’ home languages.
  – Textbooks, tasks, tests and exams (Afrikaans learners already have this advantage!)
• During teaching learners are explicitly encouraged to communicate in any language they feel comfortable with.
• Selection of tasks is key
  – They must be clearly focused on what the teachers wants learners to know and do
  – They must be of varying quality
• Teacher pays attention to building mathematical communication.
• Focus on communicating mathematically rather than English or home language fluency
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= Matšatši a pula

Look at the calendar. Answer the questions.

1. Which month has the most rain?
2. Which month has the least rain?
3. Which months have the same amount of rain?
4. How many more days does it rain in February March?
5. How many days does it rain in September and October altogether?
6. Which month has 20 days of rain?
Mandla’s cinema hall can accommodate at most 150 people for one show.

a) Rewrite the sentence above without using the words “at most”.

b) If there were 39 people who bought tickets for the first show, will the show go on?

c) Peter argued that if there are 39 people with tickets then Mandla should not allow the show to go on because he will make a loss. Do you agree? Why?

d) What expenses do you think Mandla incurs for one show?

e) Use restrictions to modify the statement above in order to make sure that Mandla does not make a loss.

f) If Mary was number 151 in the queue to buy a ticket for the show, will they accommodate her in the show? Explain your answer.
Learners’ reflections

Interviewer: I understand this week you had visitors in your class, what was happening?

Sindiswa: Er..., we were learning a lesson in which we can calculate electricity er .... amount ... er ... the way in which the electricity department can calculate the amount of electricity unit per household.

Nhlanhla: We were learning about how to calculate ...er...er... kilowatts of the electricity, how do we ... like ... how can we calculate them and when ... at ..., Besifunda mem ukuthi ugesi udleka kakhulu nini.

[We were learning about when there is high electricity consumption.]

Colbert: Er ...we were just solving for electricity, kilowatt per hour, for comparing if they are using card or the meter, which is both, I think are the same.
Interviewer: What ... what was so special about the lessons?
Sindiswa: It does not include those maths ... maths. It is not different, but those words used in Maths didn’t occur, didn’t occur but we weren’t using them. ... Er ... ‘simplifying’, ‘finding the formulas’, ‘similarities’, ...

Nhlanhla: Hayi, no mem, ku-different... Okokuqala mem, ilokhuza, la sidila ngama-calculation awemali, manje ku-maths asisebenzi ngemali.

[No mam, it is different. Firstly mam, we were working with money and usually in maths we do not work with money.]

Colbert: Iya, basenzele in order to ... ukuthi ibe simple and easy to us, because most of people, uyabona, aba-understendi like i ... like i-card ne meter. Abanye bathi i-meter is ... i-price yakhona i-much uyabona, i-card iless i-price yakhona, that’s why uyabona. So, abantu abana-knowledge, uyabona, bakhuluma just for the sake of it. So, I think for us, because we have learnt something, both are the same.

[yes, you see they made it easy for us, because most people do not understand, like card or using a meter. Some say when using the card you pay less than when using the meter, you see. So people do not have knowledge out there, they just talk for the sake of it. So think, for us we have learnt something, both are the same.]
Interviewer: So what is it that you like about the new approach that Mr Molefe was using?

Sindiswa: Ke gore, the way ne diquestion di ne di botswa ka teng, it was easy for the whole class for all of us, for all the students to understand and answer all the questions.

[The way the questions were asked, it was easy for the whole class, for all of us, for all students to understand and answer all the questions.]


[I think it works because many learners, maybe like, when their home language are not used they do not participate. When they are given their home languages, then they are able to participate.]

Colbert: Because most of us we are … be baphathisipheita. The whole class, I think be-iphathisipheitha. But before beyiyenza ukuthi like, beyi … bebabona nje i-class, kukuthishwa maybe four learners uyabona, others … (Inaudible).

[Because most of us we are…we were participating. The whole class I think was participating. But before then, it was as if the teacher is talking to only four learners, others …]

Sipho:Because kaofela digroup they were participating, wa utlwisisa mam. Le bane ba sa phathisipheiti ko klaseng, ne setse ba phathisipheita. Nna ke maketse gore ‘he banna, mothaka o kajeko ke ena oe arabant so Maths’ (Clicking fingers).

[Because all the groups were participating, you understand mam. Even those who never participate were participating. I was surprised that ‘hey man, even this guy is answering questions today in maths?’]
Opportunities that a multilingual approach to mathematics education create

• It recognizes the political role of language and thus also the inequality of languages
• More focus on mathematics rather than just ordinary language
  • Language functioning as a transparent resource (visible and invisible)
• Engagement with higher cognitive level demand mathematics tasks, which some teachers overlook because of the language limitations of the learners.
• Learner participation and interest in mathematics.
Ngiyathokozidingelo! 
ke a lebogalingelo! 
siyabonga!

dankie! 
inkomulinkingelo! 
siyabonga!

Ro livhuwalingelo! 
enkosingelo! 
UDO livhuwalingelo! 
HGIYAHONGA!