

MORE THAN TWO LANGUAGES IN THE BILINGUAL MATHEMATICS CLASSROOM

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Ollscoil na hÉireann, Má Nuad
ALM-23, Maynooth, July 2016



Overview

Research on language and mathematics education

Diversity and richness of the domain

Questions, directions and lines of concern

Research on languages and mathematics learning

Scope of what is meant by languages

Scope of what is meant by mathematics learning

Research on “bilingual” mathematics learning

Newer insights from classroom data

Resourcing languages for mathematics learning

The research domain

What are the **questions/problems** about language and mathematics education?

What are the **lessons** learned from research in this domain?

What could we learn more in the **next decades**?

Different questions/problems and lessons

Different directions and lines of concern

Directions and lines of concern

Questions/problems about representation of data

We have learned much about the **potential and challenges of multimodality** for the planning, development and evaluation of much of our research, but still need to learn more.

[Diana Coben & Keith Weeks, this Conference]

Way beyond word *data** –(re)presenting real-world issues (in a form that renders them amenable to **analysis and research****)

* *Problems* in the original

** *Mathematical analysis* (...) in the original

Directions and lines of concern

Questions/problems about social interaction

We have learned much about the **inseparability of the individual and the social in the understanding of mathematical activity**, but still need to learn more.

[Catherine Byrne, Gerard MacElligot & Paul Hickey, this Conference]

Maths initiatives in prison education. A peer mathematics education programme*)

* *A peer mathematics education programme* in the original appears in the abstract

Directions and lines of concern

Questions/problems about mathematics learning

We have learned much from the conceptualisation of mathematics learning as **participation in a culture and the many discourses there**, but still need to learn more.

[Javier Díez-Palomar, this Conference]

Mathematics Dialogic Gatherings: A way to create new possibilities to learn Mathematics* as a result of dialogue

* *As a result of dialogue* in the original appears in the abstract

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What is meant by languages

If you were asked about the languages in this room right now, what would you say?

Would you name them?

Would you qualify them?

Would you look at what they do?

Would you look at how they are used?

Would you want me to clarify the question and so would not answer?



We [Maynooth University Language Centre] offer courses and qualifications in a broad range of **modern languages...**

Languages

The metaphor of languages-as-tools

Languages are tools that work with other tools (people and objects) to make communication and learning happen.

The metaphor of languages-as-resources

Languages are resources that create opportunities to interact with others from which to gain experience and support inside a culture.

The metaphor of languages-as-resourced

Languages are resourced by people for the purpose of creating and exploring opportunities to interact with others and meet their worlds.

What is meant by maths learning

If you were asked to get up in this room right now and tell some mathematics that you have learned, what would you say?

Would you name a content?

Would you explain an idea?

Would you refer to how you came to learn it?

Would you refer to why you didn't learn it before?

Would you want me to clarify the question and so would not answer?



Mathematics learning

The metaphor of the travel

Mathematics learning occurs at the interplay of ideas travelling and people catching and transforming them in more or less reflexive ways.

The metaphor of the window

Mathematics learning occurs close to (or in) the opportunities created by people to explore travelling ideas and carry them forward.

The metaphor of the filter

Mathematics learning occurs in situations of distribution of access to the languages of interaction, of participation and knowledge.

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Insights from a study

My research context

A mathematics classroom in Barcelona with Catalan dominant students and Spanish dominant students from Latin American families.

Labeled languages and social languages

Catalan, the language of teaching and learning

Spanish, the co-official language in Catalonia

Varieties inside either Catalan or Spanish or at their intersection

Example of task

A book has 89 pages, but the page numbers are printed incorrectly. Every third page number has been omitted, so that the pages are numbered 1, 2, 4, 5, 7, 8... and so on.

What is the number on the last printed page?



“What kind of Catalan is this?”

Maria: *La darrera pàgina no és múltiple de tres. U i dos; quatre i cinc; set i vuit; deu i onze...* [The last page is not multiple of three. One and two; four and five; seven and eight; ten and eleven...]

Leo: ¡Muy largo, laaargo! [Very long, looong!]

Maria: *Cap problema, no son mil pàginas.* [No worries, it's not one thousand pages.]

Ton: *És anar escrivint. Ho tens?* [It's keep writing. Do you have it?]

Leo: *Jo? dic jo? Mirem quantes pàgines que no estiguin i añadim les pàgines que no van estar.* [Me? Do I say it? We look at how many pages are not there and we add the missing pages on.]

Ton: *Mira, és cent trenta-tres.* [Look, it's one hundred and thirty-three.]

Maria: *Quina mena de català és aquest?* [What kind of Catalan is this?]

Ton: *Què més et dóna? El que importa és quina mena de solució és aquesta. Més curta?* [Why do you care? What matters is what kind of solution is this. Shorter?]

Leo: *Cada dos números, va faltar un. Pasa cuarenta y cuatro veces. Van faltar quaranta-quatre números.* [Every two numbers, there was one missing. This happens forty-four times. There were forty-four numbers missing.]

Discussion

Mathematics learning

Traceable in the opportunities created with the introduction of the idea of decomposing 89 ($44 \times 2 + 1$)

Languages-as-resourced

Maria: *Quina mena de català és aquest?* [**What kind of Catalan is this?**]

Ton: *Què més et dóna? El que importa és quina mena de solució és aquesta. Més curta?* [**Why do you care? What matters is what kind of solution is this. Shorter?]**

If the mention to languages had not been there, would the mathematical activity of the students have developed differently?

By playing down the comment about languages, the attention to language use is drawn away and the focus on mathematical activity is kept through the reformulation “What kind of solution is this?”

“I sound like Peruvian”

- Ada: ¿Cuáles números son como ochenta y nueve? [**Which numbers are like eighty-nine?**]
- Leo: *Quatre pàgines, o sis, o vuit, o deu.* Siempre un espacio de dos. *Però que es divideixi per dos.* [**Four pages, or six, or eight, or ten. Always a gap of two. But that can be divided by two.**]
- Ton: *Ja sabem* cuáles números... *Sono com peruano...* [**We already know which numbers... I sound like Peruvian...**]
- Ada: Habla como quieras pero habla claro, que se entienda. [**Speak as you like but speak clear so that it can be understood.**]
- Leo: ¿No está claro? [**Isn't it clear?**]
- Ada: ¿Cuáles son como el del problema y por qué? [**Which are like the one in the problem and why?**]
- Ton: *Jo he entès que n'hi ha com de dos tipus. Si mirem exemples...* [**I have understood that there are like of two types. If we look at examples...**]
- Ada: No más ejemplos. ¿Cuáles y por qué? [**No more examples. Which and why?**]
- Leo: Mira, los números pares no van igual. Con todos los pares, sacas uno, *perquè no vas arribar a múltiples de tres.* [**Look, pair numbers don't go the same. With all pairs you take one out, because you don't reach multiples of three.**]

Discussion

Mathematics learning

Traceable in the opportunities created with the allusion to the lack of clarity in the mathematical explanations.

Languages-as-resourced

Ton: *Ja sabem cuáles números... Sono com peruano...* [**We already know which numbers... I sound like Peruvian...**]

Ada: *Habla como quieras pero habla claro, que se entienda.* [**Speak as you like but speak clear so that it can be understood.**]

If the mention to languages had not been there, would the mathematical activity of the students have developed differently?

By addressing the comment about languages, the attention to social groups is drawn away and the need of explanations for the clarity of mathematical communication is acknowledged.

Languages-as-resourced

Resourcing languages for mathematics learning

The resourcing orientation draws on the idea that languages cannot be called resources before they have been used by someone in some way.

It is in the use that the potential quality of resource can be recognized and thought of as accomplished in relation to a particular purpose.

In spite of the existence of occasional shifts from mathematics to language issues, **there are moments in a lesson with processes of resourcing languages for the purpose of mathematics learning.**

Findings point to a kind of circularity between the recognition and access to languages and the development of mathematical activity. One language is not enough to make the circle work: **activity develops as part of a process which requires language as multiple.**

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