I see what you mean: Language diversity and math learning.

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https://tinyurl.com/nwmcmathbetweenus
How can students’ diverse language resources be deployed in service to their math learning?

https://tinyurl.com/nwmcmathbetweenus
Agenda

The backstory: your language experiences, your perspectives as teachers/learners of mathematics, "the class" and research.

A language experience in register: Bike jumping biffs to degrees of rotation.

Reflection: What, in this workshop, resonates with your experience as a math teacher or learner or as a language user or learner?

Evaluations/New Questions

Goals

1. To consider communication about math from students’ points of view.

1. Understand some features of language diversity in relation to math learning.

1. Bring a street register to math academic register.
Your communication experiences.

Think of a time when people were talking and you had no or limited understanding of what they were talking about.

Think of a time when you had something to contribute and you couldn’t find the words to say what you meant.
Students’ perspectives on communicating about mathematics.

In your experience as an educator or a student, what factors influence whether or not people choose to communicate about math in math class?

OR

Why do people in math class keep their math thinking to themselves?

https://tinyurl.com/nwmcmathbetweenus
A Quiet Class in Olympia

Thirty HARD-WORKING and QUIET thirteen-year-olds and two teachers,

Taught the same as my “highly capable” class

⅔ of them grew by more than a year.

⅓ grew by less.
Research Question

How do teachers in the Netherlands adapt their mathematics instruction to meet the needs of students learning in a second language?

* Create space for language learners to participate productively in learning math.
Differentiation in Dutch Schools
Dutch math classes

Dutch language

VERY TRADITIONAL TEACHING PRACTICES

Bilingual English-Dutch
Changes in Teachers’ Practice

- Visual representations present, often replacing and sometimes augmenting words.
- Student talk oriented to each other.
- Puzzles and games.
- Telling students that learning math means learning some language.
- Dialog to co-create meaning.
What Research has to Say about Language Diversity & Math

What does language have to do with learning concepts?

Isn’t math a universal language?.

How can we truly invite students’ participation?
What does language have to do with learning concepts?

Anna Sfard, 2008
Isn’t math a universal language?

Pimm, 1987

You can’t express a math idea without natural language.

- Verbinding: connection
- Dichtbij: close to
- Balk: rectangular prism
- Bol: sphere
- Kubus: cube
- Cirkel: circle
- Rechthoek: rectangle
- Driehoek: triangle (cirkel=3, hoek=corner... it makes sense!)
- Vierkant: square
- Eeuw: 100 years
- Jaar: year
- Maand: month
- Dag: day
- Euroteken: euro sign
- Onvoldoende: failing
- Voldoende: passing

“Maak een tekening”: make a drawing/draw
“Hoeveel”: how many
“Wat voor soort”: what type of
“Hoeveel keer past x in y”: “how many times”
“Bij elkaar”: put together
“Klopt het?”: “does it make sense?”
How can we truly invite students to participate?

Barwell, 2020

The ways we respond in moments of tension matter.

- Students’ use of home language
- Explicit attention to discourse
- Encounters with genres
- Use of gestures
- Explaining math thinking
- Moments of reduced participation
Register may be an organizing idea for inviting students’ participation.

Susanna Prediger, 2017

Register describes language unique to a topic, situation and setting.

In everyday situations, “only if the dialogue raises further doubts must arguments be made explicit.”
What do you know about dirt jumping?

What do you know about bike jumping?

How would you describe what you see in these photographs?
What factors impact a rider’s ability to make a safe landing?

**Bike Jumping Championship**

Start at about 50 seconds.

What makes the guy not crash?
What is happening here?

What did you notice about the language narrating the video?

What is the math in this situation?
### Dirt Jumpers’ Register and Academic Register

<table>
<thead>
<tr>
<th>Everyday Register</th>
<th>Academic Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Times around</td>
<td>Degrees of rotation</td>
</tr>
<tr>
<td>Tucked</td>
<td>Shorter radius</td>
</tr>
<tr>
<td>Legs out</td>
<td>Longer radius</td>
</tr>
<tr>
<td>Distance around</td>
<td>Circumference</td>
</tr>
<tr>
<td>Tucked spin is quicker than legs out</td>
<td>Ratio of radius to circumference (2 times radius times pi:1)</td>
</tr>
<tr>
<td>Single</td>
<td>360</td>
</tr>
<tr>
<td>Double</td>
<td>720</td>
</tr>
<tr>
<td>Triple</td>
<td>1080</td>
</tr>
<tr>
<td>Biff or case</td>
<td>Incomplete rotation</td>
</tr>
</tbody>
</table>
Language Positive Practices*

- Acknowledging gestures as part of students’ finding words.
- Building on ‘home’ languages.
- Explicit attention to language as part of making meaning.
- Providing contexts that students can talk about with everyday language.
- Rich contexts — visual and kinesthetic
- Explicit attention to math genres and their idiosyncrasies. (Let $x = 4$)

* Richard Barwell inspired
Reflection

1. What personal experiences can you connect to the ideas here?
2. How do these ideas resonate with your experience as a teacher or learner of math?
3. What new questions or wonderings do you have about the relationship between language diversity and learning math?
Math Between Us

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- Subscribe to mathbetweenus.org
- Receive a draft of the Bike Jumpers to Academic register article
- Review an article about language positive practices.