

UNIVERSITY OF LEEDS

On the lexical challenges faced by students in the comprehension of mathematics lectures

Costas Loizou
c.loizou@leeds.ac.uk

Lecturer in Mathematics
University of Leeds

June 18, 2025

Context

- SWJTU - Leeds Joint School
- UK-China Joint Institute
- Transnational Education (TNE) Partnership
- University of Leeds and Southwest Jiatong University, in Chengdu China

Challenges

- Initial assumption: language won't be important as we have mathematical notation
- More evident in the TNE context that language plays several critical roles, even in mathematics (terminology and communication)
- It is more than just the mathematics

Challenges

- Students may not be able understand everything from the lectures due to language barriers
- Students not able to communicate mathematics in English to ask their questions
- Thinking about how to bring language in the mathematics lectures to support the students

Challenges

- Students need to know the meaning of the word and how to use it in context
- Sub-technical words: words that have both a mathematical and a general meaning (e.g. power, differentiate, integrate)
  - Some share core meaning (e.g., square), but others (e.g., factor/power) very different
  - Potentially difficult to access the mathematical meaning
  - Might be considered already known because of the general meaning and therefore disregarded



Need for Collaboration

- Mathematicians cannot help students on our own
  - Lack of awareness of challenges
  - Not our expertise
- EAP (English for Academic Purposes) lecturers cannot help students on their own
  - Lack the necessary mathematical knowledge



Need for Collaboration

- Need to embed language in mathematics lectures
- What terminology do the students not know?
- Need to give the students some pre work on mathematical language
- Helping students learn mathematical terminology used in the lectures, through diagrams and texts
- Micro-dialogues to help them with communicating the topic



Examples of Collaboration

- EAP lecturers created glossaries from lectures
- Based on these, I created pedagogical materials to help students with communicating mathematics
- Spend 10-15 minutes at the start of my lectures
- Acknowledgements: Warren Sheard, Alister Drury, Rachel Perkins, EAP lecturers, University of Leeds

Examples of Collaboration

Work with PGR student intern in School of Mathematics:

derivative	\dɪˈrɪvətɪv\	n.	导数	The derivative of a function measures its rate of change and is denoted as \(f'(x)\).

Figure 1: Example entry in the glossary

Examples Activities

$f(x) = \sum_{n=0}^{\infty} x^n = \frac{1}{1-x}$, provided that $|x| < 1$

1. How would you read this out? *f of x is equal to the sum from n equals zero to infinity of x to the power n, which is equal to one over, one minus x, provided that the absolute value of x is less than one*
2. How would you describe the underlined parts? *variable, series*

Examples Activities

- What is 3^4 equal to?
  Your partner should read this question to you. Answer to your partner in a complete sentence.
- What is 5^2 equal to?
  Read out this question to your partner. Your partner should answer in a complete sentence.
- What is $\lim_{x \to \infty} \frac{1}{x}$ equal to?
  Your partner should read this question to you. Answer to your partner in a complete sentence.

Examples Activities

Write down the following mathematical expressions:

1. *The integral of sine squared x dx is equal to a half x minus a half sine x cosine x plus a constant C.*
   $\int sin^2(x)\,dx = \frac{1}{2}x - \frac{1}{2}sin(x)cos(x) + C$

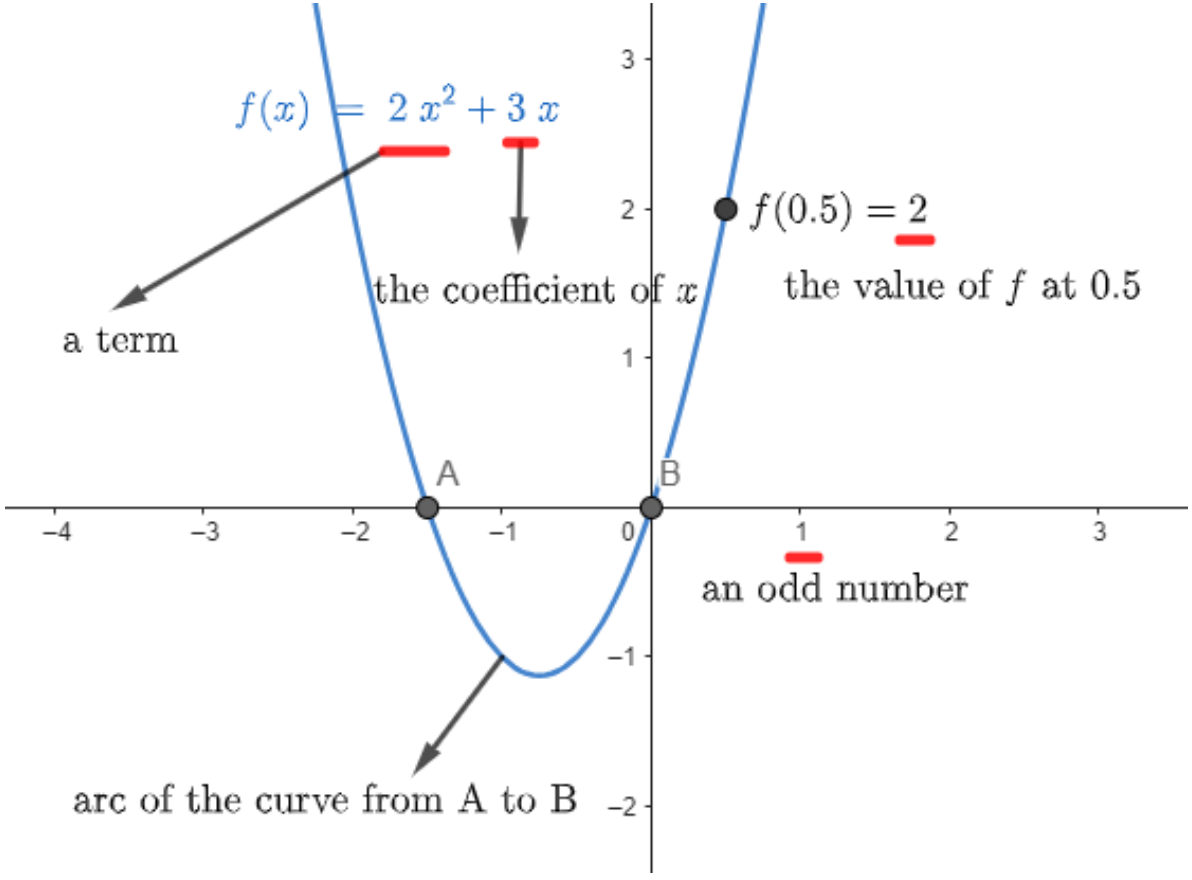
Examples Activities

Match the following keywords with their explanation: *arc*, *coefficient*, *value*, *term*, *odd*

1. Each of the various parts in an equation: *term*
2. A mathematical quantity shown by a letter of the alphabet or sign: *value*
3. An integer that is not exactly divisible by 2: *odd*
4. The part of a curve between two given points on the curve: *arc*
5. A number or other known factor by which a variable quantity is multiplied: *coefficient*

Examples Activities

Match the keywords to the diagram below.



Next Steps: open-access web-book

- Writing an open-access textbook on the *Academic Language of Mathematics*
- Supported by the University of Leeds Libraries Open Book Programme
- Co-authors:
  - Deak Kirkham, Lecturer in EAP, University of Leeds
  - Chen Shuwei, Associate Professor in Applied Mathematics, Southwest Jiaotong University

Next Steps: open-access web-book

- Aimed at any student encountering mathematics as part of their degree
- Fundamental mathematical topics, encountered by all students undertaking a STEM degree (differentiation, integration, sequences and series, vectors,...)
- Includes: interactive activities and bilingual glossaries

Next Steps: open-access web-book

- Helpful to both L1 (English first language) students and non-L1 students
- To be used by:
  - Students as a self-study resource
  - Mathematics lecturers in the first 5-10 minutes of their lectures
  - English lecturers in English classes
- Obtained peer and student feedback to one of the chapters, which has been overall positive

Summary

- Language does play an important role, even in mathematics
- Be aware of some of the challenges
- Collaboration is needed
- Hope to share our open-access book with everyone soon

Get in touch: c.loizou@leeds.ac.uk