Technology *enabled* mathematical science education

Bridging Research and Practice

Emma Cliffe

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Abstract: This talk will explore key research and technological developments that have enabled access to mathematical resources for all students, including disabled students. We will examine the role of specialist practitioners in translating research and development outputs into practical methods for the average mathematics lecturer, contributing to changes in everyday practices. We will review remaining core technical access issues and discuss how our community can effectively respond to these challenges, using two specific examples to guide our conversation.

1 Enabling access

1.1 Defining the problem

1.1.1 We want...

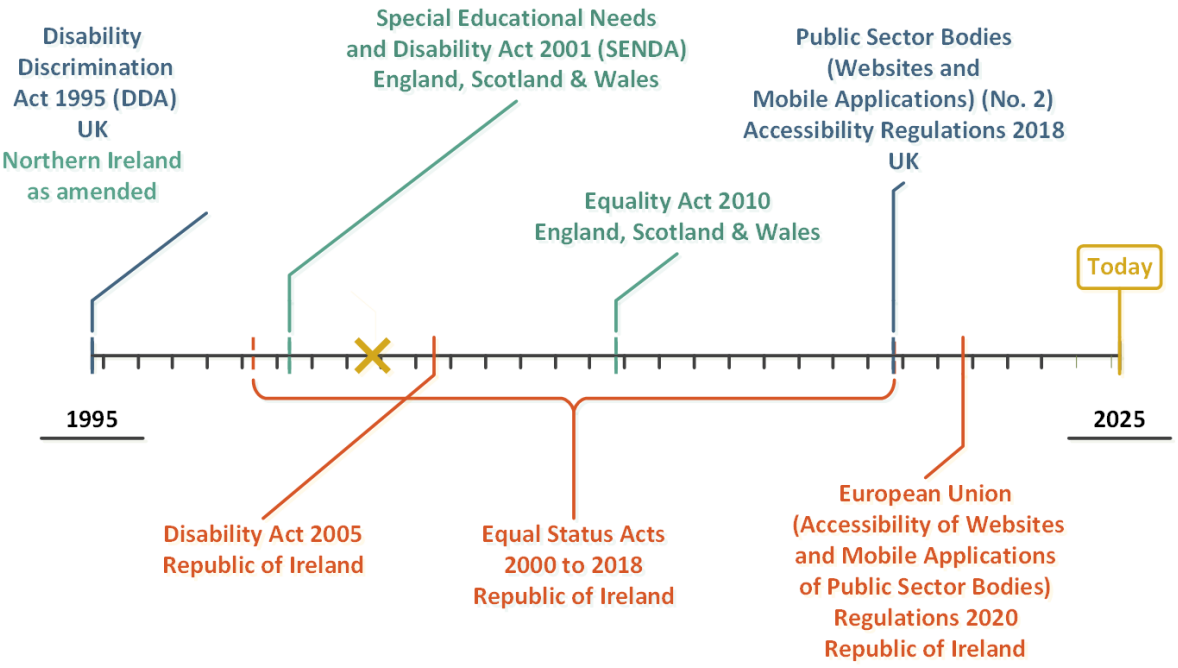
... to enable access to mathematical content by:

- People using assistive technology
- People reading on small screen devices, e-book readers...
- People searching, copying and pasting
- People verifying reproducibility of results
- Software parsing, transforming, generating and manipulating input and output
- AIs consuming and generating mathematical content...?

1.1.2 But...

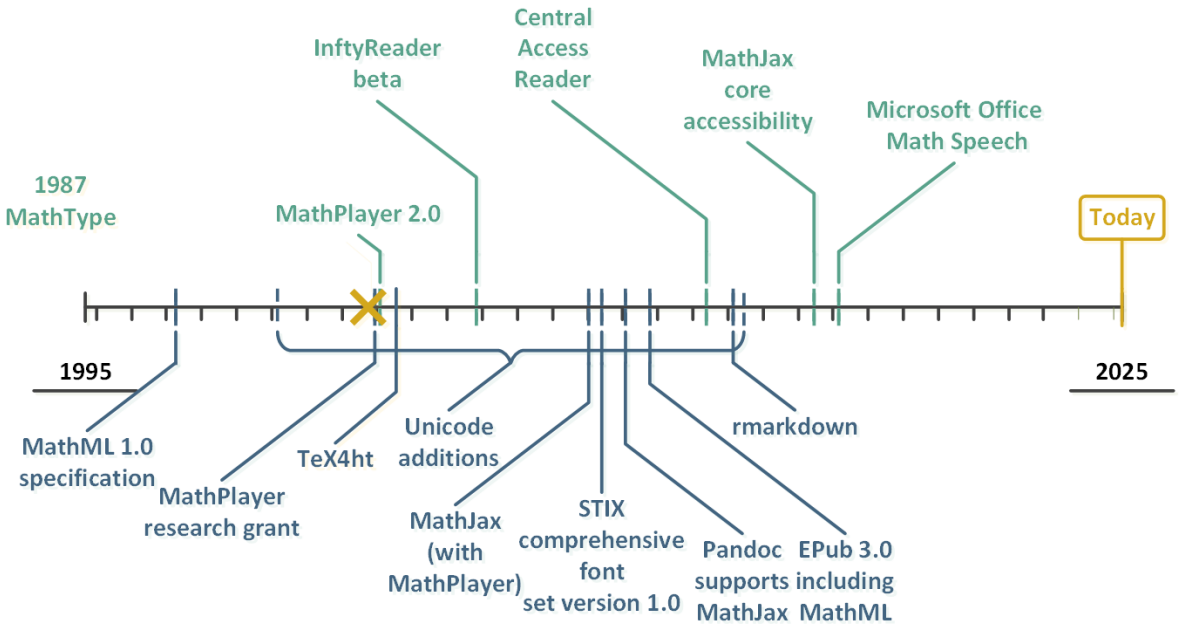
$$x \neq \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1.1.3 Legal

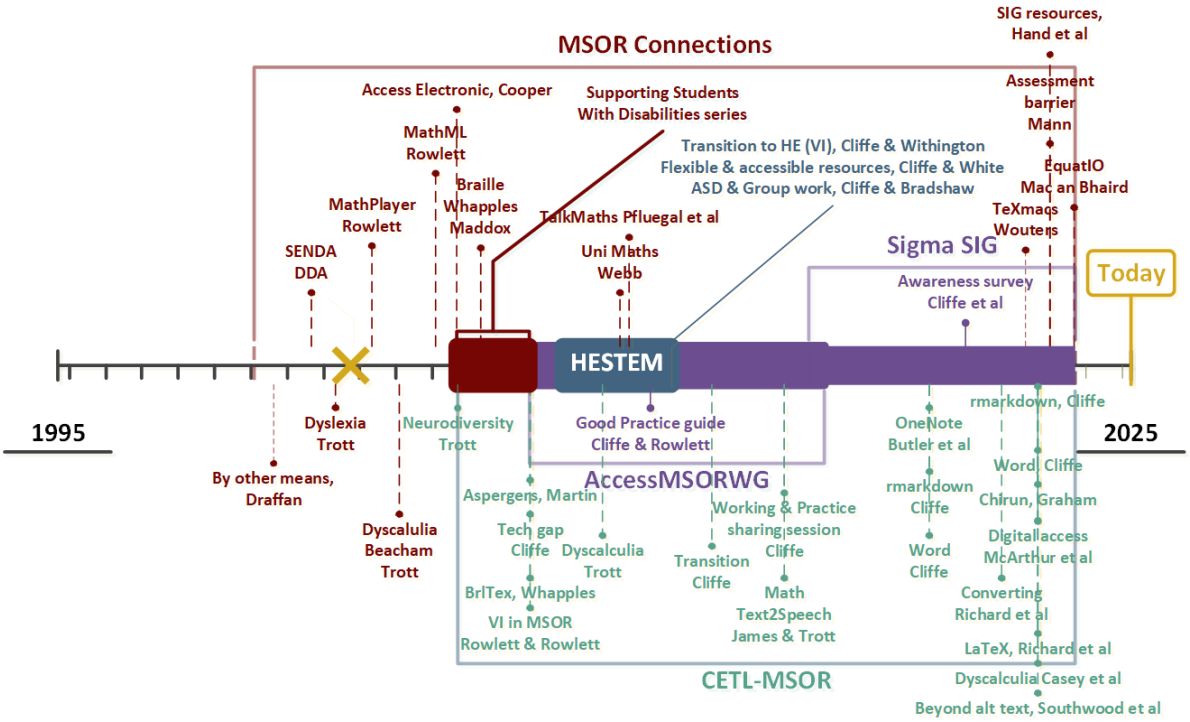

Disability Discrimination Act 1995 (DDA) UK Northern Ireland as amended
Special Educational Needs and Disability Act 2001 (SENDA) England, Scotland & Wales
Equality Act 2010 England, Scotland & Wales
Public Sector Bodies (Websites and Mobile Applications) (No. 2) Accessibility Regulations 2018 UK
Today
1995
2025
Disability Act 2005 Republic of Ireland
Equal Status Acts 2000 to 2018 Republic of Ireland
European Union (Accessibility of Websites and Mobile Applications of Public Sector Bodies) Regulations 2020 Republic of Ireland

1.2 From research to practice

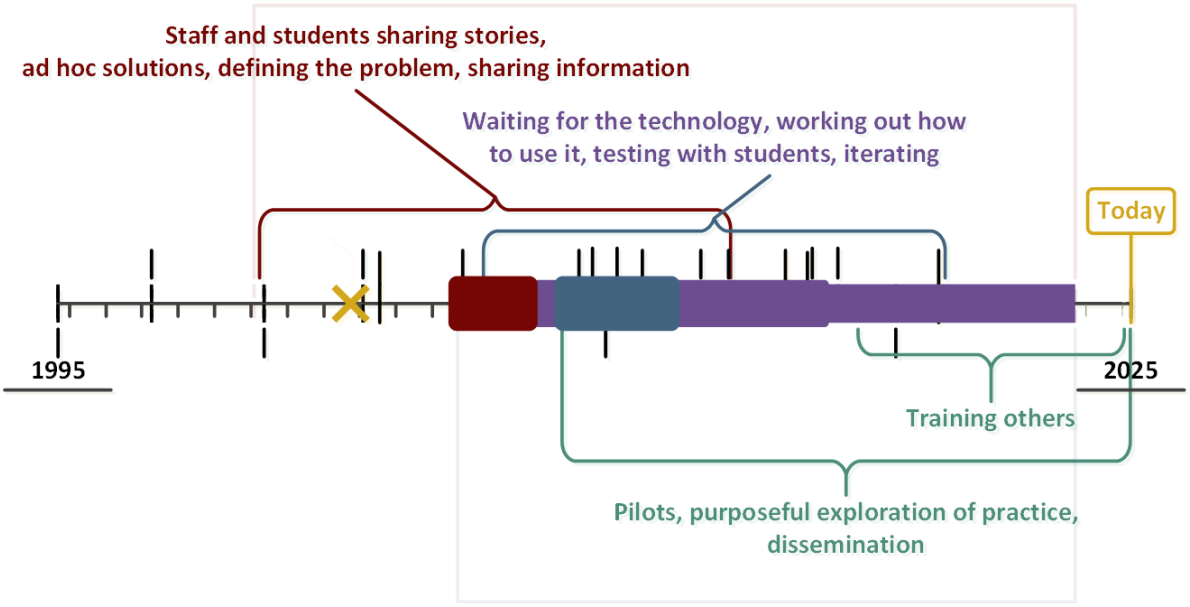
1.2.1 Technical



1.2.2 Practitioners

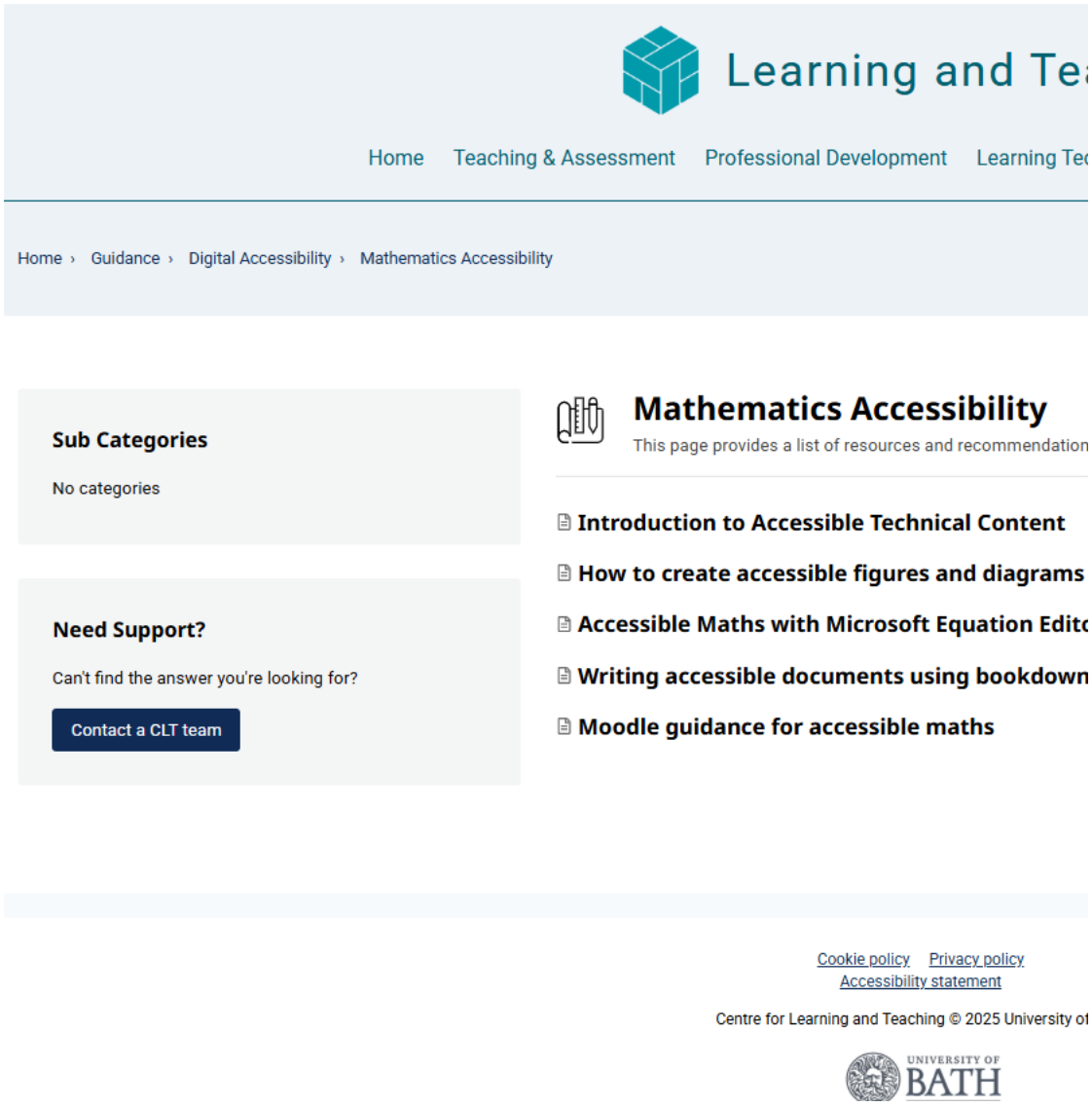


1.2.3 Phases


Staff and students sharing stories,
ad hoc solutions, defining the problem, sharing information
Waiting for the technology, working out how
to use it, testing with students, iterating
Today
1995
2025
Training others
Pilots, purposeful exploration of practice,
dissemination

1.3 Change

1.3.1 CLT & Lecturers



Lecture notes (pdf)

Last updated on Feb 3rd.

Lecture notes (html)

Week 3: Feb 17

Problem Sheet 3

Problem Sheet 3 (html)

Problem Sheet 3 Solutions

Problem Sheet 3 Solutions (html)

Problem class recording

1.3.2 MASH & Everyone!

1.3.2.1 Maths support

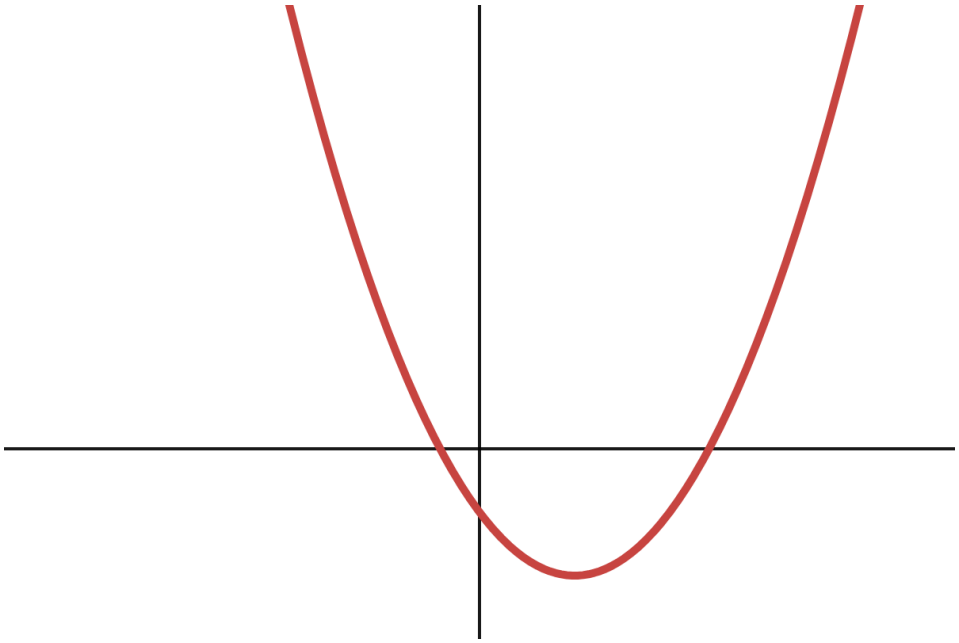
On this page

- Directing students to us
- Maths teaching support
- Individual student referrals

1.3.2.2 MathJax

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1.3.2.3 Desmos



Interactive accessible version of the quadratic graph

2 What next?

2.1 Dissemination and core challenges

2.1.1 Getting started...

- RMarkdown, Bookdown and possibly ClavertonDown
- Quarto
- Chirun
- LWarp
- PreTeXt
- Word
- Desmos and Geogebra
- BrailleR

2.1.2 Dissemination

We are still doing this, now others are too... Can you:

- Have a go yourself and tell others?
- Join JISC Accessibility Community Maths Working Group
- Consider and communicate regarding the implications for mathematical pedagogy?
- Consider and communicate regarding the implications for open and reproducible science?
- Build functionality into software and packages you create so that users automatically produce accessible output?

2.1.3 Diagrams

- It is possible to use Desmos, some functionality of Geogebra and the BrailleR package to help make accessible diagrams
- This is nowhere near sufficient or flexible enough to represent the variety of diagrams we produce in e.g. TikZ
- These formats are not easily consumed and manipulated by other software or AIs

2.1.4 Meaning

- We are no longer losing syntactic structure
- We are still losing enough of the semantics *known to the author* that things we want to do are affected
  - Sometimes the author encodes these in their LaTeX

– Not always though...

- Consider

$$|\{(a, b) \mid a \in A, b \in B\}|$$

2.1.5 Questions and discussion

Thank you for your time! Papers for discussion:

- Authoring Web-accessible Mathematical Diagrams.
- Author Intent: Eliminating Ambiguity in MathML., Pre-print

Slides:

My email address: E.H.Cliffe@bath.ac.uk