Mapping the way to accessible mathematics

We are not yet at the point where mathematical content is accessible as a matter of course but that doesn't mean there aren't a variety of solutions

Accessibility, according to the Oxford English Dictionary (2022), is the capacity for something to be 'readily understood' and 'received, acquired, or made use of'. This is fundamental to education: we must be understood for knowledge to be received and applied by any given student. Generally there is an expectation that lecturers have to make their content more accessible and, to this end, there are many tools out there to help. However, adapting materials takes time and effort and there is not yet a 'one-stop' tool that would suit everyone or every circumstance. As a consequence, in the Department of Mathematics we are ***developing a map*** to help different stakeholders find the tools that will help them the most.

Handwritten vs typed notes

Compared to straight text, typesetting mathematics is a slower process that involves not only getting the right symbols, but also the consideration of their format and layout on a page. This is a problem that only grows as the mathematics involved gets more complicated. Moreover, it is generally recognised that teaching such content in "real time" with handwritten content aids student understanding (Wakeley, 2004). It is therefore understandable why lecturers produce handwritten content, particularly in a lecture context, and why it may seem logical to share this resource with students. However, even with the nicest handwriting, scanned handwritten notes are not always welcomed by students and fail to meet the requirements of the Accessibility Regulations legislation (2018).

In recent years, the ***Digital Inclusivity team at the University of York***, with the help of interns, have supported several departments converting handwritten material into a typed format (see Figure 1). This time consuming but necessary work highlights how support can be used to make these materials more accessible for a wider audience. In addition to this manual labour, there are an increasing number of tools available which can accurately transcribe handwritten maths to digital formats such as Equatio or Mathpix. These tools can drastically reduce the time taken: a complete set of lecture notes previously would have taken up to a week to completely convert but can now be completed in a matter of days: still time-consuming but much more manageable.

PDF vs HTML formats

Increasingly, students use phones and other 'small screen' devices to access material, or may use digital magnifiers, both of which require text to rescale and reflow on screen. While a Portable Document Format (PDF) meets the minimum legal requirements for 'zooming' in this manner, HyperText Markup Language (HTML) files have a number of advantages: they can reflow, have greater structural integrity for maths, and are better supported by many assistive technologies. Despite this, mathematics students overwhelmingly (75%-80%) ask for PDF copies of lecture notes as a downloaded PDF (i) does not depend on an internet connection, and; (ii) is more easily searchable and intuitive for students to digitally annotate (Cliffe, 2022). Given the remit of 'accessible content' we would like to provide both file formats so students can use what's best for them. As such, we ideally need a way to easily produce both outputs from one input.

At the moment, many of these PDF documents will have been produced with LaTeX, a software system used for document preparation. This input can also produce HTML files via conversion tools such as LaTeXML, ***pandoc***, or ***Mathpix*** which all work relatively well, although some adaptation of the original TeX or final corrections may be needed, particularly with more complex and diverse documents.

As explored in ***issue 49 of Forum magazine*** in an article by Alexandra Dias (2022), RMarkdown is an alternative to LaTeX which directly outputs HTML and PDF. It is a simpler markup language making it easier to learn than LaTeX, and is capable of producing lots of the same mathematical content. However, plenty of content already exists in LaTeX, and transitioning between these two tools is not always straightforward or easy. Again, support for the adoption of such tools needs to factor in adequate training for both students and staff.

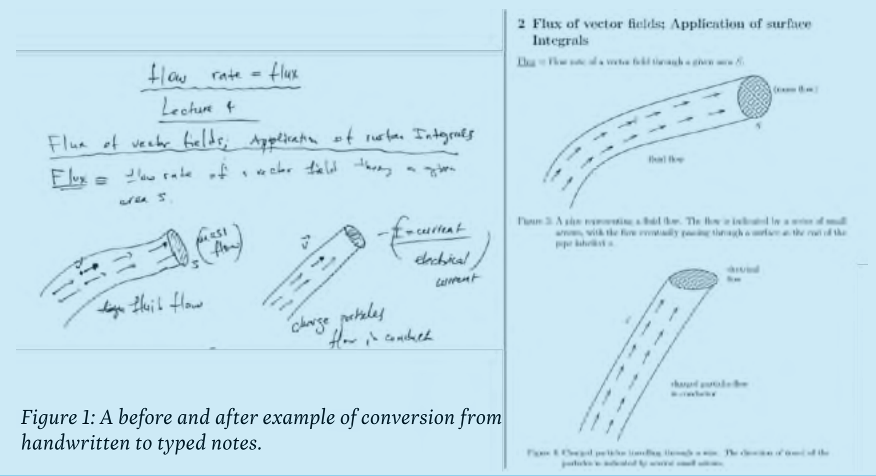

Figure 1: A before and after example of conversion from handwritten to typed notes.

Student input

It is also important that any changes do not occur without consulting students. We need to understand how they access and engage with content and what formats work best for them. We also need to be mindful that the student body is not homogeneous or static: what works for one student in a given subject, or even cohort, may not work for everyone forever.

Ongoing change is needed, and even necessary, when it comes to the application of technology in a given curriculum. However, it is important in its implementation that everyone involved has the necessary support for such changes, as well as being cognizant of the range of tools available to help them. This is why we are building on the ***current guide (which can be found via this link)*** to develop a comprehensive map of these different options and tools that will provide a common platform for both users and educators to start their journey into accessible mathematical content.

References

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