Emma Jane Rowlett

Supporting Students with Disabilities series

Accessibility in MSOR: one student's personal experience

Emma Jane Rowlett
School of Sociology and Social Policy
University of Nottingham
emmajane9@googlemail.com

Introduction

This article is a first person account of my experiences of having sat in on the first five weeks of a foundation maths course to see how I would handle maths now that I am visually impaired. I am not a mathematician; I am a PhD student in the Sociology department studying access to materials, including mathematical ones. I was fully sighted when I last did any proper maths and that was a GCSE ten years ago. I did do a small amount of statistics for my MA research methods course, but that was so heavily adapted for me that I did not really engage with any actual maths or stats. Therefore, I decided to take the foundation maths courses to see first hand some of the problems visually impaired students face.

If I was taking the course for real, I would have had someone to work on converting the materials for me, but as I was only sitting in, and because I wanted to fully understand the problems, I asked the lecturers to send the materials directly to me so I could turn them into my preferred format myself. (For those of you who are interested this is Verdana 20 point font, 1.5 line spacing, justified, and printed on a very specific brand of canary yellow paper.)

Although this article is primarily based on my experience of taking the foundation maths course, some of what I have to say in this article also stems from my work on an Maths, Stats & OR Network (MSOR Network) funded mini-project entitled "Accessibility in MSOR: LaTeX and Braille". The aims of this project are to look into the issues surrounding the accessibility of mathematics based subjects and to produce a piece of software that will reliably convert LaTeX files containing mathematics into Braille.

The course

The foundation maths course was made up of two modules - "Foundation Calculus" and "Algebra and Mathematical Techniques". I attended one three hour workshop a week for each module containing a combination of lectures and problem classes. One lecturer used PowerPoint slides, the other overhead transparencies. They both provided handouts, questions to do in class and problem sheets to do at home. We were given recommended textbooks to buy and certain chapters were suggested from each one.

Presentations

The PowerPoint slides were easy to produce in large print as all I had to do was print them, one slide to a page, on the yellow paper I use, as the font was generally bigger

than 20 point. The transparencies were more difficult as the lecturer had lost his original electronic copies and was relying on the actual acetate copies. Luckily the font on these was also of a decent size so he was able to photocopy them onto yellow paper. So, for most lectures, I had access to paper copies of the presentations that were being given.

Handouts etc

The handouts, questions to do in class and problem sheets to do at home were provided to me electronically. However, they came in a variety of formats, including: LaTeX, Word (with and without Equation Editor input) and electronic scans of textbooks.

LaTeX

In most cases, I was able to enlarge the LaTeX files (although this was not easy as I explain later) and I had varying degrees of success in terms of actually being able to read them on paper. I could, however, read the original LaTeX code using enlarged settings in my text editor (not the Windows default) and the PDF version was generally clear enough to use my screen magnifier on.

Word

If the Word document was simply written, using straight-forward text with no Equation Editor input, textboxes, complicated formatting and so on, then it was very simple to turn into large print. However, Word files that contained Equation Editor input were tricky. One way to enlarge the font would be to use the Equation Editor's own Graphical User Interface (GUI) to select the options to enlarge each equation. However, I could not see the GUI and so this was not an option. Instead, since each equation was placed in a box, I stretched that box to enlarge the font. This was time consuming to do as it had to be done for each equation in turn, and it was not always possible to stretch the box far enough to make the font readable without running off the page. These problems would also have occurred if the GUI was used; however, stretching the equations as I did had the added disadvantage of distorting them.

Electronic Scans

The electronic scans of textbooks were of such low quality that I could not read them with my screen magnifier or portable electronic magnifier. When I could not read the questions that were given to us in class because they were presented in this way, my notetaker read them aloud to me, but this was a slow process and I did not get many questions done in the allotted time.

Textbooks

Although I purchased a textbook, I did not make much use of it. It was not possible to have it produced in my preferred format as every equation would have needed typing up into LaTeX. However, the text was fairly clear and so I could access it using my portable electronic magnifier. The problem was that on a small screen you can only see a limited amount at once and I am not good at holding maths in my head. This was added to the fact that I find using any magnification method - be it traditional handheld magnifiers, portable electronic ones or screen magnification - very difficult.

Summary of main problems

Converting LaTeX to large print

This was my biggest problem and it is something that was never properly resolved. I could not find a font that got any bigger than the one I was able to produce using the "/Huge" command and that was only just big enough. Standard text was produced in a size comparable to that which I normally read but the maths font used was slightly smaller. This meant that handouts were not very easy to read but it was possible.[1]

I found it particularly difficult to handle long equations that ran off the page once enlarged. Working out the correct LaTeX code to break them onto separate lines was almost as difficult as making the decision about where the correct place was to break them without losing the meaning. Similar problems occur when turning LaTeX into other formats and this will be explored during the mini-project.[2]

All this means that visually impaired students who want larger font sizes or Braille versions of LaTeX documents would have problems creating them in very similar ways to I did (Braille actually faces even more problems but this is something covered in previous issues of *MSOR Connections* [2, 3]).

Students wanting to use electronic audio would have different problems as the LaTeX would most likely need to be turned into MathML, and then read by MathPlayer and a screenreader such as JAWS (for example). However, even if they successfully made audio renderings of the handouts, and particularly the presentations (be this electronically or using a sighted reader), it would be difficult to use these in class if they are trying to listen to their materials at the same time as the lecturer is talking.

Enlarging Equation Editor output

I managed to deal with this to a certain extent by stretching the boxes to make the equation font larger. However, as I mentioned above it was not always possible to make the font big enough without the equations running off the page. This would be easier to do using the GUI, but it would still be necessary to make the decision about where to break the equation into two lines.

Also, it is not possible to convert Equation Editor output to Braille, nor, to the best of my knowledge, can most screenreaders handle it. However, there is a paid upgrade

called MathType that allows for conversation to other formats, including MathML and LaTeX, which are much more accessible, although do face their own problems as discussed elsewhere.

Not seeing what everyone else can see

People often say that audio-visual presentations are simply an accompaniment to the lecture and are not strictly necessary. Such things are there to act as an anchor for the lecture, to draw students in and hold their attention, and visually impaired students need this as much as anyone else. The same goes for handouts and any other written materials other students have access to. However, in mathematics, I would argue that such materials are much more than anchors and all students need access to them.

The two lecturers who taught me did their best to get materials to me electronically and in advance of the lecture, but sometimes this was not possible. This was usually because electronic copies did not exist, or did not exist in a format that could be enlarged easily.

However, there were several occasions when I could not see what everyone else could see, and there were two main reasons for this. Firstly, there was the practical problem of not having large print copies of the materials everyone else was using. Secondly, there was the less easy to overcome problem of not being able to see the board or presentation.

Not having a large print copy of materials

This tended to occur when:

- the materials I needed were a text book or photocopied from a text book and so these would have needed to be typed up into LaTeX before I could enlarge them (the latter happened mostly with sheets of questions to be answered in class);
- materials were provided too late to spend time converting them in time for the lecture (this did not happen very often); and,
- a communication problem meant that I was not provided with the materials I would need (this happened only once).

When this happened it was very frustrating, as I had to rely on my notetaker to read things aloud to me when it was appropriate. She obviously could not read presentations to me while they were being shown as the lecturer was already talking, but for other materials this was a bit easier.

When it came to the problems we were given to do in class, I often did not have large print copies so my notetaker had to read them aloud. This was a very slow process and we often did not get very many questions done before the time was up. It was also difficult to hear her over other students talking amongst themselves or asking the lecturer questions. However, the main problem for me is that I find it difficult to visualise maths in my head and so I found it hard to follow the question and come up with answer.

*"Technically speaking and with unlimited resources, visually impaired students **could** be provided with all of their materials in a format they could access. It might be tricky, but it could technically be done. However, since the law requires only 'reasonable' adjustments, it is unlikely that this will ever actually happen since it is very resource intensive and other adjustments are likely to be deemed to be sufficient."*

Textbooks also present a similar challenge and many universities do not have the facilities to convert these themselves, and it can be very expensive to contract this work out. I bought one of the recommended textbooks in a rush of enthusiasm at the beginning of the course, but it proved too difficult and expensive to convert. Since it was not possible for me to get large print copies of all the materials that were given to the other students, I had to try to follow the course without them. I would have benefited from having more sources of information available to me - especially a large print version of the text book.

Technically speaking and with unlimited resources, visually impaired students *could* be provided with all of their materials in a format they could access. It might be tricky, but it could technically be done. However, since the law requires only 'reasonable' adjustments, it is unlikely that this will ever actually happen since it is very resource intensive and other adjustments are likely to be deemed to be sufficient (e.g. access to notetaker's notes, use of sighted reader, etc.).

Not being able to see the board or the presentation

This happened an awful lot, because although in both modules I generally had access to a large print paper version of the pre-prepared presentation, lecturers naturally used the board at the front (whether this was using an OHP projector, smart board or whatever) to work through problems. Seeing this would have been really useful to me, as I need to see the process to understand it. Obviously, I had someone to take notes, but since it would have been difficult for her to quickly handwrite the

information large enough for me to read while the lecturer was talking, I had to settle for seeing it written down in her notes a few days later - which is very different to seeing it worked through live.

My large print paper copies were also not very helpful if the lecturers used animations in their presentations or revealed their slides in parts rather than all at once, as I only had the final copy of each slide with everything shown. For example, one of the lecturers would often show a table with only some of the values filled in and ask us to complete the rest, but of course my copy already had all the answers. This meant that unless I was quick and covered up the offending columns as soon as I turned over the page, I was denied the chance to work the answers out for myself.

Another problem I had with not being able to see the actual live presentation being shown was that both lecturers tended to highlight parts of their presentations while they were talking, so although I had a large print copy I did not know which bit they were pointing at or underlining when they said something like 'this bit here is very important'.

Many visually impaired students would not be able to see the board and although the lecturer can follow what some universities treat as good practice and read everything out as they write it down, this is difficult to follow in your head.

"It seems to me that there are two big problems that still need solving. How do you successfully convert mathematical materials into alternative formats and how do you deal with students who cannot see the board?"

Summary

It seems to me that there are two big problems that still need solving. How do you successfully convert mathematical materials into alternative formats and how do you deal with students who cannot see the board?

The conversion of materials into alternative formats is a big headache for universities, and mathematics is particularly difficult. Students need access to a number of materials in alternative formats, including presentations, handouts, textbooks and notetakers notes too. It seems most sensible to start with LaTeX files, as these are commonly used by lecturers to produce their notes. However, converting LaTeX to other formats without a lot of manual tinkering is very difficult and needs a certain amount of expertise.

Many visually impaired students cannot see what is written on the board and even if it is read out by the lecturer this can be difficult to follow. Having problems read aloud to you is especially time consuming, and so visually impaired students are likely to get less questions done in class that their peers. However, it is as important for a visually impaired student to practice what they are learning as anyone else, and perhaps even more important if they are unable to access to all the materials they need.

Reflections

I really enjoyed sitting in on the foundation maths course and I regret that I was only able to do so for five weeks before I became overwhelmed by the workload it created in addition to my PhD. Everyone was very supportive and I would definitely like to improve my maths qualifications one day. I would like to thank everyone involved, especially my notetaker who did a marvellous job in often difficult circumstances.

Although my experience is a very personal one, a lot of the problems I faced would be the same or even worse for other visually impaired students. Some of my solutions might work for them, but some might not. Generally speaking, the less useful vision a student has the greater the problems they will face. However, everyone is different and my experience is just one perspective from one student from one university. I hope it has been helpful.

References

1. Accessing Materials Website. Available via: http://accessingmaterials.org.uk [Accessed 12 Dec 2007].
2. Maddox, S., (2007), "Mathematical equations in Braille", MSOR Connections May 2007, Vol 7 No 2. Available via: http://mathstore.gla.ac.uk/headocs/Maddox_S.pdf [Accessed 12 Dec 2007].
3. Whapples, M., (2007), «Obtaining Braille mathematical documents», MSOR Connections Aug 2007, Vol 7 No 3. Available via: http://mathstore.gla.ac.uk/headocs/Whapples_M.pdf [Accessed 12 Dec 2007].

Notes to article:

[1] If any of you know LaTeX well and are able to suggest a better way of enlarging text, please do get in touch with Emma Jane Rowlett.

[2] I have been told that this is an issue that has been explored in relation to MathML, but I have yet to look into this.