

STEM Enable: improving STEM accessibility through knowledge sharing

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1. Overview

This session will briefly introduce Science, Technology, Engineering and Mathematics (STEM) accessibility issues before considering the potential impact of crowd-sourcing Assistive Technology (AT) knowledge on professional skills and the development of new technologies in other AT fields.

2. Background

While a range of AT exists to aid individuals with problems with reading and writing, the non-linear nature, complex symbols and terminology of mathematics can present major barriers to accessibility. To learn and utilise mathematical concepts an individual must first recognise each symbol then what the symbol represents within a particular location. Finally, they must recognise whole structures accurately and without ambiguity. This can form a particular challenge for individuals who have a print impairment such as dyslexia or a visual impairment. Producing mathematical materials in an accessible format often requires a multi-step process to convert from common scientific formats (such as LaTeX) to those that can be read-aloud or displayed as braille [2]. Reading and writing is hindered further as common accessibility solutions such as screen readers, braille notetakers and text-to-speech apps may require customisation to recognise maths notation. Without suitable support and AT disabled learners may be deterred from pursuing STEM qualifications and careers [4].

Sourcing, setting-up and training on solutions in STEM accessibility requires both STEM and AT knowledge. Few specialise in these complex intersections so accessing services and professionals with these skills is difficult. Recently, the Institute of Physics (IOP) and the University of Bath have undertaken a project to produce a searchable wiki, STEM Enable, to collate information and experiences on AT in the STEM field [5].

3. Methods

Project work with STEM graduates and specialists [1] has established that producing STEM guidance locally is time-consuming and costly. Collation of a UK knowledge base

suitable for multiple roles and which enables institutions to build on good practice rather than re-inventing the wheel has been proposed e.g. [3]. Previous attempts, including the work of the Maths, Stats and OR Network and HESTEM projects were reviewed. Static resources had rapidly fallen out of date and resources were either narrow in focus or lacked necessary technical detail. Some were misleading as to suitable methods or difficult for non-specialists to use.

To mitigate these issues the STEM Enable project aims to produce a platform in which content can be updated by practitioners and in which STEM specific technical information is made available without affecting a visitor's ability to locate role appropriate information. Existing resources can be signposted, commented on with respect to updates or specifics and placed in context for non-specialists, if necessary.

The project is led by the IOP and includes a collaborative group with representatives from: RNIB, BDA, Sensory Support Services, Snowdon Trust, BCS, IMA, Open University, Universities of Bath and Birmingham. Initial funding from the IOP focussed on building a "core module" on maths accessibility, for those seeking to study STEM at higher education, with a vision that this could be extended. Contributors with personal experience, practice to share or technical expertise will be sought on an ongoing basis.

3.1 Ethical statement

Ethical approval was unnecessary because this is a knowledge transfer project. The project aims to collate and share information submitted by registered authors to a live site. Authors are provided with relevant warnings on copyright and licencing.

4. Results

The platform produced is a semantic wiki. At the most simplistic this can be imagined as a cross between a wiki, a website which can be edited collaboratively, and a database containing structured information which can be queried for specific aspects of that

information. For example, a visitor can query for all methods to convert Word documents containing equations to electronic speech. Results of queries can be embedded e.g. the page about Word format includes lists of relevant methods which update automatically.

The project has produced code, which can be updated without disruption, to manage relationships between information and the structure of the site and pages. Hence registered contributors make additions to content via forms: there is no requirement to take charge of the structure or to produce content of whole pages at once.

5. Discussion

The immediate focus is on mathematics in higher education and a critical mass of content is being added before extensions are sought through crowd sourcing. It is envisaged that this will include other STEM subjects and school education. Crowd-sourcing content will enable a range of authors to contribute to the site, based on their experience, interest and expertise. Authors can range from those who submit one complete piece, such as their personal experience of studying a STEM subject or a case study of a change to practice in one institutional context to regular registered contributors who bring deep or technical knowledge of one particular domain or a breadth of experience across many facets of STEM access.

6. Conclusion

STEM Enable aims to assist UK students and staff in locating and sharing information. It is a semantic wiki with editable content which also captures relationships between that content to form a collaborative database. Once a critical mass of content is in place updates and additions, which are made via forms, will be crowd-sourced. Visitors will be

able to query the site as if it were a database and to explore the structure of the often complex information available in this specialist area. It is hoped that as well as reducing barriers to accessing technologies, this novel approach could encourage sharing of best practice and improve awareness of how to support disabled learners in STEM subjects.

7. References

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