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Meeting Sustainable Goals Through Improved Accessibility: A Call to Action.

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Abstract:

The goal of this paper will be to inspire and engage libraries to work on sustainability as according to the UN Agenda 2030, and especially Paragraph 4 which relates to inclusive and equitable quality education for all. In particular, we will address the issue of digital accessibility and inclusivity for the virtually impaired and present innovative technologies for those with special needs. The paper will also show what some libraries are doing in the context of open science and open access publishing, including publishing and providing eBooks and eContent, so as to ensure high levels of user accessibility. Finally, we will make recommendations for library-based publishers and others as a call to action.

Keywords: *Sustainability, Accessibility, PDF/UA, Epub3*

1. Introduction

With the rise of digital technologies, the consumption of information has become an essential part of modern life for everybody. However, despite the technological evolution, electronic resources are often still not accessible by people with different kinds of disabilities. Digital material is not designed for easy access by people with all kinds of impairments which for them more layers of difficulties. And this at a time when the population is getting older.

In this paper we analyse the different possibilities that libraries have available in order to enable access to the collections for users with disabilities. For the technological challenges, the analysis will mainly focus on the usability issues and on the new opportunities created by the innovative technology but initially we provide an overview of the general concept of accessibility and sustainability in the information world and then go more into the details of the technological tools and formats. Another focus we want to underline is the involvement in the process of not only users, librarians, but also librarians and publishers, to create a common awareness about initiatives attempting to address different access needs. We also note the concept of an integrated vision of sustainability - not only environmental sustainability - which is very important for sure - but also the economic and social sustainability in order to fight inequalities.

We must satisfy our present needs without compromising the capacity of future generations to satisfy their needs. It is also critical to understand the idea of social sustainability especially in the area of libraries and information: that is, inclusive information technology for education, improving physical and digital accessibility and ensuring that digital resources meet the needs of disabled users and staff.

2. The legal and policy framework

Inspiring and engaging libraries to work on sustainability is in accordance with the United Nations Agenda 2030[1] (Goal 4) which promotes quality education and inclusivity for all. The Sustainable Development Goals are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all UN Member States in 2015, as part of the 2030 Agenda for Social Development which set out a 15-year plan to achieve those goals. Social protection has been significantly extended globally, yet people with disabilities are up to five times more likely than average to live in countries with catastrophic health expenditures.

People with disabilities must not be discriminated against and for this reason it is important to remove any barriers to information access. Accessibility to information for all is the essential component for the sustainable development. Thus, functional and digital accessibility (access to the content through technological aids) is needed in order to facilitate access for those with various kinds of disability.

In the EEA, the European Accessibility Act[2] (2019) set out that documents must be accessible (with a related audit), based on accessible platforms, and disabled users must be able to use devices with reading software. As a consequence of this new guideline, within the EU Member

[1] https://www.un.org/sustainabledevelopment/development-agenda/
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0882

States, and starting from June 2025 for the most part, new products and services put on the market should satisfy the expected accessibility requirements by law.

Two key points must meet the requirements: inclusion (self-service solutions) and accessibility (with high disclosure). All technological solutions must work for disabilities in the spirit of the UN Agenda 2030 to address the needs of blind people, low-sight people, dyslexics, people with learning difficulties, old people with vision problems, etc. These new technologies must be developed to be efficient, free and sustainable. They must be inspired by a social mission to disseminate science and culture to the whole society especially through Libraries, Museums and Archives.

3. Openness

Openness is becoming one of the core operating principles in which libraries are committed to increasing access to scholarship and provide high levels of accessibility. Collection budgets for libraries everywhere have changed significantly over the past five years and at the same time, it has become clear that to move towards a world of open knowledge it is necessary to focus more efforts on finding sustainable models, not just for publishers, but also for libraries and the wider community so as to ensure greater accessibility and thus maximize the potential of research and education.

Innovative approaches to producing eLearning materials are needed to ensure conformity with the relevant standards including the WCAG 2.1 Level AA (Web Content Accessibility Guidelines) for websites. Some technologies can be incorporated in the websites and allow conversion of documents in alternative, accessible and multimedia formats. And also important is the integration of the emerging accessibility technologies with e-learning systems in order to deliver content which will support diversity and ensure consequent inclusive training for everybody. And publishers must also extend the accessibility of eBooks to give the power of reading to those who need it most.

One example which brings together openness and accessibility is the Open eBooks[3] initiative, a coalition of literacy, library, and publishing partners, which supports the White House ConnectED[4] initiative and provides equitable access to digital books for children from low income families, military families, and for children with special needs The initiative allows adults working in libraries, schools, shelters, afterschool programs and other settings to request access to the Open eBooks app for children in need. Open eBooks is available to millions of students, in elementary school, middle, and high school, offering an unprecedented digital library. The Open eBooks Initiative partners —the Digital Public Library of America (DPLA), First Book, and The New York Public Library (NYPL) - created an app, curated the eBook collection, and developed a system for distribution and use. The partners received financial support from IMLS, assistance from eBook distributor Baker & Taylor, and contributions from major publishers. All the eBooks are available in an accessible format.

Another example is museum content, which can contribute to learning programmes and social inclusion and represent an open source for people of all ages. Museums have a key role in the social promotion, education and active participation processes. Thus, the British Museum in

[3] https://openebooks.net/
[4] https://obamawhitehouse.archives.gov/issues/education/k-12/connected

London has developed programmes for linguistic inclusivity and accessible learning. They provide museum education oriented to disable persons[5].

4. Formats and Tools

The purpose of this paper is not to provide a detailed account of the technicalities of digital accessibility, but we need at least to note the essential issues when it comes to ensuring an excellent accessible experience. Primarily, digital accessibility is dependent upon having an accessible file at the outset so that it can be effectively rendered by one or other of the readers which interoperate with digital content to provide a rich reading experience. Two formats have emerged over recent years which predominate. These are: the PDF/UA format which Adobe derived from the PDF print format and ePub3, which originated as a non-proprietary eBook publishing standard.

PDF/UA is based on the original PDF standard which has been in place for many years as a print format, ensuring that documents are printed to essentially the same standard and layout whatever equipment or software is in use. However, the problem with PDF at its most basic level is that it not much more than an image format with consequent poor accessibility. To improve on that, PDF/UA requires the original document to be tagged at levels so that there can be machine understanding of its presentation[6]. Much of this can now be done automatically or be derived from typesetting files but often and ultimately still requires a degree of human intervention to be wholly effective. The PDF/UA (Universal Accessibility) format became an ISO Standard in July 2012[7] and is soon to be replaced by PDF/UA Version 2. There are currently limitations for PDF/UA especially around scientific and mathematical formulae so that it does not particularly work well in that context. But because of its widespread use, its longevity, and its ubiquity it is often a key feature in delivering effective digital content. In some ways PDF/UA has become established through the need to deal with the very large numbers of PDFs which are in circulation, both in education and in commerce.

EPub3 by contrast was specifically designed for digital text and to comply with the ePub3 standard the appropriate formatting must be in place at the at the outset. EPub3 also assimilated elements of the earlier DAISY format for accessibility so that anything conforming to ePub3 should implicitly be accessible without further intervention. However, ePub3, whilst it supports a rich feature set for the visually impaired, has not gone on to become more widespread than its use in eBook delivery albeit that some journal publishers, such as Taylor and Francis, are now providing ePub3 journal articles as well as PDFs.

Both these standards are in wide use and have been used over multiple platforms using a variety of readers. However, there are differences which need to be noted. PDF/UA, for example, does not support interactive media such as video and audio and provides poor support for mathematical formulae, whilst ePub3 can support embedded video and audio links enabling a richer experience. And importantly PDFs are not inherently reflowable, that is able to adjust text around images to suit different screens whilst reflowability is a key feature of ePub3 thus enabling its use on a variety of mobile and tablet devices.

In summary each has their advantages and disadvantages. If a structured file is available at the outset creating an Epub3 should not be problematic but converting a source file to ePub3 can

[5] https://www.britishmuseum.org/learn/schools/access-and-sen
[6] https://www.w3.org/WAI/GL/WCAG20-TECHS/pdf.html
[7] ISO 14289-1:2012 (PDF/UA (ISO 14289-1:2012)

be complex. Although a PDF may not offer the same level of accessibility when it comes to e.g., mathematics, the format is mature, well-known, can be made to reflow[8], is easy to create, and is generally well liked amongst both users and content producers [9].

There is thus no conclusive answer as to which standard is preferable; it probably depends on what is to be achieved and for whom. It is for that reason that some platforms are supporting both. And in either case the creation of a document in accessible format can itself be a significant challenge, less so for new material which can be born that way but more so for the substantial amounts of retrospective content – the process known as remediation.

5. Tools

As to tools, we could group these into three distinct genres.

- Reading software designed to meet the needs of a visually impaired.
- Conversion tools which take documents in whatever formats and convert them into accessible formats.
- Auditing software through which you can review a single document or a corpus of documents and measure accessibility and make consequent recommendations for remediation.

There are many of these tools available. Screen readers for example, vary depending on which devices are to be used and vary from the commonplace, such as NVDA[10] - which runs on Windows systems to JAWS[11] which is an open-source software system available in different flavours and very widely deployed on reading devices.

Auditing is often undertaken prior to improvement or conversion. Much work has been done on improving accessibility evaluation so the application of AI techniques, for example, is able to review up to 1000 documents and subsequently convert them to PDF format.

And as to conversion, in the university and library sectors, two systems seem to predominate. These are Sensus Access[12] which originated in Denmark and which we will come back to later and Blackboard Ally.[13] There are many other software solutions which vary in pricing and licencing agreements from open-source agreements[14] to substantial costs where significant where a significant amount of content is to be converted.

6. The Accessibility Challenge

As we have argued the challenge to universities and libraries is to ensure that the content that they generate, and supply is digitally accessible. Thus, many universities are seeking to take greater ownership of their content output through, for example, the development of open access

[8] Ted Page GOV.UK and PDF accessibility. https://accessible-digital-documents.com/blog/gov-uk-pdf-accessibility/

[9] Lars Bailieu Sensus Access Personal Communication

[10] https://www.nvaccess.org/download/

[11] https://www.freedomscientific.com/products/software/jaws/

[12] https://www.sensusaccess.com/

[13] https://www.blackboard.com/en-uk/teaching-learning/accessibility-universal-design/blackboard-ally-lms

[14] https://www.pagina.gmbh/produkte/epub-checker/

and open science programmes and the establishment of university presses. It is important that any such initiatives take account of the accessibility requirements and the legal obligations to ensure they comply. There are several scenarios where we believe accessibility is a key concern and where more needs to be done. To that end, we interviewed a mixture of professionals in different universities worldwide, to try and establish the current practices around accessible formatting and where the deficiencies might be. Consequently, we have identified three key areas of concern which can be categorised as follows:

- Monograph, serial and other (open access) publishing activities.
- Teaching materials delivered through learning systems such as Learning Management Systems (VLEs in the UK, LMS in the US).
- Open access research outputs made available through institutional repositories.

In each case, we have identified examples which illustrate current practice and interviewed key people to glean a better understanding.

7. Library publishing

We talked to University College London (UCL), a major research university in the UK with an expanding portfolio of research and teaching disciplines and which in 2018 established an open science office under the leadership of the university librarian. Its work is formulated in line with the recommendations of the LERU roadmap for open science[15], published in 2018. There are several divisions to the office which include open access publishing, including the UCL press, research data management, metrics, the delivery of digital collections, citizen science training and community support. UCL press was launched in 2015 and has published over 200 Open Access books across all disciplines and 14 open access journals and has more recently inaugurated a programme of open access textbooks. All new titles published are being made available as PDF/UA - that is they are suitably tagged etc following typesetting (the books are also available in print format). They are thus available as accessible documents via a range of partner platforms that UCL use for that purpose. There are also ePub3 versions which are made available at a nominal price through, for example, Amazon.

The University of Essex is another example where they previously published a university journal as basic PDF files over the web designed to disseminate refereed output of university students at, for example, Master's level. Whilst this was satisfactory from one point view, the whole enterprise lacked a technical framework. So, over the past two years, they have inaugurated an ejournal system based on the Janeway[16] technology and in parallel created a template in Word, which is capable of being rendered as PDF/UA. They have brought across all the pre-existing content so as to ensure that it is all now accessible and in a standardised format. This took some effort, and they are now in a position where they have a complete "Diamond OA" journal, which is accessible via PDF/UA. There are some limitations such as the handling of slides but otherwise, it is a great improvement.

As a further example we interviewed Charles Watkinson at the University of Michigan, a seemingly typical university publisher. In their case most of their output was now ePub3 although there were a few PDFs still offered, which were less accessible. However, they

[15] https://www.leru.org/publications/open-science-and-its-role-in-universities-a-roadmap-for-cultural-change

[16] https://www.openlibhums.org/site/janeway/

regularly undertook an audit of their contents through a third-party organization, Benetech, who highlight deficiencies in accessibility which they then try and address, though in some cases, the effort in remediation could be significant. Thus, there was inevitably some content which was not 100% accessible and that was always likely to continue to be the case, albeit over a matter of time there should be improvements. Also, he noted in the USA the sharing of content which had been pre-remediated by publishers and made available through Bookshare[17]. He also highlighted the Mellon grant-funded FRAME initiative to share materials already remediated by disability services offices through the Educational Materials Made Accessible repository, also being developed by Bookshare.

In summary open access university publishing is growing and accessibility appears to be a real concern of the people to whom we spoke. Universities are developing infrastructures which are capable of delving accessible content at the outset and are slowly converting retrospective content to ensure a good user experience. However, that retrospective work maybe not fully realised given the trade-offs of costs against usage and value.

8. The Virtual Learning Environment

Elearning has become commonplace in most universities either as a standalone function or via blended learning or just as an aspect of course delivery to ensure that all students are "on the same page". This has especially been the case since the 2020 pandemic. It means that considerable amounts of teacher originated content such as notes workbooks, quizzes etc. are being available made available via the virtual learning environment to specific cohorts of students as part of the course. However, the extent to which any of this is accessible is a moot point and though some universities have made strides to ensure that it is the case, largely through the provision of conversion software, such as Sensus Access or Blackboard Ally, many have not done so. We spoke for example to an Italian University who currently deploy Sensus Access for conversion, and are planning to implement the Sensus Access LTI[18], which is a VLE plugin to allow conversion 'on the fly'.

Another example of what a developed scenario might look like is that provided by an Ireland based company Brickfield Education Laboratories[19], who provide a suite of software which both audits courses, either at departmental or faculty level or indeed across the whole institution and consequently can measure the accessibility of the content therein. The system goes on to provide tools which can be used to correct deficiencies and ensure that content is accessible by the preferred readers. Hence, this is an all-encompassing solution to the accessibility problem, which can be both deployed on a local level or more generally.

However, our Italian interviewees made one important point: that each student was different and had different needs, and hence these automated approaches may well need further human intervention to work for a given individual.

9. Institutional Repositories

The third scenario where it seemed to us that there is a clear need to ensure good accessibility is that of the institutional repository or open access repository where university research outputs

[17] Bookshare https://www.bookshare.org

[18] https://lti.sensusaccess.com/Home/

[19] https://www.brickfield.ie/

are being held and disseminated. A particularly valid concern in that such documentation is designed to have global uptake so should conform to the requisite international standards. However, in interviews and discussions, we have found very little evidence that institutional repositories are being addressed in this way.

We talked further to Charles Watkinson at the University of Michigan as an example of a significant university with an institutional repository, to understand how they are dealing with content and what policies are in place. Watkinson took the view that the repository was a "problem space" where deposition is a matter for the individuals within the university and as such there was only lightweight control as to what was deposited. The consequence was that much was probably not in any accessible format. It was unclear as to whose remit it might be to monitor that - whether it was a distributed role or not. Watkinson noted that the Michigan rules and regulations included Standard Process Guides or SPGs, a forthcoming one of which covered electronic information accessibility. So, there was an upcoming need to better address the issue.

Michigan are recording accesses of their repository of over 10 million a year from a corpus of over 100,000 individual items and this does not include other content such as research data which is separately maintained and raised accessibility issues of its own. Clearly, more could be done, especially as content was being harvested quite widely. For example, Watkinson noted that at least 30% of their access was targeted at what would have been called grey literature, which was not available anywhere else, such as theses, white papers, technical reports, and so on.

One issue was that of descriptions which were significantly difficult to deal with without considerable remediation of the item in question and remediation could be very expensive, beyond the intrinsic value in the item itself. For example, there are problems with tabular data which not only requires tagging at the table level, but also descriptive text which would be difficult to determine by a third party and probably is the role of the author themselves. Asking an author to do such work is difficult when the request is made proactively for a new formal publication - it would be even more difficult, indeed likely impossible, to do retrospectively. In many cases the solution was accessibility by exception - that is dealing with an item if it was requested rather than attempting to cover the whole content corpus.

Indeed, we are aware of research that was undertaken by Waugh et al (Waugh, 2020) who broadly came to essentially the same conclusion., They reviewed repositories across the world though mainly in North America and reported that "It is clear that most universities have not achieved an ideal level of accessibility to all materials in their institutional repositories" and that "the most cited obstacles were lack of staffing, finances, and lack of expertise". They also reinforced the Michigan view that "It's up to the faculty who submit to make their work accessible when they publish it" begging the question as to whether the solution is that of more rigorous policies about what content goes into the IR and how it is formatted or whether it is a matter of providing more tools, perhaps similar to those being deployed in VLEs but across the institutional repository. It is likely that both are requirements given the extent of retrospective material that is now that is available but not accessible.

10. Summary

We firmly believe that universities libraries, educational technologists, learning technologists, research offices all need to address the issue of ensuring that the content that they are delivering

is in accessible formats. Whilst this could be, and is being, achieved on a point of need basis - we are aware that many institutions identify students with disabilities and make exception for them – we do not believe it is as satisfactory a solution as ensuring that all content is delivered with accessibility at the outset. The situation contrasts for example with that of commercial publishers, where major journals suppliers, for example Taylor and Francis[20], now ensure that all content is available either as PDF/UA or as an ePub3 or indeed, in many cases, both, so as to meet accessibility needs. The universities in this respect are behind and must aspire to improvements to meet their sustainability goals. In summary this is a call to action for those above and all involved in open science and open access to give serious attention to improving digital accessibility in all their published content at the outset.

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