A Qualitative Study on the Digital Preservation of OER

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abstract: Libraries continue to spearhead initiatives to incentivize instructors to adopt, adapt, and create open educational resources (OER). However, these programs often do not explicitly require educators to preserve the OER they create. Drawing on an analysis of semi-structured interviews with six experts, this article presents considerations for libraries interested in preserving OER and recommendations for OER librarians who are new to digital preservation. The study makes an argument for why and how libraries could begin to preserve OER. Future areas of investigation include better understanding how OER repositories preserve such resources and how consortia models can support this work.

Introduction

> If you can't open it because it's in an obsolete format, it's not open.
>
> *Interviewee 3*

Open educational resources (OER) are learning objects shared under an intellectual property license that explicitly allows others to retain, reuse, revise, remix, and redistribute them.[1] Examples of OER include textbooks, videos, syllabi, and lectures made available under a Creative Commons license. Open educational resources have been widely discussed in recent years as a potential solution to the rising expense of course materials, which are estimated to cost full-time undergraduate students almost $1,300 per year.[2] In addition to cost savings, OER continue to be connected to student retention and course completion. For example, a study at Virginia State University in Ettrick found that students who took courses that utilized OER "tended to have higher grades and lower failing and withdrawal rates."[3]

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Libraries have begun to spearhead OER initiatives.[4] Successful programs have been implemented at the University of Massachusetts Amherst, UCLA (University of California, Los Angeles), the University of Kansas in Lawrence, Temple University in Philadelphia, and the University of Minnesota, among others.[5] Several library-led OER initiatives incentivize faculty creation of OER, often by offering stipends to compensate instructors for their time and to entice them to participate. In these initiatives, librarians assist faculty with rights checking, project management, finding content, and editing to successfully create new OER.[6]

While librarians' knowledge of copyright, open access, metadata, and instructional design is often seen as integral for creating new OER, digital preservation is rarely mentioned as an area of expertise that librarians contribute to the open education movement. Academic libraries that are committed to long-term preservation could require or at least encourage preservation of the content they pay faculty to create.

There are several reasons to consider preservation. The most obvious is accountability: if library resources, including money, are dedicated to incentivizing OER creation, the resulting materials should be available long-term. Are we acting responsibly with our funding if we financially incentivize faculty to create OER that may not be accessible in a few years? Compared to other learning objects, OER have an increased potential to impact outside educators and institutions because of how they are licensed, making them a priority for preservation. OER developed as part of a grant often represent the teaching and learning activities of a university or college, making them an important priority within university records management plans. For example, in addition to demonstrating pedagogical innovations, OER created as part of a library incentive program are usually keyed to the curriculum, and the classes in which they are used must reach hundreds of students to be supported by the library. The decision to preserve or not preserve OER will shift based on local priorities, resources, institutional capacity, and context. While this article hopes to provoke thought and provide a starting point for libraries interested in preserving OER, maintaining them is ultimately the decision of individual institutions and library preservation departments.

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This article investigates whether library incentive programs to create OER consider digital preservation. In addition to gauging what libraries currently do, the article addresses several research questions:

- If OER creation initiatives spearheaded by libraries do not require digital preservation of content, what do they require? Are there specific repositories, Creative Commons licenses, or file formats faculty must use as part of the program?
- If libraries were to systematically pursue the preservation of born-digital OER, what might good practices look like?

- In 2014, David Wiley created a litmus test, called the 5R permissions, for learning objects: for them to be considered OER, other educators must be able to retain, reuse, revise, remix, and redistribute them.[7] What specific preservation challenges arise when other educators utilize these privileges to their fullest extent?

Copyright constraints are not the only barrier to OER adoption and remixing: obsolete or proprietary file formats, software requirements, and the need for technical expertise continue to interfere with educators' ability to fully utilize the permissions that Creative Commons licenses make possible. An expert on digital preservation interviewed for this study noted that "If you can't open [an OER file] because it's in an obsolete format, it's not open." This article holds that librarians' commitment to digital preservation of content is integral to making sure that OER remain truly open for years to come.

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Literature Review

Digital Preservation

> The default for digital information is not to survive unless someone takes conscious action to make them persist.
>
> *Howard Besser*[8]

Digital preservation scholarship and literature have continued to grow significantly since the 1980s. While there are still unknowns, obstacles, and solutions to be developed in the field, there is a breadth of publications to explore. Nevertheless, explicit mention of OER within digital preservation literature is scarce.

Digital preservation is defined as "a series of management policies and activities necessary to ensure the enduring usability, authenticity, discoverability, and accessibility of content over the very long term."[9] In practice, digital preservation provides a set of guidelines to inform how institutions can approach preserving born-digital or digitized materials and assets. This content can include websites, audiovisual materials, digital text and images, databases, e-mail, and geospatial data, among other formats. While some paper items can last for decades with minimal attention, digital materials can have a much shorter shelf-life if ignored. These various information formats and content types can sometimes pose different concerns when building a digital preservation strategy. This is particularly true for interactive works. For example, Jasmine Mulliken describes three options for preserving interactive digital content, each with its own challenges: repository deposit, which creates user experience challenges; Web archiving, which relies on external entities; and emulation, which is still being developed.[10] Emulation requires using a software program in an attempt to closely replicate a digital environment or digital object for preservation purposes.[11] This helps retain the original look and feel of a digital object.

Institutions will have different approaches to digital preservation based on their context, funding, policies, expertise, user needs, and preservation goals. What may be good practice at one institution will not be sufficient, or fully possible, at another. While it is outside the scope of this article to provide a comprehensive overview of digital preservation, OER practitioners looking to delve into digital preservation literature as novices may find such guides as the Digital Preservation Coalition's "Digital Preservation Handbook"[12] and Maxine Sitts's *Handbook for Digital Projects: A Management Tool for Preservation and Access* helpful.[13] "Preserving Digital Information: Report of the Task Force on Archiving of Digital Information" was written by a group of over 20 experts and is considered a seminal report that gives a broad overview of the landscape, concerns, and recommendations for those looking to approach digital preservation at their institutions.[14] Another foundational text is the "Reference Model for an Open Archival Information System (OAIS)" created by the Consultative Committee for Space Data Systems and now published as ISO standard 14721.[15]

Preservation planning must start at the beginning of the project life cycle, with each institution considering the scope of what it wants to preserve when faculty start to create OER.

While the 5R permissions inherent in OER—retain, reuse, revise, remix, and redistribute—are liberatory, they also pose challenges from a digital preservation perspective. Preservation planning must start at the beginning of the project life cycle, with each institution considering the scope of what it wants to preserve when faculty start to create OER. Provenance, versioning,[16] and the fact that OER can be an amalgamation of digital objects and files in multiple formats that are altered over time all present challenges.

Digital Preservation of OER

Digital preservation of open educational resources is only addressed a few times in the library literature, almost always as part of a larger discussion about the repositories that host OER. In "Navigating OER: The Library's Role in Bringing OER to Campus," University of San Diego librarians Julia Hess, Alejandra Nann, and Kelly Riddle note that digital preservation "is a significant challenge due to the short lifespan of the repositories in which [OER] are typically housed."[17] They cite Norm Friesen's 2009 study of 11 open repositories that had been discontinued, which found that "the average lifetime of these repositories was less than three years."[18] They conclude that the responsibility for preservation currently falls to creators, who might lack the time or expertise to adequately preserve OER.

Several studies evaluate OER repositories, but their capacity for preservation is often not explicitly mentioned. For example, University of London faculty members Javiera Atenas and Leo Havemann analyzed the functionality of 80 OER repositories in 2013.[19] Their assessment notes peer review functionality, metadata standards, Creative Commons license integration, multilingual support, and the availability of source code, but not preservation. However, evaluation of preservation practices may come up even if it is not part of the study design. One study from researchers Tel Amiel and Tiago

Chagas Soares analyzed 50 repositories. While the researchers did not originally intend to discuss preservation of OER, one-fifth (10) of the repositories in the study had to be eliminated from the analysis because they were defunct. This left the authors to conclude that "even though we did not have the intention to promote a deeper insight on repositories regarding technical and maintenance issues, it is interesting to note that technical consistency and availability may contribute to a lack of visibility of these repositories and uptake of the resources."[20]

Studies that focus on how OER programs share content sometimes discuss the long-term availability of OER, which is related to preservation. One from the Centre for Academic Practice and Learning Enhancement (CAPLE) and the Centre for Educational Technology and Interoperability Standards (CETIS) at the University of Strathclyde in the United Kingdom explored the involvement of libraries in OER programs by surveying over 50 institutions or OER initiatives in the U.K., the United States, Spain, South Africa, India, and Nigeria. While most of the survey respondents for each program described sharing OER through a repository, one-third of the respondents shared OER through third-party services such as YouTube, iTunes, SlideShare, or Flickr, through their learning management system; or on project websites or blogs. When this same survey asked, "In which of the following activities are the librarians or the Library involved in your OER initiative and which is their level of responsibility / commitment?" only 11 respondents (or about one-fifth) said the library assisted them with preservation.[21] This lack of library preservation assistance might provide one explanation for programs utilizing third-party providers such as YouTube for storage and access. This is problematic, as University of Michigan librarians Pieter Kleymeer, Molly Kleinman, and Ted Hanss note, because open courseware publishing platforms and learning management systems are not designed for long-term preservation.[22]

Finally, a number of publications have explored issues related to long-term access and adaptability of OER, which are closely related but not always explicitly connected to the issue of digital preservation. These publications are integral resources for OER creators and introduce several issues that are fundamental to OER preservation, including ideal file formats, software requirements, versioning, and metadata.

For example, John Hilton, David Wiley, Jared Stein, and Aaron Johnson published the ALMS framework in 2010.[23] The framework provides a mechanism for assessing how editable OER are, based on the level of technical expertise and the software a user might need to modify the materials. ALMS stands for access to editing tools, level of expertise required, meaningfully editable, and source files. While ALMS does not explicitly mention preservation, its focus on file format constraints and interoperability is an important precursor. Seth Gurell has taken the ALMS framework a step further by creating a rubric that can be used to assess individual OER and entire OER repositories to understand how editable or adaptable they are.[24] Librarian Steven Ovadia's 2019 article on the technical constraints users experience when enacting the 5R permissions builds upon the ALMS framework, recommending that creators adopt several open source software practices, including using Markdown, a way of formatting text that can be converted to many output formats, and distributed version control, which tracks changes to a work and allows users to revert to a previous version if desired.[25] Similarly, the Open Textbook Network's *Modifying an Open Textbook: What You Need to Know* provides an important

discussion on the software needed to edit specific file formats, asking creators to think about longevity and downstream use as part of their creation process.[26]

Libraries' Current Approach

While the literature does not delve into how libraries currently preserve OER, discussion of OER preservation generally centers on using institutional repositories (IRs). For example, in their discussion of the future of OER, Kleymeer, Kleinman, and Hanss hold that institutional repositories built on DSpace and Fedora are committed to long-term preservation, making them an excellent option for sharing and preserving OER.[27] Librarian Christine Ferguson's examination of three library OER incentive programs found that an emphasis on IRs was a trend across institutions.[28] Ferguson reports that several more libraries use their IR as a central OER preservation strategy, including the University of Kansas in Lawrence, Cleveland State University in Ohio, Grand Valley State University in Allendale, Michigan, California State University San Marcos, and the University of Minnesota.

Libraries' explicit dependence on using institutional repositories to preserve OER raises important questions. How many IRs have preservation workflows "baked in" and can support the preservation of a range of born-digital objects, including wikis and videos? Does the reliance on institutional repositories for preservation of OER leave out creators who have less funding and no IR, including community college libraries? If an institutional repository is not available, can creators assume that community repositories such as OER Commons and MERLOT (Multimedia Education Resource for Learning and Online Teaching) will preserve their OER?

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Digital Preservation of e-Books and Other Digital Objects

While guidance on the digital preservation of OER is underdeveloped, practitioners can find inspiration in literature on preserving other complex digital objects, including enhanced e-books and monographs, research data, geographic information systems (GIS),[29] digital humanities and digital scholarship projects,[30] web pages,[31] and even gaming environments.

Literature on preserving enhanced e-books is particularly relevant. Scholarly publishing expert Charles Watkinson defines enhanced e-books as any "which may include digital affordances such as time-based multimedia (audio, video), annotations, interactive timelines, or maps."[32] Enhanced e-book projects already utilize preservation networks in a way that OER creators could emulate. As an example, the book-publishing tool Fulcrum plans to deposit enhanced media in partnership with distributed preservation networks

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such as the Academic Preservation Trust (APTrust).[33] However, this trend is new and still developing, and such preservation organizations as Portico and LOCKSS (Lots of Copies Keep Stuff Safe) do not yet have the capacity to accommodate many enhancements. Additionally, literature like the Digital Preservation Coalition (DPC) Technology Watch Report "Preserving eBooks" presents models for sustainably funding the preservation of e-books[34] that could inform a conversation about funding OER preservation: a collective model (HathiTrust), a subscription service (Portico and CLOCKSS, or Controlled LOCKSS), and government support or grant funding.

OER practitioners could also look to the preservation of digital humanities projects for inspiration. In a Library of Congress blog post titled "Digital Humanities and Digital Preservation," digital preservation expert Leslie Johnston describes two schools of thought for preserving digital humanities projects: "Preserve the content and the look and feel exactly as they were implemented, [which is] often close to impossible" or "preserve the content but forgo the look and feel, [which is] often extremely unpopular."[35] Johnston concludes that preservation planning should start at the beginning of a project, open content format standards must be considered, and all decisions should be documented, including "the rights and provenance of all content and metadata."[36] As with the discourse on e-book preservation, conversations about digital humanities and digital scholarship preservation are still emerging. While these areas of the literature are informative and inspirational, specific guidance on preserving open educational resources is still needed.

Methodology

The following research design was created with two goals: to understand how current OER creation incentive programs preserve content, if at all, and to name and explore barriers to and considerations for preserving OER.

Analysis of Current Preservation Practices

To better understand how library programs in the United States and Canada require or encourage OER creators they incentivize to preserve OER, the authors conducted an analysis of OER creation program requirements. This process utilized data from the Scholarly Publishing and Resource Coalition (SPARC) Connect OER Report.[37] Data from the 2016–2017 report "encompass 65 SPARC member libraries spanning 31 U.S. states and five Canadian provinces."[38] While 65 institutions provided profiles, only 27 submitted OER grant program information. Those 27 programs could select primary and secondary focuses of their programs from this list: adaptation, adoption, awareness, curation, pedagogy, publication, review, and research. The authors further limited the analysis to 20 programs by selecting those that chose curation or publication as a primary or secondary strategy, since creation was core to the analysis.

Of those 20 programs, those where creation or publication of OER was not explicitly mentioned on the grant program website were omitted. Those where the link to the program website provided through the SPARC survey was broken were also excluded. This limited the analysis to 14 programs. The authors navigated to the public grant ap-

plication sites of each of the 14 programs and assessed the publicly available information by answering a set of questions about digital preservation of content:

- Is "digital preservation" or "preservation" explicitly mentioned?
- Is a digital preservation librarian mentioned or listed on any related OER program committee list or contact information?
- Are there preservation or digital preservation requirements on the OER program evaluation rubric or application?
- Is "sustainability" mentioned or listed on the OER program evaluation rubric or application?
- Is there a requirement to share the final OER in an institutional repository?
- Is there a requirement to share the final OER in another repository outside of the program's institution?

The authors acknowledge that some of the information sought, as it relates to digital preservation and OER grant program specifics, may not be listed on the public website for the OER program, but rather within internal documentation. This could lead to inaccuracies in the findings. However, it is important to note that if this information is limited only to internal documentation, it is not public to faculty applying for the incentive, making these requirements invisible at the outset.

None of the programs evaluated explicitly mention preservation or digital preservation on their public OER program websites, applications, or evaluation rubrics. Three programs, those at Kansas State University, the University of Kansas, and the University of Minnesota, mention "sustainability," though not necessarily in a preservation sense. In using the term "sustainability," the authors assume these programs refer to whether the OER will be utilized in a class that will be taught every academic year.

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About a third of programs (6) explicitly require creators to deposit the final OER in either an institutional or outside repository to receive funding. This could imply that these OER incentive programs believe that repositories suffice as preservation. Table 1 explores each program's requirements in more detail. Details about each program are accurate as of 2019 but may change over time.

There are many reasons why an institution may not consider digital preservation of OER. First, digital preservation requires resources, staff, and expertise, all of which may be out of reach for an institution. Perhaps current library staff do not know how digital preservation works and are not sure how to approach preserving OER. Digital preservation may not be discussed or seen as necessary. Perhaps an institution has determined that OER on its campuses are not worth preserv-

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Table 1.

Institution	Mention of digital preservation?	Licensing requirement	Repository submission requirement
University of Arkansas, Fayetteville	No	Yes, must be published with an open Creative Commons license	Yes, must be made available on an accessible open platform
Clemson University, Clemson, South Carolina	No	Not required, but preference will be given to proposals using materials licensed CC-BY (a license that requires attribution)	Not stated
Fort Hays State University, Hays, Kansas	No	Yes, program does not allow the creation or adaptation of textbooks without the accompaniment of a Creative Commons license	Yes, must be uploaded to the FHSU Scholars Repository
Kansas State University, Manhattan	No, but "sustainability" mentioned in evaluation criteria	Not required, but is discussed in the evaluation rubric: *http://www.lib.k-state.edu/textbook-selection-criteria*	Not stated
University of Kansas, Lawrence	No, but "sustainability" mentioned in evaluation criteria	Not stated	Not stated
North Carolina State University, Raleigh	No	Not stated	Not stated

Table 1, cont.

Institution	Mention of digital preservation?	Licensing requirement	Repository submission requirement
University of Oklahoma, Norman	No	Yes, grantees in the "Creation" category will be expected to apply a Creative Commons License (of author's choice) to the OER they create	Yes, grantees in the "Creation" category will be expected to upload their OER to the university's institutional repository SHARE OK in exchange for grant funding
Portland State University, Portland, Oregon	No	Not stated	Not stated
Simon Fraser University, British Columbia, Canada	No	Yes, agreement that the end product will be openly licensed (e.g., using Creative Commons licenses)	Yes, must be uploaded to Summit, SFU's institutional repository
Temple University, Philadelphia	No	Not stated	Not stated
University of Minnesota, Twin Cities	No, but "sustainability" mentioned in evaluation criteria	Yes, participants will be asked to license any newly created materials (CC-BY or similar open license)	Not stated
Utah State University, Logan	No	Yes, applicants must facilitate the distribution of the OER via an OER-compatible Creative Commons license	Yes, must be uploaded into USU's Digital Common
Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg	No	Yes, requires OER produced through the grant program to be licensed CC-BY	Grant letter of agreement requires that the OER output is publicly shared via a public portal
Washington State University, Pullman	No	Yes, all OER creation or adaptation must be accompanied by a Creative Commons license	Not stated

ing for the long term. Lastly, an OER team or librarian may not consider consulting with preservation experts on their campus as they develop their program, especially since the focus is often on outreach and cost savings.

Interviews

After discovering that digital preservation of OER is a gap both in practice and in the literature, the authors opted to interview experts in digital preservation, metadata, repositories, and OER to better understand the challenges related to preserving OER. The aim of each interview was to construct a set of practices for preserving OER.

Participants

Potential interviewees were identified by reviewing publications on relevant topics and through word of mouth. The authors invited 10 individuals and 4 OER repository staff members to be interviewed for this study. Six of the 10 invited individuals were willing and able to be interviewed. None of the OER repository staff members were available. Interviewees represented perspectives from university presses, libraries, and consortia projects.

While there are limitations to a small interview pool, the authors intentionally prioritized in-depth conversations with a small number of internationally recognized experts over collecting a large number of more general responses via a survey. In addition to more readily surfacing complexities and nuances, this qualitative approach attempts to make the interviewees' expertise more accessible to all, including OER librarians who are novices in digital preservation. Additional details about interviewees are described in Table 2. The "Results" section refers to interviewees by the specific number assigned in the table.

Data Collection and Instrument

The authors conducted semi-structured interviews between July and December 2018. Interview questions (available in the Appendix) were given to participants beforehand as part of the consent form they were required to sign. The interview protocol was approved by both Indiana University's and the University of Washington's Institutional Review Boards (IRB).

Interviewees were often asked follow-up questions based on their response, area of expertise, or current position. This flexible research design recognizes the value of having the expert lead the interview to surface new lines of inquiry not yet considered by the authors. Both authors were present for each interview. Interviews varied in length from 25 to 50 minutes.

Data Analysis

All participants permitted the authors to record their interviews. Recordings were auto transcribed and then reviewed and edited by one of the authors for accuracy. Each author reviewed a subset of the transcripts and proposed themes of interest. The authors then reexamined these themes, combining similar concepts and adding additional themes as

Table 2.

Interviewee number	Expertise	Type of institution
1	Digital libraries	Large public research university (Canada)
2	Scholarly publishing	Large public research university (U.S.)
3	Digital preservation	Library consortium (Canada)
4	Open education	Large public research university (U.S.)
5	Digital preservation	Large public research university (U.S.)
6	Digital preservation	Medium private research university (U.S.)

needed, to create a final codebook before reviewing all transcripts. Both authors coded each of the six interviews individually, tagging relevant text with specific codes. The authors then analyzed interview transcripts for each code individually.

Results

The following sections summarize key themes discussed by multiple interviewees. While themes are presented as distinct topics within this section, many of the themes overlap or complement each other and, as such, should be considered in tandem. Themes move from more straightforward suggestions (such as collaborating with archivists) to more complicated issues (such as forming consortia groups and implementing standardized metadata practices). The end of each section summarizes key recommendations.

Inspiring Cross-Pollination

Many of the interviewees emphasized that digital preservation is not done alone. Interviewee 6 noted that digital preservation librarians must be intentional about not creating fiefdoms and instead should focus on finding allies to avoid duplication of work. This speaks to the collaborative approach inherent in digital preservation work. Conversely, interviewee 4 lamented the loneliness of being "the OER person" at the library. This individual mentioned not being introduced to other people in the library who could further the OER work, namely digital preservation and archives experts. In what ways can institutions help spark cross-departmental collaborations if OER are a priority? How can management ensure that people meet one another and share expertise? This is a special concern within "new" types of library positions (such as OER librarian positions), where an individual may be the first person to hold the job and not know where to seek partnerships and allies within the library. Interviewee 4 suggested, "Another way that might be really helpful for people who are just getting started . . . is if there were best practices of people you should identify as collaborators . . . Nobody is making [those guidelines] yet." Such a list could help librarians tasked with OER work jump-start conversations with key partners.

Several interviewees proposed that the list of potential collaborators include digital preservation librarians, archivists, and record managers. This was in part because of the importance they placed on archival appraisal when considering preservation of OER. Appraisal in archives is a decision-making process whereby archivists consider which objects to keep for preservation, including the expected usefulness for their user community, the anticipated length of preservation or the retention schedule, the object's condition and costs to maintain, its authenticity, and its overall intrinsic value. Consulting with an archivist to establish parameters and understand what is possible when preserving OER at one's institution is essential for responsible and realistic stewardship. Going forward, this helps establish a foundation for making decisions about which OER to keep and provides guidelines for discussions about preservation with OER creators.

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Interviewee 6 conveyed the importance of this process by noting that "every time you decide to preserve something, it's got a long-term commitment associated with it, you can't take a year off [with preservation], you've got to keep going . . . There's no category I know of where we keep everything always. And that's records management." This interviewee applied this statement to OER specifically, stating that if 150 courses used OER at a given campus, appraisal might involve preserving a sample across courses or using an event-based appraisal that prioritizes particular OER "because [they were] the first, the best, award winning, [or] by the first woman faculty person." Interviewee 5 further elaborated on archival appraisal by encouraging those interested in OER to consider periodically evaluating new challenges to preservation and changes in preservation resources every few years. This iterative approach to appraisal might mean that materials are deaccessioned. In short, since we do not know "whether these objects will be difficult to preserve or not," gathering download data and information on new preservation challenges every few years could be invaluable. The recommendations to collaborate with record managers and archivists who have vast experience in selecting which objects to preserve and to make policies flexible will be integral for librarians interested in sustainable preservation.

Those interested in inspiring cross-pollination between OER experts and digital preservation or archives experts could look to professional development opportunities. Interviewee 2 encouraged OER and digital preservation experts to consider coauthoring publications and copresenting at conferences to increase exposure. Interviewee 6 wondered how different groups, such as the Association of Research Libraries (ARL), the Association of College and Research Libraries (ACRL), the American Library Association (ALA), and the Digital Library Federation (DLF), among others, could bring these experts together. Such connections could take the form of publishing a white paper on OER and digital preservation or hosting webinars and conversations around this topic.

Recommendations related to this theme include:

- Create a list of key stakeholders OER experts should approach when creating incentive programs.
- On a national level, encourage such organizations as ARL, ACRL, and DLF to create spaces for cross-pollination.
- In partnership with archivists, establish an appraisal policy for OER that considers the local user community, preservation challenges, and value to the broader teaching and learning community.

The Need for Management and for Librarians to Own Their Expertise

The previous section makes clear that the digital preservation of OER is a management issue. Preserving OER involves utilizing expertise within the library, making decisions early about preservation policy, and determining what should be preserved and maintained, all of which require communication and coordination across multiple units. Some interviewees encouraged libraries to take a "high-level view" of their organization and its priorities when considering preserving OER and to strategically plan for overlap across units. Interviewee 1 even proclaimed that digital preservation of OER is not a technical issue or one of faculty interest, but instead a management issue. This is partly because taking on digital preservation of OER requires that time, energy, and resources be diverted from other activities to make efforts sustainable.

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In addition to management making the preservation of OER a priority, preservation will require librarians to own their expertise and intentionally incorporate this knowledge into grant programs. Libraries have established precedent for requiring specific file formats or other submission parameters for researchers when they upload electronic theses, dissertations, and other works into institutional or data repositories. OER grant and award programs interested in preserving their completed OER projects could consider outlining required OER file formats or creation parameters in the submission requirements for awardees to participate and receive funding. Academic librarian and technology expert Steven Ovadia's guidance on using Markdown or text files might be useful in this endeavor.[39]

Interviewee 1 highlighted this idea of owning one's expertise:

> I think we just need to start seeing all of these digital pieces as our responsibility . . . This is literally our area of expertise, and we would never go to [instructors] and assume to tell them how to teach their history class. I don't know why we acquiesce when they're like, "No, I want to create [a digital object, project, or OER] in this format only, and you'll have to figure it out."

Interviewee 6 echoed this sentiment, stating that "managing well doesn't mean some faculty member figuring out what's good enough. It means partnering with them to make sure that it's easy for them to do what they need to do."

In short, when librarians hesitate to require faculty to plan for preservation, either through identifying acceptable file formats or by requiring that a librarian is embedded in the creation process, they do a disservice to their professional expertise and to the longevity of the OER created. Before figuring out the details of what OER libraries will preserve or how, administrators must decide that preservation of OER is important and librarians must recognize that their professional expertise can inform the creation process.

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Recommendations related to this theme include:

- Intentionally and structurally bring disparate groups together to make OER preservation possible.
- Decide what other services or resources will be cut to make preservation endeavors realistic and sustainable.
- Own the preservation expertise librarians have by requiring faculty to create OER with tools and file formats that have been evaluated beforehand, ideally articulating this in policy.

Consortia Strategies

Several interviewees discussed the real financial barriers to quality digital preservation. As a result, consortia strategies for funding digital preservation of OER were continually mentioned. Interviewees generally felt that consortia models enable the community to share the burden of cost, ultimately empowering institutions that have less resources to preserve their OER.

Interviewee 3 noted that "there's no need to reinvent the wheel" because a variety of consortia digital preservation networks already exist. That person noted that "many institutions have subscriptions to those [networks]" and declared there was no reason why "a library with a subscription to Portico or CLOCKSS couldn't extend some of that benefit to a smaller situation with which they have an agreement." Consortia preservation providers mentioned by interviewees included LYRASIS, Portico, LOCKSS, and CLOCKSS.

However, using existing preservation networks might be more challenging than simply formalizing partnerships. Another interviewee questioned the technical infrastructure that would be needed to make pushing content to a consortia network feasible. That person explicitly mentioned building application programming interfaces (APIs) into OER tools to send content to entities like CLOCKSS. Other questions involve using consortia preservation networks for OER preservation. For example, interviewee 3 mentioned the challenge of shared values: how might we, as a community, agree on what level of preservation to offer? What are the challenges inherent in sharing resources and shifting financial responsibility to well-resourced institutions?

Recommendations related to this theme include:

- Build upon existing consortia agreements that preserve digital content so that OER are included.
- Facilitate community conversation about how to preserve OER through consortia.

Managing Parts and Versions

Interviewees clearly articulated that adequately capturing the versions (defined here as iterations of OER) and parts (defined here as portions, chapters, or sections) of OER is an essential and inherent element of preservation. The concern with capturing provenance information, adaptations, and even interactions with the OER is closely tied to the 5R permissions and users' ability to enact them fully. Interviewee 1 posited that libraries' ability to manage parts and versions will be key to faculty finding open education valuable in the future:

…adequately capturing the versions (defined here as iterations of OER) and parts (defined here as portions, chapters, or sections) of OER is an essential and inherent element of preservation.

> Showing the currency of the work is always going to be important and I think will become even more important . . . [to show that] your work is actually being used. So, I think it's being able to show the different versions and to store them in a way . . . kind of like Time Machine backup on your laptop, like how can we pick a time and a place and see what that chapter was used for?

One way librarians could approach this kind of versioning is by assigning a unique digital object identifier (DOI) to each version of the OER, or even each part of the OER, to track changes over time. This would also enable more robust citation of the original version. Another option is creating a distributed version control tool for OER, similar to Git, as Ovadia recommends.[40] This approach would allow OER creators to track iterations of their OER while maintaining a master copy for their own use.

In addition to thinking through the pieces of OER, a question that many interviewees grappled with is "When are OER 'done enough' to preserve?" The beauty of OER is that they are never complete because the license empowers anyone to revise and update them whenever they like. While there was not a consensus on how to handle parts and versioning, interviewees generally felt that saving changes to individual parts of OER, along with recording the relationships between each of these parts through detailed metadata, were often useful first steps. They also recommended that OER preservation policies define how significant changes must be for the OER to be considered new.

The beauty of OER is that they are never complete because the license empowers anyone to revise and update them whenever they like.

Interviewee 2 noted that versioning is more complex than just tracking content and encouraged those interested in preservation to consider the "layers of interaction" OER embody. The interviewee noted three layers: the base content, the dynamic media, and the network layer. This person defined the network layer as interactions readers and students have with the OER, which might include annotations. Using this model to evaluate which layer or layers need to be preserved will be integral. Such preservation brings up important privacy questions and requires a larger discussion about how to attain students' consent.

Recommendations related to this theme include:

- Explore assigning DOIs to whole OER or parts of OER to track versioning and encourage permanence.
- Explore using distributed version control mechanisms as described by Steven Ovadia.
- Decide when OER should be deemed new objects and articulate this in preservation policies.
- Record relationships between parts of OER with robust metadata.

Metadata

Nearly all the interview participants emphasized how integral metadata is to preservation, noting that even if we can create tools and workflows that effectively track versions, assigning metadata that adequately describes how OER were revised and remixed is key to any preservation strategy. Interviewee 2 explained that metadata is a mechanism for "rich, deep, complex storytelling . . . to the future" and that even if the OER are lost, the knowledge "about what was there would remain if the storytelling was done effectively." This interviewee suggested that preservation and metadata policies at least include chain of custody information or background on how the OER were acquired. For example, the PREMIS (Preservation Metadata: Implementation Strategies) schema is widely recognized as the standard for documenting preservation metadata. It allows for the recording of digital provenance and specific preservation actions undertaken by institutions. The data model allows actions to be related to specific objects as well as to the responsible parties (both human and computer).

. . . assigning metadata that adequately describes how OER were revised and remixed is key to any preservation strategy.

Still, figuring out the logistics of describing OER and collecting this metadata can be challenging. Interviewee 3 held that using existing metadata schema or an XML file might suffice, mentioning the "is part of" element of the Dublin Core, a widely used metadata schema, as an example. While this might be easy to implement if a library runs the institutional repository where faculty submit OER, it is more challenging if faculty share their OER in a community repository. In Atenas and Havemann's analysis of repositories, they found that "only 38.75% of the repositories include the use of standardised metadata such as either Dublin Core or Learning Object Metadata which

. . . can be transferred across repositories."[41] In addition to advocating for specific metadata schema in these repositories, OER practitioners should push for optional metadata fields that add context useful both for educators and for preservation purposes. These standardized fields might include learning outcomes, accessibility information, mobile compatibility, technical requirements, geographic coverage, temporal coverage, source information, clearly defined rights statements, and date uploaded.

One potential solution for including more detailed metadata is creating a "code book" that provides additional context. Interviewee 1 expressed a desire to see "a workflow attached to every learning object [about] where the source information came from, who supported it, [and] how the library did what they did." This interviewee further explained that the code book could describe pieces of the learning object, who was involved, and which funding source or sources was used. The interviewee added, "I think that's where you surface all the labor that goes into these [OER] as well . . . the labor just disappears because they assume that it's a tool that does all the work, not all the people poking at the tool." There is precedent for creating such a "code book" in other open spaces. For example, it is fairly common practice to submit a ReadMe when sharing open data so that users of the data set know how the data were collected, cleaned, and analyzed. Those interested in preserving OER could easily mimic this practice, providing an explanatory ReadMe when OER are deposited in institutional or community repositories.

Recommendations related to this theme include:

- Consider requiring a code book or ReadMe when OER are deposited to encourage additional context around labor, funding, tools used, and decision-making.
- Use and enhance existing metadata schema in institutional and community repositories, possibly exploring PREMIS and learning object metadata (LOM).

Repositories and Preservation of OER

Interviewees expressed the disconnect between institutional repositories and preservation strategies. For example, interviewee 5 said,

> A lot of [institutional repositories] end up being a sort of dumping ground. There's not necessarily a guarantee of the long-term accessibility of that content. I think that's better than nothing, but just by virtue of it being an IR, it doesn't necessarily guarantee what we mean by preservation. It could, but it depends on the policies of the IR and how that IR is staffed and operated.

Interviewee 3 explained a common difference between IR and preservation workflows: "[IRs] do access . . . If there are preservation workflows, they tend to be separate from the IRs. You might deposit something that could get preserved using another workflow."

Interviewee 5 suggested "going back to the basics" as a strategy for untangling IRs and preservation. This person emphasized secure redundant storage, fixity checking, and using trusted repositories whenever possible. Fixity checking is way to document the integrity of content and then periodically recalculate the checksums of digital objects to compare against the stored values. Essentially, this process checks to make sure that none of the digital information associated with the object has changed over time. Interviewee 5 also felt that institutional repositories must have explicit preservation approaches baked into their systems to claim to preserve OER.

Interviewees also discussed community OER repositories, or repositories open to all depositors (regardless of institutional affiliation), and devoted OER. The interviews surfaced a lack of transparency about who "owns" community OER repository infrastructure. There was sometimes an assumption that the repositories are supported by the institutions within which they are housed or even by funders like the Hewlett Foundation. However, funding sources and sustainability plans should be explicit and clear both to those searching for and those creating OER for deposit.

Recommendations related to this theme include:

- Be clear with users about the preservation capacity of your institutional repository.
- Demand that community repositories explicitly state their preservation and sustainability plans before recommending them to depositors.
- Compile deposit requirements (or best practices) for preservation, including file format.

Discussion

Librarians can take several important steps to operationalize the themes discussed here, both in their day-to-day work and in their OER incentive program requirements. The following section synthesizes interviewees' ideas so that they can be made operational by those working with OER creators. These ideas will not make sense in every institutional context. There are several barriers to successfully implementing these recommendations, most obviously that OER work is almost never a librarian's sole responsibility. Other barriers include negotiating with funding partners (such as the Center for Teaching and Learning or IT) on grant requirements and structuring funding so that creators comply.

Create Policies to Outline Creator versus Library Responsibilities

Communicating institutional practices and priorities clearly in a formal policy before the OER creation process begins is ideal. This level of transparency can help creators understand expectations and benefits in the planning stages of their project instead of in the middle. A policy might define the object of preservation (that is, the OER themselves or interactions with the content), include specific preservation actions the library can commit to, and make explicit the appraisal criteria the library will use to select OER to preserve as well as conventions for version control, including how often the library will preserve new versions. Policies should clearly outline the expectations of creators regarding file format, tools used, and sharing requirements. If creators get a financial stipend from the library for creating the OER, policies might need to be formalized in a memorandum of understanding (MOU). The process of crafting policies and MOUs can be a reflective exercise for deciding which of the following recommendations an institution prioritizes.

Communicating institutional practices and priorities clearly in a formal policy before the OER creation process begins is ideal.

Review Periodically

Librarians involved in OER work should consider reviewing what kinds of OER are being created and OER already created and shared (possibly within the IR) at their institution. The review process will inherently shape the creation of standards and guide collaboration with digital preservation experts. For example, we cannot outline which tools do not allow exporting or harvesting until we know about them. We cannot and should not preserve everything, but auditing can inform how we might strategically assess or preserve a sample of the OER created at our institutions.

Include Digital Preservation Experts on Incentive Committees

OER creation working groups or committees should include not only librarians focused on instruction or OER outreach but also records managers, archivists, and digital preservation librarians

OER creation working groups or committees should include not only librarians focused on instruction or OER outreach but also records managers, archivists, and digital preservation librarians to further conversations about preservation. Including them in planning could mean that metadata, format, and repository functionality are considered from the outset.

Require OER to Be ADA-Compliant

Interviewee 1 noted that if OER are accessible, then they are generally easier to preserve. Requiring ADA (Americans with Disabilities Act) compliance from stipend recipients (and encouraging it whenever the library is doing outreach) can be a useful strategy for ensuring that creators design accessible OER from the beginning instead of trying to make existing OER accessible after the fact. Interviewee 1 noted that this strategy would lead to the creation of "uber usable learning objects," not only because of the license under which they are shared but also because they are "technologically . . . as friendly as possible to as many systems as possible." If libraries are committed to accessibility, this requirement is integral.

Improve Metadata

One way to improve the metadata shared alongside OER is to attach a ReadMe file. This would give future readers and educators additional context while also documenting the labor that goes into the creation of any OER. Potential ReadMe items could include funding body, creators, license shared under, preservation decisions made, source URLs and licenses, and even educational context (learning objectives, syllabus, curriculum sequencing, and the like). Librarians should also advocate for using established metadata schema like learning object metadata (LOM) when creating guidelines and requirements for instructors.

Next Steps

Interviewees identified several areas where future research is needed. These ideas were outside the scope of this article but are important for moving the conversation about OER preservation forward.

Interviewee 5 suggested that the first step in preserving OER at scale would be to collect a corpus of OER and analyze the preservation needs, common file formats, current metadata standards used, tools used to create, and any risks for access. The interviewee noted that until this kind of analysis is done, we can only speculate on what difficulties OER librarians might encounter. This approach would also allow the community to identify common models for preservation and articulate how they might differ for specific kinds of OER. For example, highly interactive OER with 3D objects intended for an upper-level course would probably require different preservation planning than a static Biology 101 textbook.

In line with the theme of sharing resources across institutions, interviewees recommended that the OER community investigate drafting a shared business case for persuading grant funding institutions and local administration to consider OER preservation as a strategic priority. Other community resources could include an assessment of OER creation tools for preservation needs, draft OER preservation workflows, and information on how other areas of librarianship have approached the preservation of complex content. Further study is also needed to gauge feasibility and interest in this topic.

Limitations

This study was designed to be exploratory. As such, it has several limitations. The assessment of what libraries currently do to preserve OER created as part of an incentive program is limited to public information shared on a small subset (14) of OER creation programs' websites. Data were pulled from SPARC's OER Connect data set, also limiting the type of institutions evaluated. Future studies interested in assessing what libraries do to preserve OER could interview OER creation programs firsthand to map out their process in more detail. This kind of investigation would help the OER community understand current practices, not just best practices.

One obvious limitation of this study is the small number (six) of interviews conducted. Interviews were generally skewed toward a particular type of institution and perspective, namely the view of librarians working in well-funded research libraries. This approach misses the important perspective of technical staff, who potentially have greater expertise in the day-to-day preservation practices at an institution. The authors also reached out to staff at key OER repositories, but they were unable to discuss their preservation policies and infrastructure. Preservation information is generally difficult to find but foundational to creators looking for a space to share their work. OER repositories should clearly state their funding structures, sustainability plan, preservation policy, and preservation infrastructure on their public website. This information should also be shared at conferences and discussed in the literature to raise awareness.

Conclusion

Academic libraries of all sizes and missions continue to express an interest in furthering the adoption and creation of open educational resources at their institution as awareness of OER grows. This work is more complex than raising faculty awareness or even incentivizing faculty exploration of OER. Ovadia holds that "a work's license can decree the work reusable, but if there is no software to open it, the work is not actually reusable in practice."[42] This is an important reminder for librarians collaborating with instructors to make and adapt OER. Librarians have a responsibility to thoughtfully audit, select, describe, and preserve OER that hold significant value for the teaching and learning missions of their institutions. When they overlook preserving OER, they miss an opportunity to help users realize the first and arguably most essential of Wiley's 5R permissions: retain. In addition to making content available, preserving OER provides an important opportunity to collaborate with colleagues whose expertise can enhance librarians' own, showcase the breadth of expertise the library offers to more holistically support users, and extend the reach of open education.

Librarians have a responsibility to thoughtfully audit, select, describe, and preserve OER that hold significant value for the teaching and learning missions of their institutions.

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Appendix

Interview Questions for Digital Preservation and Metadata Experts

- What context do you work in?
- What would you consider the 2–3 best practices for preserving born-digital learning objects, including videos, textbooks, interactive materials?
- Open educational resources or OER are defined as learning objects shared under an intellectual property license that allows others to retain, revise, and reuse.

What digital preservation advice would you give librarians working with faculty to create OER?

- What recommendations would you make for doing digital preservation or incorporating it into current OER programs with little to no funding?
- Why might OER offer a unique preservation issue, especially in regard to versioning issues with remixing?
- One of the issues we see with use and revision of OER is proprietary and obsolete file formats. What recommendations, if any, would you make to prevent or ameliorate this issue?
- In your professional opinion, how might libraries encourage cross-pollination between OER experts and digital preservation experts?
- Do you have any other thoughts on digital preservation and OER that we did not cover?

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