The Infrastructure of Openness: Results from a Multi-Institutional Survey on OER Platforms
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ABSTRACT
The purpose of this study is to understand how higher education institutions are selecting and using technology platforms for the creation and delivery of Open Educational Resources (OER). A survey about OER technology was sent to various higher education institutions, resulting in 33 responses. The results suggest that institutions are most commonly using existing tools like the Learning Management System (LMS) to deliver OER, however third-party courseware also has a strong presence. The results also suggest that there is little evidence that institutions engage in structured evaluations when selecting OER technologies, but rather the selection process is most often driven by faculty preference. Institutions were also asked about their level of satisfaction with their platform’s ability to support the 5Rs of openness. Respondents were most satisfied with the ability to retain, but least satisfied with the ability to remix content.

Keywords: open educational resource, evaluation, platforms, technology
The Infrastructure of Openness

For the past decade, higher education has seen increases in the awareness and adoption of Open Educational Resources (OER), which are defined as

...teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions.

(Hewlett Foundation, n.d.)

While OER can take on many forms, one of the most common forms of OER in higher education are textbooks. These textbooks have been seen as a potential solution for higher education in at least two major ways. First, they are available free of charge and are seen as a way to drive down the cost of education. Second, because these materials are published with an open license, they allow faculty member to engage in 5R activities. These include the ability to retain, reuse, revise, remix, and redistribute (Wiley, 2014) – meaning that faculty members can adapt the content to more closely meet the needs of their course. Some institutional stakeholders may have concerns that this alternative model of content production may result in lower quality or outcomes, however, a wealth of research has shown that students perceive the quality of OER as being comparable to commercially published materials (Bliss, Hilton, Wiley, & Thanos, 2013; Hilton, Gaudet, Clark, Robinson, & Wiley, 2013; Ozdemir & Hendricks, 2017) and that outcomes are similar, if not better (Lovett, Meyer, & Thille, 2008; Robinson, Fischer, Wiley, & Hilton, 2014; Grewe & Davis, 2017).

In 2017, Cengage made a splash in the world of OER when they announced their OpenNOW product. OpenNOW includes OER from OpenStax and other sources, aligned to learning outcomes, and delivered in one of Cengage’s courseware platforms (McKenzie, 2017). For access to an OpenNOW course, students pay a 25-dollar course fee. Cengage argues that this course fee is not for the OER content, which is still free and open, but for the technology and services that help deliver the content. Other companies, such as Lumen Learning and Barnes & Noble LoudCloud work on a similar course fee model.

While some critics have argued that Cengage’s approach is not a good approach to the stewardship of OER -- placing open content in a locked down, proprietary platform -- it brings up an important opportunity to differentiate between OER content and the platforms or technologies by which it is delivered. What values should OER platforms
hold? How should institutions of higher education select platforms for the delivery of OER? How can they be strategic about the use of those platforms?

In order to determine best practices for platforms and OER, we first need to understand how institutions are currently using technology in the creation and delivery of OER content. To facilitate this, we surveyed higher education institutions to understand what tools are currently being used to deliver OER, how these tools are selected and evaluated, and perceptions regarding how these technologies help to support processes surrounding the creation, revision, and use of OER. This descriptive study is intended as an initial step in starting a wider dialogue regarding how institutions make decisions about the technology that they use for OER.

**Literature Review**

The literature review covers two areas: (1) research related to OER and technology platforms and (2) research involving the evaluation of educational technology.

**OER and Platforms**

While studies examining OER platform use across multiple institutions was sparse, several studies exploring technological infrastructures used to support individual OER initiatives were discovered. Khanna and Basak (2013) recommend an overall architectural framework proposed for an OER system to support distance education in India. Their framework is composed of six character dimensions: 1) Pedagogical; 2) Technological; 3) Managerial; 4) Academic; 5) Financial; and 6) Ethical. In addition, the architecture contains five key component areas and support services: 1) IT infrastructure; 2) Management support systems; 3) Open content development and maintenance; 4) Open teaching and learning; and 5) Learner assessment and evaluation.

Kanjilal (2013) describes eGyanKosh, an OER repository that was built by the Indira Gandhi National Open University using DSpace. Stankovic et al. (2014) describe a node-based architecture that aggregates OER published at six universities in Eastern Europe. The authors emphasized the importance in defining an appropriate metadata scheme, so that the resources can be appropriately shared amongst the institutions. Abeywardena, Chan, and Tham (2013) describe their OERScout technology framework, which utilizes text-mining methodologies to make OER repositories more discoverable.

Cohen, Omolla, and Malick (2014) describe the infrastructure of the Open.Michigan platform - where materials from University of Michigan courses are made available as
OER. The platform itself is built upon Drupal, the open-source content management tool. The authors emphasized the importance of being able to collect data from an OER platform arguing that it can act as evidence to support the effort and expense that is often put into the creation of OER. Showing faculty data surrounding the use of their course materials can tangibly demonstrate the impact of sharing those resources in the open. To facilitate the collection of analytics, the platform was instrumented in such a way that it could collect data via Google Analytics.

While the aforementioned research looked at the architecture of OER platforms in individual contexts, only one study examined the use of OER platforms across multiple contexts. Amiel and Soares (2016) conducted a survey of OER leaders in Latin America countries, asking them what the most important OER repositories were in their country. Once repository information had been collected, the authors did a content analysis of the repositories to examine the infrastructure used for the repository and how well licensing information was displayed within the repository. Four types of repositories were identified:

- **Exclusive:** The sponsoring organization/institution is the sole owner of the content
- **Linked:** A referatory, where content is linked to the original hosting location
- **Aggregated:** The resource did not originate from the sponsoring organization/institution, but the content is hosted there
- **Contributed:** User submissions are welcomed and encouraged

After examining the 50 repositories that were reviewed as a part of the study, 50 percent of the repositories were identified as exclusive, 14 percent linked, 10 percent aggregated, and two percent contributed. The researchers also explored the repositories to determine what technologies they were built upon. The most common architectures included: Joomla \( (n = 10) \), repositories built from scratch \( (n = 10) \), undefined (meaning the platform could not be determined, \( (n = 6) \), Wordpress \( (n = 5) \), Drupal \( (n = 4) \), DSpace \( (n = 3) \), and Blogger \( (n = 2) \).

After further examination of the platforms, the researchers discovered some additional interesting findings. Seventy percent of the repositories had non-existent metadata. Despite being OER repositories, only 44% of the sites had copyright disclaimers on their landing pages; and 46% showed some kind of misalignment in between the permissions of the content and how the licensing was displayed to the end user.
Albeit limited in scope, Amiel and Soares’ (2016) research nonetheless represents an important effort in critically examining the technology that institutions are using to deliver OER. Importantly, their research points out misalignment between the goals of OER (as easy to find and use) and technology used to deliver it. In the current research study, the goal is to look critically at the technologies that institutions of higher education are using to deliver OER to their students. While looking at the architectures supporting these technologies is appealing, the evaluation process (and respective criteria indicators) used to select these platforms is also of interest.

**Evaluation of Educational Technology**

Prior to the adoption of any educational technology, educational institutions are typically required to preface adoption with some form of evaluation. While one can never be certain that a technology is adopted using a full evaluation process, there are nonetheless several models for how these types of technologies can be evaluated. Bates and Poole (2003) suggest the ACTIONS model, whereby several criteria have been established for evaluating the technology including:

- **Access** - how accessible is the technology for learners?
- **Costs** - what does the technology cost, per learner?
- **Teaching and Learning** - how does the technology support the teaching and learning process?
- **Interactivity and user-friendliness** - how intuitive is the technology to use?
- **Organizational issues** - what organizational requirements exist for the technology?
- **Novelty** - how new is the technology?
- **Speed** - how quickly can the organization?

The authors also recommend an overall decision process to use in the evaluation of the technology. First, they suggest using a framework (such as the ACTIONS model) to ensure that all of the main factors have been identified. Second, analyze the technology against the framework factors by using a set of guiding questions. Third, collect and review responses from reviewers to these questions. Fourth, make an assessment of the resources available. Finally, make an intuitive or subjective decision. The authors note that while you should gather as much evaluative evidence as you need, you’ll ultimately need to make an intuitive decision in the end.

Another evaluation model comes from a meta-analysis of studies involving the evaluation
Van Melle, Cimellaro, and Shulha (2003) identified five essential elements that should be a part of any implementation of technology used for teaching and learning: 1) The technology should be used to enhance student learning; 2) The technology should be an integral aspect of teaching; 3) Professional support for the technology should be ongoing; 4) Planning, budgeting, and evaluation of technologies should be key organizational activities; and 5) The implementation is supported by collaborative efforts.

A few studies looked more closely into the adoption of specific educational technologies. Van Rooij (2008) focused specifically at the evaluation processes of higher education institutions who adopted open source technologies. A qualitative analysis of documents related to the evaluation revealed several key themes including: 1) Social and philosophical benefits; 2) Software development methodology benefits; 3) Security and risk management; 4) Software adoption lifecycle benefits; and 5) Total cost of ownership benefits.

Similarly, Stewart, Briton, Gismondi, Heller, Kennepohl, McGreal, & Nelson (2007) provide a case study from Athabasca University regarding the adoption of the open source learning management system, Moodle. In their study, they outline a process they used to undertake the evaluation of the new tool, including defining evaluation criteria (with specific factors identified related to systems administration, cost, instructional design, and teaching and learning tools). They then developed a survey system to gather feedback from a variety of stakeholders, and a scoring system to identify the preferred LMS of the institution. Their chosen method seems to follow closely to the evaluation method proposed by Bates and Poole (2003), showing an intentional process to select technology that supports student learning.

While the authors of the aforementioned studies examined the evaluation process of educational technologies, and even in some cases open-source educational technologies, there existed no research that focused specifically on the evaluation and implementation of technologies to support the use of OER. This is one of the major goals of the current study.

The current study was guided by the following research questions:

R1: What are the most common tools that institutions are using to create and deliver OER content?
R2: What processes are institutions using in the selection of OER platforms?
R3: How well do institutions’ selected OER platforms support the 5Rs of openness?
Method

Survey Design

A survey was designed with questions aligned to address the stated research questions. An initial version of the survey instrument was distributed to a variety of OER stakeholders from inside and outside the author’s institution. Once refined, the questions were placed into Qualtrics for distribution.

Participants

The goal of this research was to understand how institutions were choosing and using technologies to support the creation and distribution of OER, therefore it was imperative to recruit participants who could credibly represent we sought to recruit respondents who their respective institution. Toward this goal, a comment in the recruitment letter was added stating “If there is someone at your institution who you feel is better aware of the technology being used for OER at your institution, please send this information to them.” While we cannot guarantee that respondents had a full knowledge of OER at their institution, this was the best way to recruit these individuals.

The recruitment message and Qualtrics survey link were posted on the author’s personal Twitter account and sent through various email lists. Email lists included WCET, the Open Textbook Network, Affordable Learning Georgia, and Washington State Board for Community and Technical Colleges (SBCTC). Overall, representatives from 33 institutions responded to the survey. Of those institutions 60% (n = 20) were from public 4-year institutions, 27% (n = 9) were from public 2-year institutions, and 12% (n = 4) were from private not-for-profit 4-year institutions. There was no representation from for-profit institutions. All respondents were from institutions based in the United States.

In terms of the size of the institution, 42% (n = 14) represented medium-sized institutions with student enrollment between 5,000 and 20,000. 39% (n = 13) were from large institutions, with student enrollment exceeding 20,000, and the remaining 18% (n = 6) were from small institutions with student enrollment of less than 5,000.

Participants were also asked to estimate the current number of courses utilizing OER that were offered at their institution. While several respondents indicated that they were not sure how many courses were utilizing OER at their institution, of those that gave a number, the responses ranged from 1 course to 632 courses. The mean number of courses offered was 84, albeit with a large standard deviation of 152. The median number
of courses utilizing OER in the sample was 18.

Data Analysis

Once the Qualtrics survey was closed, data were pulled into SPSS for cleaning. Incomplete responses were removed. Additionally, institutional names were checked to determine if there were any duplicate responses from a single institution. While the original plan was to combine any such cases into a single response, after examining the data, there was only one institution that was included twice. In this case, the respondent stopped part of the way through on the first response and then came back later to submit a full response. Due to this oversight, the first incomplete response was removed. All other responses represented unique institutions.

Once the data were cleaned, descriptive statistics were generated using SPSS. Open responses were downloaded and independently coded using an open coding technique by two researchers; differences were discussed and resolved by consensus. Once the coding was applied to all of responses, descriptive statistics of the codes were calculated. Open comments could have more than one code applied, thus the descriptive statistics represent the number and percentage of total responses that had a given code.

Results

The results of the survey are broken out in four sections: 1) Content and Technology, 2) Evaluation, 3) The 5Rs, and 4) Analytics.

Content and Technology

In the first section, it was important that a solid understanding of the institution’s OER infrastructure was established. For the first survey question, respondents were asked about their sources of OER content. Specifically, respondents were asked, “Which of the following sources is your institution using for OER content?” The results of the question are displayed in Table 1 below. Overall, the results suggest that most institutions select OER content from a variety of sources. The most commonly used OER was OpenStax (85%, n = 28), followed by original content authored by the institution’s faculty and staff (79%, n = 26), the Open Textbook Library (73%, n = 24), and OER Commons (61%, n = 20).

Table 1
Most commonly used resources for OER content

<table>
<thead>
<tr>
<th>Tool</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpenStax</td>
<td>28</td>
<td>84.8%</td>
</tr>
</tbody>
</table>
Content authored by institution’s faculty and staff 26 78.8%
Open Textbook Library 24 72.7%
OER Commons 20 60.6%
Other 11 33.3%
MERLOT 11 33.3%
Lumen Learning 11 33.3%
BCCampus 6 18.2%
eCampus Ontario 1 3.0%

The next survey question focused on the delivery mechanism for OER. Respondents were asked “Which of the following technological tools are being used to deliver OER content to students? In other words, “What place are students reading or interacting with OER?” Along with a selection box, the respondent was also given an open response area where they were invited to name the specific tool that is used at their institution. The results of this question, with aggregated open responses for each of the selections, are shown in Table 2 below.

The results show that the Learning Management System is the most popular mechanism for delivering OER content to students, with 97% of respondents (n = 32) indicating that they use them to deliver OER. The next most popular tools were Third-Party Courseware Tools (58%, n = 19), with OpenStax, Lumen, Cengage, and TopHat being listed as the most frequently chosen vendors. Forty-six percent of respondents (n = 15) indicated that they used a file system or institutional repository (Google Drive, BePress), 33% of respondents (n = 11) used an eTextbook reading platform (Pressbooks, Redshelf, VitalSource), 27% (n = 9) responded “Other”, and 12% (n = 4) used a text-based repository to deliver OER.

Table 2
Technological tools used to deliver OER

<table>
<thead>
<tr>
<th>Tool</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Open Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Management System</td>
<td>32</td>
<td>97.0%</td>
<td>Brightspace by D2L (n = 4), Blackboard (n = 3), Canvas (n = 3), Other (n = 2)</td>
</tr>
<tr>
<td>Third-Party Courseware Tools</td>
<td>19</td>
<td>57.6%</td>
<td>OpenStax (n = 3), Lumen (n = 3), Cengage (n = 2), TopHat (n = 2), Other (n = 3)</td>
</tr>
</tbody>
</table>
A file system or institutional repository 15 45.5% Google Drive ($n = 4$), BePress ($n = 3$), Equella ($n = 1$), Other ($n = 2$)
eTextbook Reading Platform 11 33.3% Pressbooks ($n = 5$), Redshelf ($n = 2$), VitalSource ($n = 1$), iBooks ($n = 1$)
Other 9 27.3% Wordpress ($n = 4$)
A text-based repository 4 12.1% Github ($n = 2$)
Total 33

The final set of survey questions regarding technology focused on the creation of OER materials. First, respondents were asked if faculty at their institution authored their own open textbooks. Seventy-eight percent of the respondents ($n = 26$) indicated that faculty at their institution authored their own open textbooks. These respondents were then asked to describe the tools that their faculty used to author OER materials. After coding these responses, seven different themes of authoring tools emerged (displayed in Table 3). The most common tool for authoring was standard word processing tools such as Microsoft Word and Google Docs (44%, $n = 10$). Other popular tools included the Learning Management System (22%, $n = 5$), Pressbooks (22%, $n = 5$), and web-authoring tools like Wordpress (17%, $n = 4$).

Table 3

<table>
<thead>
<tr>
<th>Categories of tools for the authoring of open textbooks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theme</td>
</tr>
<tr>
<td>Word Processing (e.g. Word, Google Docs)</td>
</tr>
<tr>
<td>Learning Management System</td>
</tr>
<tr>
<td>Pressbooks</td>
</tr>
<tr>
<td>Web-Authoring (e.g. Wordpress)</td>
</tr>
<tr>
<td>Media (e.g. Captivate)</td>
</tr>
<tr>
<td>File Repository</td>
</tr>
<tr>
<td>Text-based</td>
</tr>
</tbody>
</table>

**Evaluation**

The next set of survey questions was aimed at better understanding the process that the institution used to evaluate platforms to deliver OER. In the first question in this section, respondents were asked to “Please describe the process that your institution used to select the technological tools used to deliver OER to students”. The themes that emerged from
this question are displayed in Table 4. The most common theme that emerged was faculty preference, simply meaning the selection process was faculty-driven (54.8%, \(n = 17\)). In these instances, faculty are free to use their OER delivery tool of choice. A few responses that echo this theme include:

“This is not an institutional decision. Faculty select their own.”
“I don’t think we have a process other than letting faculty do what they want.”

Another response hinted that there might be challenges associated with this faculty-driven process, noting

“It varies from college to department to individual faculty member. We are in the process of organizing this process and standardizing it across institutional areas. We still have much to do in this area.”

Table 4.
Processing for selecting OER platforms.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty preference</td>
<td>Institution allows the faculty to pick their own tools to deliver OER</td>
<td>17</td>
<td>54.8%</td>
</tr>
<tr>
<td>Existing Tool</td>
<td>Used tools that already existed or were adopted at the institution</td>
<td>11</td>
<td>35.5%</td>
</tr>
<tr>
<td>Recommend Options</td>
<td>OER Coordinators would make recommendations for tools</td>
<td>4</td>
<td>12.9%</td>
</tr>
<tr>
<td>Grants</td>
<td>Tools had grants associated with them. In order to obtain the grant, the tool needed to be used</td>
<td>3</td>
<td>9.7%</td>
</tr>
<tr>
<td>No Process</td>
<td>No strategic process</td>
<td>1</td>
<td>3.2%</td>
</tr>
<tr>
<td>Pilot process</td>
<td>Piloted a tool in a limited manner</td>
<td>1</td>
<td>3.2%</td>
</tr>
<tr>
<td>Integrations with existing tools</td>
<td>Looked for tools which integrated with existing tools</td>
<td>1</td>
<td>3.2%</td>
</tr>
<tr>
<td>Usable process</td>
<td>Were primarily concerned about a usable workflow/tool for faculty</td>
<td>1</td>
<td>3.2%</td>
</tr>
</tbody>
</table>
The second emerging theme, *existing tool*, was that the institution chose to use a tool that they already owned, rather than finding something specific for OER (35.5%, \( n = 11 \)). The existing tool often included some sort of institutional repository or Learning Management System. Here are some comments that illustrate the theme:

“We already had a program in place that utilized BePress for creating an institutional repository. We expanded its [sic] use for OER. . . By adapting existing resources we avoided additional costs.”

“We use Canvas because the faculty and students are accustomed to it and we have institutional support for it.”

Other prominent themes that emerged were *recommend options* (12.9%, \( n = 4 \)), wherein OER coordinators pre-select tools and recommend them to faculty who create or use OER, and *grants* (9.7%, \( n = 3 \)), whereby a tool is selected because it is attached to the parameters of an OER grant.

Digging deeper into the evaluation process, it was important to better understand specific criteria that institutions used when selecting technology to support OER. Respondents were asked “What evaluation criteria do you feel were the most important in your institutions decision regarding an OER platform?” Respondents were given a list of evaluation criteria, and asked to rank the top three they felt were most important. They were also given an opportunity to select “other” which was included in their evaluation process.

In order to determine which of the criteria was most frequently cited as important, a medal count process was used to weight the different criteria. For each instance a criterion appeared as a number one in the rankings it was given three points (#1 = 3 points), two points for being ranked number two (#2 = 2 points), and one point for being ranked number three (#3 = 1 point). The points for each criteria were then added to determine which of the criteria had the highest overall ranking. Due to the variety of answers included in “other”, this category was excluded from the medal count. The result of the process is shown in Table 5.

In terms of medal count total, *integration with existing institutional technologies* (39 points, \( n = 17 \)), was the most important criteria when selecting an OER platform. Other popular criteria included the *cost of the platform* (23 points, \( n = 12 \)), the *ability to edit / remix content* (19 points, \( n = 10 \)), *accessibility* (18 points, \( n = 9 \)), *availability of support and training* (11 points, \( n = 7 \)), and *ability to easily find content* (11 points, \( n = 7 \)).
Table 5

*Evaluation criteria of OER platforms ranked by medal count*

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Medal Count Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration with existing institutional technologies</td>
<td>17</td>
<td>51.5%</td>
<td>39</td>
</tr>
<tr>
<td>Cost of the Platform</td>
<td>12</td>
<td>36.4%</td>
<td>23</td>
</tr>
<tr>
<td>Ability to edit / remix content</td>
<td>10</td>
<td>30.3%</td>
<td>19</td>
</tr>
<tr>
<td>Accessibility</td>
<td>9</td>
<td>27.3%</td>
<td>18</td>
</tr>
<tr>
<td>Availability of support and training</td>
<td>7</td>
<td>21.2%</td>
<td>11</td>
</tr>
<tr>
<td>Ability to easily find content</td>
<td>7</td>
<td>21.2%</td>
<td>11</td>
</tr>
<tr>
<td>Existing user base</td>
<td>4</td>
<td>12.1%</td>
<td>9</td>
</tr>
<tr>
<td>Hosting Model (self-hosted / cloud-hosted)</td>
<td>3</td>
<td>9.1%</td>
<td>6</td>
</tr>
<tr>
<td>Mobile Access</td>
<td>1</td>
<td>3.0%</td>
<td>2</td>
</tr>
<tr>
<td>Reporting or analytics</td>
<td>1</td>
<td>3.0%</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>24.2%</td>
<td>0</td>
</tr>
</tbody>
</table>

_Helping with the 5Rs_

Also of interest in this study were institution’s levels of perceived satisfaction and engagement of their OER technology and the 5Rs (Retain, Reuse, Revise, Remix, and Redistribute). They were asked to rate their overall satisfaction (1 - Extremely dissatisfied to 5 - Extremely satisfied) with their OER platform’s ability to allow faculty to engage in each of the 5Rs. A definition of each of the 5Rs was displayed alongside the questions. Results are displayed in Table 6.

Overall, respondents were mostly satisfied in all of the categories, but most satisfied with their platforms ability to retain \((M = 3.72, SD = 1.1)\). Following retain, respondents were most satisfied about reuse \((M = 3.65, SD = 1.1)\), while revise \((M = 3.34, SD = 1.2)\) and redistribute \((M = 3.34, SD = 1.43)\) had similar levels of satisfaction. Remix, had the lowest level of satisfaction overall \((M = 3.19, SD = 1.2)\).

Table 6

*Satisfaction levels of OER platforms in engaging in 5R activities*
Analytics

In the final set of questions, understanding what kind of data were made available to an institution regarding the use of their OER was paramount. Participants were asked, “Does your institution currently use any analytics regarding how students use OER?” Only 15% of the respondents ($N = 5$) indicated that they currently used analytics, while 81% of the respondents ($N = 27$) indicated that they did not use analytics.

Respondents were next asked about their overall level of satisfaction with their current level of access to data from their OER platform(s). As shown by the results in Table 7, most of the respondents were neutral in their response to this question, with 54% of the respondents ($n = 15$) being neither satisfied nor dissatisfied, and the mean level of satisfaction being slightly lower than the midpoint ($M = 2.89, SD = .956$).

Table 7
Level of satisfaction with access to data from OER platform(s)

<table>
<thead>
<tr>
<th>Level of Satisfaction</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely dissatisfied</td>
<td>6</td>
<td>21.4%</td>
</tr>
<tr>
<td>Somewhat dissatisfied</td>
<td>2</td>
<td>7.1%</td>
</tr>
<tr>
<td>Neither satisfied nor dissatisfied</td>
<td>15</td>
<td>53.6%</td>
</tr>
<tr>
<td>Somewhat satisfied</td>
<td>3</td>
<td>10.7%</td>
</tr>
<tr>
<td>Extremely satisfied</td>
<td>2</td>
<td>7.1%</td>
</tr>
</tbody>
</table>

$M = 2.89, SD = .956$
Discussion
The overarching goal of this research study was to better understand how institutions employ platforms for the creation and distribution of OER. Additionally, understanding how institutions select and evaluate these technologies and platforms was also of interest.

In terms of content, the results suggest that institutions are utilizing OER content from a variety of resources. This is not surprising given one of the main benefits of OER. Because the content is licensed in such a way that end-users can exercise 5R permissions, institutions will likely cast a wide net when selecting resources that meet the needs of their courses. The most commonly cited sources of OER content included OpenStax and the Open Textbook library, both of which are well-vetted sources for quality open textbooks and materials. This further suggests that institutions primarily seek high quality OER materials they can easily adopt in their courses.

Additionally, nearly 80% of the institutions surveyed were using OER content authored by the faculty and staff of the institution. This suggests that overall institutions are engaging in the process of either creating new OER or exercising permission to modify existing OER to meet their needs. This prompts possible further questions for exploration such as where is the content being created, authored and distributed?

Participants were asked about the mechanisms that they used to deliver OER content to students. Nearly all of the respondents said that content was delivered to students via the Learning Management System. While there may be some confusion regarding the wording of this question, respondents may have interpreted this choice as meaning “delivery via a tool integrated with the LMS.” OER content authored in the LMS may suffer from a lack of discoverability from other users at the institution, and if this is the case, institutions may want to more carefully think about their strategy regarding technology to support the distribution of OER content.

Another noticeable point regarding technology for delivery is that slightly over half of the institutions were using some form of third-party courseware to deliver at least some of the content, being split between several different vendors. Using third-party courseware in this fashion will be of interest to monitor, especially as publishers are eager to deliver OER on their proprietary courseware platforms.

Also examined in this study was the evaluation processes institution’s use when selecting technology to support OER. While there was not a process that was consistent across institutions, survey participants reported that faculty were largely the decision-drivers in terms of selecting a tool. While this is likely in line with goals to preserve academic
freedom, possible repercussions should be noted. As the use of OER scales across the institution, it is quite possible that students may have a fragmented learning experiences with the different ways that the content is delivered. For example, a student may find that the content is delivered via PDF in one course, while it may be offered via courseware in another. While this is not necessarily problematic, it may diminish student recognizability of OER. A single platform experience could make the student experience with OER more cohesive, and as a result help students understand when OER is being used in their course.

After assessing the results, there is little evidence in this sample to support the idea that institutions engage in a rigorous evaluation process regarding OER platforms. Notwithstanding, the criteria institutions found most important in selecting technology for OER was informative. The most frequently selected criteria was integration with existing institutional technologies, signaling that it is important for OER technology to integrate with existing learning technologies like the LMS. Institutions also prioritized the cost of the platform. This is important because one of the goals of OER is to lower the cost of resources for the students, and oftentimes OER initiatives are funded directly by either institutional or via and external grant. Institutions are likely to seek low-cost technologies because those costs are not recouped in the traditional sense, where the return on investment is instead measured on total student savings. Even in newer cases where we are seeing a student or institutional pay model for OER courseware (e.g. Cengage or Lumen), costs still need to remain low in order to demonstrate that the overall cost of materials are being lowered.

Other notable evaluation criteria include ability to edit/remix content, showing that institutions want technology that will allow them to exercise 5R permissions, and accessibility which is becoming an increasingly must-have for institutions around the world.

Also important to understand in this research study was how technology for OER assisted institutional engagement in the 5Rs. Overall, institutions were slightly satisfied with their ability to engage in each of the 5Rs. The highest rated among respondents, retain and reuse, which focus on the ability to store and consume the content comes as no surprise as these are clearly traits of OER that are inherently favorable.

Lower levels of satisfaction were in revise and remix, or the ability of individuals at the institution to make changes to the content. This suggests that the platforms that the institutions are using may not be friendly to the revision process. This finding seems to be in line with some of the challenges that could be associated with the common ways
that some institutions are storing OER content. Not all third-party courseware allows the institution to make edits or revisions to the content and file repositories often contain read-only PDF versions of OER. If institutions are unsatisfied with their ability to engage in revision and remix practices, they need to make sure that they choose technology appropriately that will support these workflows.

Lastly, it was important to understand to what extent institutions were using analytics from their technology to deliver OER. Analytics are a strong force in continuous improvement with OER (Bodily, Nyland, & Wiley, 2017). Surprisingly, only 15% of institutions were currently using analytics regarding OER usage. When asked about their satisfaction regarding access to data from their OER platform, over half of the respondents were neutral, while 20% of the respondents were extremely dissatisfied. The neutrality likely reflects the fact that most institutions were not taking advantage of the information that analytics could provide from their OER platform. It is also possible that those who were dissatisfied with the current analytics capabilities of their platforms are those that are hopeful they will eventually engage in the process of using analytics more frequently.

It is suggested that institutions need to become more critical on how the data from their OER platform are being used, especially when third-party vendors are involved. Full evaluations are needed to ensure that data meet the privacy and security requirements of the institutions. Meinke (2018) emphasizes the need for institutions to be more critical regarding how textbook publishers use student data from their courseware tools.

**Conclusion**

This study was intended as a starting point for a conversation regarding the use and selection of technology of OER. As such, it has many limitations and potential areas for further investigation. The biggest limitation is the size of the study \( n = 33 \), therefore to glean a better understanding of institutional OER technology, a larger sample size will strengthen future studies. Additionally, because the source of the data is self-reported from a single institutional representative, it is difficult to determine if the data is completely accurate. To validate the data, additional follow-up studies are needed. Additional qualitative research could probe deeper into the evaluation process of individual institutions regarding OER technology. This might allow for the establishment of cases outlining how an institution could evaluate OER technologies.

That being said, this study serves as a firm starting point for beginning to understand the current landscape of technology being used to support OER in higher education, and
how institutions are making decisions regarding the adoption of that technology. According to the results of the study, there seems to be a wide variety of technologies being utilized to deliver OER, with little evidence that institutions are engaging in rigorous evaluation processes to determine which technologies are most appropriate to meet the needs of their institutions. Rather, institutions report using existing and default tools such as the Learning Management System to deliver content, and Word and Google Docs to create content. This may be because much of the decision is left up to the discretion of individual faculty members who are creating and delivering OER. While this is not necessarily problematic for students in the courses who are benefitting from the use of OER, it may cause challenges for the discovery and recognizability of OER across an institution.

This study also found evidence that a growing number of institutions are turning to third-party courseware (e.g. Lumen, Cengage, Tophat) to create and host OER courses for their students. While students of these courses will likely benefit from the cost-savings that come from the use of OER in these courses, institutions should also engage in evaluation processes to ensure that these platforms align with the institutional values for OER - this may include such things as accessibility, how the platform handles student data and privacy, whether analytics from the platform are available to the institution, and how easily the platform allows OER content to be modified to meet the needs of the faculty and the institution. Institutions should be willing to ask these tough questions of vendors to ensure that their chosen technology will really support the success of their students.

Author

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