

## **Insights and Lessons Learned from Engineering OER Authors**

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## **Introduction and Motivation:**

This work examines characteristics, motivations, and challenges open educational resource authors face in engineering. Open educational resources (OER) are “learning, teaching and research materials in any format and medium that reside in the public domain or are under the copyright that has been released under an open license, that permits no-cost access, re-use, re-purpose, adaptation and redistribution by others.” [1] While higher education instructors have been making course materials available freely for decades, the term open educational resources (hereafter OER) is believed to have been coined in the early 2000s by UNESCO.

## The Importance of OER:

Because OER are, by their nature, freely accessible to students, using OER in the classroom saves students money. In 2023, the College Board [2] estimated that students should budget \$1250 a year for “Books and Supplies” for four-year degree programs at private and public institutions. The US Bureau of Labor Statistics [3] estimated that college textbook costs, even after adjusting for inflation, increased by 87.5% between 2006 and 2016, outpacing even the rising costs of tuition and fees in higher education. According to Hanson [4], 66% of students have reported skipping buying a required textbook because of the cost. This can present a have-and-have-not scenario for students, putting those without the funds to purchase textbooks at a disadvantage. Backing this claim up, a study by Colvard et al. [5] found that replacing traditional textbooks with OER resulted in lower DFW rates (percentage of students getting a D, an F, or withdrawing from a course) among Pell Eligible students in the study. OER can not only help students save money but can also help narrow the achievement gap between well-off students and disadvantaged students. A 2017 survey of over 2,700 higher education faculty summarized both the challenges facing OER, the low awareness, and significant perceived barriers to adopting, but also highlighted the widespread optimism for the future of OER [6].

## OER in Engineering:

Given the decentralized nature of creating and hosting OER, it is challenging to quantify the exact number produced. One of the most commonly used reference libraries, The Open Textbook Library [7], lists a total of 1,361 resources as of Jan 1, 2024. As seen in Figure 1, most OERs have been written for the Humanities, followed by the Natural and Social Sciences. While Computer Science has 116 developed OER, other Engineering & Technology branches have only developed 70 OER. Furthermore, 48 of the OER in Engineering & Technology have been written for either general Engineering & Technology or Electrical Engineering. This leaves only 22 OER in the Open Textbook Library across the topics of Civil Engineering, Mechanical Engineering, and Materials Science. Though arguments can be made about what counts as engineering and the categorizing of some OER into engineering or non-engineering bins, this fact supports a general lack of OER in engineering.

## Number of OER in Open Textbook Library

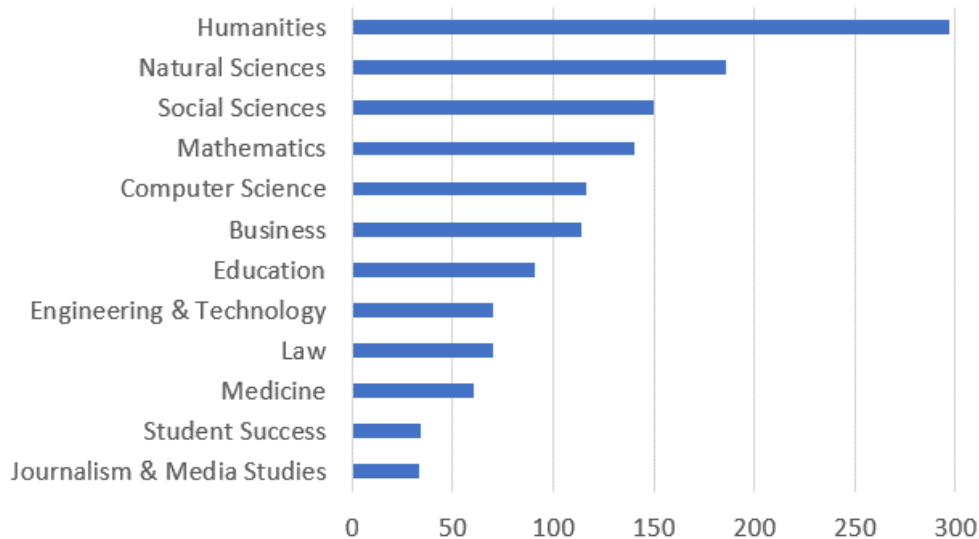


Figure 1: Number of OER by subject area in the Open Textbook Library.

Further illustrating this need for more OER in engineering, when Moore and Reinsfelder [8] surveyed engineering mechanics instructors who had gotten to the stage of evaluating OER for their classroom and found that the number one reason cited for not adopting OER was that they were unable to find an OER for their subject, or at least they were not able to find an OER that had sufficient content to completely cover their needs.

To have faculty adopt OER, OER needs to be available for the courses that faculty teach in engineering. To have this OER available, someone must decide to author and share content with others. This paper seeks to learn from those who have authored OER in engineering to help other engineering faculty members who may become OER authors or administrators who may want to encourage their faculty to publish OER as a form of scholarship.

### Understanding OER Authorship:

While a moderate body of literature examines faculty perceptions of OER and barriers to OER adoption, a much smaller body of literature examines the experiences and barriers to OER authorship. The authors of this paper could not find any broad, general study investigating this topic. What does exist, however, are assessments that examine specific institutional programs aimed at encouraging faculty to author their own OER, as well as written guides aimed at faculty who are writing OER, often associated with these same institutional programs.

In a study of an institutional initiative at Rutgers, which was aimed at getting more faculty to adopt or author OER for their classrooms [9], the authors surveyed 30 faculty participating in the initiative. These faculty members were a relatively even mix of tenure-track and non-tenure-track faculty with a broad range of experience in terms of years of teaching. The respondents represented a variety of fields, though it should be noted that despite having a robust engineering

program at Rutgers, none of the participating faculty were from the engineering program. Though the participating faculty were asked to evaluate and adopt OER, rather than author original material, they were asked what kind of support would be most helpful if they were to author their own OER. The top two responses to this question were editorial assistance and copywriting assistance, putting these responses ahead of monetary support such as direct funding or course releases.

A second study investigating OER authoring and adoption initiatives echoed similar themes at the University of Washington and the University of Houston. [10] Again, editorial, copyright, and technical support were highly valued, and the institutions at both sites had trouble keeping up with demand. To ease some of this demand, the programs would focus more on adoption as that required less support than authoring, but there were still many instances of faculty being unable to find suitable existing content to adopt. For adoption to be an option, someone must author original content in the subject area first. In examinations of the authoring process and design choices, the authors found that much of the newly written content did not stick to the traditional textbook framework and, instead, was more tailored to the immediate student needs. Additionally, the study found that the proposed one-year time frame for the grant was insufficient. Even then, the idea of “completion” was fuzzier than initially anticipated as many faculty members continued to expand and refine the resource well beyond the original timeline.

In addition to the more reflective studies, there are multiple guides for aspiring OER authors and those wishing to set up OER adoption and authorship programs at the institutional level. The OER guide on authoring OER, Authoring Open Content [11], offers many solid advice to prospective OER authors. The resource covers far more than we can summarize here, but the list of ten tips for OER authors does reiterate some of the same lessons learned in the previous papers.

10. *Good authoring begins with planning*
9. *It's going to take longer than you think*
8. *Share the load*
7. *Do the prep work (understand the licenses)*
6. *Learn the ropes (learn your publishing tools)*
5. *Beware of scope creep*
4. *Don't reinvent the wheel*
3. *It doesn't have to be perfect*
2. *Think about ancillary resources*
1. *Embrace open*

Given the benefits of OER but the limited availability in engineering, we were motivated to survey the existing OER authors we could identify to better understand the experiences and perspectives of engineering OER authors.

### **Methods:**

To understand the experiences of OER authors in engineering, the authors of this paper used a survey instrument containing multiple-choice and open-ended questions. This was distributed to engineering OER authors, and the results were analyzed to identify common themes.

#### Compiling a List of Engineering OER Authors:

The first task in surveying OER authors in engineering was to compile a list of contacts to reach out to. Locating OER has thankfully become easier as lists and databases of these resources have become more common, but this also presented our first choice as there are multiple lists of OER in engineering, some with more than a hundred resources. Because we were submitting the paper to the ASEE Libraries Division, we decided it would be appropriate to use the ASEE Engineering Libraries Division Open Textbooks for Engineering list [12] as our central resource for identifying authors. This list contains over a hundred resources and is consistently updated to include the most recently published OER. In addition to this database, the authors added a few OER with which they were personally familiar.

The authors developed a set of inclusion and exclusion criteria from this list. This consisted of the following four criteria.

1. There had to be an identifiable lead author (or a few lead authors) where contact information could be determined. Some resources, particularly Wikibooks resources, did not have clear lead authors to contact, and we could not find contact information for some other authors.
2. The book must be written primarily for an engineering audience, which we took to include computer science and engineering technology. Some resources included in the list were clearly mainly written for science rather than engineering, which put them outside of the intended scope of our study.
3. The lead author, or at least one of the lead authors, needed to be in an engineering department. Subjects such as technical writing for engineers could be written by English faculty, which again puts them outside the scope of what we were examining.
4. The resource had to be written primarily for educational rather than research purposes. Some of the resources in the list were books of original open-access research, with each chapter written by a different author that more closely resembled a series of research papers than a textbook. Though these may have educational value in some circumstances, we decided to exclude these resources from our list as the development process would be significantly different from purely educational resources.

In total, 77 authors with contact information were identified as meeting our criteria.

### Survey Development:

We wanted to cover a broad range of topics to help potential OER authors, administrators considering an OER support program, or support staff in an OER program be better informed about the motivations, characteristics, and challenges of successful OER authors. The survey was a mix of quantitative multiple-choice questions and qualitative free responses. As OER authors themselves, the researchers collaboratively developed and organized the set of questions to be used. The questions and our discussions are broadly organized into the following seven categories.

1. Author School, Appointment, and Class Types
2. Inspiration and Motivation
3. Authoring Design Choices
4. Authoring Support
5. Challenges and Barriers
6. Professional Impact
7. Advice and Looking Forward

The final list of questions can be seen in Appendix 1.

### Survey Dissemination and Data Collection:

The survey was administrated via Qualtrics, with the initial emails being sent out in December 2023. The researchers used an initial group email invitation with personal follow-up emails about two weeks later. Ultimately, the researchers had a 45% author response rate (35 of 77). Survey responses from the two authors of this paper are included in the set of 35 responses. The survey began with a consent statement, but as the survey was not distributed to students and did not present more than minimal risk to participants, IRB review was not required.

The quantitative survey questions were counted, and percentages were calculated to the nearest 0.1%. The authors evaluated the trends and categories in the qualitative questions by semi-qualitatively counting the appearance of reoccurring themes. The researchers additionally used ChatGPT (<https://chat.openai.com/> using model GPT 4.0) to help summarize and categorize responses.

### **Results and Discussion:**

#### Author School, Appointment, and Class Types:

The first set of questions addressed the types of institutions the OER authors were from. As seen in Table 1, the responding authors reported that they are primarily at public universities, with the remainder at private universities and community colleges.

Institution Type	Number	Percentage
Private University	9	25.7%
Public University	23	65.7%
Community College	3	8.6%

*Table 1: Author Institution Type*

Additionally, as seen in Table 2, more than half of the responding authors are at large (15,000+ student) universities, with only four authors teaching at schools with less than 3,000 students.

Institution Size	Number	Percentage
0 - 500 students	0	0.0%
501 - 1,500 students	2	5.7%
1,501 - 3,000 students	2	5.7%
6,001 - 15,000 students	8	22.9%
More than 15,001 students	18	51.4%

*Table 2: Author Institution Size*

This data could indicate that faculty at large public institutions, which often support high enrollment engineering programs, are most likely to author OER resources for engineering. With larger enrollments and budgets, these institutions may also be the most likely to have institutional programs encouraging OER adoption and authorship. Finally, in terms of pure cost savings, implementing OER in high-enrollment courses at these universities will also save students the most money.

As seen in Table 3, at the time of writing their OER, most responding authors held tenure-track appointments, with more than two-thirds of the tenure-track faculty already granted tenure. Most of the remaining respondents were full-time non-tenure track faculty.

Author Appointment Type	Number	Percentage
Tenure-track faculty prior to tenure	7	20.0%
Tenured	15	42.9%
Full-time non-tenure track faculty	9	25.7%
Part-time faculty	1	2.9%
Retired	3	8.6%

*Table 3: Author Appointment Type*

When asked what level of classes they typically teach, authors reported a reasonably even distribution from first-year undergraduate courses to graduate courses (Table 4). It should be noted that authors could select more than one response if they taught multiple courses, so the percentages add up to more than 100%.

Class Type	Number	Percentage
First-year undergraduate	15	42.9%
Second-year undergraduate	20	57.1%
Third-year undergraduate	20	57.1%
Fourth-year undergraduate	21	60.0%
Graduate	17	48.6%

*Table 4: Class Types Taught*

When asked about class size (Table 5), most authors reported teaching moderate-size classes between 11 and 50 students, with eight commonly teaching over 101 students per class. The results here contrast with the earlier speculation, indicating that OER development may not necessarily focus on the highest enrollment courses within engineering programs.

Typical Class Size	Number	Percentage
0-10 students	2	5.7%
11-25 students	10	28.6%
26-50 students	10	28.6%
51-100 students	4	11.4%
More than 101 students	8	22.9%

Table 5: Typical Class Size

When asked about their background in the engineering education research community, the respondents' research focus and conference attendance varied widely, with some focusing on Engineering Education as a primary research topic and others with no experience with engineering education research or conferences. Many are involved in the American Society for Engineering Education (ASEE), while others interact with the education arms of their discipline-specific professional organizations, like the American Society of Mechanical Engineers (ASME) and the Institute of Electrical and Electronics Engineers (IEEE).

### **Inspiration and Motivation:**

Starting the next section of the survey, the authors were asked open-ended questions about their primary motivation for writing an OER. The OER authors' inspiration can generally be categorized into the following five areas, listed from most prevalent to least:

- *Content Adaptation and Existing Materials:* Many authors addressed the need for materials that fit non-standard courses, including up-to-date, practical information. Additionally, some saw OER as a practical way to package their existing notes or resources.
- *Access and Affordability:* Many responding authors extolled the benefits of expanding access while reducing student costs.
- *Grant and Sabbatical Support:* Authors were further motivated by financial support through grants or sabbaticals, providing them the time needed for authoring.
- *Innovation and Engagement:* Multiple authors emphasized the desire to create engaging, relevant, and enjoyable learning materials by integrating an approachable writing style, practical examples, and interactive learning materials.
- *Autonomy:* Some authors shared a general dissatisfaction with the publishing industry and a desire to create material free from the publishers' control.
- *Community Contribution:* Multiple respondents expressed altruistic aspirations to share with the educational community, including their students and broader educational circles.

When asked about the intended audience for their OER, the most common response was students in their own classes (77.1%). Authors here also commonly reported students at the university, students in the region, or engineering students everywhere. However, response patterns to this question, which allowed respondents to select multiple options, may indicate that respondents interpreted the question in different ways. It appeared that some surveyed authors assumed that “engineering students everywhere” included students also at the regional, university, and course



levels, while others selected all the levels. Hence, given the potential multiple interpretations of the question, the results should be taken with a grain of salt.

When asked if the intended audience and goal for their OER had shifted over time, most authors reported that the intended audience had not shifted or that as their resource became more universally used, they worked to keep it globally accessible and relevant.

When asked about the primary goals they aimed to accomplish by writing OER, the authors share themes similar to those of their previously summarized inspiration, with responses in categories organized by prevalence.

- *Enhancing Accessibility and Affordability*: A key goal was to provide students with free or low-cost educational materials, thereby improving access to education and reducing financial burdens.
- *Innovative, Customized Content*: Authors aimed to develop original, tailored content for specific courses or fields, often integrating cutting-edge research of interdisciplinary material and interactive technology to enhance learning.
- *Improving Educational Quality and Relevance*: Many authors focused on improving education quality by updating teaching methods, ensuring content relevancy, and incorporating practical information that aligns with current industry practices and scientific understanding.
- *Service to Communities*: Some authors reported wanting to serve broader educational and professional communities by providing resources that improve practice and understanding in their fields.
- *Fostering Collaboration and Open Knowledge*: Multiple authors expressed a desire to promote a culture of collaboration in education, with authors expressing intentions to lead by example in the selfless sharing of current content.

When asked, “How does authoring OER align with your personal and professional goals?” authors responded across the following categories:

- *Enhancing Accessibility and Educational Equity*: Many authors wanted to make education more accessible and equitable. This includes providing free learning materials and removing barriers to education, thus serving the public good and contributing to global knowledge sharing.
- *Personal Satisfaction and Public Service*: Authors expressed personal fulfillment in creating OER, derived from the quality of their work and its impact on reducing student expenses. This sentiment complimented the strong sense of public service, especially among those working in public institutions, who view sharing knowledge as part of their duty.
- *Alignment with Goals*: Authoring OER is closely aligned with educators’ academic professional responsibilities regarding content delivery in their courses and contributing to their field.
- *Professional Recognition and Career Advancement*: Although some responding OER authors reported facing challenges in gaining recognition, others found that their work

contributes positively to their professional portfolio, including tenure and promotion processes, demonstrating their commitment to student success and educational innovation. More on this topic is also discussed in the professional impact section of the results.

- *Contributing to the Advancement of Knowledge and Practices:* Some authors were driven by advancing knowledge in their fields, sharing innovative practices, and providing up-to-date and relevant resources. This includes integrating new technologies and approaches in their OER materials.

### **Authoring Design Choices:**

When asked which elements authors felt were essential in their OER and why, authors responded with a broad range of topics, which could generally be summarized within the following themes.

- *Interactivity:* Many authors included interactive multimedia, animations, and video lectures to make their content more engaging and allow users to interact with the concepts.
- *Practicality:* Authors expressed the need to include practical applications and real-world examples. These elements helped ensure content applicable to real-life and professional contexts.
- *Accessibility and Engagement:* Authors also stated the desire to make resources accessible, free, and engaging, focusing on clear, concise communication and student engagement to encourage use and improve learning outcomes.
- *Comprehensiveness and Alignment with Curricula:* Multiple authors desired to create content covering comprehensive subjects that align with course syllabi, offering a full spectrum of learning materials from foundational concepts to advanced applications.
- *High-Quality and Updatable:* Some authors expressed the need for professional presentations comparable with traditional textbooks, with the advantage of being easily updated to reflect the latest information and educational practices.
- *Support for Self-Learning:* Lastly, a few authors wished to include resources like formative assessments and clear documentation, especially for software components, to facilitate self-learning and adaptability to different technical skill levels.

When asked how they licensed their work, authors mainly reported utilizing Creative Commons (CC) licenses ([website](#)), with only two authors utilizing copyright statements and one a GNU General Public License, which is a comparable free and open license for software ([website](#)). Though the works licensed under traditional copywrite and the CC-BY-ND (No Derivatives) licenses may not meet the strictest definition of OER, they were freely available to the students and were included here. The distribution of license types is shown in Table 6 below.

License Type	Number
CC-BY	7
CC-BY-NC	4
CC-BY-SA	6
CC-BY-NC-SA	12
CC-BY-ND	1
CC-BY-NC-ND	2
Other	3

CC License Attribute	Definition	Number
BY	Attribution to Author	32
NC	No Commercial Use	18
ND	No Derivatives	3
SA	Share Alike	18

Table 6: License Used

When looking at the license components within the CC licenses, the most common element was the attribution (BY) element, which is unsurprising given that this is included in all but the most permissive CC license. The two most common optional CC components, each used by 56.3% of authors, were Non-Commercial (NC) and Share Alike (SA). Non-commercial precludes any future selling of derived works, while Share Alike requires that derivative works use the same license and terms. The most restrictive CC component, No Derivatives (ND), was only adopted by 3 of the 32 CC license users, and it prevents others from making any changes to the original work.

A few themes emerged when the authors were asked why they chose the specific license for their OER. First, many authors chose their licenses based on the desire to make their work widely accessible and to encourage sharing. This includes wanting the content to be freely available to students and practitioners, ensuring the work is shared and adapted freely, and aiming for the broadest possible audience. Second, multiple authors expressed a desire to maintain some level of control over their work. This includes concerns about commercial use, wanting proper attribution, and retaining creative control. Third, some authors indicated that their license choice was influenced by recommendations from library staff and university policies or was simply the default option provided by the authoring platform they were using.

### Authoring Support:

When asked about authorship teams, over half of responding authors wrote their OER alone, and several also mentioned being self-motivated for their projects. A slightly smaller group reported working in small teams of 2-3, while just a handful of authors reported working in teams of four or more to develop their OER. Many authors mentioned support and inspiration from previous OER authors, librarians, and other university staff outside the formal authorship team, even if most authors were writing the content themselves.

Authorship Team Size	Number	Percentage
Just me	18	51.4%
2-3 person team	12	34.3%
4-6 person team	2	5.7%
6 or more person team	3	8.6%

Table 7: Authorship Team Size

When asked about this support during the authoring process, most authors reported help from local university support structures, with a handful reporting support from help from a larger system. Additionally, the majority of respondents reported some funding from the university, the system, or from national sources. Text responses to the “Other” category included help from teaching assistants, faculty and student reviews, and multiple responses that shared that they didn’t receive any help. A complete inventory of the support received can be seen in Table 8.

Support Type	Number	Percentage
Local University Support Structure	22	62.9%
Regional or System Support Structure	3	8.6%
University Funding	17	48.6%
Regional or System Funding	5	14.3%
National Funding	4	11.4%
Mentoring from Key Individuals	3	8.6%
Other	6	17.1%

Table 8: Authorship Support Received

When asked an open-ended question about the most crucial help they received or the most important resources they wished they had received, some key themes emerged in the responses. In order of prevalence, these themes are:

- *Publishing Support*: By far, the most common theme emerging in the responses to both questions was publishing support. This could have been in the form of copywrite or license help from librarians, IT help with technology platforms, copyediting help, or even assistance from students in setting up multimedia content like images and interactives. Though the nature of the help and people helping varied, authors tended to be comfortable with the subject matter but needed help with the publishing process. This result is in line with the existing literature discussed earlier [9], [10], [11], which emphasizes the importance of publishing support in promoting OER authorship.
- *Funding*: The next most common set of responses revolved around funding. Seven authors mentioned this as part of the most essential resource they received. Still, only four authors noted this regarding what they wish they received, indicating that personnel assistance is likely more important than funding. However, funding is still necessary, perhaps as an element of professional validation or to buy out time, both of which are also discussed as important.
- *Content Feedback*: Several authors discussed the importance of content feedback from other faculty or students during OER authorship. However, only one faculty member mentioned this as the help they wished they had received. The drop between receiving and wishing they received feedback is stark but may simply indicate that the opportunity for faculty or student feedback was not lacking in most cases.
- *Time*: A handful of authors mentioned the free time necessary for authorship. This could be provided through a course buyout but was more commonly cited as part of the freedom to focus on what you want that comes with receiving tenure.
- *Technology Platforms*: A handful of authors mentioned technology platforms that made the authoring and publishing process easier for them.

- *Professional Validation*: A small theme worthy of mention is professional validation, which is the only theme to increase from one mention of what was received to three mentions regarding what the authors wished they had received. This cross-cutting theme was also reflected in the previous section, which discussed the alignment of work with professional goals.

## Challenges and Barriers

The following two open questions asked what the biggest challenges were and what design changes, if any, resulted from them. The themes that emerged from the responses, in order of prevalence, are as follows.

- *Time*: In terms of the challenges authors faced, the most common theme to emerge in the results was the time required to complete the project. A total of 18 of 35 respondents mentioned this as the biggest challenge.
- *Technology Issues*: The next most common theme was difficulties with the technology or platform, with nine responses on this theme. The exact nature of the difficulty varied, from some mentioning the underlying platform or formatting tools to some mentioning graphics and interactives. Still, the publishing support mentioned in previous sections could do some to address these issues.
- *Collaboration and Communication*: Finally, a theme of “chasing people,” as one respondent put it, also emerged as the third most common theme. Some author teams struggled to get everyone to contribute on time, but others shared challenges related to tracking down permissions for images or graphics from someone outside the team.

Regarding changes prompted by the challenges, it was heartening to see that most authors persevered in their vision and said they had no significant changes. That said, the two themes that did emerge were as follows.

- *Pulling Back on Scope*: Five authors mentioned pulling back on their original scope, either by reducing the topics covered or the design elements in the resource. With time being the most mentioned challenge, this result is not surprising.
- *Platform Changes*: The second theme, which also had five authors, mentioned a change in platform. This was usually paired with some discussion of the original platform's limitations that conflicted with the author's initial vision for the OER. This change may ultimately be viewed as a success, but changing platforms will undoubtedly take time away from content authorship, and early publishing support may help get authors on the right track early on.

## Professional Impact

The next question asked if the authoring process was viewed as part of the promotion and review process, with a multiple-choice response. The answers to this question can be seen in Table 9 below. As can be seen in the results, most authors did not see a direct impact from their work on the promotion or review process. Despite the time commitment required, many authors were unsure about how OER authorship impacted them in promotion and review.

Was your authoring effort viewed as part of promotion and tenure?	Number	Percentage
No, it was not.	14	40.0%
I'm not sure	8	22.9%
Yes, but the impact was indirect.	8	22.9%
Yes, it has a direct impact.	5	14.3%

Table 9: Answers to “Was your authoring effort viewed as part of promotion and tenure?”

Despite the answers to the previous question, when asked if they felt the time spent authoring OER was worthwhile professionally, all but one of the authors either agreed or strongly agreed. Despite the uncertainty around authorship in the promotion and review process, it seems most faculty felt authoring OER to be worth it. This likely points to a high intrinsic motivation among OER authors in engineering.

### Advice and Looking Forward

When asked what advice they would offer to someone considering authoring or just starting to author their own OER, the authors surveyed offered a wealth of advice. Though there was a lot to work with in the open responses, some themes did emerge, and these themes also naturally paired up in some cases.

The first pair of themes centered around the ideas of 1) just getting started and 2) understanding and keeping up your motivation. Regarding the advice of just getting started, more than one author could be quoted simply with “Do it.” Getting started on any task can be a hurdle, and writing down that first word will always require some motivation. However, as is seen in the responses to previous survey questions, the authors who have completed an OER have found it fulfilling in many ways.

Beyond taking that first step is the question of understanding your motivations and keeping those motivations up in the long term. Authoring an OER is a long-term commitment, and as put by one of the respondents:

*Take your time. This is not a job done in a couple of months. Best to do this iteratively, over a couple of years, and in parallel to several teaching cycles of the corresponding course.*

As with any long-term commitment, keeping your motivation up can be a challenge, and multiple authors suggested that you need to understand those motivations to keep them up in the long term. As put by one author:

*My advice is ... you have to know your WHY. It is a tremendous amount of ongoing work to author and maintain OER material especially in fields (like engineering) where things continually advance, and updates will need to be made.*

Despite the challenges described around maintaining motivation, the responses were also quite positive regarding those motivations. As put by an author...

*You get a lot of goodwill when authoring OER. So many people appreciate it, and many people are willing to support OER efforts in many ways. Students appreciate the low cost, librarians appreciate the lack of bureaucracy, colleagues appreciate the availability, and so on.*

The next pair of related themes that emerged centered around 1) seeking mentorship from other OER authors and 2) seeking publishing support. Both themes were discussed earlier in the context of essential resources but were seen again regarding advice.

The themes of mentorship and seeking guidance from other OER authors showed up in multiple responses. This seems to be straightforward advice, but as one author noted, it may be challenging to find other OER authors as they're still relatively rare.

The idea of seeking publishing or editorial help also showed up in multiple responses. The survey respondents advised that authors seek assistance from other faculty for editorial help, from librarians for help with licenses and publishing, and from IT who can help with technology issues. As one respondent puts it...

*Find a diverse and experienced team to work with, their skills and motivation will be invaluable.*

Though there was also some discussion on the difficulties of working in a team, one respondent succinctly stated, "It's hard to do it alone."

Finally, the last pair of related themes that jumped out in the advice centered around 1) planning and understanding and 2) not starting from scratch. Though many OER authors embark on the process of writing their resources before they fully understand the process, having a plan and understanding what you need upfront can save significant time later. Multiple authors mentioned having a plan and/or a timeline as being important. Similarly, understanding the authoring platforms and the licensing rules is critical to getting a good start. As engineers, we can all appreciate the concept of a systematic and thorough design process, and the same can be applied to the OER authorship process.

Similarly, we can also appreciate the concept of not reinventing the wheel. Multiple authors mentioned examining other OER, and some advised starting with an existing OER rather than starting from scratch. As stated by one respondent...

*Starting with an existing text is much easier, even if you end up rewriting everything.*

The open licenses specifically allow us to adapt and remix other's content. Though this isn't necessarily an option if no OER is already in your area, as more OER is authored, it opens new possibilities to adopt and adapt rather than starting with a blank page.

In a final bit of contrasting advice, however, another respondent advises readers not to build something that looks like what we are used to...

*Don't feel obligated to make it look like traditional textbooks. Use your experience teaching the course to come up with a book that will best serve the students.*

When asked how they see the role of OER evolving in engineering education in an open-ended question, some themes emerged, though there was also some disagreement. Unsurprisingly, the most common responses indicated that the respondents wanted to see more OER used in engineering courses, to the point where using OER is standard in most courses. Paired with this wish was a sense of dissatisfaction with the traditional publishing industry and hope that OER could help everyone more equitably. While most authors wanted to see OER used widely in engineering, there was disagreement on how likely we are to reach that goal. The responses seemed to be an even mix of those who thought mass OER adoption is inevitable, those with a quiet and measured optimism, and those who feel let down by the rate of progress they have seen.

Finally, when asked what changes or developments authors want to see in the OER landscape, the survey respondents offered several changes they want to see.

- *Findability and OER Repositories:* Despite a growing number of OER repositories, many faculty members discussed the difficulty of finding OER in engineering and wished for a system that makes locating OER for all subjects easier.
- *More OER Promotion by the University:* Universities often have stated commitments to access and affordability, and OER can help in that endeavor. Despite this match, multiple survey respondents indicated they wanted their universities to do more to raise awareness of OER and push faculty to adopt more OER in the classroom.
- *Better Incentives:* Multiple authors mentioned the large amount of work with OER authorship and the uncertainty around how that work will be perceived professionally. There is a desire for clear incentives and paths to promote OER authorship in academia. Some authors asked for recognition through tenure or promotion, while others asked for funding and dedicated support staff.
- *More Consistent Platforms and Community Standards:* Finally, the survey respondents wanted better and more standardized platforms and a more formal and consistent peer review process. In terms of the platforms, having more consistency would allow for more community involvement in authoring and maintaining these resources with a lower barrier to becoming involved. Regarding peer review, research papers undergo a more formal and consistent peer review process. Having this in place around OER could help to increase the credibility of the resources.

### **Implications and Conclusions:**

In the previous section, we examined perspectives for individual questions from over thirty engineering OER authors. In this final section, we summarize the themes into recommendations for both 1) faculty members considering writing their own OER and 2) administrators looking to promote and support OER authorship at their institution.



## Recommendations for Prospective OER Authors:

OER authorship will certainly require a lot of effort, but in retrospect, the authors surveyed here found that work to be highly fulfilling. Writing your own OER can allow you to build the exact resources you need. Additionally, releasing the work under an open license typically lowers the cost and broadens the availability. The following are key takeaways from the responding authors if you are considering or have just started writing your own OER.

- *Evaluate your Motivations:* Successful OER authors need strong intrinsic motivation based upon their desires to make education materials more accessible, equitable, and innovative. Grant funding or an institutional initiative may help you start, but commitments will likely extend past these programs. If you believe external motivations like grants or administrative pressure will be enough to carry you through the process, we suggest further reflection.
- *Seek Publishing Support:* The most valuable resource that authors used or wished they used was help from others to plan, build, and publish their work. Seek help from librarians to choose a license and get your work out there. Seek technical experts to help select and use publishing platforms. Seek mentorship from existing OER authors at your institution or within your field, as they can help you develop a plan. Find out if your institution, state, or region has structured programs to support OER authorship. Focus your time on developing the content and build a network of others to help with the publishing.
- *Do Your Research Up Front:* Before you start writing, establish your objectives, including required key technical elements, and research the available licenses and their implications. You will find that this limits your platform options when you want to include specific types of interactives, videos, and other elements. Starting a project on an incompatible platform could waste your valuable time. Also, if you pull in elements from other OERs, ensure you understand their licenses and the related effects. Your local or system librarians can help with this aspect.
- *Plan for the Long Term:* OER authorship is a long-term commitment. Building a resource spanning an entire course or more will take longer than a few months and likely more than a year. Maintaining the resource so that it stays available and up to date will be an even longer commitment. It's essential to understand your motivations. You may sometimes struggle to stay motivated. Develop a plan and break the larger task into smaller goals along the way. Consider finding co-authors to help share the load in the short and long term. Also, OER authorship support programs and grants can help formalize long-term plans.
- *Build on the Work of Others:* Most OER allow for adapting and remixing the work of others. Hence, don't reinvent the wheel. Before you start writing, search the OER databases to find all related publications. Then, consider using others' work within their license bounds to lighten your authorship load. Even if an outside resource is not a perfect fit for your long-term vision, maybe it's a good enough fit to start with. You can always come back and adapt the section to your liking later.

- *Understand Professional Impact:* Finally, it's essential to understand how OER authorship impacts you professionally. Things like student teaching evaluations or research publications are standard elements of the promotion and review process, but OER authorship is still rare enough that it's not well understood. Talk with your administrators to establish how this work will be perceived as part of promotion and review and determine what metrics will be used to establish the impact of your work.

#### Recommendations for Institutions and Organizations:

Having faculty use OER in the classroom can result in significant cost savings for the students, and it's an excellent way to promote access and affordability at your institution. The resources available in engineering are still limited, however, and there is a need to widen the pool of OER in engineering. Like research, OER authorship is a way for faculty to get their name out there and establish themselves as experts in the field. If you wish to support faculty in authoring OER, below are some suggestions based on our findings.

- *Establish Publishing Support:* The work here reinforces the need for support structures and personnel for potential authors. Authors may be experts in their content area but are likely not experts in the publishing process. Having librarians or staff available to help understand the licenses, the publication platforms and, generally guide authors is critical.
- *Reward Authorship in Promotion and Tenure:* Despite the large amount of time required to author OER, less than 20 percent of surveyed authors felt that their authorship directly impacted promotion and tenure decisions. If colleges and universities wish to promote OER authorship at their institution, they need to clearly communicate how this form of scholarship will be considered as part of the promotion and tenure process.
- *Understand Authorship Timelines:* When developing programs to support OER authorship, it is crucial to understand the typical authorship timeline. Resources development will take at least a year, with many authorship processes taking multiple years. Beyond the initial publication, simply maintaining and updating the resource will be ongoing. Programs designed to support OER authorship need to understand this timeline and consider the long-term nature of authorship.
- *Provide Funding to Offset Authors' Time:* Though some faculty may spend their time authoring OER without external compensation, funding time spent in the authorship process can still be a good gesture. Grant funding can provide money for the time spent and the validation of scholarship regarding promotion and tenure. Additionally, providing grant funding may push a potential OER author to become an actual OER author.
- *Foster a Culture of Collaboration and Service:* Potential authors who see others contributing to the knowledge base of the broader community are more likely to take on their own projects. One way to foster this culture is to increase awareness of existing projects and successes at your local university or region. If your institution supports OER authorship, make sure to showcase successful publications as a way to promote the idea of "open" as valuable work.

## Conclusion:

In summarizing the insights from 35 engineering Open Educational Resources (OER) authors, key recommendations emerge for both faculty considering OER authorship and administrators aiming to foster a supportive OER environment. The journey for prospective authors is both demanding and rewarding, yet offers the chance to tailor resources precisely to educational needs and enhance accessibility. Institutions are recommended to provide robust publishing support, value OER contributions in promotion and tenure decisions, and cultivate a collaborative culture. Combined, these strategies underscore the symbiotic relationship between individuals and institutions to expand the development and utilization of OER in engineering education.

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## Appendix 1: Distributed Survey

### OER Author Survey for American Society for Engineering Education (ASEE) Paper

**Engineering OER Author Survey** This survey will be used to help authors Jacob Moore and Dan Baker write a paper for the American Society for Engineering Education (ASEE) 2024 National Conference summarizing the demographics, motivations, and experiences of engineering faculty who have authored open educational resources (OER) content. We hope the paper will offer advice and guidance to engineering faculty members who are considering or have just started the process of writing their own OER.

#### Demographics and Institution:

What is your name? [First Name] [Last Name]

What was your job title at the time you wrote your OER? \_\_\_\_\_

What was your job type at the time you wrote your OER? (select ONE)

- Tenure-track faculty prior to tenure (1)
- Tenured (2)
- Full time non-tenure track faculty (3)
- Part-time faculty (4)
- Retired (5)

What is the name of your institution? \_\_\_\_\_

What type of institution do you work at? (select ONE)

- Private University (1)
- Public University (2)
- Community College (3)
- Technical School (4)
- Other (5) \_\_\_\_\_

How many students attend your institution? (select ONE)

- 0 - 500 students (1)
- 501 – 1,500 students (2)
- 1,501 – 3,000 students (3)
- 3,001 – 6,000 students (4)
- 6,001 – 15,000 students (5)
- More than 15,001 students (6)

What level classes do you typically teach? (select ALL)

- First-year undergraduate (1)
- Second-year undergraduate (2)
- Third-year undergraduate (3)
- Fourth-year undergraduate (4)
- Graduate (5)

How large are your typical classes? (select ONE)

- 0-10 students (1)
- 11-25 students (2)
- 26-50 students (3)
- 51-100 students (4)
- More than 101 students (5)

What is your background with engineering education research and/or engineering education conferences? \_\_\_\_\_

Inspiration and Motivation:

What inspired you to author your own OER? \_\_\_\_\_

Were there any specific people that inspired you to author an OER? \_\_\_\_\_

What was the primary goal you were aiming to accomplish with your OER?  
\_\_\_\_\_

How does authoring OER align with your personal and professional goals?  
\_\_\_\_\_

Authoring Design Choices:

How many people did you work with to write/develop your OER?

- Just me (1)
- 2-3 person team (2)
- 4-6 person team (3)
- 6 or more person team (4)

Who was the intended audience for your OER? (select ALL)

- Students in my classes (1)
- Students at my university (2)
- Students in my region (3)
- Students everywhere (4)
- General population (5)

What were the key elements you felt were essential in your OER and why?

\_\_\_\_\_

Has the intended audience and goal for your OER shifted over time and how?

\_\_\_\_\_

What license did you choose for your work? (select ONE) Review license types at <https://creativecommons.org/share-your-work/ccllicenses/>

- CC-BY (1)
- CC-BY-NC (2)
- CC-BY-SA (3)
- CC-BY-NC-SA (4)
- CC-BY-ND (5)
- CC-BY-NC-ND (6)
- Other (7) \_\_\_\_\_

Why did you choose the license above? \_\_\_\_\_

#### Authoring Support:

What support did you utilize during your authoring process? (select ALL)

- Local university support structure (1)
- Regional or system support structure (2)
- University funding (3)
- Regional or system funding (4)
- National funding (5)
- Mentoring from key individuals (6)
- Collaboration with small group (2-4) (7)
- Collaboration with large group (5+) (8)
- Other (9) \_\_\_\_\_

Describe the most important help you received during your authoring process.

\_\_\_\_\_

What additional resources or support do you wish you had available during the process?

\_\_\_\_\_

#### Challenges and Barriers:

What was the biggest challenge you faced during the authoring process? How did you overcome this challenge? \_\_\_\_\_

Were there challenges that led to a change in the design or scope for the project?

\_\_\_\_\_

#### Professional Impact and Looking Forward:

Was your authoring effort viewed as part of the promotion / review process for you?

- Yes, it has a direct impact. (1)
- Yes, but the impact was indirect. (2)
- I'm not sure. (3)
- No, it was not. (4)

Do you feel as if the time you have spent authoring OER has been worthwhile professionally?

- Strongly agree (1)
- Agree (2)
- Uncertain (3)
- Disagree (4)
- Strongly disagree (5)

What advice would you offer to someone considering authoring their own OER? Are there specific strategies, resources or people you would recommend? \_\_\_\_\_

How do you see the role of OER evolving in engineering education? \_\_\_\_\_

What changes or developments would you like to see in the OER landscape?  
\_\_\_\_\_