Examples of OER products where WPI students were co-creators and partners.

Small is Beautiful: OER for Cultural Change in a STEM Institution

Prepared By: Marja Bakermans, Anna Gold, Courtney Kurlanska, Lori Ostapowicz-Critz, and Sarah Stanlick, Worcester Polytechnic Institute

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About the Authors:

All members of the team collaboratively authored this report.

Marja Bakermans, Associate Teaching Professor, Department of Integrative and Global Studies and Biological Sciences, shown here with a northern saw-whet owl, is a conservation biologist researching drivers of bird population declines. Marja applies a similar hands-on approach with her students in using open pedagogies and co-creating OERs on climate change, extinctions, and biodiversity.

Anna Gold, University Librarian, Gordon Library, has championed low- and no-cost OER initiatives at several academic libraries for over ten years; in 2012 she established one of the first OER librarian positions in an academic library. She sees OER as important for advancing social justice through affordability but also as part of a larger 'open' movement that shifts the framing of knowledge in research and learning from knowledge as a commodity to knowledge as a human and creative system.

Courtney Kurlanska, Assistant Teaching Professor, Department of Integrative and Global Studies is an economic anthropologist researching community development and alternative economic practices. Courtney combined theory with practice through the co-creation of an OER on green economies with her students.

Lori Ostapowicz Critz, Associate Director, Academic Strategies, Gordon Library, supports the library's teaching, learning, and research endeavors of the WPI community. Lori offers personalized support for faculty partners as they adopt, create, adapt, license, find, evaluate, and share OERs; she has created myriad OERs to support information literacy skills instruction, and supports the digital publishing infrastructure to curate WPI OERs.

Sarah Stanlick, Assistant Professor, Department of Integrative and Global Studies and Director, Great Problems Seminar. Sarah was a first-generation college student and has served as an advocate for student access and inclusion. She believes OERs are one strategy to address inequities and challenges for students who come from differently resourced backgrounds. While she has been using open access and zero-textbook-cost approaches to teaching for years, she is increasingly adding student-created OERs.

Copyright

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Introduction

"Small is beautiful." E.F Schumacher (1973)

The Open Educational Resources (OERs) movement has developed rapidly over the last two decades, evidenced by abundant global and national platforms, conferences, organizations, and funding. The goal of achieving OER at scale has been a key ambition, and there has been continuing growth in awareness of OER and in practices of creating and offering zero- or low-cost course materials aimed at achieving large-scale reductions in student costs (Addy et al. 2021). At the same time, OER is an invitation to create, co-create, revise, adapt, and collaborate in designing course materials. This secondary focus on the process and the pedagogical goals and outcomes of creating OERs has emerged as equally compelling (Weller et al. 2015).

At Worcester Polytechnic Institute (WPI), a private mid-sized university with a historic commitment to distinctive undergraduate pedagogy (Tryggvason and Apelian 2012; Wobbe and Stoddard 2019), OER as an affordability strategy resonates and aligns with university strategic initiatives aimed at reducing student costs to increase access for students from lower socioeconomic backgrounds. Based on national data and institutional estimates, these are not trivial concerns. We estimate that our 6000+ students spend an average of $1200/year on textbooks and course supplies – a collective expenditure of $7.2 million.

But in assessing student and faculty attitudes toward and interest in OER, we found that student agency and quality of pedagogy matter even more than affordability to our faculty and students. At WPI, faculty and institutional interest in inclusion in STEM and in open pedagogy practices suggested we adopt a different - and "small" - approach to growing OER practices in our community.

The primacy of goals of creation, co-creation, inclusion, and social justice, with OER as a key strategy in contributing to achieving those goals, meant a change in the strategies we initially envisioned for growing OER at WPI. Rather than approaching this work through top-down or university-wide policies, or systematic programs of financial incentives for adoption of existing OERs to effect OER adoption at scale, our chosen strategies are smaller, more personal, and very practical. The potential for OERs to support transformative and inclusive pedagogy with an impact on inclusion in STEM requires a complex and personal commitment by individual faculty members.

Background

OERs: An Overview

OERs are 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 (UNESCO).

When used as an alternative to commercially published textbooks, OERs can save students significant amounts of money (Hilton et al. 2014), and several recent reviews find that faculty and students perceive OER materials as of equivalent quality compared with traditional commercial course materials (Luo et al.

2020; Berti 2018; Hilton 2016). In addition to supporting quality learning and saving students money, additional benefits to students include greater currency and relevance of OERs over other sources, and higher course grades, presumably due in part to immediate access to course materials, compared with students who may defer buying an expensive textbook for all or part of a course term (Berti 2018; Colvard et al. 2018).

In addition to these financial benefits, OERs enable faculty to customize and curate material that is applicable to the course. This includes, but is not limited to, course material that is influenced by current events or new discoveries. OERs provide a pathway for representation in the material that can widen the understanding of a field beyond the monopoly of storytelling that the textbook publishers have on narratives. OERs also allow for student engagement and co-creation of material that can be pedagogically significant and allow for a more polyvocal approach to topics. In short, OERs can level the field for accessibility, be drivers of epistemic justice, and provide an outlet for student scholarly identity development.

The Intersection of OERs, STEM, and Social Justice

In their book *What Inclusive Instructors Do*, Addy et al. (2021) argue that OERs are essential in resolving critical accessibility issues. However, using open and low-cost course materials does not necessarily translate into achieving greater equity and inclusivity. It is well-known that traditional course materials are expensive; what is less often recognized is that many traditional textbooks are biased, representing white male, cisgender individuals as primary identities or as central historical figures at the expense of recognizing other vital contributors to the field. OERs can reinforce these same biases.

Women, LGBTQ+, first-generation, and BIPOC (Black, Indigenous, people of color) communities are systematically unrecognized and underrepresented in STEM fields, and this reality is reflected throughout materials that students engage with in their STEM courses (e.g., texts, case studies, lectures). For example, research on the representation of women of color in case studies found that authors identified STEM professionals as Black or Latinx women only 1.4% and 0.9% of the time, respectively (Couret and Medina 2021). This reflects the restrictive process of textbook creation and modification which relies on invited experts who do not reflect the increasing diversity of the students using these resources (Nusbaum 2020).

While there is little evidence to support a direct (causal) connection between OERs and social justice or the promotion of justice, equity, diversity, and inclusion (JEDI)*, OERs provide the opportunity to make this happen. One study recently found that first-generation students that read OER textbooks that had been modified to include greater diversity and representation did not have the reduced sense of belongingness found in the control group that read the standard version (Nusbaum 2020). OERs have been found to increase agency and empowerment and benefit learners across disciplines, levels, and career goals, from trades students (Flinn 2020) to doctoral students (Seiferle-Valencia, 2020).

* NOTE: We understand that different institutions might have different terminology for this. We appreciate and affirm those differences and also are using this work from Truong and Martinez to contextualize our understanding: From DEI to JEDI | Diverse: Issues In Higher Education (diverseeducation.com)

OERs can be a part of the solution to these systemic issues by aligning with social justice principles of redistribution, recognition, and representation (Lambert 2018). Creating and using OERs that are intentional in their connection with social justice can increase student access, develop deeper student relationships with course content, and strengthen our collaborative capacity to pursue the larger goals of a more empowered educational ecosystem. After all, increasing access and representation in STEM education for historically minoritized students improves collaborative problem-solving and strengthens these fields for everyone (Folk-Williams 2010; Medin et al. 2014).

Culture of Collegiality, Colleagueship, and Collaboration

The adoption, creation, and curation of OERs within a university can help create an environment of openness, a culture of sharing, and learner autonomy (Smyth et al. 2016).

For ***students*** (Fig 1), the opportunity to grow as scholars and develop their own identity as creators of knowledge is a way in which we can engender a valuation of epistemic justice in burgeoning scholars. It implicitly messages to students the value of multiple voices and the spectrum of expertise from across experiences, training, and identities (Lambert 2018). Treating students as colleagues and intellectual peers is a way of developing students more holistically through respect, voice, listening, and validation in the process of pursuing a shared goal beyond the classroom (Zlotkowski and Longo 2006).

Beyond considerations for student equity and agency, OER co-creation and utilization has been found to bridge access and equity issues for ***staff*** in higher education through increased customization and representation in resources, additional professional development opportunities, and

Fig 1. An active learning classroom where students brainstorm, consult, and share their work on their OER project during class.

opportunity to customize and prioritize resources with more direct applicability or diversity of perspectives (Bossu and Willems 2017). Addy et al. (2021) highlight the critical partnership between faculty and libraries as a vehicle for pedagogical justice and access through OER promotion, utilization, and creation. Librarians – in their boundary-spanning roles – provide critical care and advocacy for adoption of OERs at universities, with attention to and care for student voice, co-creation, and participation (McClure and Sinkinson 2020). The essential partnership across roles can bring about new collaborations and an implicit and explicit affirmation of the educator role that cuts across faculty/staff divides.

Finally, the impact of OER usage on individual ***faculty*** praxis and pedagogy is also often overlooked in discussions or evaluations of OERs. The use of OERs has also been found to be a way for educators to engage with a self-evaluation of their own teaching and expectations for quality pedagogy. Weller et al. (2015) point out that the impact on the educator is often ignored in the study of OERs – with such an emphasis on cost savings and student impact. However, they found that overwhelmingly educators thought more deeply about their practice, and it served as a critical professional development opportunity as well as a pedagogical innovation opportunity.

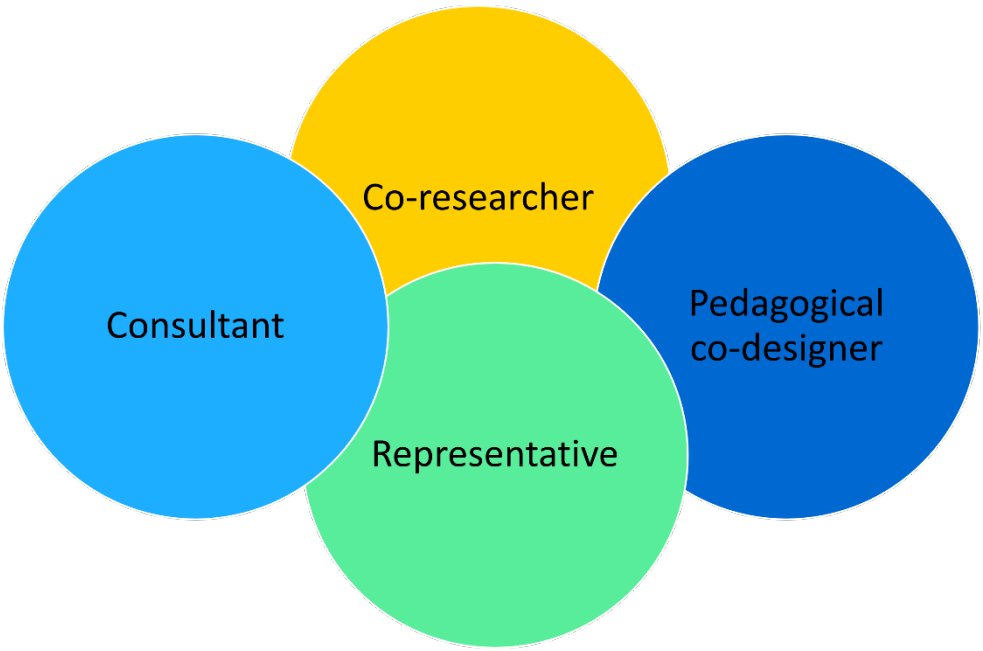


Fig 2. A visualization of the four roles of students in the co-creation process of learning and teaching. Adapted from Bovill et al., 2016.

Students as Partners and Co-creators

In open pedagogical practices, faculty engage with students as partners in the process of teaching and learning, including creating OER materials. Several models exist describing students' role as valuable contributors in partnership with faculty (Healey et al. 2014, Bovill et al. 2016, Healey et al. 2016). Healey et al. (2015) argue that students can partner in learning as teachers, scholars, and change agents. Bovill et al. (2016) describe non-mutually exclusive student roles as *consultants* who share their views, *co-researchers* who participate in research, *pedagogical co-designers* who share in design, and *representatives* who contribute their voices to the teaching and learning (Fig 2).

Although some faculty may be cautious of working with students as partners (Bovill et al. 2016, Matthews 2019), guidelines exist to help faculty and staff navigate the complexities. For example, best practices, as laid out by Matthews (2017), aim to 1) foster inclusiveness, 2) reflect and discuss power-sharing relationships, 3) accept uncertain outcomes, 4) engage ethically, and 5) support transformation. Key takeaways to consider are that one should not underestimate student abilities; and one should also embrace challenges along the way (Bovill et al. 2016; Matthews 2017).

Evidence of benefits to students is building. Students demonstrate an openness to sharing their knowledge and helping others. For example, students at WPI shared, "The reason that the team is accepting of this level of copyright license (CC-BY-NC) is because we want others to be able to use the content that we create. We are also allowing as much transparency as possible for the sake of making the academic community the best that it can be by sharing and collaborating with one another."

Reflections like this by students demonstrate a transformation of their role in learning communities (Cook-Sather et al. 2014; Williams and Werth 2021). Students also report positive impacts on their attitudes, motivation, development of scholarly identity, and growth in 21st-century skills (Cook-Sather et al. 2014; Trust et al. 2022). Finally, OERs created by students have been shown to be effective in

supporting the learning of others (Wiley et al. 2017).

Our team is interested in the ability of student-created OERs to build recognition and representation in course materials (Lambert 2018). The co-creation of OERs by students can empower the next generation of STEM professionals to shape the way disciplinary content is represented and engage in a reinvigoration of course material that allows a diversity of voices to be heard. A recent review of work completed by Think Open at University of Idaho Library found that graduate students charged with creating OERs that embraced this model were highly successful in creating materials with redistributive and recognitive justice, while representational justice was harder to achieve due to the identities of the authors (Seiferle-Valencia 2020). This speaks to the need to increasingly promote opportunities for collaboration and co-creation with diverse populations. Co-creation of OER materials with students is a tool to promote participatory, collaborative education that connects our learning objectives to students' academic and personal curiosities.

Our Context

Institutional Context

This work (Fig 3) was undertaken during a year when the university was deeply engaged in strategic planning. Major themes emerged on increasing the affordability of our undergraduate education and increasing access for students from lower socioeconomic backgrounds. An equally strong and complementary theme was to increase the representation of BIPOC and women students at WPI, and more broadly in STEM disciplines. Finally, an important strategic theme shaped in part by the extraordinary stresses of the pandemic during 2020-2021 was a critical appraisal and review of pedagogy and curricular structures and cultures as they contributed to (or failed to address) student challenges in mental health and well-being. This context presented a rich environment in which to raise issues of pedagogy, inclusion, and social justice and experiment with the strategies and opportunities of OER.

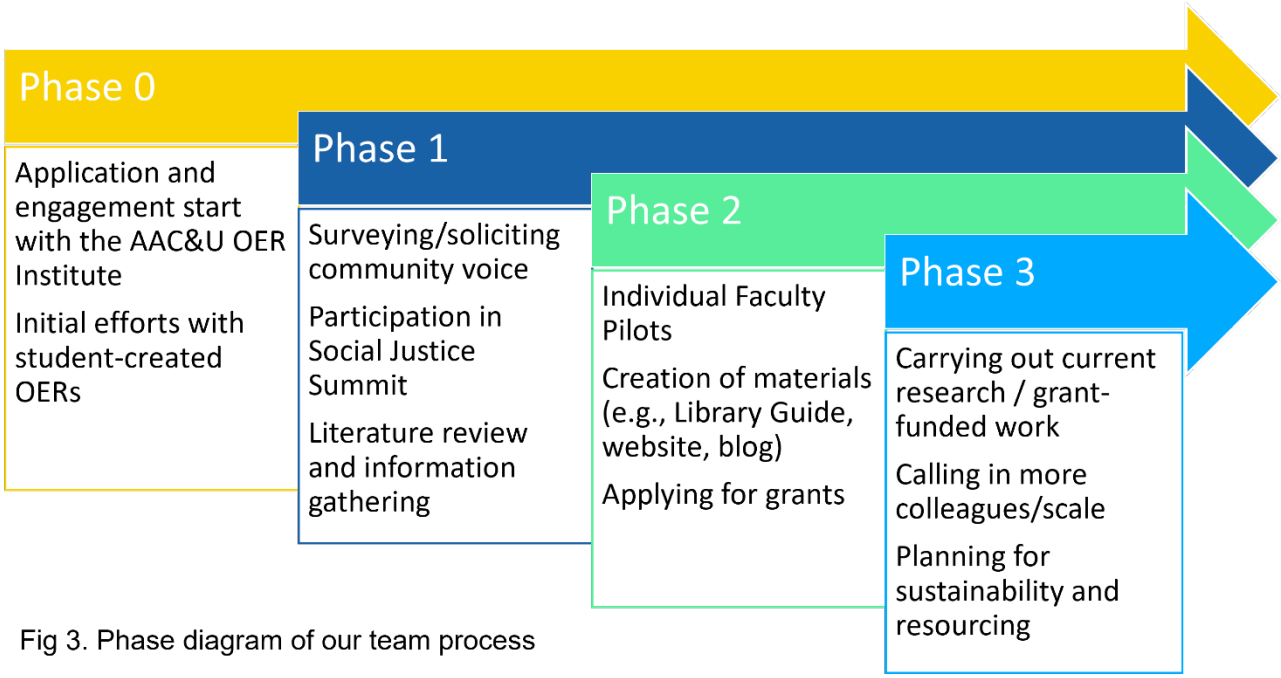


Fig 3. Phase diagram of our team process

AAC&U Institute

The team that undertook this work consisted of faculty and staff who were invited by senior academic administrators to participate in a year-long virtual AAC&U OER Institute. The team began working together in July 2021, guided by the Institute's overall purpose, "seeking to actualize an ambitious strategy to broaden campus engagement with and adoption of OER." (https://community.aacu.org/21-22-ioer/) Our team set initial goals of assessing the interest and receptivity of WPI faculty and students in using OER materials in learning; raising institutional awareness and capacity for creating OERs; and exploring connections between student and faculty commitments to social justice through creating and using OERs.

Participants

The team consisted of five individuals: three faculty who shared a common affiliation with the Department of Integrative and Global Studies (DIGS), and two senior leaders of the university library. The three faculty members included a biologist who teaches courses on biodiversity, climate change, and extinction; a specialist in community and international engagement who also leads the university's distinctive first-year "Great Problems Seminar" program; and an economic anthropologist who studies global issues from an ethnographic perspective. All three faculty had experimented with creating and using OER materials and actively integrated social justice perspectives and values in their teaching and research. The two library administrators had championed library support for OER both at previous institutions and at WPI. They were motivated to understand how to engage faculty in OER, and to take actions in the library that would support faculty champions and innovators in OER practices.

Goals and Objectives

Based on our shared and joint goals, we identified several key objectives that we would address through actions and research.

1. Build support, resources, and motivation for adoption and creation of OERs at a STEM institution. This complex objective addressed the culture, priorities, and specific challenges of shifting existing resources and expectations for both faculty and students in a strongly STEM-identified academic setting.
2. Identify and engage individual faculty willing to create, adopt, or modify OERs in their teaching.
3. Demonstrate and share the significance of OERs from a social justice perspective, including affordability but also extending to issues of student voice and inclusion of historically minoritized identities and perspectives in traditionally unrepresentative STEM fields.

Our Approach

Our approach to addressing these objectives took three paths: (1) surveying and knowledge mobilization in our community, (2) piloting OERs in the classroom, and (3) building capacity and connections for scaling this work at WPI. Throughout the year we also engaged in other outreach activities to share our goals, and what we had learned.

Preliminary Outreach: Knowledge Mobilization and Surveys

As we began the year's work, we undertook several activities to invite student and faculty voices and to connect with

colleagues to mobilize knowledge about the use of OERs for accessibility, affordability, and representation – both inside and outside of the institution.

Social Justice Summit: While our university community struggled with competing and often urgent demands on attention at every level (students, faculty, administrators), our team was able to organize a successful initial event in the early fall - a panel of students and faculty talking about OER, organized as part of a university-wide social justice summit, an annual event that brings together staff, students, and faculty who are incorporating social justice into their research, teaching, learning, and service. During that event, we hosted a student panel where we engaged students in questions about the intersection between open pedagogy, representation, support, and mental health.

Surveys: To invite our community to share their needs and attitudes regarding course materials and OER, we deployed two surveys, one sent to all faculty; and the other an informal survey of hundreds of students (IRB-22-0040). While designed to gather data on current attitudes and practices, current knowledge of OERs, and interest in knowing more about OERs, both surveys also had an outreach goal: raising awareness and stimulating thinking about current course materials practices and the potential of OERs.

For the faculty survey, administered by email, we employed questions adapted from surveys conducted at several other institutions and organizations (Seaman and Seaman 2017; Nagashima and Hrach 2021). The student survey was likewise informed by work at other institutions (Pate 2021) and was conducted in person, and informal responses were captured on flipcharts and post-it notes.

Faculty Survey Findings: Our survey found that WPI faculty currently use a wide array of materials in their classrooms either to supplement or in lieu of a core textbook. We also learned that survey respondents "often" consider the cost to students one of their primary factors when selecting these materials. Most faculty respondents (n=59) were not familiar with OERs for classroom use, but many expressed interest in incorporating OER materials – if appropriate institutional support is provided – to supplement their course content (15%), to make their teaching more culturally diverse or responsive (10%), or to broaden the range of resources available to their students (14%). These results indicated that if there is effective support for their use, OERs have the potential to both reduce costs to students and provide a more representative experience for historically minoritized students.

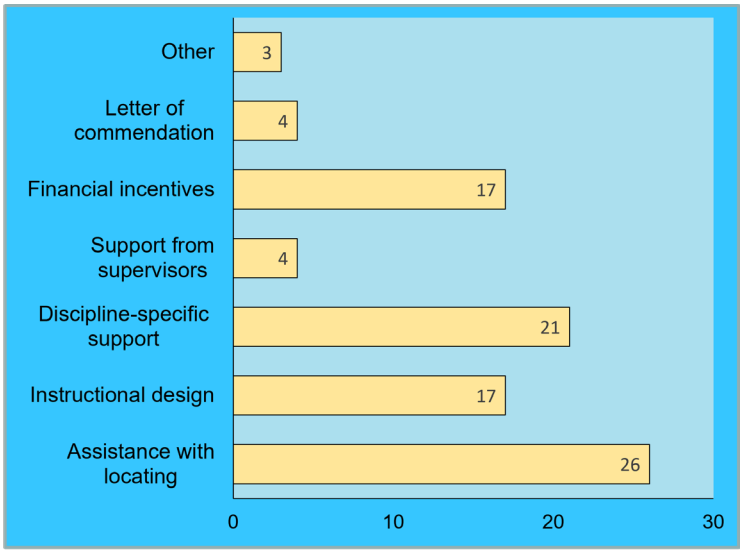


Fig 4. OER support desired by faculty from the institution.

When asked what kind of institutional support they needed to make more use of OERs, faculty indicated they needed assistance with locating and evaluating OERs, especially targeting OERs in their subject areas; assistance with instructional design; and financial incentives (such as grants or stipends) to support the additional work required to adapt or create an OER (Fig 4). These supports would help mitigate the barriers or challenges they would face,

including issues with locating suitable OER resources, finding the time needed to adopt or create OERs, the need for faculty compensation, and their lack of skill or tools to edit resources.

Fig 5. Student responses to purchasing texts.

Student Survey Findings: The informal but lively and interactive student survey received over 200 student responses, gathered through interactive poster boards in the library's entrance lobby. Student responses showed that over 85% of the WPI students surveyed (n=207) rarely or never buy the course textbooks - often citing other financial needs (Fig 5).

Additionally, over 60% of the students indicated they often download online content (both legally and illegally) for class use, which potentially may contain content not explicitly required or recommended by faculty. When asked what they would have bought instead of textbooks, basic living expenses were at the top of their list, including food, rent, utilities, and transportation costs (Fig 6).

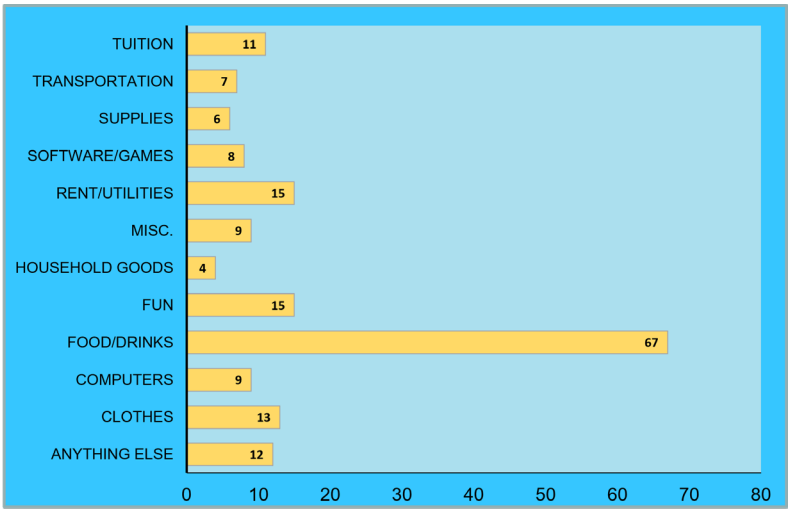


Fig 6. Instead of textbooks, students would have spent money on these items.

Our research findings from this informal survey were closely reflected in the formal student surveys conducted by one of our AAC&U cohort institutions (Wesleyan), suggesting that the issue of affordability, while still important, was overshadowed at our institutions by changes in student behaviors and specifically the students' "taking charge" of what and how they accessed course materials – and expressing the desire that faculty provide them with better information about how much 'required' materials would, in fact, be used (Pate 2021). Both WPI's and Wesleyan's findings were then shared with the campus community through our project website and in the form of presentations at campus-wide meetings of academic leaders (deans and department heads).

Additional Outreach

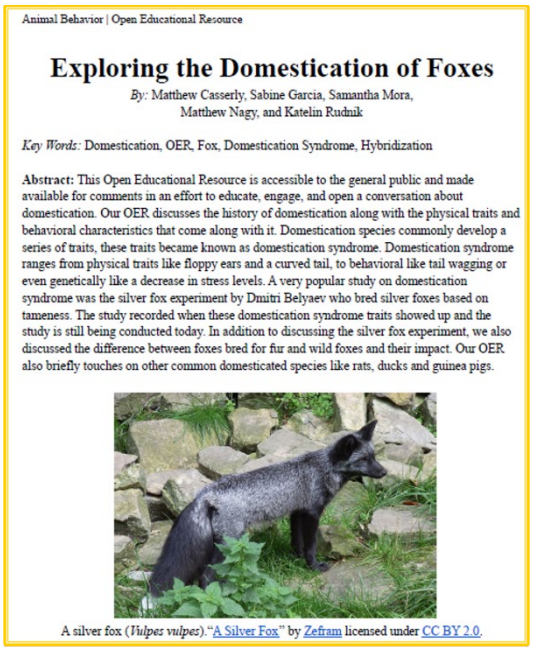
We also undertook various outreach efforts to connect with colleagues, report preliminary findings, and call in new partners to the work. This strategy offered two main benefits – increasing the community's understanding and openness to OERs and recognition of underlying systemic challenges for which OERs could be a powerful solution. For this outreach effort, Anna Gold and Lori Ostapowicz-Critz represented the team at academic leadership meetings.

Another outreach activity was to establish an OER section of our institutional repository (Digital WPI), initially populated by works created by one of our team

members and now including several OERs created by student teams in their courses. One of the OERs created has been accessed nearly 1000 times in the past year [https://digital.wpi.edu/concern/generic_works/t148fm35g?locale=en]. Our faculty participated in more open publishing of OERs, several of which are described in the next section on our pilots – and encouraged more thoughtful archiving and tagging of intellectual resources generated by students, staff, and faculty.

We also created and maintained a public website sharing stories about OER at our university and beyond. The website and blog provide information for colleagues to learn more about OERs, see and be inspired by examples, and have access to connections and supports for using OERs in their classrooms.

Beyond our campus, we had the opportunity to engage with colleagues working with OERs in a variety of contexts and at other institutions. Marja Bakermans presented through the AAC&U on our efforts. Courtney Kurlanska and Sarah Stanlick presented at Elon's Center for Engaged Learning conference in June 2022, expressly on OERs as an avenue for decolonizing the curriculum. In July 2022, the team participated in the closing events of the year-long AAC&U Institute on the successes, learnings, and future directions of the work. This provided a powerful opportunity to reflect and share our work thus far. It also allowed us to connect with over sixty (60) other campuses, nationally and internationally, to continue to build a network of educators dedicated to issues of open and inclusive pedagogy. Finally, we will be presenting webinars to the Oberlin Group of Libraries (fall 2022) and the Community-Based Global Learning Collaborative (spring 2023) that will link ethical global learning, pedagogy, and open educational resources.


Animal Behavior | Open Educational Resource

Exploring the Domestication of Foxes

By: Matthew Casserly, Sabine Garcia, Samantha Mora, Matthew Nagy, and Katelin Rudnik

Key Words: Domestication, OER, Fox, Domestication Syndrome, Hybridization

Abstract: This Open Educational Resource is accessible to the general public and made available for comments in an effort to educate, engage, and open a conversation about domestication. Our OER discusses the history of domestication along with the physical traits and behavioral characteristics that come along with it. Domestication species commonly develop a series of traits, these traits became known as domestication syndrome. Domestication syndrome ranges from physical traits like floppy ears and a curved tail, to behavioral like tail wagging or even genetically like a decrease in stress levels. A very popular study on domestication syndrome was the silver fox experiment by Dmitri Belyaev who bred silver foxes based on tameness. The study recorded when these domestication syndrome traits showed up and the study is still being conducted today. In addition to discussing the silver fox experiment, we also discussed the difference between foxes bred for fur and wild foxes and their impact. Our OER also briefly touches on other common domesticated species like rats, ducks and guinea pigs.

A silver fox (*Vulpes vulpes*)."A Silver Fox" by Zefram licensed under CC BY 2.0.

Fig 7. Front page of an OER created by students in an intermediate-level animal behavior course.

Piloting OERs in the Classroom

Much of the effort of our faculty members throughout the year went into creating or extending teaching pilots. Three pilots are described here that helped document the varying ways in which faculty can utilize OERs, and what we learned from a variety of contexts and implementations of OER.

Pilot 1: A course centering diversity and inclusion in student-authored OERs

In the spring of 2022, Marja Bakermans piloted modifications that centered diversity, inclusion, and open learning practices in an animal behavior course, culminating in the creation of an OER by each of several student teams (Fig 7). Thirty-five students, nine of whom were Biology majors, took this intermediate-level course. The composition of course participants was self-described by students as 53% female, 41% male, 3% non-binary, 3% transgender and 3% Asian American, 14% biracial or mixed race, 11% Black or

African American, 14% Latinx/Hispanic, and 57% White/non-Latinx.

The course covered content and activities that explored the field of animal behavior (e.g., development, reproductive strategies, cooperation) while simultaneously examining the role of diversity and inclusion, or lack thereof, in shaping the discipline. This was achieved with a mix of lectures, in-class activities, open annotation readings, reflections, and OER project work (Table 1). For example, in the first week of the course students read and compared sources that did and did not explicitly address diversity and inclusion in the discipline (e.g., Lee 2020, Wikibooks webpage). Throughout the course, students completed three reflections on 1) the disparities in the discipline and the role of historically minoritized scholars in the field, 2) an audit of a source for openness and inclusion and how this applies to or sparks ideas for their projects, and 3) what is open and inclusive learning to them and how did they apply it in this course.

Other steps taken to make this course more inclusive included making the course a "zero textbook cost" course; using inclusive language in the syllabus; teaching a diversity of systems rather than reinforcing binary options (https://projectbiodiversify.org); featuring scientists from historically minoritized groups; soliciting feedback from students; and implementing changes based on student comments in a prompt manner. At the end of the course, Bakermans surveyed students about their sense of belonging in my course compared to at WPI with questions modified from the Sense of Social Fit Scale (https://sparqtools.org/mobility-measure/sense-of-social-fit-scale/#all-survey-questions; Walton and Cohen 2007). Students taking the course reported they 'strongly agreed' they get along better with others (62% vs 47%) and felt more comfortable (71% vs 61%), included (79% vs 53%) and accepted (88% vs 53%) in this course compared to at WPI.

Activities	Week in the term						
	1	2	3	4	5	6	7
Background (lectures, readings, activities, assignments) on DEI in the discipline	X	X	X	X			
Background (lectures, readings, activities, assignments) on disciplinary content	X	X	X	X			
Reflection on obstacles and contributions of women and BIPOC scholars in animal behavior		X					
Brainstorm OER project topic idea and team formation			X	X			
Audit a source relevant to the project topic for openness and inclusion and reflect on these components				X			
Mid-term check-ins on course progress and well-being			X	X			
Research and process of project information				X	X	X	X
Ongoing team activities toward building an inclusive OER				X	X	X	X
Outline for OER project					X		
Copyright and inclusive science communication					X	X	
Rough drafts of OER project					X	X	
Peer review and audit another team and process your team's review						X	
Student survey on inclusion and belonging in this course compared to university							X
Final OER project complete							X
Reflection on the need and usefulness of inclusive educational materials and statement of learning							X

Table 1. Activities and timeline for a 7-week course that centered diversity and inclusion in student-authored OERs.

Pilot 2: OERs as an extension of core theoretical concepts

In Spring of 2022, a second faculty member, Courtney Kurlanska, had the opportunity to teach a new class on alternative economies and she placed the creation of an OER at the center of the center of the course design. Given that the course, *The Green Economy and Alternative Models for Development*, focused on questioning the neoliberal economic model and highlighted economic strategies that promoted equity and sustainability over profit, OERs were a good match for the course. While the course content itself did not use OERs and instead took a zero textbook cost approach using materials available from the university library, the final project created by the students was an OER introducing alternative economy concepts to a broad audience.

Fig 8. Samples of student OERs related to alternative economies.

Reflecting the collaborative and community based economic framework that was discussed in class, the development and creation of the OER was determined using these principles. Within given parameters, the students determined the content, delivery mode, and organization of the OER. With the goal of reaching a broad public audience they chose to produce an e-zine that could be distributed electronically and would have a greater public appeal than a more formal textbook. While the students also considered developing podcasts, they felt that a written document was more feasible given the time constraints of a seven-week term (Fig 8).

After learning some of the fundamentals of different alternative economic models and concepts during the first three weeks of the course the students met one-on-one with Kurlanska during week four to discuss the focus of the content that they wanted to contribute to the OER. Drawing on these conversations, the students were grouped into learning communities where the members had distinct, yet related topics that they each researched and wrote about individually but spent time discussing together in class for 30 minutes twice a week. During this discussion time, the learning communities shared resources, found connections across topics, and developed a deeper understanding of each other's content. This was critical for the group to develop a coherent section in the e-zine where they brought together their topics for a coherent discussion of the theme or topic at hand.

While the students commented that the project was a lot of work, they all agreed to have their contributions published in the final document, and many were very excited about sharing what they had learned and written with a broader audience. They appreciated how the final product in the course reflected the values they were learning about in the course content and saw greater value in their efforts. Many asked when it would be published because they wanted to share it with others and distribute it on their social media pages. Helping them provide an outlet for their work to live beyond the classroom helped bring greater meaning to their contributions to the course. Two students volunteered to help after the term was over to help finalize and publish the e-zine.

Pilot 3: Supporting graduate student engagement and authorship through OERs

In Spring 2022, Sarah Stanlick taught a foundational graduate course for the Learning Sciences & Technology program. The course, comprised of 13 students from upper-level undergraduate, master's, and doctoral students from across disciplines and motivations, was an ideal space for OER experimentation. The first motivation came from the fact that the same textbook has been used for foundational courses such as these for at least the last 15 years. While it is a seminal textbook and used frequently because of the quality of its pedagogy and effective blend of neuroscientific information, it also presented opportunities for content updates and representation of voices beyond the textbook.

Taking the approach that course participants were members of a small learning community was a strategy for developing more authentic relationships with the students and more opportunities for engagement with student perspective and co-creation. Another benefit was the ability to honor and validate the diversity of disciplines in the room through an inclusive co-creation process where students could make connections to their research, experiences, and disciplines. The course was a hybrid synchronous-asynchronous online course, with a weekly 3-hour synchronous meeting, intentionally planned office hours, and flipped classroom synchronous lectures and materials. Each week, student pairs were asked to co-teach a lesson, and had the opportunity to use that same topic for their OER for continuity and depth of research. From equity in classroom design to neurodiversity in teaching, the students were able to share their perspectives and think about how they might frame their lessons and add to a resource that might reach other students.

The students were first surveyed about areas of interest and experiences to gauge what they might be invested in pursuing in depth, and to match them with a collaborator. The parameters for the OER were co-created by the participants but were developed with the understanding that future students in this course would learn from and add to the OER. The creation of the OER was also an opportunity to exercise the practices of democratic classrooms, as voting, consensus, and coordination were used to bring the OER to life (Fig 9).

Among the lessons learned from this pilot were that more structure and support were needed up front to prepare the students for co-creation and to define the task more clearly. Initial student responses included frustration with the openness of the assignment design, a mismatch of understanding of the purpose of the OER, and a real desire to be told what was expected outright. Ultimately, the students produced interesting, high quality work of which they were proud, and in negotiation with their partners and co-instructors, as well as the instructor. While they desired extra structure, they also expressed in the end the value of co-creation, and that navigation of ambiguity and discovery are also important parts of learning. In the future, it may be possible to address the initial student responses by providing them with more parameters and more support.

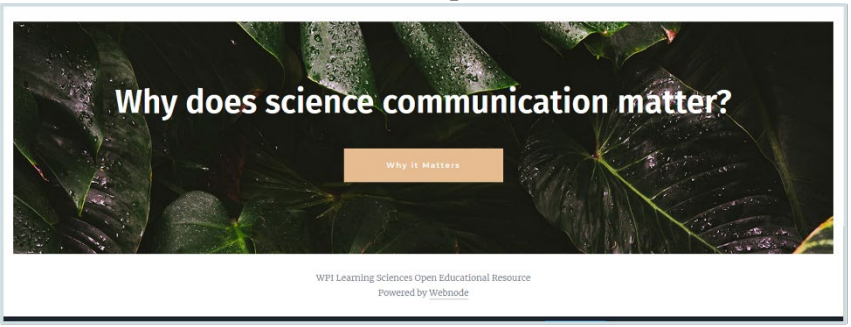


Fig 9. Student-created OER in a learning sciences course.

Capacity Building and Networking

Grant writing/acquisition

As we outlined our goals for the year-long AAC&U Institute on OERs, it became clear that we would need additional support to keep the momentum going in future years. While our faculty members were able to incorporate the use, creation, and co-creation of OERs into individual courses, they did not have the capacity to expand beyond a small scope of influence without supplemental support. We set goals for this first year to grow support and gain wider input on OER in relation to STEM/Social Justice + connections to open pedagogy.

One opportunity emerged from the Woman's Impact Network (WIN), an organization of WPI alumnae and women associated with WPI, that supports the advancement of women in STEM. Our team received a small grant ($15,000) to support the development of OER materials that provide greater diversity and representation in STEM courses. In the coming year (AY22-23), we will provide stipends and one-on-one curricular development support for up to 10 STEM faculty members interested in adopting, adapting, or creating OERs for their courses. As part of the process, faculty will also work with students who can provide insights and feedback on the materials they are developing. The goal of this project, "EMP**O**W**ER** (Engaging More Powerfully, Openly with Educational Resources)", strives to create a more inclusive, engaging, and empowering environment, especially for our female and BIPOC students, by increasing representation in the classroom and empowering students as co-creators of course content.

Coordinating efforts and joining forces

With the limited scope of the above grant in mind, we realized it was important to diversify our approach to promoting and supporting the use of OER materials. As a result, we received funding for a Professional Learning Community in AY 22-23 that will support our team's efforts. In this initiative, "Building Capacity for Open Pedagogy and Open Educational Resources (OERs) at WPI: Increasing Inclusion and Student Agency," our team will partner with two other faculty from STEM disciplines with a commitment to open pedagogy. We will develop materials to support other faculty adopting, adapting, or creating open pedagogical strategies. This project will focus on the development of a wide variety of resources and guides for developing OER and other open content including syllabi, materials to support the creation of OER content, the creation of discipline-specific OER research guides and library resources, tools for auditing existing OERs for inclusivity, and developing an online presence for this community of practice.

Fig 10. Students consult with librarians (top) and practice communicating (bottom) their OER project work.

Key Takeaways

In this section, we outline some of our insights and lessons learned from the ongoing experience of adopting, adapting, creating, and scaling OER use at WPI. While our work thus far has been intentional and coordinated, our work has also used intersecting and iterative processes to keep making connections and growing as opportunities arise. Our insights, therefore, grew out of a variety of engagements, events, and experiments throughout this year.

Strategies for Inclusive OERs

First and foremost, we offer our perspective on promising practices and strategies for the implementation of OERs across courses and experiences.

- **Leverage institutional resources**: Connect with your librarians- bring them into the classroom to talk and provide information about copyright and expanding sources to represent a diversity of voices (Fig 10). Bring in your technology staff to help students with design elements or work on different platforms.
- **Student voice:** Your students are an amazing resource and want to continue to be a part of the conversation and curation of ideas and resources. Curate advice during the course and share back with students.
- **Recruit near peers:** Once you have students who have experience, bring them back the next year to be mentors to the teams. (Don't forget to hire those students so you can pay them!)
- **Provide a map**: Provide a framework or visual summary for the project to facilitate student understanding of the process (Fig 11). If they have never completed a project like this before, students appreciate structures to help guide them.

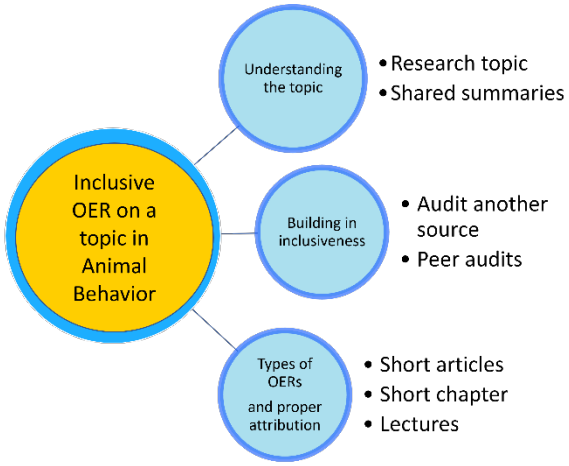


Fig 11. This overview provides the steps to create an inclusive OER. Next, students are shown specific assignments for each component.

- **Use examples**: Integrate examples into classroom lectures and activities so that students get familiar with different types of OERs and can reference them later in their own project progress.
- **Student choice**: Allow students the agency to make decisions about their OER project topic, format, and platform of delivery. As a class, explore the variety of platforms where students can publish their work.
- **Privacy and openness**: Each student should have the opportunity to decide which copyright license applies to their writing and have the right to remove their name from any public document. Provide clear documentation on these topics for your students.
- **Set clear expectations**: Be clear that you do not expect projects to solve the world's inclusivity problem. As a community, we use OERs to improve respect, recognition, and representation of experiences and contributions in the discipline- *one OER at a time*.

Strategies for Community Capacity Building and Resourcing

• **Diversify**: To adopt OERs in an institution, Nikoi and Armellini (2012) emphasize a mix of approaches to open educational resources through a "4 P" model: purpose, process, product, and policy. In our experience, we have identified different areas and levels where we can nudge the conversation forward.

  - Engaging with other colleagues with shared **purpose** and joining forces.
  - Elaborating **processes** and establishing new mechanisms to incentivize or support OER development.
  - Sharing **products** from the classroom that have been created by our students and highlighting their successes in ways that are public.
  - Identifying language for **policy** that might help establish norms in classrooms for open pedagogy (e.g., syllabus language) and understanding bureaucratic or legal mechanisms that might challenge OER adoption and use.

• **Find a hook**: In our experience, we found that specific and intentional efforts focusing on what makes our university unique (STEM, Project Based Learning) and how OERs can contribute to the WPI experience, was a more effective strategy for engaging colleagues and supporters the promoting the use of OERs in a more general sense.

• **Play to your strengths:** By emphasizing the strengths of the university, highlighting specific areas of need, and identifying how OERs have the capacity to address those needs, we were able to effectively secure support from the university and associated organizations to fund the creation of OERs and supporting materials.

• **Use the numbers**: In this case, we don't mean $ (although that can be a selling point), but instead the enrollment numbers. How many students can benefit from OERs when they are incorporated into large enrollment courses or across programs?

WPI's 2021 Senior Class Gift is a mural representing and celebrating diversity in STEM. This mural is prominently displayed on the Campus Center building. Photo credit: WPI

Conclusions and Next Steps

As we move forward with this initiative, we continue to recognize that small is beautiful, and see the power and potential of adopting, adapting, creating, and co-creating OERs that meet the needs of our institution and our students. However, we are few and the needs are many. Small IS beautiful and more beauty emerges as small initiatives multiply in number. From our perspective, growth is not about scaling-up, but scaling-out across disciplines and across departments to grow a network of faculty that believe in the power of OERs to meet the needs of their students, courses, and learning objectives in new and creative ways. In this spirit, we plan on expanding our OER efforts to include more diverse groups of faculty across campus who can also harness the power of OERs to engage their students in innovative learning experiences. We have started this with our small grants program that will be initiated this fall and with the Professional Learning Community which expanded to include additional STEM faculty. It is our hope that we will continue to bring new faculty into the OER fold.

Finally, while we believe in the power and efficacy of OERs to support a wide range of students, help to create a more inclusive environment, increase student sense of belonging and improve performance in learning outcomes, we recognize the importance of data to support these assertions. As a result, our next goal is to conduct research using the OERs that we use and those that we will be developing to better understand the capacity of OERs to support an increased feeling of belonging and achieve specific learning outcomes. Our proposed research aims to examine the capacity of OERs to support intercultural competency, ethical values, and students' sense of belonging. As we move forward, we are actively looking for funding to support this research and strengthen the argument to support the increased use of OERs.

We see our work through the frame and context of effecting cultural change. This perspective means that the measures of our success may include reduced student costs but will focus even more on the positive impacts OER creation and adoption can have on student agency and inclusion in our STEM-focused culture.

AAC&U

Women's Impact Network
Leading with Purpose

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APPENDIX 1: FAQs

Top Frequently Asked Questions (FAQs)
Q: Where can I find OER resources for my discipline?

A: There are myriad resources to help faculty find relevant, high-quality OER in their respective disciplines. Consult with a subject-specific librarian or an OER Librarian for guidance and support. Librarians can not only help find appropriate OER but can also provide guidance on working with OER and library materials and finding OER textbooks, can help to integrate OER into Blackboard or Canvas or another LMS, and can provide advice on determining copyright, licensing, and reuse rights for OER used or created.

Many libraries provide research guides/libguides that provide information and links to resources for finding OER (e.g. https://libguides.wpi.edu/oer; https://open.umich.edu/find/find-open-educational-resources). These guides provide curated starting points to find OER, including resources such as OER meta-search engines and repositories, discipline specific OER repositories, Open textbooks and journals, and openly licensed multimedia (images, video, and audio).

Meta-search engines – such as OASIS or the OER Metafinder - for OER are also a good starting point to find a wide variety of open educational resources. These meta-search engines search across multiple platforms and multiple OER repositories to provide an in-depth list of OER materials.

Q: How can I reduce student stress and anxiety around a project like this?

A: Students that have never completed a project like this before may be anxious at the start. To help reduce that anxiety, you can provide frameworks and overviews of the project; scaffold assignments to make the final product more manageable; provide examples so students have models to access; set clear expectations of the OER project; provide regular feedback and touch base with students; and allow classroom time for students to work, ask questions, and get peer feedback. A number of toolkits or guides exist to help students understand, advocate, and create OERs (e.g., https://www.oercommons.org/courseware/lesson/65748).

Q: How do students learn disciplinary content by creating an OER?

A: When students conduct research on a topic for the creation of an OER, they become experts and learn disciplinary content. Depending on the project or the level of the course, faculty can provide few or lengthy guidelines for research activities and depth. Next, peer-to-peer learning should occur within teams (e.g., shared research summaries) and across teams (e.g., peer reviews, presentations) so that students can learn from one another.

Q: Can students do this? And at what level?

A: Yes! Students can get involved in modifying and creating OERs at any level! Let those first-year students surprise you with their passion for a topic! Allow those fourth-year students to wow you with their expertise and share their connections with the world! Promote a more empowered educational ecosystem and let all the students participate in shared knowledge production and communication! You can see an example of an OER text written by first-year students here: https://digital.wpi.edu/concern/generic_works/t148fm35g?locale=en.

APPENDIX 2: Sources used in Pilot 1

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