*The International Journal of*
# OPEN EDUCATIONAL RESOURCES

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# Letter from the Editor

Melissa Layne, *American Public University System, USA*

**Dear Readers of *IJOER,***

Well, we've made it to our second issue and still going strong! Our Editorial Peer Review Board is growing, manuscript submissions have been pouring in, very high quality and are representative of current and future directions in OER and we are averaging at least 10 user registrations per day on the IJOER.org website. We are maintaining this momentum as our 2019 spring issue includes an impressive array of OER leaders, authors, research topics, and conceptual pieces.

Our regular special section, *3 Questions for an OER Leader*, features Dr. Barbara Illowsky. As the first OER & Innovation Fellow by the Michelson 20MM Foundation, Barbara was tasked with advocating and promoting large-scale OER adoption in California's public higher education systems. Her achievements are extensive and I had the opportunity to learn more about this remarkable lady who is admired by many and who is a true thought leader in the OER community.

In our first article, *Adapting and Adopting Open Educational Resources: An Analysis of Student Cost Savings, Use, Performance, and Perception*, the author Mike T. Springer uses a comparative analysis to examine student learning using customized OERs versus traditional textbooks for an introductory chemistry course, and a general science course. This valuable study specifically covers students' cost savings, use, performance, and perceptions of OERs versus traditional textbooks, thus adding to the literature on this important and *sometimes,* controversial topic.

Our second article, *A Look at the Future of Open Educational Resources*, philosopher and commentator Stephen Downes takes a critical look at transformative technologies including cloud infrastructure, open data, artificial intelligence, and decentralized networks and how these four technologies fit within our understanding of OER. In this fascinating article, Downes explains that these technologies result in a model of "dynamic and adaptive resources" that draw on constantly changing requirements and data sources, distributed community-based processes, and adopts a pedagogy based on "supporting student experiences rather than content transmission", which of course all have substantial implications in OER. True to form, Stephen's visionary ability to examine technologies and their potential


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effects in education, which gradually removes complacency and promotes movement. Great stuff, indeed.

Our third article, *Student Learning Outcomes with Wikipedia-Based* Assignments by authors Zachary James McDowell and Mahala Dyer Stewart boldly step outside of the prescribed traditional textbook-based assignment zone and explore Wikipedia as a platform to develop students' researching, writing, and information literacy skills. The authors use a mixed methods approach to measure students' perceptions around the value of using Wikipedia-based assignments. They discovered that in addition to learning the aforementioned skills, students also found the value in writing for a public audience, and in the process, thus facilitating the motivation to complete these assignments using this platform. I appreciate studies that test the boundaries!

In our fourth article, *Pre-service Teacher Awareness of Open Educational Resources,* authors Liz Thompson, Jessica Lantz, and Brian Sullivan expand OER "awareness" research by taking a close look at a new demographic pre-service teachers. Much of the existing awareness research focuses on K-12 and higher education; however, the effects of OER continue to reach within and across these educational levels, and even beyond the field of education. This study is very important in that it provides support (and ultimately, a call to action) for the integration of OER skills and knowledge into pre-service teacher curricula before they actually become teachers or instructors. Make sure to take a look at what the authors discovered about pre-service teachers' awareness of OER, you might be surprised. The authors have kindly provided us their survey instrument for those who are interested in replicating their study.

In our fifth article, *Impact of Open Educational Resources on Course DFWI Rates in Undergraduate Online Education*, authors Cassandra S. Shaw, Kathleen C. Irwin, and Doris Blanton examine the relationship between the use of open educational resources (OER) and course DFWI (Drop, Fail, Withdrawal, Incomplete) rates at the undergraduate level of a fully online university. This study breaks new ground in OER in a number of interesting ways: (a) *fully online* courses were converted from traditional texts and materials to using OER; (b) DFWI rates were examined; (c) the number of courses examined was substantial (57); and (d) the topic of retention using OER in a fully online university was broached. The results are fascinating and provide a solid foundation in which to replicate or develop similar studies. Again, I am excited to receive manuscripts that you know will inspire further studies.

For our sixth article, *OER and OEP for Access, Equity, Equality, Quality, Inclusiveness, and Empowering Lifelong Learning*, we are excited to have

ICDE's (International Council for Open and Distance Education) Open Educational Resources Advocacy Committee (OERAC) Chair and Ambassador, Ebba Ossiannilsson shares how ICDE and OERAC are working together to expand globally, access to lifelong learning opportunities, achieve quality in education, and establish legal and political frameworks that promote social justice, collaboration, and coordinated partnerships with OER. This important work aligns the United Nations UNESCO Recommendations (2019); therefore, this collaborative community assumes a number of activities and projects that contribute toward the global mission of UNESCO's Sustainable Development Goal 4 (SDG4) which ensures inclusiveness and equitable quality education and promotes lifelong learning opportunities for all. Current mandates, visions, missions, global work, and activities were presented at the ICDE Lillehammer Lifelong Learning Summit 2019 where items including policy, developing guidelines for advocacy, identifying opportunities for the development of projects, and connecting these projects with existing projects and trends across the globe were presented. Here is the Slideshare from this session. Take a look at Ebba's article to learn more about the exciting advancements in OER on a global scale, that are currently in progress and that are planned in the not-so-distant future.

In our final article, *Creating Faculty Professional Development on OER*, authors Caroline Kinskey and Carrie Lewis Miller tackle a topic that has (and continues to be) at a loss for a viable solution. Unsustainable funding models, locating appropriate OER resources, lack of time to design, and finding peer reviewers for the development of OER places a huge burden on faculty. The authors of this study not only share the construction of their grant-funded professional development program for faculty on OER, they also present us with the survey results from both faculty and student responses to evaluate the program's efficacy. It's studies like these that will spark innovative ideas around sustainable funding and compensation models for the development of OER. Continue the great work Ladies!

Before letting you loose on all of these fantastic articles, I do wish to mention that our next issue is a special issue focusing on librarians, libraries, and OER. Take a look below at the Call for Papers and consider submitting a proposal.

As always, stay with us and expect more.

Melissa Layne, Ed.D.

Editor-in-Chief, *International Journal of Open Educational Resources*

**Call for Proposals:** *IJOER* Special Issue Fall/Winter 2019 Librarians, Libraries, and OER

**Note:** Due to an overwhelming number of submissions for this issue, we have decided to extend the *IJOER* Special Issue Fall/Winter 2019 Librarians, Libraries, and OER to the Spring/Summer 2020 issue as well. So, if you did not get a chance to submit a proposal for the Fall/Winter 2019 issue, then I encourage you to do so for the Spring/Summer 2020 Special Issue. Details below.

Paper proposals may draw from any of the following topics, though authors are encouraged to elaborate on these ideas. This list is meant to be broad, general, and to get your creative juices flowing! If you have another topic of interest that you would like to write about that is not listed here, please send the editors a brief message with your thoughts and ideas.

**Topics of Interest**

OER Collaborations between Librarians and Faculty

Incorporating Open practices and Open Educational Resources in library instruction

OER grant programs and/or partnerships

Open Educational Processes

OER Platforms

Copyright and OER

Assessment of OER and/or OER Grant programs

OER and accessibility

Library support for OER

OER and open pedagogy

OER and institutional repositories

OER and digital scholarship/digital humanities

OER best practices

OER and collection development

Demonstrating the value of OER

**Submitting a Paper Proposal**

Paper proposals should be submitted via google form with all author information, an abstract of no more than 500 words describing your proposed article, and up to five keywords. Paper proposals are accepted on a rolling basis. If submitting for the Spring/Summer 2020 issue, please indicate this in the subject of the form below. Accepted paper proposals will be invited to submit full articles for peer review.

Full link to the paper proposal submission form:
https://forms.gle/SioYfKMzU8USUoPe7

Please contact *IJOER* Guest Editors Kristina Clement kclemen8@uwyo.edu, Samantha Cook scook13@uwyo.edu, or Hilary Baribeau hbaribea@uwyo.edu for more information.

# 3 Questions for an OER Leader | Featuring Barbara Illowsky

Dr. Barbara Illowsky is the co-author of "Introductory Statistics," "Introductory Business Statistics," and "Collaborative Statistics" published by OpenStax of Rice University. She received the 2013 International ACE Educator Award by the Open Education Consortium. Dr. Illowsky has been a faculty member at De Anza College since 1989. She received the 2018 California Coalition of Early and Middle Colleges (CCEMC) Educator of the Year Award for advancing dual enrollment. And, if you thought her accolades ended there, you're mistaken. She is the first OER & Innovation Fellow by the Michelson 20MM Foundation, created to advocate and promote large-scale open education resources (OER) adoption in CA's public higher education systems.

Dr. Illowsky was nominated for *3 Questions for an OER Leader* by Ryan Erickson-Kulas, of the Michelson 20MM Foundation.

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1 ***Melissa:*** At what point in your educational career did you become involved in OER?

***Barbara:*** Really interesting question, and I've thought about this journey a lot because I am a mathematics and statistics faculty member. I was very fortunate to have Dr. Martha Kanter, who was originally the President of De Anza when I first met her. She became the Chancellor of our District, and then became the Under Secretary of Education. She was a great mentor to me. When this whole field of OER came about, Dr. Kanter invited me to go with her to Rice University for a conference. I went there for a Connexions conference. It was out of the Department of Electrical Engineering, and I was so hooked that this is something that I could do to help my students. I could make that book free and then on day 1 of the class, everyone has access to the course materials. For me, this is a real social justice issue.


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2 ***Melissa:*** The Michelson 20MM Foundation awarded you the very first OER and Innovation Fellowship. What was their motivation behind funding this fellowship?

***Barbara:*** I'm so grateful to Dr. Michelson, founder of the Michelson 20MM Foundation, for funding this position. I started assisting them in about a dozen years ago with work on OER. This year, now that I'm back to a faculty position, they created a fellowship for me. I'm the first OER and Innovation Fellow. I am assisting with increasing OER adoption rates in public higher education in California, working with the colleges, and helping to support the policy work. Dr. Michelson believes that access to education is a fundamental human right. The knowledge disseminated and proliferated through OER is part of our collective consciousness and should not be restricted or withheld behind a pay wall. He believes OER is key in making education more equitable and lowering barriers for student success. And because of that I've been very fortunate to work with them.

3 ***Melissa:*** What does the future look like for Dr. Illowsky?

***Barbara:*** I'm retiring from the Foothill-De Anza Community College District at the end of June after 30 years of service. However, I don't expect to be retired. There is much work to do with OER advocacy and policy, as well as mentoring young, emerging leaders. In the past 8 months, I've gone from zero to three grandchildren, so I expect to spend much of my time flying to each of them and interfering with their lives. My work with OER has certainly enriched my life. I was doing this in order to help my students and it does help them. On the other hand, I feel that I have gained so much more than what I've given because I have a great community of colleagues, actually from around the world. I was on the Board of Directors for the Open Education Consortium which is an international organization and it is an elected position. I have colleagues around the world and I feel that every time I go to give a keynote and I stay for the day, I learn so much more that helps me. Ω

# Adapting and Adopting Open Educational Resources: An Analysis of Student Cost Savings, Use, Performance, and Perception

By Mike T. Springer, *Southwestern Oregon Community College, USA*

Abstract

Open educational resources (OERs) are significant in terms of cost savings to the student, but there are questions surrounding the quality of these resources, as well as whether students prefer OER or traditional textbooks. Many of the OERs available today are often peer-reviewed, but some platforms allow the users to alter or customize the content, like OpenStax Connexions (CNX). When open content is altered or rearranged by an instructor, then it becomes essential for the instructor to determine whether those changes are beneficial or detrimental to student learning. Using the OpenStax Connexions (CNX) OER educational content repository and content management system, two customized OERs were developed and used as the only textbooks for two introductory chemistry courses at a community college in rural Oregon. The author of this study examined students' cost savings, performance, use, and perception. Student scores for the OER-only courses were compared with scores from courses taught with traditional text-

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books. The results of Student's *t*-test suggest that there was a significant difference between scores, in favor of those taught with an OER textbook. Because of small sample sizes, Cohen's *d* was also calculated and indicated that, in most cases, the effect size was not large enough to be considered significant. Although it is difficult to say that learning was improved in light of the small effect sizes, it seems reasonable to suggest that learning was not adversely affected by the adoption of customized OERs. Lastly, an analysis of clickstream data from the learning management system and data obtained from an end of course survey seem to indicate that student usage and perception of OER does not differ significantly with traditional textbooks.

***Keywords:*** Student perception, student performance, student usage, custom OER, OpenStax, OpenStax Connexions (CNX)

# 修改和运用开放教育资源（OER）：学生成本节省、使用情况、学习表现和学习感知分析

美国俄勒冈州西南部社区学院 Mike T. Springer

## 摘要

虽然开放教育资源（OER）极大地节省了学生上课成本，但这些资源的质量以及学生倾向OER还是传统教学材料都有待考究。如今，许多OER都是经过同行审查的，但诸如OpenStax Connexions (CNX) 这类平台允许用户修改或定制内容。因此当教师修改或重新安排开放内容时，教师必须明确这些改变对学生的学习到底是有益还是有害的。笔者利用OpenStax Connexions (CNX) OER教育内容存储库和内容管理系统开发了两种定制OER，并将它们作为俄勒冈州农村一所社区学院的两门入门化学课程的唯一教科书。笔者分析了学生的学习表现，使用情况和学习感知，并对只接受OER授课的学生和接受传统教学的学生成绩进行了比较。学生的t测试结果表明，学生的分数之间存在显著差异，OER教材授课的学生成绩占优势。由于样本数较小，笔者也通过Cohen's *d*（均值比较）计算了效应量，并指出在大多数情况下，效应量不大，称不上显著。鉴于效应量太小，很难断言学习得到了改

善。但似乎有理由认为，运用定制OERs不会对学习产生不利影响。最后，来自学习管理系统的点击流数据和从课程调查结束时获得的数据分析似乎表明，学生对OER的使用和感知与传统教材并无显著差异。

关键词：学生认知，学生表现，学生使用，定制OER，OpenStax，OpenStax Connexions (CNX)

## Adaptación y adopción de recursos educativos abiertos: Un análisis del ahorro, el uso, el rendimiento y la percepción de los costos de los estudiantes

Por Mike T. Springer, *Southwestern Oregon Community College, EE. UU.*

### Resumen

Los REA son significativos en términos de ahorro de costos para el estudiante, pero hay preguntas sobre la calidad de estos recursos, así como si los estudiantes prefieren REA o libros de texto tradicionales. Muchos de los REA disponibles en la actualidad a menudo son revisados por pares, pero algunas plataformas permiten a los usuarios modificar o personalizar el contenido, como OpenStax Connexions (CNX). Cuando el contenido abierto es alterado o reorganizado por un instructor, entonces es esencial que el instructor determine si esos cambios son beneficiosos o perjudiciales para el aprendizaje del estudiante. Usando el repositorio de contenido educativo y el sistema de gestión de contenido de REA OpenStax Connexions (CNX), se desarrollaron dos REA personalizados y se utilizaron como los únicos libros de texto para dos cursos introductorios de química en un colegio comunitario en el área rural de Oregón. El autor de este estudio examinó el rendimiento, el uso y la percepción de los estudiantes. Los puntajes de los estudiantes para los cursos solo para REA se compararon con los puntajes de los cursos impartidos con libros de texto tradicionales. Los resultados de la prueba t de un estudiante sugieren que hubo una diferencia significativa entre las puntuaciones, a favor de las que se enseñan con un libro de texto REA. Debido a los tamaños de muestra pequeños, la d de Cohen también se calculó e indicó que, en la mayoría de los casos, el tamaño del efecto no era lo suficientemente

grande como para ser considerado significativo. Aunque es difícil decir que el aprendizaje se mejoró a la luz de los tamaños de los efectos pequeños, parece razonable sugerir que el aprendizaje no se vio afectado negativamente por la adopción de REA personalizados. Por último, un análisis de los datos del flujo de clics del sistema de gestión de aprendizaje y los datos obtenidos de una encuesta de final de curso parecen indicar que el uso y la percepción de los REA por parte de los estudiantes no difiere significativamente de los libros de texto tradicionales.

***Palabras Clave:*** percepción del alumno, rendimiento del alumno, uso del alumno, REA personalizado, OpenStax, OpenStax Connexions (CNX)

## Introduction

### *Open Educational Resources*

Open educational resources (OERs) are freely accessible, openly licensed documents, images, and multi-media assets that are useful for teaching, learning, and assessing, as well as for research purposes.

### *OpenStax Connexions*

Many authors who create customized OERs use *OpenStax Connexions* (CNX), an educational content repository and content management system. Created in 2012, OpenStax is a nonprofit educational initiative based at Rice University, and is supported by partnerships with philanthropic foundations and educational resource companies. OpenStax provides peer-reviewed, open textbooks that are contributed freely by authors across the globe, and are also provided free to the end-user. The CNX platform offers users the ability to create, organize, and/or remix learning *modules* into *collections*, which can be offered as open textbooks. A learning module is similar to a section in a textbook; it is smaller than an entire chapter, but it is a complete, stand-alone lesson including content around a topic that can easily be remixed and used in different collections and contexts.

The present study utilized the CNX platform to remix several modules and create two open education resources that were offered as free, open textbooks for two different courses.

### *Traditional Textbooks versus OERs*

#### Traditional Textbooks: Pros and Cons

***Pros.*** The content within traditional textbooks is generally thought to be of higher quality than OERs. Traditional textbooks are updated regularly and edited by a team of experts. This regular revision requires resources. Although the cost of this revision is passed on

to students in the form of an expensive textbook, many rounds of revision do tend to remove the vast majority of factual errors and inadequacies of early editions that may have been missed initially. Not only are traditional textbooks being reviewed by their authors and editors, but also by the professors that adopt those resources for their classrooms. Although the same could be said of OERs, authors of OERs generally do not receive any type of compensation for their work and thus have little incentive to update or maintain their published materials. Not only do traditional textbook publishers employ authors and editors, they also employ professional photographers and can pay for copyrighted images. It is often difficult for authors of OERs to find high quality, copyright-free images to include in their materials (Perez, 2017). OERs are freely available on the Internet, but as such, require a device and an Internet connection for access. At the very least, the OER must be initially downloaded (which requires an internet connection) and stored on a device for offline access. There are times when it may be difficult for a student to access the OER, such as when they do not have access to an Internet connection or when the battery in their device has died. Traditional textbooks do not suffer from the same accessibility issues.

***Cons.*** The cost of textbooks increased 82% between the years 2002 and 2012. (Student PIRGS, 2014), roughly three times the rate of inflation. Whether they choose to or not, higher educational faculty are often stuck using the latest editions of textbooks due to two primary reasons: (1) on average, a new edition of a textbook is released every 3.5 years (Ozdemir & Hendricks, 2017) and (2) publishers rarely offer previous editions. The National Association of College Stores indicates that 77 cents of every dollar spent on a new textbook goes directly to the publishers and at least 18 cents per dollar is pure profit. Meanwhile, a survey of 156 college instructors across more than 10 public colleges and universities in California and Oregon found that more than half of all faculty respondents indicated that the new editions of textbooks that they used were "rarely-to-never" justified, in terms of the difference in content between editions (Fairchild, 2004). The high cost of textbooks is often an obstacle for low-income students. A survey of 22,000 online students on the Florida Virtual Campus found that as many as 67% did not purchase a textbook at some point in their college career because of its exorbitant cost (Florida Virtual Campus, 2016).

One solution for addressing this financial barrier is for faculty to adopt, adapt, and/or develop OERs. However, in terms of quality and efficacy between traditional textbooks and OER textbooks (as perceived by faculty and students), OERs have been questioned in these categories. This has been an important issue, with many variables that the larger OER community continues to address with research.

### *OERs: Pros and Cons*

***Pros.*** One of the greatest advantages of OER textbooks is that they are free and/

or can be printed cheaply at the college bookstore or at an office supply store, like FedEx or Staples. OERs can be used to supplement traditional textbooks to explore a content area that is tangential to the main content for little or no cost. OERs are more easily transported than traditional textbooks. Another decisive advantage that OERs offer over traditional textbooks is the capacity for multi-media components: it is relatively straightforward to add a video, song, or other animation into an OER that exists as a webpage or a PDF file. Further, active links to external websites and resources can easily be embedded in an OER for students to delve deeper into certain topics than the main text allows. Because OERs can easily be accessed with any device and Internet connection, students have access to the learning materials at the very beginning of a course, rather than having to wait for financial aid to purchase expensive textbooks.

***Cons.*** An important issue surrounding OER is in regard to the quality of the content. Certainly, students are excited about cheap or free course materials, but likely not at the cost of their own academic performance due to inferior textbooks. Some of the OER resources that are available have been authored and reviewed in processes that are similar to those of traditional publishers; *OpenStax* textbooks are a good example of this model. However, even resources from *OpenStax* can be altered or "customized" by adding, changing, or removing content. These "customized" OER textbooks do not require peer-review before they are used in the classroom. There are certainly advantages to using a customized OER textbook, like reordering topics or adding an example for context, but if the customizations are associated with lower scores than a traditional textbook, then the customized OER is a disservice to students.

This study seeks to investigate the amount of tuition costs that community college students save by enrolling in a course offering an OER versus a traditional textbook, whether using a customized OER textbook affects student scores by comparing student scores from courses taught with traditional textbooks to those taught with customized OER textbooks, and whether students prefer to use OERs or traditional textbooks.

## Literature Review

### *Student Learning Outcomes*

Several studies have investigated the extent to which student learning is affected by the use of an OER versus a traditional textbook. Robinson, Fischer, Wiley, and Hilton (2014) investigated OER use in high school science courses in the Nebo School District in Utah and compared standardized exam scores between students that used an OER versus those that used a traditional textbook. They found that students in a chemistry course that utilized an OER scored significantly higher than those that utilized a traditional textbook, but they found no difference in student scores for earth science or physics courses that utilized an OER. These results suggest that OER use does not negatively affect student

learning and, in some cases, might even improve student learning. The authors of this study compared the scores of 4,183 students taught by 43 teachers and even though the study controlled for possible differences due to individual teacher effects, it is possible that the effect observed was due to differences in teaching style, especially since teachers independently chose whether to use the open textbooks.

Another study compared 478 students using OERs to 448 students using traditional textbooks in a chemistry course at UC Davis (Allen, Alvarez, & Larsen, 2015). This study did not suffer from the possible confounding effects of individual teachers since both courses were taught by the same teacher and TA, and used the same exams. Regardless, these researchers found no significant difference in student scores.

Hilton (2016) examined the results of nine studies that pertained to student learning outcomes in courses taught with an OER versus those taught with a traditional textbook. Eight of these studies conclude that students perform as well or better in courses taught with an OER and the one study that connected OER use to lower student scores showed that these differences were not statistically significant.

Hendricks, Reinsberg, and Rieger (2017) published a study investigating the use of OER in an introductory physics course at the University of British Columbia that enrolls between 800 and 900 students per year. There was no statistical difference in student scores on final exams between the section that utilized an OER in the fall of 2016 and the previous three years of sections that utilized a traditional textbook.

The general conclusion in all of these studies is that student learning does not seem to be negatively affected by the use of an OER versus a traditional textbook.

### *Student Perceptions of the Quality of OER*

Illowsky, Iii, Whiting, and Ackerman (2016) examined student perceptions of OERs in a mathematics course at De Anza College, a community college in California. These researchers designed a multi-media textbook, *Collaborative Statistics* (first written in the mid-1990s), and the collaboration with Rice University that ensued was the beginning of what would later become the OpenStax Connexions (CNX) platform. After many revisions, Collaborative Statistics was renamed *Introductory Statistics* and it became the prototype for OpenStax College's open textbook model. Their analysis showed that students saved money and viewed the OER as a useful resource. Whether students purchased a hard copy of text or printed the pages, most students experienced significant cost savings. The study reported that 66% of the students said they used the textbook at least twice a week, similar to their use of other traditional textbooks. Survey results also revealed that students perceived OER favorably: 62% said the quality of the OER was equal to traditional textbooks, 25% said the quality of the OER was better, and 13% said the quality of the OER was worse.

Bliss, Robinson, Hilton, and Wiley (2013) investigated student and faculty perceptions of OER used in eight community colleges across the United States. In all, 490 students and 58 faculty from 8 colleges responded to an online survey about OER in their classrooms. The majority of students and faculty had a positive experience using the open textbooks, appreciated lower costs, and thought quality was equal.

Jhangiani, Dastur, Le Grand, and Penner (2018) examined student perception of OERs at a large research university in Canada, Kwantlen Polytechnic University. This study revealed that the print format of the open textbook was rated significantly higher in quality than the commercial textbook and that the digital version of the open textbook was not significantly different than either. Their results showed that there was no dimension of the commercial textbook that was rated higher than either format of the open textbook.

Whether in a small community college or a large research university, most studies involving student perceptions of OER seem to indicate that students perceive the quality of OERs to be at least as good as traditional textbooks, and even better, in some cases.

## Purpose of the Study

The average college student in the United States spends $900 a year on textbooks (Allen, 2010). For students at some community colleges, this is nearly the same amount that they pay for tuition every year. It is important to examine ways to reduce this cost, and OERs are a viable, potential solution. However, the quality of the OER, in terms of whether it helps or hinders student learning, is paramount to this discussion. To examine this issue, this study compares student scores between courses taught with OERs versus those taught with traditional textbooks. It is also important to measure the students' perception of quality of OER textbooks offered in their college courses. Though students often cannot comment on the *accuracy* of the content, they can provide information about how often they used the material, whether they prefer the online format of the textbook, etc. Data regarding students' perception of OER materials can add a valuable perspective to the conversation.

## Research Questions

In the present study, to examine any differences between courses taught with a traditional textbook and those taught with a customized OER textbook, the courses will be compared in terms of students' cost savings, performance on course assignments, use of course resources, and perceptions of the quality of open educational resources. The following research questions were addressed in the study:

**RQ1:** What are the cost savings to students when an OER is used in place of a traditional textbook?

**RQ2:** Do students use OER differently than they use traditional textbooks, in terms of their study habits?

**RQ3:** Do students using an OER perform differently on course exams from students that use a traditional textbook?

**RQ4:** Do students perceive OERs to be of similar quality to traditional textbooks?

## Methods

This study was performed at a small, rural community college on the Oregon coast. This college utilizes the quarter system. Two courses were examined in this study during the 2016 and 2017 winter quarter (Table 1). CHEM 110 is a 1-quarter introduction to general, organic, and biological chemistry primarily for undergraduate health and nursing majors and GS 105 (General Science) is a 1-quarter introduction to general chemistry for undergraduate, nonscience majors. In winter 2016, a traditional textbook was used, and in winter 2017, a customized OER textbook, created on the CNX platform, was used.

**Table 1.** A Comparison of Traditional and a Customized OER Textbooks in Chemistry 110 and GS 105 During 2016 and 2017 Winter Quarters

| | **Traditional textbook** | **Customized OER textbook** |
|---|---|---|
| **CHEM 110** | Winter 2016 | Winter 2017 |
| **GS 105** | Winter 2016 | Winter 2017 |

## OER Organization and Development

Creating a customized open textbook from the CNX platform (https://legacy.cnx.org/) begins with identifying which modules to use, how many modules to use, and in what order to place them. A module is a short lesson on one specific topic. Modules can be added together to create a "collection" or a "book." It is possible for authors to edit existing modules or to create their own. To limit the number of any unintentionally added errors in the development of the custom OER textbook, the present study did not add any original content or materials. The customized textbooks were created by selecting modules from two peer-reviewed collections from the *OpenStax* library: *Chemistry (OpenStax College, 2016)* and *Biology (OpenStax College, 2016)*. A customized OER textbook was created for each course and was made available as a link on the LMS course portal, as well as in print through the bookstore. A course outline was created to align with the content of each course, then appropriate modules were chosen and arranged to support the course outline.

Two guiding principles were followed when organizing content for customized OERs: (1) to make each textbook no longer than eight chapters and (2) to craft a coherent narrative that is woven throughout the text to connect stand-alone chapters and topics. The OERs were designed for use in a 10-week quarter-system course. As such, it was decided that the maximum number of chapters should be kept to 8. Many traditional textbooks for these chemistry courses are designed for the semester system and, as such, have upwards of 15 chapters, which is unrealistic for a 10-week course. To reduce the number of chapters in the OER, similar chapters were combined into a single chapter, thereby retaining all of the content from the original course, simply packaged into more manageable chunks.

Modules are generally stand-alone units that can be reshuffled in many different ways depending on the curriculum. To adhere to guiding principle #2, an overarching theme of "*how molecular structure affects function*" was followed when determining which modules and topics to include, as well as how to organize them. This is a typical theme in chemistry and helps nonexperts approach and understand chemical reactivity. To the greatest extent possible, it was decided that the book should tell a compelling story about nature that is connected throughout by the idea that chemical function is based on chemical structure. If a topic did not fit this story narrative, it was removed from the course outline. Because both courses are one-term, terminal courses (not part of a sequence), there was some freedom to modify the curriculum in this way.

For example, Unit 2 of the OER created for CHEM 110 contains the chapters: Cell Structure (Chapter 5, Figure 1), Structure and Function of the Plasma Membrane (Chapter 6), and Metabolism (Chapter 7).

## Analysis

The ***student cost savings*** of traditional textbooks versus OER textbooks used for courses CHEM 110 and GS 105 was measured by determining the cost of each traditional textbook as charged by the campus bookstore and comparing that to the cost of the OER textbooks.

To examine any differences between ***students' usage*** of course materials between the two types of textbooks, clickstream data collected automatically by the LMS were analyzed to compare the number of times each student clicked on each link on the LMS course page.

Differences in ***student performance*** were measured by comparing scores on different types of assignments (homework, exams), as well as final course grade, in a course taught with a traditional textbook versus a course taught with a customized OER. A *t*-test was performed on the data to determine whether there was a statistically significant difference in student performance between the two courses. Because the number of students in each course was very small (between 15 and 30), the sample size was also small

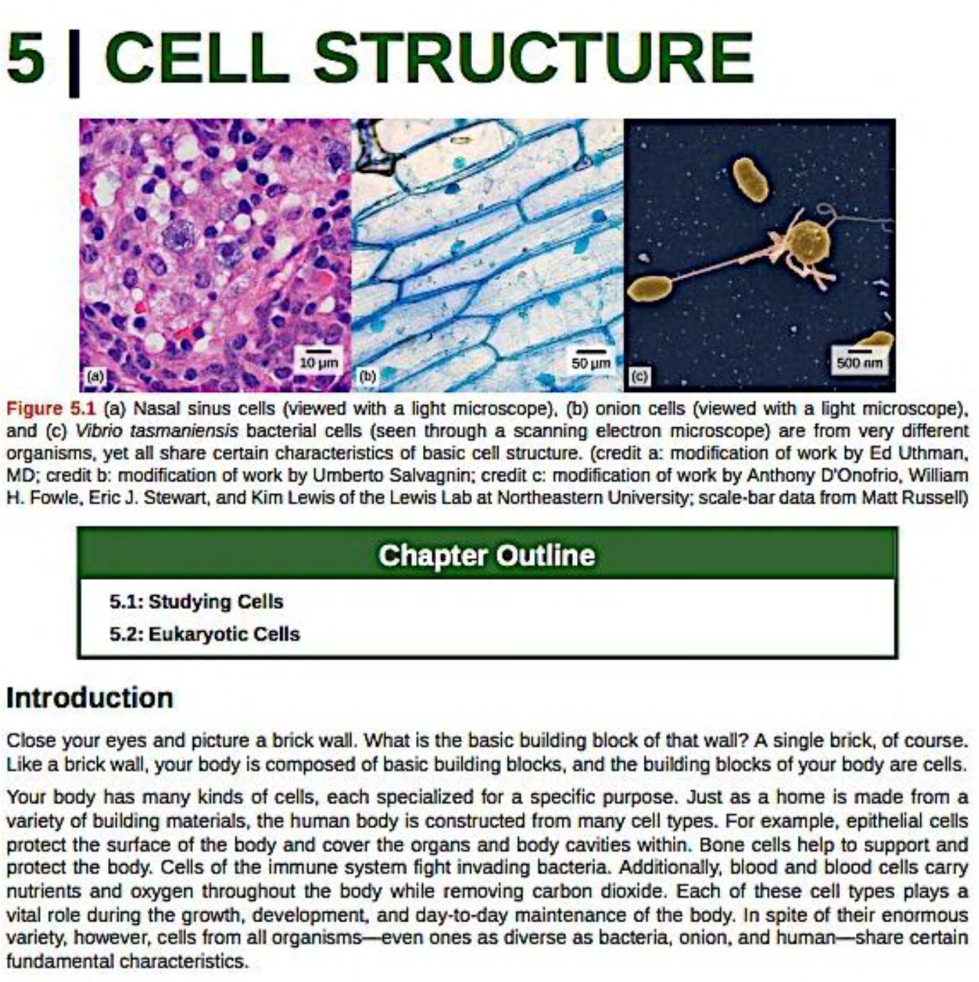



***Figure 1.*** An Example of a Page from Chapter 5 of the CHEM 110 OER: General, Organic, and Biological Chemistry: A Cellular Perspective

and the results of a *t*-test are of limited value by themselves. Therefore, the effect size was also determined by calculating Cohen's *d* (Cohen, 1977). The LMS automatically records these data. Students' perceptions of the quality of the customized OER versus traditional textbooks were assessed by administering an anonymous survey at the end of the term (provide the survey at the end of the paper).

## Results

### *Demographic Data of the Student Population*

The demographic information of the student population is shown in Table 2. These data were collected as responses to an anonymous survey administered at the end of the term. The survey questions used were developed by Bliss et al. (2013).

**Table 2.** Demographic Data of Students from Courses with OER Textbooks

| | | CHEM 110 | GS 105 |
|---|---|---|---|
| **Age** | Under 18 | 2 | 2 |
| | 18–19 | 9 | 7 |
| | 19–20 | 3 | 5 |
| | 21–22 | 6 | 0 |
| | 23–25 | 0 | 1 |
| | 26–30 | 3 | 2 |
| | 30–35 | 3 | 0 |
| **Gender** | Female | 14 | 11 |
| | Transgender | 0 | 0 |
| | Male | 10 | 5 |
| | Other/prefer not to say | 0 | 0 |
| **Terms in college** | 1–2 | 13 | 5 |
| | 3–4 | 3 | 3 |
| | 5–6 | 4 | 2 |
| | 7–8 | 1 | 6 |
| | 9–10 | 1 | 0 |
| | More than 10 | 2 | 0 |
| **Courses per term** | 1–2 | 0 | 1 |
| | 3 | 2 | 3 |
| | 4 | 13 | 5 |
| | 5 | 7 | 5 |
| | 6 | 1 | 1 |
| | 7 | 0 | 0 |
| | 8 or more | 1 | 1 |
| **Cumulative GPA** | Less than 2.6 | 0 | 0 |
| | 2.6–3.0 | 8 | 3 |
| | 3.1–3.5 | 9 | 5 |
| | 3.6–4.0 | 4 | 8 |
| | I don't know | 3 | 0 |

Students' responses were also collected about financial behavior with respect to loans and grants (Table 3) used to finance their education.

**Table 3.** Survey Data of Students' Financial Behavior

| | | CHEM 110 | GS 105 |
|---|---|---|---|
| Have you received any loans to fund your education? | Yes | 12 | 3 |
| | No | 12 | 13 |
| Have you received any Pell Grants or Fee Waivers to fund your education? | Yes | 18 | 6 |
| | No | 6 | 9 |

### *Students' Cost of Traditional Textbooks versus OER Textbooks*

**RQ1: What are the cost savings to students when an OER is used in place of a traditional textbook?**

The amount of money that students saved because they did not have to purchase a traditional textbook is summarized in Tables 4–6. The dollar amounts in the table are the prices charged by the campus bookstore for each textbook. The traditional textbook used for CHEM 110 was "General, Organic, and Biological Chemistry," by Frost and Deal, 3rd edition (ISBN: 978-0134162003). This book was priced at $160.00 new from the campus bookstore. The CHEM 110 course typically enrolls between 30 and 40 students per term, an average of 35 students. As such, the amount of money that students spent on textbooks for this course was about $5,600 per term. The traditional textbook used for GS 105 was "Introductory Chemistry, Essentials" by Tro, 5th edition (ISBN: 978-0321910295). This book costs $144.50 new from the campus bookstore. The GS 105 course typically enrolls between 18 and 24 students per term, with an average of 21 students. As such, the amount of money that students spent for textbooks in this course was about $3,035 per term. Adapting and adopting an OER textbook saved students about $8,635 during the 2016–2017 winter term.

**Table 4.** Cost of CHEM 110 and GS 105 Traditional Textbooks, Number of Students, and Total Cost for Students During Winter Quarters 2016 and 2017

| | New traditional textbook | Number of students | Amount per course |
|---|---|---|---|
| **CHEM 110** | $160.00 | 35 | $5,600.00 |
| **GS 105** | $144.50 | 21 | $3,034.50 |
| ***Total cost to students*** | | | ***$8,634.50*** |

**Table 5.** CHEM 110 and GS 105 OER Textbooks, Number of Students, and Cost Savings for Students During Winter Quarters 2016, 2017

| | OER textbook | Number of students | Amount per course |
|---|---|---|---|
| **CHEM 110** | $0 | 35 | $0 |
| **GS 105** | $0 | 21 | $0 |
| ***Total savings for students*** | | | ***$8,634.50*** |

**Table 6.** Survey Data of Student's Typical Textbook Purchasing Behavior

| | | CHEM 110 | GS 105 |
|---|---|---|---|
| How often do you purchase the required texts for the courses you take? | Never | 0 | 0 |
| | Rarely | 3 | 4 |
| | About half the time | 3 | 1 |
| | Often | 7 | 8 |
| | Always | 11 | 3 |
| How much do you typically spend on Textbooks each year? | Less than $100 | 1 | 1 |
| | $101–$200 | 1 | 2 |
| | $201–$300 | 4 | 3 |
| | $301–$400 | 6 | 6 |
| | $401–$500 | 6 | 3 |
| | More than $500 | 6 | 1 |
| Did you purchase any textbooks for this course? | Yes | 6 | 4 |
| | No | 17 | 12 |
| Were the textbooks used in this course available to you primarily online? | Yes | 22 | 15 |
| | No | 1 | 1 |

| | | | |
|---|---|---|---|
| If you did buy one or more textbooks for this course, how much did you spend? | Less than $20 | 6 | 4 |
| | $21–$40 | 3 | 4 |
| | $81–$100 | 2 | 0 |
| | More than $100 | 0 | 1 |
| Did you print the textbook for this course? | Yes | 1 | 0 |
| | No | 22 | 15 |
| If you did print the materials, then how much did you spend? | Less than $10 | 7 | 10 |
| | More than $10 | 0 | 1 |

### *Students' Usage of Traditional Textbooks versus OER Textbooks*

**RQ2: Do students use OER differently than they use traditional textbooks, in terms of their study habits?**

Figure 2 shows a screenshot of the appearance of the course portal to students. The number of times that students clicked on each link was recorded and reported in Tables 7 and 8.

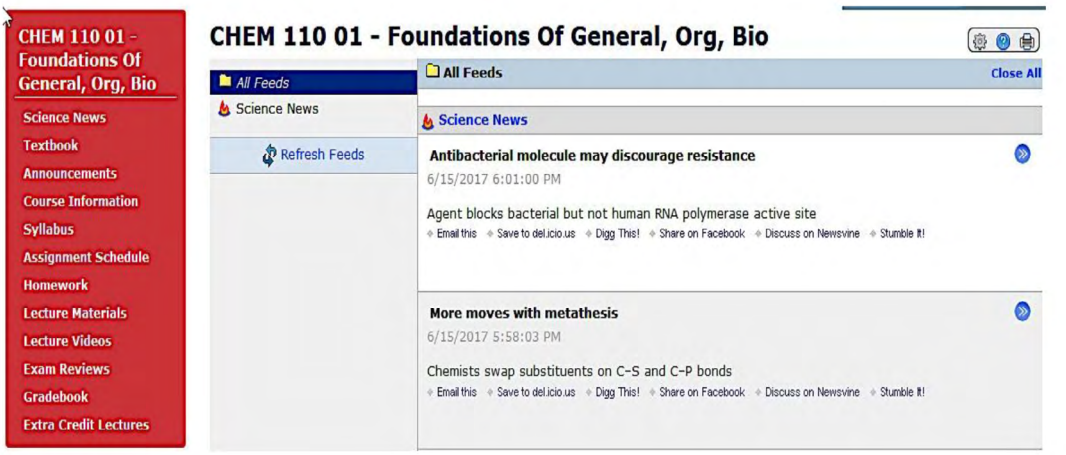
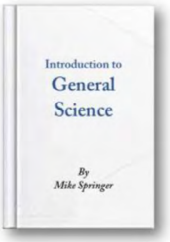
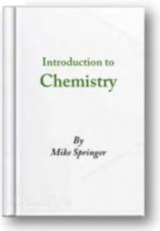



***Figure 2.*** A Screenshot of the Learning Management System Webpage for *CHEM 110* in Winter 2017

The finished versions of the customized OER textbooks created CNX platform can be found here:




Link to customized OER for GS 105:
https://legacy.cnx.org/content/col12103/latest/




Link to customized OER for CHEM 110:
https://legacy.cnx.org/content/col12104/latest/

Both courses, GS 105 and CHEM 110, utilized the learning management system, *Jenzabar*. Clickstream data, the number of times that each link was clicked, were automatically recorded to determine how students used the portal, as shown in Tables 7 and 8. Because a traditional textbook was used in winter 2016, there was not a link to the textbook included in the LMS portal.

**Table 7.** Clickstream Data from the CHEM 110 Learning Management System Course Portal. The Number of Visitors and Views is Reported for Each Link, as Well as the Percentage of the Total

| | Textbook | | Gradebook | | Lecture materials | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Visitors | Views | Visitors | Views | Visitors | Views | Visitors | Views |
| Winter 2016 ($N = 30$)[b] | [a] | [a] | 33 | 836 (18.2%) | 27 | 170 (3.7%) | 33[b] | 4,591 |
| Winter 2017 ($N = 32$)[b] | 26 | 73 (2.4%) | 36 | 617 (20%) | 29 | 251 (8.2%) | 36[b] | 3,074 |

[a] A traditional textbook was used in winter 2016, so there wasn't a textbook link on the LMS page.

[b] Total student population ($N$) does not match the number of visitors because some students visited the portal before they dropped the course.

**Table 8**. Clickstream Data from the GS 105 Learning Management System Course Portal. The Number of Visitors and Views is Reported for Each Link, as Well as the Percentage of the Total

| | Textbook | | Gradebook | | Lecture materials | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Visitors | Views | Visitors | Views | Visitors | Views | Visitors | Views |
| Winter 2016 ($N$ = 18) | [a] | [a] | 18 | 327 (16.7%) | 14 | 87 (4.4%) | 18 | 1,959 |
| Winter 2017 ($N$ = 22)[b] | 15 | 54 (3.8%) | 24 | 376 (26.6%) | 15 | 89 (6.3%) | 24[b] | 1,414 |

[a] A traditional textbook was used in winter 2016, therefore there was not a textbook link on the LMS page.

[b] Total student population ($N$) does not match the number of visitors because some students visited the portal before they dropped the course.

In addition to collecting clickstream data about *actual* student use of course resources, survey questions collected data about students' *perceived* use of course resources, as reported in Tables 9 and 10.

**Table 9.** Survey Data of Students' Perceived Use of Course Resources

| | | | |
|---|---|---|---|
| How often did you use the textbook this term? | Never | 7 | 5 |
| | 2–3 times per term | 4 | 4 |
| | 2–3 times per month | 3 | 4 |
| | 2–3 times per week | 8 | 3 |
| | Everyday | 0 | 0 |

### *Students' Performance Between Using Traditional Textbooks and OER Textbooks*

#### RQ3: Do students using an OER perform differently on course exams from students that use a traditional textbook?

To determine whether there were any significant differences in student performance between courses taught with a traditional textbook and those taught with an OER textbook, the mean score was calculated for a variety of assignments within each course. Table 10 shows the mean score for each type of assignment in the GS 105 course, as well as the $p$-value from Student's $t$-test and Cohen's $d$ to measure the effect size. The GS 105 course with a traditional textbook was taught during the winter term of 2016 and had 16 total students ($N$ = 16). The GS 105 course with

a customized OER was taught during the winter term of 2017 and had 22 total students ($N$ = 22). Though most of the assignments in the course were kept the same between terms, the homework system was changed and each term was working with a different online homework system.

**Table 10.** Comparison of Average Student Scores in Two Terms of GS 105. In One Term, a Traditional Textbook was Used and in the Other, a Customized Open Educational Resource

| | **Traditional textbook ($N$ = 16)** | **Custom OER textbook ($N$ = 22)** | ***p*-value** | **Cohen's *d*** |
|---|---|---|---|---|
| Homework[a] | 82.81 | 92.63 | 0.0002 | 0.516 |
| Lab Worksheets | 90.82 | 95.65 | 0.0019 | 0.422 |
| Midterm exams | 73.24 | 80.32 | 0.0385 | 0.483 |
| Final exams | 69.02 | 83.27 | 0.0031 | 1.126 |
| Final scores | 81.58 | 91.63 | 0.0004 | 1.287 |

[a]The online homework program was changed from WT16 to WT17.

Table 11 shows the mean score for each type of assignment in the CHEM 110 course, as well as the $p$-value from a student's $t$-test and Cohen's $d$ to measure the effect size. The CHEM 110 course with a traditional textbook was taught during the winter term of 2016 and had 30 total students ($N$ = 30). The CHEM 110 course with a customized open educational resource was taught during the winter term of 2017 and had 24 total students ($N$ = 24). Again, students in the course with a traditional textbook were using a different online homework system than the students in the course with a customized OER textbook.

**Table 11.** Comparison of Average Student Scores in Two Terms of CHEM 110. In One Term, a Traditional Textbook was Used and in the Other, a Customized Open Educational Resource

| | **Traditional textbook ($N$ = 30)** | **Custom OER textbook ($N$ = 32)** | ***p*-value** | **Cohen's *d*** |
|---|---|---|---|---|
| Homework[a] | 91.72 | 82.51 | 0.0001 | 0.807 |
| Midterm exams | 71.58 | 78.01 | 0.0147 | 0.470 |
| Final exams | 61.08 | 70.80 | 0.0155 | 0.699 |
| Final scores | 81.44 | 81.13 | 0.9157 | 0.029 |

[a]The online homework program was changed from WT16 to WT17.

### *Students' Perceptions of Open Educational Resources versus Traditional Textbooks*

**RQ4: Do students perceive OERs to be of similar quality to traditional textbooks?**

In addition to demographic questions and questions about the use of course resources, student survey responses about student's perceptions of the quality of the OER resources used in their courses and their preference for either online or traditional course materials (Table 12).

**Table 12.** Survey Data of Student's Perception of OER Textbook Quality

| | | CHEM 110 | GS 105 |
|---|---|---|---|
| How would you rate the quality of the textbook used for this course? | WORSE than texts in other courses | 1 | 0 |
| | SAME AS texts in other courses | 18 | 10 |
| | BETTER than texts in other courses | 1 | 6 |
| How do you feel about the online format of the textbook used for this course? | WORSE than texts in other courses | 9 | 2 |
| | SAME AS texts in other courses | 7 | 8 |
| | BETTER than texts in other courses | 5 | 6 |
| How likely are you to register for a future course with online textbooks like the one used in this course? | Very unlikely | 2 | 1 |
| | Somewhat unlikely | 3 | 1 |
| | Somewhat likely | 16 | 6 |
| | Very likely | 1 | 8 |
| Imagine a future course you are required to take. If two different sections of this course are offered by the same instructor during equally desirable time slots, but one section used OER texts similar to those used in this course and the other used traditional printed texts, which section would you prefer to enroll in? | Traditional text | 8 | 4 |
| | OER text | 8 | 8 |
| | No preference | 7 | 4 |

## Limitations

Because of the limitations of this project, it is presented here as more of a case study than an experiment. First, the sample sizes were quite small, making statistical analysis difficult. To address the small sample size, Cohen's *d* was calculated and reported as a measurement of the effect size, but this, too, was quite small. As such, it is difficult to make any definitive conclusions based on statistical analysis. Second, although most of the modules used to remix the customized OERs were from OpenStax, a peer-reviewed resource, some of the modules were not. The author took care to review the modules included for accuracy, but this is not the same as a peer-review process and it is possible that the OERs created contained factual errors. Although assessing the *factual content* of a customized OER is certainly a vital process, it is beyond the scope of this paper; determinations about factual accuracy should be left to the content experts by using a peer-review process. Finally, although care was taken to present the same lecture material and use the same assignments in courses taught with OERs and with traditional textbooks, the online homework system was changed between 2016 and 2017, so it is difficult to make any conclusions about differences in homework scores.

## Discussion and Conclusions

The most noncontroversial benefit of adopting an OER textbook was the cost savings to students. Textbooks costs continue to increase, and the number of students wishing to obtain a credential and that are unable to pay for tuition and course materials is also increasing. The average amount of student debt of 2016 college graduates was $37,172 per student (https://www.debt.org/students/).

Of course, it comes as no surprise that OER textbooks are cheaper than traditional textbooks. The real question is whether students are equally able to learn with them, as well as whether they are equally satisfied with them. The results of this study suggest that this is the case, though confounding variables prevent definitive conclusions from being drawn. Although care was taken to ensure that assignments between the two courses were consistent, if it was determined that a change in assignments between the two terms would be beneficial to student learning, then modifications were made accordingly. Therefore, it is likely that the two courses were similar, but it is probable that slightly different material was covered and with slightly different delivery. In addition, not only was the textbook changed between sections, but so too was the homework system. This change alone is enough to cast doubt on any inferred cause of a statistically significant difference between the two sections.

The results reported in Tables 5 and 6 on student performance included a variety of course assignments, but it is important to note that any observed difference in scores between the two sections could be the result of a difference in the abilities of the students in each

group before the course began. Since a pretest was not administered to the students in either section before the course began, it is not possible to determine any differences in the academic abilities or previous knowledge between the two groups. The *p*-values shown in Tables 5 and 6 suggest that there are some significant differences between the scores of the students taught with a traditional textbook versus those taught with a customized open educational resource.

The data seem to suggest that student learning is significantly improved when the course is taught with a customized OER. However, as mentioned above, there are many reasons to be cautious of such a conclusion. The Cohen's *d* statistic provides a measure of the effect size. Typically, an effect size of less than 0.8 indicates that the size of the effect is not large enough to be significant. For many of the *p*-values reported in Tables 5 and 6 that signify statistical difference, the associated values of Cohen's *d* are small. The smaller the effect, the more difficult it is to determine its cause, especially in an educational environment like a classroom, where there are often many variables. That the two courses were taught by the same instructor during the same term (winter) does limit the number of differences in the delivery of the two courses, as well as the type of students that might enroll in a winter term course. However, it is likely that there were enough differences to cast doubt on whether any observed effect was due to the experimental treatment or to some unintentional difference in delivery or student population.

Tables 7 and 8 report the clickstream data of students, the number of times that they clicked each link on the LMS portal seen in Figure 1. There were not any significant differences in student use of course resources between students enrolled in a course with a traditional textbook and those enrolled in a course with an OER textbook. The most notable result from this analysis is that not only did the "textbook" link receive the smallest number of clicks in both courses, there were a surprising number of students that never even clicked the textbook link. The survey data are consistent with the clickstream data as regards the use of the textbook: in CHEM 110, six students did not click the textbook link (Table 7) and seven students reported that they never used the textbook (Table 10) and in GS 105, seven students did not click the textbook link (Table 8) and five students reported that they never used the textbook (Table 10). The number of students that use the textbook in any given course is not likely to be 100%, but the number of students that never even clicked the link once was truly shocking to this instructor. Of course, the link provided on the LMS course portal was not the only way to access the textbook and students might have been accessing it another way, such as through *Google* or the *OpenStax* website.

The most viewed link was the "gradebook," another result that is not particularly surprising. Students have always likely been slightly obsessed with grades, but modern technology allows students to monitor their grades in real time, so this obsession may have

become stronger. The "gradebook" link was the only link that was actually viewed by every student. Another comparison of note is the large difference between clicks on the "textbook" link and clicks on the "lecture materials" link. The "lecture materials" link is where the instructor posts PowerPoint slides and recorded .mp3 files containing audio of each lecture and the notes the instructor made on the board during the lecture. At first glance, it appeared students were not using the textbook, therefore, perhaps, there was a large number that were not studying.

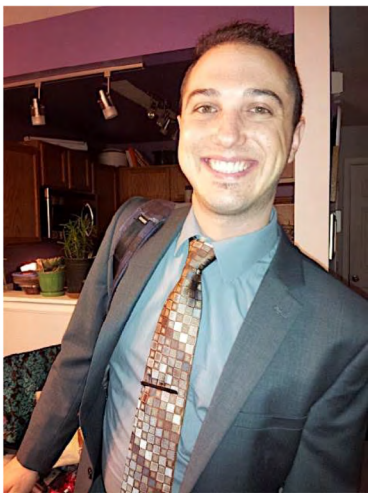
However, it is possible that some students found the PowerPoint slides and lecture notes more useful than the textbook. Although neither the "textbook" link nor the "lecture materials" link were clicked by every student, it is at least conceivable that about half of the students used the textbook to study and the other half used the recorded lectures.

Tables 9 and 10 report survey data collected on student use. Although the clickstream data suggest there were a number of students that never clicked the textbook link once, Table 9 shows that there were zero students that reported "never purchasing the textbook." Are students purchasing textbooks that they don't use? Indeed, several students report that they "never used the textbook" and zero students reported that they "used the textbook every day." Further, although an economical option was provided to students to print the textbook at the college bookstore, only one student actually elected to print the textbook. These data suggest that students may feel obligated to purchase textbooks that they may not even intend to use, with most students spending hundreds of dollars per year.

A vast majority of students reported that the quality of the customized OER textbook used in their course was "the same as" the quality of textbooks used in other courses (Table 12)—although, since it seems that many of them may never have even looked at the textbook, this doesn't mean much. Students are more divided about whether they prefer the online format or the traditional format or a textbook, with nearly half of the students in CHEM 110 reporting that they felt the online format was "worse" than in other courses. Some of the open-ended responses from the survey cited the very long time that it takes to load the customized OER after clicking the link as one reason that they did not prefer that format. Students were told, however, that they could download a .pdf of the textbook that would load much faster. A clear majority of students indicated that they either preferred the course with an OER textbook to traditional courses or they had no preference, although about one-third of students indicated that they preferred the traditional course format.

These results suggest that student–learning outcomes were not negatively affected by the use of OER. Although the current study is too limited in duration and sample size to provide any definitive determination about student learning, the results indicate that

students are not opposed, in most cases, to taking a course with an OER textbook and, in some cases, they would even prefer this option.



## Author

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# A Look at the Future of Open Educational Resources

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Abstract

Open Educational Resources (OER) have been traditionally defined as educational contents that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution. As the nature of educational content changes with new technology, however, so does the nature of OER. This paper explores the impact of four major types of technology on our understanding of OER: cloud infrastructure, open data, artificial intelligence, and decentralized networks. It is argued that these technologies result in a model of dynamic and adaptive resources that will be created at the point of need and will draw on constantly changing requirements and data sources. They will be created through distributed community-based processes, and they will support a pedagogy based on supporting student experiences rather than content transmission. As a result, the emphasis on content publication and licensing will decrease, while questions of access and interoperability will move to the fore.

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***Keywords:*** Open Educational Resources (OER), licensing, cloud, artificial intelligence, decentralized networks, content addressable resources for education (CARE)

# 開放教育資源的未來

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*full Chinese version of article follows English version

摘要

开放教育资源（OER）在传统意义上被定义为公共领域内的教育内容，或是在开放许可下发行的内容，即允许无成本获取、使用、改编和再分配。当教育内容的性质随新技术发生改变时，OER的性质也随之改变。本文探索了四种主要技术类型对人们所认识的OER产生的影响：云基础设施、开放数据、人工智能和去中心化网络。本文认为，这些技术造成一种具备动态性和适应性的资源，该资源会随需求而产生，并且将利用经常变化的请求和数据源。这些资源将通过基于社群的分配过程创造，并且资源将支持一种基于加强学生体验而不是内容传输的教学法。因此，强调内容发布和许可的趋势将减少，而有关内容获取和互操作性的问题将成为优先解决的事项。

关键词：开放教育资源（OER），许可，云，人工智能，去中心化网络，教育内容可寻址资源（CARE）

# Una Mirada Al Futuro De Los Recursos Educativos Abiertos

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Resumen

Los recursos educativos abiertos (REA) se han definido tradicionalmente como contenidos educativos que residen en el dominio

público o se han publicado bajo una licencia abierta que permite el acceso, uso, adaptación y redistribución sin costo. Sin embargo, a medida que la naturaleza del contenido educativo cambia con las nuevas tecnologías, también lo hace la naturaleza de los REA. Este documento explora el impacto de cuatro tipos principales de tecnología en nuestra comprensión de REA: infraestructura en la nube, datos abiertos, inteligencia artificial y redes descentralizadas. Se argumenta que estas tecnologías dan como resultado un modelo de recursos dinámicos y adaptativos que se crearán en el punto de necesidad y se basarán en requisitos y fuentes de datos en constante cambio. Se crearán a través de procesos distribuidos basados en la comunidad y apoyarán una pedagogía basada en apoyar las experiencias de los estudiantes en lugar de la transmisión de contenido. Como resultado, el énfasis en la publicación de contenido y las licencias disminuirá, mientras que las cuestiones de acceso e interoperabilidad pasarán a primer plano.

***Palabras clave:*** Recursos educativos abiertos (OER), licencias, nube, inteligencia artificial, redes descentralizadas, recursos direccionables de contenido para educación (CARE)

## Introduction

Online and distance education have been from the outset dependent on the design and distribution of learning resources. Absent the traditional face-to-face instruction offered by a teacher or professor, it was necessary to develop what were called 'course packages' containing readings, quizzes and exercises, and guidance to help the students manage their own learning in the absence of a classroom.

Traditionally these packages were proprietary to the institution offering the course; each institution would create its own course package.

Additionally, materials would be created by publishers for use in both distance education and traditional classrooms. Gradually, however, there emerged a desire to make use of new Internet technologies, to pool resources, and to be able to share the cost and benefit of learning resources between teachers and institutions. This practice became widespread, and ultimately included high-profile examples such as MIT's OpenCourseWare.

Concurrently, in the field of computer technology a similar desire led to the creation of a type of computer program intended for sharing. Originally, programs were distributed

as 'shareware' and were free to use but could not be sold. Operating systems such as GNU/Linux were distributed as 'free software' where the right to use and redistribute the software were restricted by what Richard Stallman called the "four freedoms": the freedom to run the program, the freedom to read the source code, the freedom to modify the program, and the freedom to redistribute the program under the same license.

These ideas come together in the form of 'open educational resources' (OER). The idea was that educational content could be 'free' in the same manner as free software by licensing it using an open content license. Around the same time, an organization called Creative Commons introduced a set of licenses designed for this purpose. Thus, OER came to be defined (by organizations such as UNESCO) in terms of its licensing: "Open Educational Resources (OER) 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, 2002).

The development of the concept of the OER raised at the same time the question of the sustainability of OER. Course packages can be expensive to produce, and the expectation among advocates of OER was that students would not pay for them. Initial OER projects were supported by government, institutional and foundation support, but generally with the expectation that these projects would become self-sustaining over time. The development of OER thus began to focus on commercial viability, and models of OER distribution came to include bundling (where an OER is combined with a commercial product for sale, thus making access to the OER contingent on purchasing the commercial content), enclosure (where access to OERs is limited by the requirement to pay tuition or subscription fee), or conversion (where a free resource is converted to a commercial resource, for example, by changing it from digital form to paper-based form).

Additionally, the nature of digital resources, and of online learning generally, began to change. The early web was dominated by pages and documents, but the later web (often referred to as web 2.0) focused on social interactions and user-generated content. This change impacted online learning as well, and the focus shifted from course packages to online interaction. The development of the MOOC beginning in 2008 led to a model where students created and distributed their own educational resources and participated in learning networks.

In the present day, the model whereby publishers create and distribute openly licensed static content is drawing to a close. A 'web page' today is actually a dynamic resource, connected to live data generated by cloud services. The contents can change minute by minute, and these changes are often driven by the activities of people using the page. The 'design' or 'content' of an

OER may actually be designed by the page design, or the pedagogical practice it supports, rather than the content created and transmitted by its users.

The concept of the OER is in flux. The purpose of this article is to focus on how these technological changes are changing the nature of OER. It will look at the impact of four key technologies—**cloud technologies, open data, artificial intelligence**, and **content-based addressing.** It's true that in discussions of educational resources we don't necessarily want to begin by focusing on technology, but in this case understanding the technology is important because the technology is going to create some affordances for us that will change the shape of open educational resources within ten to twenty years.

In the final two sections, we will return to the pedagogical question and examine the impact of these changes and discuss how we in the educational sector, will need to adapt in response to that impact, in order to shape it in the future.

## New OER Technologies

### *Cloud*

Access to content that is stored on the cloud requires an Internet connection. It's true that a lot of people, and especially people in the global south, cannot easily access cloud-based resources, but more and more as time goes by, access will improve and we will be looking at cloud environments and cloud technologies in order to support open educational resources.

> ***By 'cloud' hosting, we mean storing and accessing our content on computers accessible through the Internet.*** *What's important about these computers is not simply that they are hosted and managed by Internet service providers, but also that the resources are not on any particular computer, and indeed, might be spread across a number of computers.*

What that means, is a shift from resources created by content providers or publishers to resources created collaboratively or cooperatively.

For example, Figure 1 depicts a web-based article about open educational resources. On the screen, we see what looks like an ordinary website, but this website is actually hosted on a site called GitHub (https://github.com/). What's important about this website is that it isn't just a website. It's something that multiple people can contribute to.

GitHub enables people to create their own copy, or 'clone' the website in question. Or they can start editing the document to create a new version, known as a 'fork' of the original article.

GitHub was originally designed for cloud-based collaborative authoring of software, but sites like this demonstrate that it can be used for any sort of content.

This changes the dynamics of open publishing and open educational

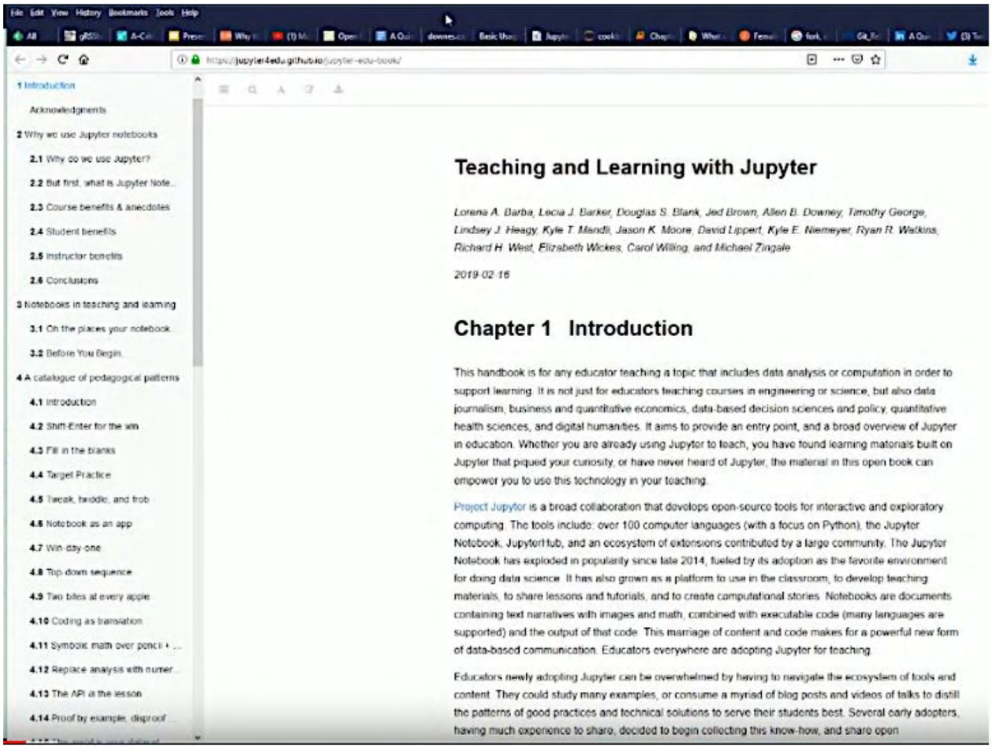


***Figure 1.*** OER located on GitHub.

resource publishing because it removes the divide that exists in the traditional environment between the author and publisher and the consumer. It makes the consumer equally a part of the creation.

In addition to creating and reading documents in the cloud, we can create and run full applications on these remote computers. These applications are encased in virtual machines or 'containers'. We can run them and interact with them through a web browser, or, just like the contents of a cloud-based document, we can download these applications to our own computer and run are them on our own computer. Services like Vagrant, Docker and Kubernetes make this possible today.

> **"*Open Data is an umbrella term*** *describing openly-licensed, interoperable, and reusable datasets which have been created and made available to the public" (Atenas & Havemann, 2015).*

What this means is that the types of resources that we will be working within the future as open educational resources will not simply be documents, will not simply be textbooks, but will actually be functioning programs and even fully functioning virtual computers that people can work with, manip-

ulate, use to create things like videos or audio or new applications of their own, develop their own content, and share them over the cloud.

### *Open Data*

In addition to cloud hosting, and partially as a result of it, people are beginning to think about open data as a new type of open learning resource.

For example, in Canada's open data portal (located at https://open.canada.ca/en/open-data) readers can browse by subject. Under a topic like 'law', for example, they can research the law of monetary penalties, statistics, questionnaires that members are asking people to fill, etc. This is all part of open government. But it's also a whole set of resources that are accessible as educational resources.

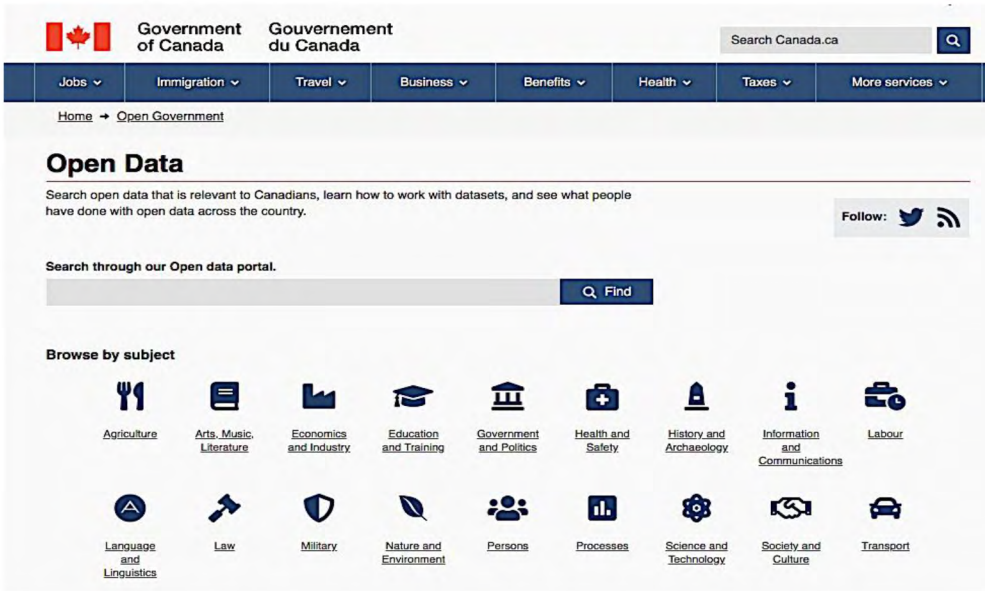


***Figure 2.*** Government of Canada Open Data Portal

Because it's data it's not really usable directly as a learning resource—it's not structured with educational outcomes in mind. However, when open data are made available through an application programming interface (API) it can be integrated into learning resources. The Government of Canada has created a new 'API Store' (at https://api.canada.ca/en/homepage) which hosts and publish APIs which allows developers to access and leverage government datasets and services for integration into apps or other services.

An example of this is an application called Jupyter Notebooks (https://jupyter.org/). Jupyter Notebooks are online text-based notebooks containing computer programs such that you can use Jupyter Notebooks to run the com-

puter programs it contains on your own computer. The programs allow the reader to change the program from inside the notebook and then run it again, producing a new result. Readers can either download a Jupyter Notebook application to run on the desktop, or they may access a service called Binder (https://mybinder.org/) to read and use a Notebook through a web browser.

Additionally, because the Notebook is running an actual computer program, it can access *live data* as it runs. For example, a notebook might address an analysis of housing in Eastern Canada. It may contain a program that displays housing data in a graph or diagram. Each time the program is run, this data is accessed anew from the API and the presentation of information in the Notebook is fully current (Hirst, 2018).

The potential is enormous. For example, Naughton (2019) takes a student "from an idea for a protein all the way to expression of the protein in a bacterial cell, all without touching a pipette or talking to a human." The post includes embedded computer code and interoperates with a 'cloud lab' to actually manipulate the instruments and create the protein samples.

Additionally, there is a program called Jupyter Graffiti that enables an instructor to animate a Jupyter notebook, in other words, to display the operation of the program as though it were a video. "Jupyter Graffiti are recorded, interactive demonstrations that live inside your Notebooks .... Since a Graffiti 'video' is a live replay of the instructor's interactions, you can pause it any time—and when it's paused you can dive in to play with the instructor's work right in the Notebook (execute it, copy it, change it, execute it again)—and then resume playback when you're ready."

Graffiti thus blends the instructor role, which is to model and demonstrate, with the learner role, which is to practice and reflect.

So the document isn't just a document anymore, it's a computer program that we can change and run again, thereby learning both about the subject matter and learning about computer programming. These computer programs can use open data such as the data that we just looked at on the government of Canada website as their input. So we can be working with open data using a Jupyter notebook that I'm running either on my browser or running on my local desktop.

This changes the conception of an educational resource from something static to something that's interactive, to something that can be used to create, as well as to consume. An educational resource isn't a single resource that's served from a static web server. It is part of an environment sometimes called a 'headless website' or 'decoupled CMSs' (Koenig, 2018). The database is located in one place, the web page is located in another place, the programming environment is in another place, and these can be either in the cloud, or on a local area network, and users can switch back and forth from Internet to cloud as they wish.

*AI will be used to facilitate learning processes, provide student support, assessment and feedback, manage business processes, and help with identity and security.*

### *Artificial Intelligence*

Open AI and open artificial intelligence algorithms are already becoming available and are beginning to be used in online learning. For example, the OpenAI project (https://openai.com/) offers "open-source software tools for accelerating AI research, and release blog posts to communicate our research." Related projects include the Open AI Gym (https://gym.openai.com/docs/) and various cloud AI projects offered by companies like Google and Microsoft. Additionally, many resources are available through Jupyter Notebooks to help people learn about artificial intelligence.

What is relevant to open education is that the services offered by these programs will be available as basic resources to help build courses, learning modules, or interactive instruction. For example, Figure 3 illustrates a simple case. It takes the URL of an image, loads it, and connects an online artificial intelligence gateway offered by Microsoft as part of its Azure cloud services using an API key generated from an Azure account.

The Azure AI service automatically generates a description of the image, which is used as an alt tag, so the image can be accessible; the alt tag can be read by a screen reader for those who aren't able to actually see the image. In this case, the image recognition technology automatically created the text "a large waterfall over a rocky cliff," along with a more complete set of analytical data about the image.

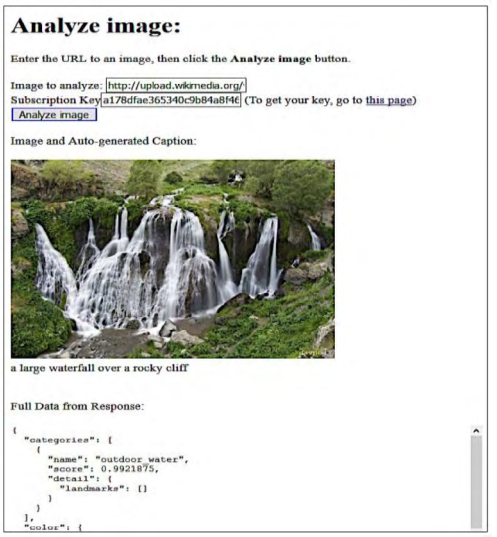


***Figure 3.*** AI-based image captioning with Azure https://www.downes.ca/files/msindex.html

This may appear to be a trivial example, but it addresses a clear need in the creation and use of open educational resources. It reduces the need for humans to create image metadata, thereby making the images much more discoverable, and much easier to use to create open and accessible resources.

The widespread availability of AI will make these capacities available not only to instructors and developers,

but to everyone, greatly enhancing the capacity of people to create their own learning resources without relying on publishers.

Artificial Intelligence has wide application in education. A recent survey (HolonIQ, 2019) projected the use not only of artificial vision and image recognition technology, but also a similar impact for voice and language processing, algorithms and hardware.

What's important is not simply that artificial intelligence exists, but that it will be easily accessible as a service to the population as a whole. For example, some journalists created a facial recognition machine for only USD 60 (Chinoy, 2019). It uses input from publicly accessible web cameras showing people walking on the street, and compared the faces to images of people on nearby corporate websites. The facial recognition software is a service (on theoreti.ca Geoffrey Rockwell suggests it might be Amazon's Rekognition). This is something almost anyone could do.

While to date, most applications of AI discussed in relation to education and learning have been in the areas of learning analytics and automated course generation, it is arguable that in the future the more useful applications will actually support interactivity and community-based creation of open educational resources. For example, Cognii (http://www.cognii.com/) is "enabling personalized deeper learning, intelligent tutoring, open response assessments, and pedagogically rich analytics", Magpie (https://learn.filtered.com/magpie) "provides learning opportunities based on challenges" such as tests or quizzes and X5GON (https://www.x5gon.org/) "fully automates the creation of OER courses." AI technologies will provide people with ways to interact with remote services in a way that helps them create new multimedia artifacts to be used for teaching, for art, or for business, and it might help them create these by creating alts tabs, it might help them create them by criticizing their text, or it might help by generating some text for them (deWaard, 2019).

### *Content Addressable Resources for Education*

To introduce the concept of Content Addressable Resources for Education (CARE) we need to look more deeply at some of the technologies previously discussed. Supporting these are technologies sometimes categorized under the heading of 'blockchain'. But the word 'blockchain' is not really a good descriptor, because it shifts the focus to crypto-currencies and financial networks. The wider term 'distributed ledger technology' is more appropriately applied to the methods being used to store and access digital resources on distributed and decentralized networks.

An example of such a network is called the Interplanetary File System (https://ipfs.io/). The idea is this: instead of accessing an online resource using a URL the way web browsers work now, we access the resource based on its content using what is called 'content-based addressing'. (Benet, 2014). The URL used on the web today references the

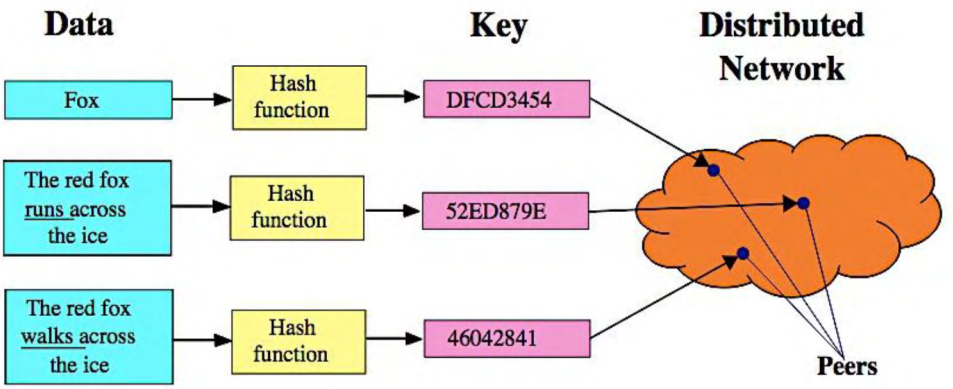


***Figure 4.*** Distributed Hash Table

location of a web resource; that is, it is associated with the Internet address of a specific web server. So, someone accessing Uber.com is getting that from a very specific service hosted by one specific server.

This system has already been modified to a considerable degree to address weaknesses in the concept. A single server might be far away. It might be a single point of failure. So, a system of load balancing and content distribution networks treat the URL as a virtual address and redirect requests to where the content is actually located. Despite these improvements, location-based access protocols are still based on a single point of failure, so that if the resource is not at that location, it cannot be found at all, except through indirect means such as a web search, and if the address is 'spoofed', it can result in people downloading unwanted content.

With content-based addressing the user is essentially asking whether anyone has some specific content. This content might be located anywhere on the network. It is expected that it may be in multiple locations on the network. In the case of blockchain technologies like BitCoin, every node in the network has the content being requested, so the nearest node can respond. In the case of IPFS, a subset of the nodes will have the content, and so the request may be passed from one node to the next until the content is found. In the case of GitHub, individuals can have copies of their own subsets of the content stored locally, and use content addressing for version control and updating.

> ***Content-based addressing is important*** *because it allows us to have multiple copies of a resource out there on the Internet, and once a resource is created and published in this way, it is permanently open. It is permanently open because there are multiple independent copies of this resource. So, things like licensing and that become less and less important.*

To make content easier to identify, instead of relying on the entire content, content-based networks generate a 'hash' of the content. This is a cryptographic version of the content, that is, the output of an encryption algorithm, such that for any given resource there's a unique hash value, and this value maps to that resource, and only that resource. So, the search is based on the hash value, and anyone who has a resource matching that value can send the resource. For security, the recipient can apply the hashing algorithm to any content they receive to check whether the hash from what they were sent matches the hash they were asking for? If yes, they know they've been sent the real resource.

## Consequences

These new technologies provide the basis for speculation about the future of open educational resources.

*First,* the creation and the use of open educational resources will merge. In traditional educational publishing a resource is first created by an author and then later consumed by a reader. The purpose of the resource is to transmit information from the author to the reader. Even collective models of content creation, such as the wiki, operate in this way. The reader of a wiki expects to learn from content that has been created by the authors. Such a resource, while it may change from time to time, is generally static, and the flow of information is generally one-way, from producer to consumer.

However, new models of open educational resources will be more like *tools* that students use in order to create their own learning content, which they will then consume or use for some other purpose. For example, the educational use of a Jupyter Notebook, say, is not to present a certain body of content to the reader, but rather, to allow the reader to select their own source of open data, to manipulate that data by manipulating the algorithms provided, and then to use the results of that manipulation for their own purposes.

We see this, for example in the development of the Creative Commons open educational strategies that is being authored by multiple people and shared on GitHub. The development of educational strategies is an ongoing process. It is not a process that needs to converge toward a single outcome; people will want to develop different strategies for different purposes and different environments. So the process is not (or should not be) based on collectively writing a single document, but rather, collectively working within a common environment for the production of documents as needed.

Thus, in an environment like GitHub, individuals can access this document, clone it, and have their own copy on their own computer. They can make changes to that copy and then recommend those changes back to the original authors, who are free to accept them or reject them. They can use what has been created as a starting point, and diverge from that point, or combine it with other content from other reposi-

tories, to create something completely unique.

From the pedagogical perspective, the learning happens not through the consumption of the content but through the *use* of the content. People learn to write computer programs, for example, by using GitHub to copy programs from other repositories and manipulate those programs (just as a person might borrow a tool and work with that tool).

*Second,* licensing issues fade into the background. This should be seen as a welcome development. Laws governing content licensing and copyright differ from jurisdiction to jurisdiction around the world, and the interpretation of even common licensing standards, such as Creative Commons, is often unclear and requires litigation to resolve (Harris, 2018, p. xi). The complexity of licensing content has prompted Creative Commons to create and offer a Certificate course in the subject (Creative Commons, 2019).

One reason licensing fades to the background is that most resources are created and used only once. The resource taps into current data and may be localized or adapted to the content consumer. The tools employed to manipulate the resources are adapted from a common 'pattern language' of open access algorithms and tools; proprietary tools simply aren't useful in a one-off context such as data-driven online resources.

An additional reason is that the static components of the learning resources are distributed through decentralized networks. The nature of these networks is such that all nodes of the network participate in content distribution, and therefore, the contribution of content to the network grants *de facto* a license to reproduce the content. Access restrictions on content are therefore government not by licensing, but rather, by access restrictions on the network as a whole, for example, through authentication.

Finally, access conditions previously stipulated by licensing are embedded in the resource itself. Technologies such as encryption, hashing and blockchain create a record of ownership and provenance of any resource, and the conditions related to access of the resource are recorded either indirectly, through means of access controls, or directly, by means of a smart contract (Bodó, Gervais, & Quintais, 2018).

*Third*, the form of learning changes with the use of next-generation open educational resources. Developers are now able to use live data for real world applications, or local or downloaded data for training or for simulations. This shifts the locus of learning from the content—which will change on a day-to-day basis—to the *use* or *application* of the resource. For example, if an educational resource consists of a Jupyter Notebook containing an averaging algorithm, 'learning' will not consist of remembering the algorithm, but rather, it will consist in the use and modification in order to adapt to novel scenarios.

Because students are learning through practice and use, the learning

'content' (that is, the tools and algorithms) can be the same in the classroom or learning environment as they are in an actual work environment. It is, for example, like learning architecture by using the same computer-assisted drawing (CAD) software as is used by professional architects, using data drawn from open architectural drawing data networks (OPSHub, 2018).

## What's Needed?

What do we need, what do we need to know, what do we need to master, in order to get to this?

The first, and perhaps most important, is to change our mindset a bit. We need to change our framing, and in particular, we need to start thinking in terms of data and networks rather the documents, to get away from the idea that we're publishing course packages, chapters, and modules. The existing system of learning and publishing is designed around static and unchanging resources, however, in this future, resources will need to be created as-needed to address current data and current contexts.

The focus of instructional design, therefore, shifts from a foundation of content-based learning objectives to one based on (perhaps less-well defined) capacities and skills. These capacities and skills will *themselves* be fluid and adaptive to current environments, and learning to work in these environments will be more like achieving a fluency rather than remembering specific sentence structures or even vocabularies.

Instructional designers should be thinking in terms of environments and experiences. These environments will need to be fit for purpose—that is, they will need to generate real outcomes, whether they are used to design a building or to pilot a ship. Designers will also need to focus on the experiences learners have in these environments. It's not about the contents of the resource anymore, but rather the contents coming from open data, and this data might be anything possible within the constraints of the system.

Second, it will take some time for instructors and designers to learn how to think this way. GitHub, for example, requires a huge learning curve (GitLab, 2017). There is a change of perspective required in order to see works (whether software or content or other media) as dynamic, as branched, as modular, and as interoperating. Instructors and designers will require user-friendly interfaces that assist in this change of perspective. This will take something like the content management system of next-generation interactive cloud technology. In the early years of the web open educational resources were really difficult to create until things like Blogger and Facebook and Twitter and some publishing services like Rice's Connexions came along. This is what will be needed for this next generation as well.

Again, it's a shift in focus from the content to the interactions and operations. It's about how to merge this data with this application or this capacity or this bit of artificial intelligence to create a learning experience for a

person. This is a very different way of thinking about instruction and instructional design than what instructors and designers may be used to, and it will require practice and application on new leading design systems in order to support this transition.

Third and finally, designers and developers will need to learn to co-create cooperatively. This is *not* the same as collaboration, where small or large teams work on a certain product or outcome. Cooperative work involves multiple individuals and groups working within a common environment or infrastructure, and helping support that network or infrastructure for mutual benefit, while working on different objectives or outcomes.

Part of this involves building and sharing resources in common. But an equally large part of it involves being able to work in the open, or as it is sometimes called, 'open working'. Examples exist in, say, the philosophy of 'open science', where "many of the benefits envisaged for open methods relate to how far they enable not only access but active participation in a research community by newcomers and outsiders, and maintain low barriers to this participation." Internships, co-op student placements, apprenticeships and sport development leagues all embody the same principle.

## Concluding Remarks

Students today face the challenge of complex and rapidly changing work and study environments. These challenges, and the affordances enabled by new technologies, are driving a new generation of learning resources. These resources will be dynamic and adaptive. They will be created at the point of need by AI-assisted learning design systems and will draw on constantly changing requirements and data sources. These resources will not teach by means of content transmission, but rather, will require that students interact with both the data and algorithms, modifying the resource and creating solutions to real-world challenges. They will work using the same tools as people already working in the field, adapting to changes in the tool alongside the experts, working with and alongside them in a cooperative open working environment.

In this scenario, our understanding of the concept of the 'open educational resource' changes from a definition based on the concepts and metaphors of textbooks and libraries, and toward one based on the concepts of data-processing networks, cloud services and applications, decentralized encryption-based ledgers, and AI-assisted design and information processing. OERs will no longer facilitate learning by means of content transmission, but rather by constituting parts of, and working within, distributed cooperative networks, supporting the student *experience* as they become fluent in new challenges and new technologies.

## Author

**Stephen Downes** is a Canadian philosopher and commentator and works with the Digital Technologies Research Centre at the National Research Council of Canada specializing in new instructional media and online personal learning technology. He is one of the originators of the first Massive Open Online Course, has published frequently about online and networked learning, has authored learning management and content syndication software, and is the author of the widely read e-learning newsletter OLDaily. Through a thirty-year career Downes has contributed pioneering work in the fields of online learning games, learning objects and metadata, podcasting, open educational resources. Today he is developing gRSShopper, a personal learning environment, offering a course on new e-learning technologies, and supporting research and development in the use of distributed ledger technology in learning applications. He is a popular keynote speaker and has spoken in three-dozen countries on six continents.

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# 开放教育资源的未来形态

□ [加]史蒂芬·道恩斯　肖俊洪　译

【摘 要】

传统上，开放教育资源被定义为存在于公共领域或者根据开放许可协议发布允许他人不受限制或者受到有限限制免费获取、使用、改编和再分配的教育内容。然而，教育内容的性质随着新技术的出现而发生变化，开放教育资源的性质也随之发生变化。本文讨论四种主要技术对我们理解开放教育资源的影响，即云基础设施、开放数据、人工智能和内容寻址。文章认为，这些技术催生了一种动态和自适应的资源模式，这种资源按需创建，并根据不断变化的要求和数据源而变化。资源的创建过程是分布式、基于社区的过程，支持旨在提升学生体验而非内容传输的教学法。因此，内容出版和授权许可的重要性将受到削弱，而其获取和互用性则会成为关注热点。

【关键词】开放教育资源；授权许可；云技术；人工智能；去中心化网络；内容寻址的教育资源 导读：2019 年 3 月 5 日史蒂芬·道恩斯 (Stephen Downes) 在知识共享组织 (Creative Commons) 举办的“开放教育周：知识共享组织环球网络 24小时马拉松式网上会议” (Open Education Week: 24-Hour Global CC Network Web-a thon) 上有一个 20 分钟发言。他在发言中简要阐述对新技术背景下开放教育资源 (OER) 的新认识，诚如在最后互动环节中一位与会者所言，道恩斯提出的观点具有前瞻性。道恩斯在回应这位同行时也再次明确指出，他所谈的开放教育资源未来形态可能需要再过 10 年或 20 年才能实现。其实，这正是道恩斯的风格，这几年他在本 刊“国际论坛”发表的系列文章中所提出的种种“构想”无不具有“原型” (prototype) 性质，需要假以时日方能得到验证。然而，这些“原型”的构想在现阶段却总能 给我们诸多有益启发。

我加入远程开放教育这一行已经卅载有余，虽然也可以称得上是这个领域的研究者，但实践者的情结更浓。因为一直都在最基层从事远程开放教育教学工作，对于远程开放教育的 rhetoric (言辞) 与 reality (现实) 的差距感受更深，一直不能释怀。开放教育资源 (包括以各种不同名称称呼而实际上又都可以归入这一类的资源) 便是长期困扰我的问题之一，因为其所倡导的理念令人向往，可是这么多年过去了，虽然各方投入巨大，但是仍然“壮志未 酬”。“国际论坛”对这个问题也一直保持持续关注，先后发表了多篇相关文章。①②③道恩斯这个发言令我耳目一新，于是我建议他以这个发言为提纲，对相关论点展开深入讨论，给“国际论坛”写一篇文章。

道恩斯花了一个多月的时间三易其稿，定稿之际，他说他相信英语世界的读者同样会对他的这些观点感兴趣，并在获得我方同意后把英文稿送给一家英文期刊。几乎是同一天 (时差的缘故)，我就收到他和《国际开放教育资源期刊》(International Journal of Open Educational Resources) 主编梅丽莎·莱恩 (Melissa Layne) 博士之间的电子邮件往来。莱恩博士非常欣赏这篇文章，表示正好可以安排在春/夏这一期刊出，并提出希望能连同中译文一起发表。

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① 保罗·川内. (2013). 开放教育资源质量保证准则——TIPS 框架[J]. 中国远程育 (10): 11-21, 46, 95.
② 保罗·川内. (2014). 开放教育资源 TIPS质量保证框架的验证研究 [J].中国远程教育 (11): 15-19, 95.
③ . 托马斯·里克特，帕特里克·威斯(2014). 论开放教育资源之适宜性质量观 [J].中国远程教育(11): 5-14, 32, 95.

本文“引言”简要介绍开放教育资源的演变和发展历程。开放教育资源运动在经历初期的“蜜月”之后，人们开始越来越关注其可持续发展的问题。一方面，教育资源的开发成本高昂，而政府、机构和基金会不可能长期无偿提供所需资金；另一方面，开放教育资源的理念是“学生无须支付使用费”，因此，如何确保开放教育资源的可持续发展成为学界关注的热点，包括捆绑模式、附件模式和转换模式应运而生。此外，新技术的出现也促使（开放）教育资源的性质发生变化，尤其是始于2008年的cMOOC。一言以蔽之，“出版商根据开放许可协议开发和发行静态教育资源的模式即将终结”，而新技术在促使开放教育资源形态发生变化方面扮演重要角色。文章接着介绍四种对开放教育资源形态有重要影响的新技术：云技术、开放数据、人工智能和内容寻址（content-based addressing）。

云技术模糊了作者与出版商和消费者（读者）之间的传统分界线，消费者（读者）同样能够参与内容建设。另一方面，在云环境下，我们除了能创建和阅读文档外，还能开发和运行完整的应用程序。“这意味着未来我们与之打交道的开放教育资源不仅仅是文档或教科书，而且还会包括实际应用的程序，甚至是功能齐备的计算机，人们可以在这些计算机上工作，进行操作，用它们制作视频或音频或开发自己的新应用程序，创建自己的内容并在云端进行分享。”文章以GitHub为例进行说明。

开放数据也开始被视为“一种新型开放学习资源”，这在一定程度上得益于云托管。当然，这些数据“不是按照特定教育目标进行组织”，因此不能直接用作学习资源，但可以通过API获取并融合到学习资源中。此时的开放教育资源不再是静态的，而是具有交互性，是“Headless网站”或“解耦内容管理系统”的一个部分。文章以加拿大政府开放数据入口、“API商店”、Jupyter Notebook和Jupyter Graffiti为例说明开放数据的教育用途。

文章指出很多人工智能项目的服务“可以被用作开发课程和学习模块或开展交互式教学的基本资源（素材）”提高教师自己创建学习资源的能力，摆脱对出版商的依赖。文章还简要介绍Cognii、Magpi¥5GON等平台，说明“未来人工智能将在支持交互性和基于社区的开放教育资源创建方面有更大用途”。

与内容寻址的教育资源（Content Addressable Resources for Education，简称CARE）相关的技术是分布式账本技术。文章以星际文件系统（Interplanetary File System，简称IPFS）为例说明内容寻址的原理以及对于开放教育资源的重要性。

文章第三节从四个方面阐述这些新技术对建设开放教育资源的影响。首先是“开放教育资源的创建和使用将融为一体”，资源不再是静态的，信息也不再是单向流动，而更像是工具，“学生可以使用这些工具创建自己的学习内容”，既满足自己的学习需要也能服务于其他用途，“犹如借了一件工具，然后用这件工具完成其他工作一样”。其次是版权许可对于未来的开放教育资源而言不再是一个主要问题。这主要是因为大多数资源的创建和使用将是按需一次性进行，而且能利用实时数据，使用的也并非是受到专利保护的那些工具。另一个原因是学习资源的静态成分（内容）分布于去中心化网络，此类网络的内容贡献者实际上是默认开放许可的。第三是“把原来通过许可协议规定的访问条件嵌入资源本身”。这一点可以通过诸如加密、散列和区块链等技术实现。最后，开放教育资源形态的变化也会导致学习形式的变化；在未来，内容不是学习的重点，学习强调的是“资源的使用或应

用”，做中学，而且学生的学习“内容”（即工具和算法）与职场人士所使用的东西是相同的。

那么，面对这些挑战，教育工作者应该如何应对呢？文章在第四节提出三种对策，包括改变思维定式（学会用数据和网络而非文档思考问题，摒弃静态、一成不变的学习资源观）、用心学习如 何用新的方式思维（这是一条陡峭学习曲线）和学会合作共建（文章专门解释协作与合作的不同，合作共建既包括共同开发和分享资源也指“开放式工作”）。

由此可见，本文提出的开放教育资源观与人们 此前对开放教育资源的认识有很大不同，一些观点在某种程 度上讲甚至是颠覆性的。虽然文中所述的一些“构想”已经开始付诸实践，但是，要真正形成比较稳定成熟的 “模式”，诚如道恩斯所言，牵涉多方因素，并非短期内能够实现。毫无疑问，本文有助于我们更好认识新技术环境下（开放）教育资源的新形态，除此之外，对于我们在其他教育教学活动中应该如何大胆创新发挥新兴技 术的教育能供性也富有启发意义——这一点在当下显得更为重要，因为以xMOOC为主流代表的在线学习正在席卷全球高等院校，形成颇为壮观的“千人一面”景象，以至于有学者认为从教学法的角度讲这是一种退步。①② 衷心感谢老朋友道恩斯对本刊一如既往的诚挚支持！（肖俊洪）

## 一、引言

在线和远程教育从一开始就有赖于学习资源的设 计和传送。由于没有传统的教师或教授面对面教学，开发被称为“课程包”（course packages）的资源必不可少，包括阅读材料、小测验和练习，以及帮助学生在非课堂环境下管理好自己学习的指导。

传统上，这些课程包的所有权归开课的教育机构所有；每一个机构都会建设自己的课程包。此外，出版商也会建设可供远程教育和传统课堂教学共同使用的资源。然而，随着时间的推移，人们希望能利用新的因特网技术，能够把资源集中起来，教师和教育机构则能够分摊学习资源的费用也能够共享这些资源。这种做法被广为接受，最终出现了诸如麻省理工学院 OpenCourseWare 这一类引起广泛关注的运动。

与此同时，计算机技术领域也有类似的愿望，因此开发了一种用于分享的计算机程序。起初这些程序作为“共享软件”（shareware）发布，供免费使用，但不能用于销售目的。诸如 GNU/Linux 这样的操作系统也作为“免费软件”发布，但是这种软件的使用和重新发行权受到理查德 斯托尔曼 （Richard Stallman）称为“四种自由”的限制，即运行这种程序的自由、阅读其源代码的自由、修改程序的自由和以相同的许可协议重新发行程序的自由。

这些理念集中体现在开放教育资源 (open educational resources)上。换言之，教育内容可以如同免费软件一样根据开放内容许可协议授权成为“免费”内容。几乎与此同时，知识共享有限限制免费获取。使用、改编和再分配的教学、学习和研究资源”（UNESCO, 2002）。

在开放教育资源这个概念进一步发展的同时，人们也开始关注这种资源的可持续性问题。课程包的制作可能费用高昂，而开放教育资源的倡导者则希望学生无须支付使用费。最初的开放教育资源项目由政府、机构和基金会提供建设资金，但是人们普遍希望这些项目随着时间推移能够实现“自给自足”。于是，开放教育资源的发展开始把重点放在商业上是否可行上，开放教育资源的发行模式包括：①捆绑 （bundling）模式 （把开放教育资源与商业产品搭配 在一起出售，换言之，开放教育资源的获取取决于是否购买了属于商业性的那部分内容）；②附件（enclosure）模式（必须支付学费或订阅费才能获取开放教育资源。比如，一门在线课程可能把《汤姆索亚历险记》作为课程资源的一部分，但是这本书被存放在一个非对外开放的学习管理系统上，学生必须支付这门课程的学费方能进入这个学习管理系统，阅读这本书）；此外，数字资源乃至在线学习的性质也开始发生变化。

① 安东尼·威廉·贝茨. (2016). 自动化还是赋权 · 在线学习路在何方？[J]. 中国远程教育 (4): 5-11, 79.
② 乔恩 · 巴格利 . (2017). 教育症结何在？ [J]. 中国远程教育 (4): 5-14, 79.

早期的网站主要包括网页和文档，但是后来的网站（即常被称为“Web 2.0”）则强调社会交互和用户生成的内容。这个变化也影响到在线学习，其重点也从强调课程包变成突出在线交互。始于2008年的慕课带来了一种模式，即学生创建和发布自己的教育资源，参与学习网络的活动。

如今，出版商根据开放许可协议开发和发行静态教育资源的模式即将终结。今天的“网页”实际上是一个动态资源，连接着云服务所产生的实时数据。因此，“网页”的内容可能每分钟都在发生变化，而这些变化则常常是人们使用网页这些活动所致的结果。开放教育资源的“设计”或“内容”实际上可能体现为网页设计或者网页所支持的教学活动，而不是用户创建和传输的那些内容。开放教育资源的概念不断变化。

本文拟重点阐述这些技术上的变化正在如何影响开放教育资源的性质。文章将分析四种主要技术对开放教育资源的影响，即云技术、开放数据、人工智能和内容寻址(content-based addressing)。的确，讨论教育资源并不一定非得从技术开始，但是对于本文而言，了解技术非常重要，因为这些技术的一些能供性可能在未来10~20年内改变开放教育资源的形态。本文也会讨论教学法上的问题，分析这些变化的影响，讨论教育工作者将应该如何回应这些影响。

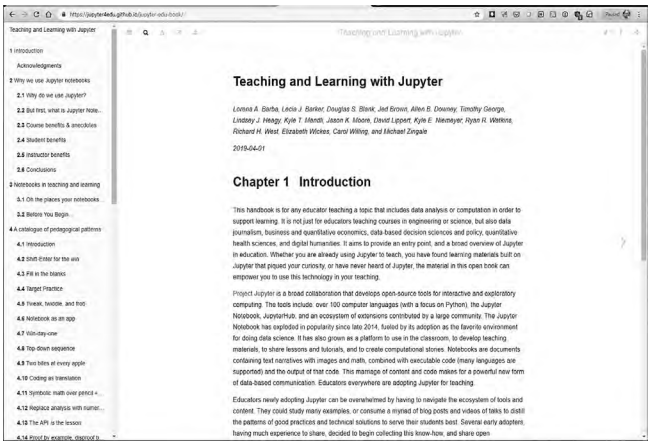


图 1 GitHub

## 二、新的开放教育资源技术

### （一）云技术

我们所说的“云”托管，指的是计算机上内容的储存和访问通过因特网进行。这些计算机的重要之处不仅体现在其由因特网服务提供商进行保管和管理，而且也在于资源不是存放在某一台计算机上，而是可以同时存放在多台计算机上。

访问存放在云端上的内容要求连接因特网。诚然，很多人，特别是在全球南方，尚不能方便地访问云资源，但是，随着时间的推移，访问这些资源的条件将越来越得到改善，因此我们将会利用云环境和云技术进行开放教育资源的开发和应用。这就意味着会出现这种转移，即从由内容提供商或出版商建设资源变成协作或合作创建资源。

比如，图1展示的是一篇基于Web的开放教育资源文章。从屏幕上看，这似乎是一个普通网站，但是这个网站实际上是托管在GitHub上（https: //github. com/）。GitHub的重要之处在于它不只是一个网站，而且还是多人共同做出贡献的一个网站。GitHub允许人们复制或“克隆”某个网站。

他们也能对文档进行编辑以创建新版本，即原文章的“分叉”（fork）。GitHub原本是设计用于基于云技术 协作开发软件的目的，但是这种网站证明也可以用于创建任何类型的内容。

这促使开放出版以及开放教育资源出版的变革动力发生变化，因为存在于传统环境中的作者与出版商和消费者之间的分界线不复存在了。消费者同样参与到内容创建之中。

我们除了能在云环境下创建和阅读文档外，还能在这些远程计算机上开发和运行完整的应用程序。这些应用程序被放在虚拟机器（“容器”[containers]）里面，我们可以通过 Web 浏览器运行它们或与它们互动，也可以如同云端文档的内容一样把这些应用程序下载到我们自己的计算机上，在自己的计算机上运行。Vagrant、Docker 和 Kubernetes 这些服务使这一切在今天成为可能。

这意味着未来我们与之打交道的开放教育资源不仅仅是文档或教科书，而且还会包括实际应用的程序，甚至是功能齐备的计算机，人们可以在这些计算机上工作，进行操作，用它们制作视频或音频或开发自己的新应用程序，创建自己的内容并在云端进行分享。

（二）开放数据

除了云托管以外，一定程度上也是因为能云 托管，人们开始把开放数据（open data）看作是一种新型开放学习资源进行考虑。“开放数据是一个统称，指符合开放许可协议、互用性（interoperable）和重新使用的数据集，这些数据集是为公众创建、供公众 使用的”（Atenas & Havemann, 2015）。

比如，图2 是加拿大政府开放数据入口（https: //open.canada.ca/en/open-data）。在这里，读者可以按主题浏览。比如，在“法律”这一项，人们能够了解到罚款的法规、统计数字以及成 员机构希望人们参与的问卷调查等。这是开放政府的一部分，但也是可以用作教育资源的一整套 资源。

当然，作为数据，它们不能真的被直接用作学习资源。这是因为它们不是按照特定教育目标进行组织的。然而，开放数据一旦可以通过API(应用程序编程接口) 获取，便可以被融合到学习资源中。加拿大政府建了一个新的“API商店”（https://api.canada.ca/en/homepage），里面托管和发布各种API，这些API允许开发者访问和利用政府数据集和服务并把它们融合到应用程序或其他服务中。

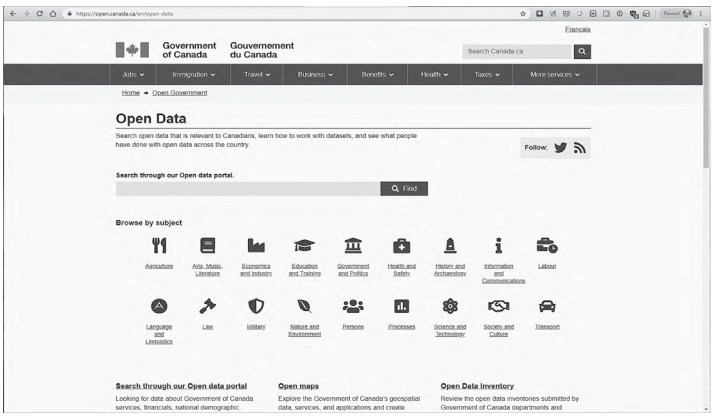


图 2 加拿大政府

Jupyter Notebook （https: //jupyter.org/ ） 便是一个这样的例子。Jupyter Notebook是在线、基于文本的笔记本，含有计算机程序，用户可以使用Jupyter Notebook在自己的计算机上运行该Jupyter Notebook所包含的程序。用户还可以在Jupyter Notebook上修改一个程序，然后重新运行，产生一个新结果。用户可以下载一个 Jupyter Notebook 应用程序并在桌面运行，也可以访问 Binder （https: //mybinder.org/）服务，通过Web浏览器阅读和使用一个Notebook。

此外，因为 Jupyter Notebook 运行的是真实的计算机程序，它能够在运行的时候获取实时数据。比如，为了分析加拿大东部住房情况，它可以包含一个能以曲线图或图解形式展示住房数据的程序。每一次运行这个程序的时候，它便重新通过 API获取数据，因此，用户得到的是最新的信息 （Hirst, 2018）。

这方面的潜力非常之大。比如，诺顿（Naughton, 2019） 在其博文中介绍了如何“无须动一根吸管或与人交谈便能”使学生掌握“从什么是蛋白质到细菌细胞中蛋白质的表达的全部知识。”这篇博文还包含嵌入式计算机代码，与一个“云实验室”互通以实际操作相关仪器，制作蛋白质样本。

此外，还有一款叫作 Jupyter Graffiti 的程序，允许教师以动画形式呈现 Jupyter Notebook 内 容，即如同播放视频一样展示一个程序的操作。“Jupyter Graffiti 是存放在你的 Notebook 里面预 先录制、交互式的演示……因为 Graffiti 的‘视频’是教师讲解演示的实况重播，你可以随时暂停；暂停播放时，你可以亲自在Notebook上学着老师做（执行、复制、修改、再次执行）；你准备好之后可以继续播放。” 由此可见，Graffiti 融合了教师的角色 （示范和演示）和学习者的角色（实践和反思）。

此时的文档已经不再仅仅是一份文档，而是一个计算机程序，我们可以对它进行修改然后再次运行，因此，学生在学习学科知识的同时，也学到计算机编程知识。这些计算机程序可以输入上文提到的开放数据 （比如加拿大政府网站的数据），因此，不管 是通过自己的浏览器，还是在自己的计算机桌面上，我们 都 能 用 Jupyter Notebook处理开放数据。

这一切改变了教育资源观，即教育资源从静态的东西变成交互式的东西，既可用于学习，也可用于创建其他资源。一件教育资源不是静态网站服务器所提供的单独一个资源，而是环境的一部分，这个环境有时被称为“Headless 网 站”或“解耦内容管理系统” （Koenig, 2018）。数据库、网 页和编程环境各处一方, 可以 是在云端或一个局域网，用户可以随心所欲在因特网和云端之间变换。

三）人工智能

开放人工智能和开放人工智能算法现在越来越 寻常，已经开始被应用于在线学习。比 如,提供了“促进人工智能研究的开放源码软件工具，发表博文交流研究成果。” 相 关 项 目 包 括 OpenAI Gym （https: //gym.openai. com/docs/） 以及 Google 和 Microsoft 等 公司开展的各种云人工智能项目。此外，OpenAI项目 （https: //openai.com/ 通过 Jupyter Notebook 也能够获取很多资源帮助人们学习人工智能知识。

从开放教育的角度讲，这些项目所提供的服务可以被用作开发课程和学习模块或开展交互式教学的基本资源（素材）。比如，图3显示将一个图像的 URL 加载，连 接 上 Microsoft 提 供 的在 线人工智能入口，这是Microsoft的Azure云服务的一部分，使用的是 Azure 账户生成的API key。

Azure 人工智能服务自动生成图像的描述文字，即Alt 标签，这样就可以访问这个图像了。无法看到这个图像的人可以通过屏幕阅读器阅读 Alt 标签，此时，图像识别技术自动创建相应文字说明：“一道大瀑布从悬崖峭壁飞流直下”，同时还显示这个图像更完整的一套分析数据。

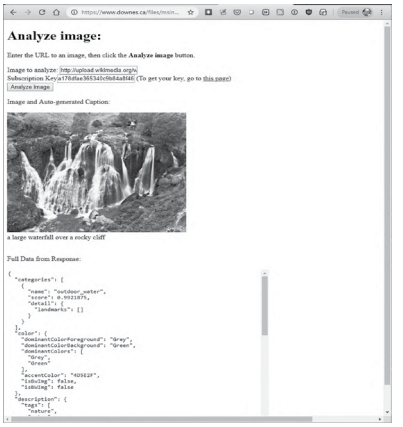


图 3 用 Azure基于人工智能给图像添加文字说明

(https: //www.downes.ca/files/msindex.html)

这个例子可能显得微不足道，然而它却能满足开放教育资源创建和使用过程的一个需要，即减少人工创建图像元数据的必要性，因此使图像更容易被发现，更容易被用于创建开放、访问便捷的资源。人工智能的广泛应用不但使教师和开发者而且使所有人都能掌握这些能力，极大提高人们不依靠出版商自己创建学习资源的能力。

人工智能在教育领域有广泛用途。最近一项调查（HolonIQ, 2019）预计，可以应用于教育的人工智能技术不但包括人工视觉和图像识别技术，而且还包括语音和语言处理、算法和硬件等。人工智能将可用于学习过程，提供学生支持服务、考核和反馈，管理业务过程，帮助识别身份和确保安全。重要的不仅仅是有了人工智能，而且是对于所有人而言人工智能作为一种服务的唾手可得。

比如，一些记者仅花60美元便建成一台人脸识别机器（Chinoy, 2019），这台机器采集了通过公共网络摄像机拍摄到的人们在大街上行走的图像，把这些行人的脸谱与附近企业网站上显示的员工图像进行比较。这种人脸识别软件是一种服务（杰弗里罗克韦尔[Geoffrey Rockwell]在 theoreti.ca 网站上说这可能是 Amazon Rekognition）。几乎任何人都能完成这种事情。

今天我们在讨论人工智能的教育用途时，大多集中在学习分析技术和自动课程生成这些方面，但是我们有理由认为，未来人工智能将在支持交互性和基于社区的开放教育资源创建方面有更大用途。比如，Cognii（http: //www.cognii.com/）“使得更深度的个性化学习、智能辅导、对回答开放型问题的评价以及富有教学意义的学习分析成为可能”；Magpie（https: //learn.filtered.com/magpie）“以设置挑战的形式提供学习机会”，比如测试或小测验；X5GON（https: //www.x5gon.org/）则“实现开放教育资源课程制作的完全自动化”。人工智能技术将使人们能与远程服务交互，帮助他们制作用于教学、艺术或商业目的的新多媒体工件，人工智能可以帮助他们通过创建 Alt 标签、评论文本或生成文本等制作资源（deWaard, 2019）。

（四）内容寻址

要介绍内容寻址的教育资源（Content Addressable Resources for Education，简称 CARE）这个概念，我们必须更加深入分析前文讨论的一些技术。这些技术有时被归在“区块链”（blockchain）名下。但是，“区块链”并不是一个好术语，因为它把重点转移到加密货币和金融网络上。“分布式账本技术”（distributed ledger technology）这个术语的所指更 加广泛，更适合用于指储存和访问分布式和去中心化网络数字资源的方法。

星际文件系统（Interplanetary File System，简称IPFS）（https: //ipfs.io/）便是这样的一个例子。IPFS的理念是：通过URL访问在线资源是Web浏览器的原 理，但是我们不采用这种方法，而是采用“内容寻址”这种方法根据内容访问资源（Benet, 2014）。今天网站上的 URL 指的是网络资源的位置，换言之，某一个网站服务器的因特网地址。因此，访问Uber.com时，实际上是使用某一个服务器提供的某一项服务。

这种系统已经在很大程度上被修改了，以解决其自身的缺陷。一个服务器可能被放在很远的地方，它可能会出现单点故障（single point of failure）。所以负载均衡系统和内容分布网络把一个 URL 当成一个虚拟地址，把请求重定向到内容的实际位置。虽然有了这些改进，基于位置的访问协议仍然受制于单点故障，因此，如果这个资源不在这个位置，我们便无法找到它，除非通过间接方法（比如Web搜索），而如果这个地址是“伪造的”（spoofed），我们下载的 东西可能不是我们所需要的。

用户使用基于内容的寻址，本质上讲是在询问谁有某项内容。这项内容可能存在于网络的任何地方，估计可能存在于网络的多个地方。以比特币之类的区块链技术为例，网络的每一个节点都储存有所请求的内容，所以最接近的节点会回应这个请求。而IPFS的情况则是节点的子集会储存内容，因此，这个请求可能会从一个节点传到另一个节点，直至找到所请求的内容。至于GitHub，用户个人可以把内容子集复制储 存在本地盘，并使用内容寻址控制和更新内容版本。

为了使内容更加容易被发现，基于内容的网络生成内容“散列”（hash），不用依靠整个内容。这是内容的加密版本，即用加密算法运算的结果。因此，每一个资源都有一个独一无二的散列值，这个散列值仅对应这个资源。资源搜索是建立在散列值的基础上，拥有符合这个散列值的资源的人都能够把这个资源发送给请求者（见图4）。出于安全考
虑，资源接收者可以用散列算法验证所收到的资源的真实性，即检验他们接收到的散列值是否与他们发送出去的散列值一致。如果两者一致，他们收到的资源就是他们所请求的。

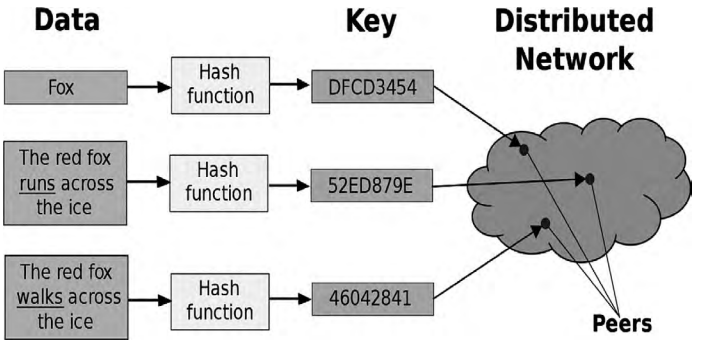


图 4 分布式散列表

内容寻址非常重要，因为一个资源在因特网上能有多个备份。一旦一个资源以这种方式创建和发表，该资源便具有永久开放性。这是因为因特网上有这个资源的多个备份。这样一来，许可协议之类的东西就变得越来越不重要。

## 三、对开放教育资源建设的影响

首先，开放教育资源的创建和使用将融为一体。传统上出版教育资源，作者要先建设一个资源，然后才供读者使用。资源的目的是把信息从作者传送给读者。即使诸如维基等内容创建的集体模式，其目的也是如此。维基的读者希望从众多作者创建的内容中学到知识。虽然这种资源可能不时发生变化，但总体上是静态的，信息单向流动，从制作者流向消费者。

然而，新的开放教育资源模式将更像是工具，学生可以使用这些工具创建自己的学习内容，供自己消费或用于其他目的。比如，Jupyter Notebook 的教育用途不是向读者提供一堆内容，而是允许读者选择自己的开放数据源，用所提供的算法运算这些数据，然后把所得到的结果用于自己的目的。

以知识共享方式制订开放教育资源策略便是一个典型例子。这是一项众人一直在共同参与的事情，通过GitHub网站分享。具体说来，开放教育资源策略的制订是一个持续的过程，这个过程无须最终汇集成某一个结果。人们将根据不同目的和环境制订不同的开放教育资源策略。因此，这个过程不是（也不应该是）集体撰写一个开放教育资源策略文本，而是大家在一个共同环境下各自按需制订相关文本。在GitHub这样的环境下，人人都能够获取这样的一份文件，对其进行复制并存放在自己的计算机上。他们能够对复制下来的文件进行修改，然后把这些修改反馈给原作者，是否接受这些修改由后者决定。用户还可以以他人已经创建的内容为出发点，创建新的内容，或者把它跟来自其他地方的内容结合在一起，创建独具一格的内容。

从教学的角度讲，促使学习发生的不是消费内容，而是使用内容。比如，人们在 GitHub上复制他人的程序，并通过操纵这些程序学习编写计算机程序。这犹如借了一件工具，然后用这件工具完成其他工作一样。

第二，版权许可问题退居幕后。这应该被当成是一个受欢迎的发展。世界各地司法辖区涉及内容许可和版权的法律法规各异，甚至对于具有共性的许可标准（比如知识共享协议）的解读都经常不清晰，需要通过诉讼才能解决 （Harris, 2018, p. xi）。内容许可如此复杂，这促使知识共享组织专门开设了一门证书课程（Creative Commons, 2019）。

版权许可的问题退居幕后，原因之一是大多数资源的创建和使用是一次性的。资源利用实时数据，可以根据内容消费者的需要“本土化”或修改。创建 资源的工具则是根据开放获取算法和工具的一种共同 “模式语言”（pattern language）修改而成的。对于 诸如数据驱动的在线资源这些一次性环境，受到专利保护的工具没有作用。另一个原因是学习资源的静态成分分布于去中心化网络中。这些网络的性质决定其各个节点都参与内容分布，因此向网络贡献内容实际上便是认可这些内容被重新制作。内容的访问限制不是通过许可体现，而是通过诸如身份验证方式限制访问整个网络。

第三，把原来通过许可协议规定的访问条件嵌入资源本身。诸如加密、散列和区块链这些技术能够创建任何资源的所有权和来源的记录，访问资源的条件可以通过设置访问控制间接嵌入这些记录中，也可以直接以智能合同 （smart contract） 形式体现 （Bod ó , Gervais, & Quintais, 2018）。

最后，随着下一代开放教育资源的出现，学习的形式也会发生变化。开发者现在能够将实时数据应用于现实世界用途或者将局部的或下载的数据用于培训或模拟练习上。这样一来，学习的重心从内容（每天都会变化）转移到资源的使用或应用上。比如，如果 包含一条平均算法的 Jupyter Notebook 是学习资源，那么“学习”并不是说要记住这条算法，而是如何使用和修改它，以适应新情况。

**因为学生是在实践和使用中学习，课堂上或学习环境中的学习“内容”（即工具和算法）与实际工作环境所使用的“内容”是相同的。比如，建筑学专业的学生所使用的 CAD 软件与专业建筑师所使用的CAD 是一样的，其数据则是来自开放性建筑制图数据网络（OPSHub, 2018）。**

## 四、我们如何应对？

为了应对上述挑战，我们需要什么？我们需要知道什么？我们需要掌握什么？

首先，可能也是最重要的，我们要改变自己的思维定式。我们必须改变我们的认识，尤其是要开始围绕数据和网络思考问题，而不是围绕文档思考问题；我们不是在出版课程包、章节和模块——要摒弃这种 想法。现有的学习和出版制度是围绕静态和一成不变的资源设计的，然而，未来的资源必须是按需创建，使用实时数据，解决当下问题。因此，教学设计的重点从以基于内容的学习目标为基础转向基于（可能不容易清晰界定的）能力和技能为基础。这些能力和技能本身将会是不断变化的，以适应当下环境的需要，学习在这些环境下工作更像是为了达成熟练的目标而非背诵某些句子结构或甚至是词汇。因此，教学设计者应该围绕环境和体验思考问题。这些环境必须适合相关目的，换言之，不管是为了设计一栋楼房还是为船只引航，它们都必须能产生真实结果。设计者还必须重视学习者在这些环境中的体验。由此可见，教学设计不再是关乎资源的内容，因为这些内容来自开放数据，而这种数据可能是系统范围内的任何东西。

第二，教师和教学设计者需要经过一段时间才能学会用新的方式思考问题。比如，学习使用 GitHub的过程必定是一条陡峭学习曲线 （GitLab, 2017）。把资源（不管是软件、内容还是其他媒体）看作是动态的，可以分岔扩张，组合式的和具有互用性——这需要转变看问题的角度。教师和教学设计者需要有用户友好的界面（诸如基于下一代交互式云技术的内容管理系统），这有助于他们改变看问题的视角。在早期网页时代，开放教育资源的创建并非易事，这种情况直到博客、脸书和推特等的出现以及莱斯大学 （Rice University） Connexions 这一类出版服务的出 现才得以改观。这也是下一代交互式云技术所必备的功能。同样的，教学的重点从内容转变为交互和操作。换言之，如何把数据与某一项应用或某一种能力或人工智能融合在一起，创建一种学习体验。由此可见，这与教师和教学设计者可能早已熟悉的教学和教学设计思维方式有很大不同。教育工作者必须练习新的学习设计系统、使用新的学习设计系统，方能实现思维方式的转变。

第三，设计者和开发者必须学会合作共建。这不同于协作。协作是指团队不分大小为了完成一个共同产品或达成一个共同结果而努力；合作则指多个个人或团队在共同的环境或体系下为了各自利益而帮助支持某个网络或体系，但他们要达成的目标或结果并不相同。合作共建的一部分工作是共同开发和分享资源，另一部分工作则是指能够在开放环境下工作，有时被称为“开放式工 作”（open working）。“开放 科学”（open science） 的工作原理便是这样一个例子。

“人们认为开放方法能带来好处，而其中很多好处都跟这些方法多大程度上不但能提高获取机会，而且能促使新来者和局外人积极参与到研究社区中有关，以及能在多大程度上维持较低的参与门 （White & Pryor, 2011）。实习、合作教育学生实习（co-op student placement）、当学徒和体育发展联盟等都体现与此相同的原则。

## 五、结束语

今天，学生面临着复杂且快速变化的工作和学习环境的挑战。这些挑战和新技术带来的能供性正在推动着新一代学习资源的出现。新一代学习资源将是动态和自适应的，将是由人工智能辅助的设计系统按需创建的，将会根据不断变化的要求进行调整以及利用实时变化的数据源。这种资源将不是通过传输内容达成教学目的，而是要求学生与数据和算法交互，对资源进行修改，提出应对现实世界挑战的方案。学生在学习过程中使用的工具与实际工作中人们所使用的工具是一样的，他们跟专家一样适应工具的变化，在一个合作开放的工作环境中和专家一起、在专家身边工作。

在这种情况下，我们对开放教育资源这个概念的理解也发生了变化，从把开放教育资源的定义建立在教科书和图书馆这些概念和比喻的基础上转而从数据处理网络、云服务和应用、基于去中心化加密账本技术以及人工智能辅助的设计和信息处理等概念的角度认识开放教育资源。开放教育资源将不再是通过传输内容促进学习，而是成为分布式合作网络的组成部分，在这些网络环境下创建和使用开放教育资源，支持学生熟练应对新挑战、使用新技术的学习过程，以此促使学习的发生。

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# Student Learning Outcomes with Wikipedia-Based Assignments

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Abstract

A goal of higher education is to ensure that students learn information that enriches both their lives and their careers. Instructors constantly seek out new tools to help students engage and thrive in a shifting marketplace of ideas, technologies, and career paths. Students must master new skills to prepare for the world beyond the classroom and improve their careers, lives, and future scholarship. Among the most cited skills deemed valuable are digital/information literacy, critical research, teamwork, and technology skills.

In Fall 2016, over 6,000 students used a Wikipedia-based assignment in lieu of a traditional paper assignment. We conducted a mixed-methods research study using surveys and focus groups to study attitudes, context, and skills transfer. Surveys employed a variety of quantitative and qualitative questions administered online. Thirteen focus groups were also conducted. A total of 1,627 students and 97 instructors completed the surveys.

Preliminary statistical analysis suggests that both students and instructors valued Wikipedia assignments more for learning digital literacy, critical thinking, learning to write for the general public,

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and learning about the reliability of online sources. Students reported that they were proud of their work, spent more time, and were more satisfied with their class assignment than with traditional coursework.

Qualitative findings suggest overwhelmingly that respondents' perceptions of Wikipedia positively change after having edited Wikipedia. While many students expressed having perceived the space as unreliable prior to editing Wikipedia, their perception shifted through completing the Wikipedia assignment to show more trust in Wikipedia as a reliable information source.

Triangulating focus group responses and quantitative survey responses showed that overall students perceived the assignment as useful for developing researching, writing, and information literacy skills, in addition to demonstrating mastery in these skills. Students found their assignments valuable because their work was useful for a public audience as it contributed to conversations outside of the classroom. Responses suggest that students directly engaged concepts outlined in the Association of College and Research Library's (ACRL) Framework for Information Literacy in Higher Education, particularly when engaging understandings of systemic biases, construction of information, and value of information.

This research suggests that in addition to their value in learning digital/information literacy, critical research, teamwork, and technology skills, Wikipedia-based assignments also help increase students' motivation to complete work over traditional writing assignments.

***Keywords:*** student learning outcomes, Wikipedia-based assignments, mixed methods, digital information literacy, critical research, teamwork, technology skills

# 完成维基百科作业的学生学习成果

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## 摘要

高等教育的一个目标是确保学生学习的知识能够丰富他们的生活，助力他们的事业。教师不断寻求新的教学工具来帮助学生在思想不断活跃、技术不断革新和职业道路曲折的市场中踊跃参与并茁壮成长。学生必须为走出校园做好准备，掌握新的技能从而改善他们的事业和生活，以及未来更好地开展学习研究。数字或信息素养、批判性研究、团队合作和技术技能被认为是其中几个最有价值的技能。

2016年秋季，6,000多名学生完成编辑维基百科网站的互联网作业，以代替传统的写作作业。笔者通过结合调查和焦点小组访谈这两种研究方法，分析了学生的学习态度、学习背景和技能转移。该调查涵盖了一系列在线进行的定量和定性问题。笔者还建立了13个焦点小组，共有1,627名学生和97名教师完成了这项调查。

初步统计分析表明，学生和教师都更重视维基百科作业。这有助于他们提高数字素养、培养批判性思维、学习公众写作，以及了解网上来源的可靠性。据学生反映，比起传统的课程作业，他们为自己的成果感到自豪，花费更多的时间完成作业，对布置的课堂作业更为满意。

定性调查结果显示，绝大多数受访者在编辑维基百科后，对维基百科的看法发生了积极的变化。虽然许多学生在编辑维基百科之前认为这个网站不可靠，但在完成维基百科作业后，他们的观念发生了转变，更加信任维基百科是一个可靠的信息来源。

三角式焦点小组反映和定量调查结果表明，学生们总体上认为这项作业除了展示对研究、写作和信息素养技能的掌握之外，对开发这些技能也很有帮助。学生们发现他们的作业很有价值，因为这些作业通过促进课堂外的沟通能让公众受益。这些反映表明，学生直接参与了大学与研究型图书馆协会(ACRL)高等教育信息素养框架中提出的概念，尤其是参与理解了系统偏差、信息构建和信息价值。

这项研究表明，编辑维基百科的互联网作业除了在帮助培养学习数字或信息素养、批判性研究、团队协作和技术技能方面具有价值外，也有助于激励学生完成传统写作作业。

关键词：学生学习成果，维基百科作业，结合方法，数字信息素养，批判性研究，团队合作，技术技能

## Resumen

Un objetivo de la educación superior es garantizar que los estudiantes aprendan información que enriquezca sus vidas y sus carreras. Los instructores buscan constantemente nuevas herramientas para ayudar a los estudiantes a participar y prosperar en un mercado cambiante de ideas, tecnologías y trayectorias profesionales. Los estudiantes deben dominar nuevas habilidades para prepararse para el mundo más allá del aula y mejorar sus carreras, vidas y escolaridad futura. Entre las habilidades más citadas que se consideran valiosas se encuentran la alfabetización digital o informática, la investigación crítica, el trabajo en equipo y las habilidades tecnológicas.

En el otoño de 2016, más de 6,000 estudiantes hicieron una tarea basada en Wikipedia en lugar de una tradicional. Llevamos a cabo un estudio de investigación de métodos mixtos mediante encuestas y grupos de enfoque para estudiar las actitudes, el contexto y la transferencia de habilidades. Las encuestas emplearon una variedad de preguntas cuantitativas y cualitativas administradas en línea. También se realizaron trece grupos focales. Un total de 1,627 estudiantes y 97 instructores completaron las encuestas.

El análisis estadístico preliminar sugiere que tanto los estudiantes como los instructores valoran las tareas de Wikipedia más que todo para aprender alfabetización digital, pensa-

miento crítico, aprender a escribir para el público en general y aprender sobre la confiabilidad de las fuentes en línea. Los estudiantes informaron que estaban orgullosos de su trabajo, pasaban más tiempo y estaban más satisfechos con su tarea de clase que con los cursos tradicionales.

Los hallazgos cualitativos sugieren abrumadoramente que las percepciones de los encuestados de Wikipedia cambian positivamente después de haber editado Wikipedia. Si bien muchos estudiantes expresaron haber percibido que el espacio no era confiable antes de editar Wikipedia, su percepción cambió a través de completar la tarea de Wikipedia y reportaron tener más confianza en Wikipedia como una fuente de información confiable.

Las respuestas de los grupos de enfoque de triangulación y las respuestas de la encuesta cuantitativa mostraron que los estudiantes en general percibían la tarea como útil para desarrollar habilidades de investigación, escritura y alfabetización informativa, además de demostrar dominio en estas habilidades. Los estudiantes consideraron que sus tareas eran valiosas porque su trabajo era útil para una audiencia pública, ya que contribuía a las conversaciones fuera del aula. Las respuestas sugieren que los estudiantes se comprometieron directamente con los conceptos descritos en el Marco de la Alfabetización de la Información en la Educación Superior de la Asociación de Universidades y Bibliotecas de Investigación (ACRL), en particular cuando se entienden los sesgos sistémicos, la construcción de información y el valor de la información.

Esta investigación sugiere que además de su valor en el aprendizaje de alfabetización digital/informática, investigación crítica, trabajo en equipo y habilidades tecnológicas, las tareas basadas en Wikipedia también ayudan a aumentar la motivación de los estudiantes para completar el trabajo sobre las tradicionales.

***Palabras Clave:*** Resultados de aprendizaje de los estudiantes, tareas basadas en Wikipedia, métodos mixtos, alfabetización en información digital, investigación crítica, trabajo en equipo, habilidades tecnológicas

## Background and History

Wikipedia started in 2001 as an online, open-license encyclopedia open for anyone over 5 million articles in the English Wikipedia. But, article quality varies widely. Because Wikipedia's authors are all volunteers, they naturally gravitate toward writing about what they're most interested in. And because the editors are 80%–90% men, articles on topics such as video gaming, military history, or sports are of high quality, while articles on more academic subjects like art, feminism, or public policy lag behind.

In 2010, a program launched to specifically tackle the content gaps in academic subject areas. In the program, college and university faculty assign students to edit Wikipedia articles related to course topics as a class assignment; the program staff provide Wikipedia training and expertise, so the faculty do not need to have any experience editing themselves. In the United States and Canada, the program is run by the Wiki Education Foundation (Wiki Ed), which in the Fall 2016 term supported more than 6,000 students in more than 270 courses as they contributed academic content to Wikipedia.

Previous research suggests that Wikipedia provides an opportunity for students to experience public writing, often results in increased student motivation and engagement, and is comparable or better for learning writing skills than a traditional research paper (Cummings, 2009; Roth, Davis, & Carver, 2013; Vetter, 2014). However, the majority of analysis on these assignments has been theoretical, or limited to small-scale studies. Despite the increasing popularity of the Wikipedia assignment, the evidence Wiki Education has gathered regarding Wikipedia as a teaching tool has been limited to anecdotal evidence. In Fall 2016, Dr. Zachary McDowell was invited to conduct research to understand how learning outcomes from Wikipedia assignments affect student learning outcomes such as digital literacy, peer review, and collaboration in comparison to outcomes achieved by more traditional research paper assignments.

This large-scale study examines student experiences with a Wikipedia-based assignment. The study draws participants from over 6,000 students enrolled in courses across the United States that used a Wiki Education-sponsored Wikipedia assignment in the Fall of 2016. The mixed-methods study (which combines literacy assessments, surveys, and focus groups) examined students' information literacy and research skills, their attitudes toward the assignment and toward Wikipedia, and their reflections on the experience. While this study yielded data that can be analyzed for a variety of research questions (only some of the preliminary findings are represented here), the data is of significant interest to those studying education, communication, online communities, and composition, because the questions utilized deal specifically with learning in a technologically mediated environment.

## How to Use This Article

This research report is intended to help contextualize the data, codebooks, and other documentation provided alongside this report, as well as to present preliminary findings and analysis to help inform future research. We hope to empower and encourage researchers to conduct their own analyses as well as future collaboration and discussion about student learning through Wikipedia-based assignments. All the data and tools from the research are released openly under a CC-BY-SA license.

## Methods Overview

We conducted a mixed-methods research study that assessed students' information literacy and research skills, alongside surveys of attitudes toward the assignment and toward Wikipedia, and reflections on their experience.

Student survey respondents were recruited via email and the Wiki Ed Dashboard course management software. Focus groups were recruited via email through the instructors participating in Fall 2016. We utilized a drawing for Amazon.com gift cards for incentivization. The focus groups were recruited by emailing instructors participating during the semester.

## Survey Design and Implementation

Each survey was designed in collaboration with a variety of instructors, researchers, and instructional designers (see Acknowledgments section). Surveys were designed to assess a variety of outcomes, skills, and attitudes. Although this research was designed with few overarching questions in mind, the overall intention was to create research data that would be beneficial to a variety of instructors and researchers.

Surveys were administered online, on the Wiki Ed Dashboard using a custom-built survey tool. There were three surveys that employed a variety of questions, mostly quantitative but a few qualitative and follow-up questions, as well as 13 focus groups. A total of 1,627 students and 97 instructors completed the surveys.

The first survey ($N$=1,228, referred to in the codebook as "Pre-Assessment") included demographic questions, comfort questions, and questions from the Information Literacy Assessment & Advocacy Project (ILAAP). This survey was administered in the beginning of the course (which varies, but we have dates starting from early September through late October).

The second survey ($N$=888, referred to in the codebook as "Post-Assessment") included contextual questions about the student's

assignment, comfort questions, and questions from the ILAAP. This survey was administered at the end of the course, triggered in the last couple weeks of the timeline on the Wiki Ed Dashboard.

The final survey (*N*=558, referred to in the codebook as "Post-Course Survey") was administered immediately after the second survey was completed to minimize student dropout rate on the second survey. This survey included comfort questions, perceived value questions, as well as specific questions about students' interactions on Wikipedia during the assignment.

Not all students took every survey, so survey respondents that did not answer questions have blanks for their answers. All of the questions and potential answers can be found in the codebook.

## Information Literacy Assessment & Advocacy Project Data

We utilized a series of questions from the ILAAP (ilaap.ca), a Creative Commons licensed information literacy assessment question set. These questions are mapped to the Association of College and Research Libraries (ACRL) information literacy standards and framework.

Although initial survey results showed promise, comparative data between the pre and post-test led us to believe that students at the end of the semester tended to "click through" or skipped over assessment questions, which were long and required much more time commitment than the standard survey questions. Many students who scored high in the pre-test scored far worse afterwards, with a very short overall test time length. We believe this was in part amplified by the incentivizing system in place, as students were reminded that taking the second survey would enter them into a drawing for an Amazon.com gift card.

There are additional tests for validity that can be performed on this data, but we believe that this was a methodological oversight. Future studies utilizing this assessment tool should be administered separately using ILAAP's system rather than integrating it into the Wiki Ed Dashboard.

## Focus Groups

Alongside the surveys, we conducted 13 focus groups in the Northeastern United States. The focus group data was intended to help triangulate deeper understandings of student learning outcomes when assessed with the survey data.

Due to the difficulty of fully de-identifying the entirety of the focus group transcripts, we are releasing only some of the focus group transcripts, which include some preliminary analysis (see Focus group analysis section).

## Quantitative Analysis

We conducted univariate descriptive statistics and bivariate relationships of pre- and post-assessment survey data using students' responses to close-ended questions. We then ran a series of multivariate analysis using ordinal logistic regression models, each with a different dependent variable that assessed outcome (Cameron & Trivedi, 2005; Kleinbaum & Klein, 2010). The coefficient of these models measure the odds ratio, or the odds that respondents will report the reference category ("much less valuable").

The total sample ($N$=1,228) containing demographic data included more females (65%) than males (33%), and was predominately white (54%). The average age of respondents was 22, with ages ranging from 17 to 74. Very few (4.69%) participants indicated they had used Wikipedia for a class assignment before. The full descriptive statistics report can be found in Table 1.

### *Dependent Variables*

The dependent variables for this analysis were based on five-point Likert questions regarding how students found the assignment compared to traditional ones (from much more valuable to much less valuable) for helping them learn:

> (1) about the topic, (2) critical thinking, (3) reliability of online sources, (4) digital literacy, (5) writing clearly for the general public, (6) writing a literature review, (7) working on a team, (8) technical or computer skills, and (9) peer review skills.

### *Independent Variables*

The independent variables for this analysis included contextual and demographic factors for the influence on students' attitudes toward Wikipedia assignments. These factors included age, gender, race/ethnicity, year in college, institution type, academic discipline, prior experience with Wikipedia, first-generation status, and additional five-point Likert questions regarding students' prior comfort with a variety of skills from writing publicly, working on a team, to digital literacy.

## Results

### *Descriptive Statistics*

Despite mixed initial reactions to hearing they would be using Wikipedia in the classroom (30% negative, 30% neutral, 40% positive), a majority of students spent more time (31% more time versus 20% less time), were more satisfied with their work on the Wikipedia assignment (50% more satisfied versus 13% less satisfied), and found the assignment more valuable in a variety of ways.

**Table 1.** Descriptive Overview of Quantitative Data

| **Variable *N*=1,228** | **Frequency** | **Percent** |
|---|---|---|
| | | |
| **Gender** | | |
| Male | 407 | 33% |
| Female | 795 | 65% |
| Nonbinary/no response | 26 | 2% |
| **Race** | | |
| White | 668 | 54% |
| Hispanic or Latino | 82 | 7% |
| Black or African American | 72 | 6% |
| American Asian or Pacific Islander | 259 | 21% |
| Multiracial/more than one | 104 | 8% |
| Other (includes American Indian) | 43 | 4% |
| **Year in College** | | |
| Freshman | 228 | 19% |
| Sophomore | 194 | 16% |
| Junior | 222 | 18% |
| Senior | 372 | 30% |
| Graduate | 173 | 14% |
| Nontraditional | 39 | 3% |
| **College/University** | | |
| Public Research University | 605 | 50% |
| Public Liberal Arts College | 136 | 11% |
| Community College | 55 | 4% |
| Private Research University | 119 | 10% |
| Women's College | 12 | 1% |
| Private Liberal Arts College | 130 | 11% |
| Hispanic Serving Institution | 5 | 0.5% |
| Historically Black College and University | 5 | 0,5% |
| Not sure/no response | 161 | 13% |
| **Academic discipline** | | |
| Social Science | 312 | 25% |
| Humanities/Arts | 192 | 16% |
| Natural Sciences/Mathematics | 318 | 26% |

| | | |
|---|---|---|
| Medical | 154 | 12% |
| Business | 19 | 2% |
| Introductory Writing | 233 | 19% |
| **First generation to attend college** | | |
| Yes | 228 | 19% |
| No | 988 | 80% |
| Don't know/no response | 12 | 1% |

## Comparing Assignments

Instructors found Wikipedia assignments much more valuable when rating a Wikipedia assignment against a traditional assignment in developing digital literacy (96% more/much more valuable), for learning about the reliability of online sources (85% more/much more valuable), and for learning to write clearly for the general public (79% more/much more valuable).

Students survey responses skewed slightly to the center, with a high percentage (~30%+) selecting "about the same" for their valuation. However, similar to instructor responses, students were most confident about Wikipedia being more valuable for the reliability of online sources (63% more/much more valuable), developing digital literacy (70% more/much more valuable), and learning to write clearly for the general public (72% more/much more valuable).

In fact, none of the ways in which students or instructors were asked to rank a Wikipedia assignment—learning about the topic, developing critical thinking, computer skills, peer review, or working on a team—were perceived as "less valuable" than a traditional paper assignment (see Figures 1 and 2).

## Bivariate and Multivariate Analysis

The value students place on Wikipedia assignments was affected by several contextual factors: type of assignment, satisfaction with work, team versus solo work, time spent on assignments, comfort with writing, digital literacy, and teamwork. In particular, students marked assignments as especially valuable for learning to write for a public audience, developing skills for working in groups, and gaining digital literacy and peer review skills.

Engaging more fully in Wikipedia assignments through using multiple types of assignments, or making more substantial changes is linked to the value students placed on Wikipedia assignments. Basically, the more involved the Wikipedia assignments were, the more value

*In comparison with a traditional assignment,* ***instructors*** *value Wikipedia assignments for learning.*

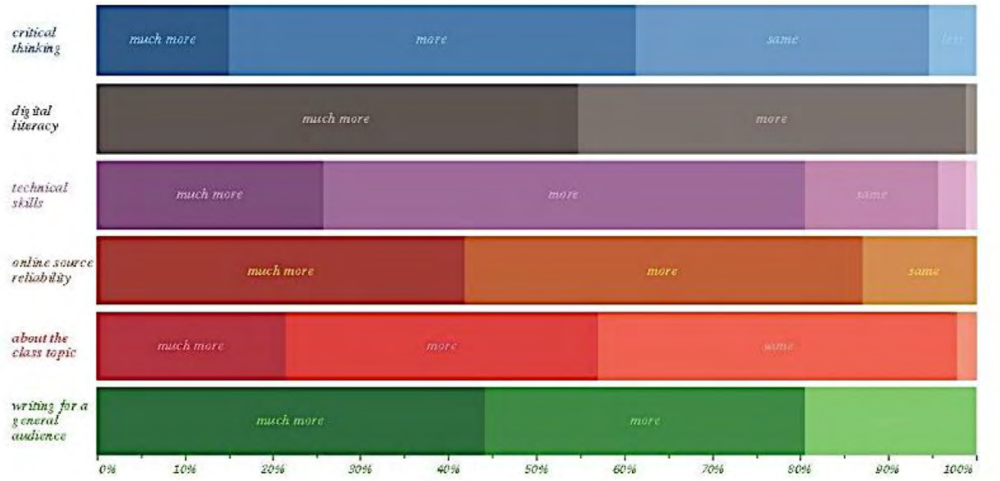


***Figure 1. Instructor*** Comparison of Perceived Value of Wikipedia Assignments versus Traditional Assignments

*In comparison with a traditional assignment,* ***students*** *value Wikipedia assignments for learning.*

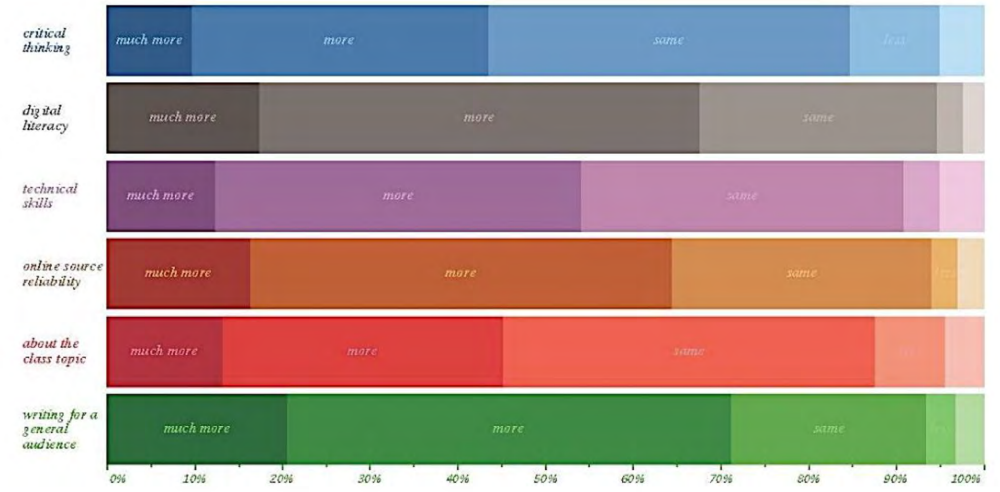


***Figure 2. Student*** Comparison of Perceived value of Wikipedia assignments versus traditional assignments

students place on Wikipedia assignments, with particular gains through assignments that involved critiquing a Wikipedia article for developing peer review, literature review, and public writing skills.

This suggests that using Wikipedia assignments that involve critiquing Wikipedia articles and/or using multiple types of assignments may be most effective for developing skills, particularly for peer review, literature review, and writing publicly.

## General

Students who reported less comfort with writing publicly reported more value in Wikipedia assignments for learning to write for the general public. In addition, those reporting less comfort with giving peer feedback were more likely to report higher value in Wikipedia assignments for learning to write a literature review. Those reporting having worked on a team were more likely to report Wikipedia assignments as helping to learn to work on a team.

Finally, there was a statistically significant relationship between the type of assignment in which students were engaged and Wikipedia assignment value. Assignments that involved critiquing a Wikipedia article also reported more value in Wikipedia assignments compared to traditional ones for helping to develop peer review, literature review, and public writing skills.

This suggests that this type of Wikipedia assignment (critiquing Wikipedia articles) is especially effective for students' development of peer review, literature review, and public writing skills. These assignments may show the most improvement for those who have least comfort with these skills from the outset.

## Social Location Factors

Social location indicators—gender, social class, and race—were found to mostly not affect assessment of Wikipedia assignments, with a few notable exceptions. First, women reported some different scope and perception of Wikipedia assignments than men students. In particular, women students were less likely to report working on things in Wikipedia that were not directly part of their assignment, while the knowledge that the assignment is public was more likely to affect the way that they approached the Wikipedia assignment.

Future research might examine gender variations further by considering, for example, in what ways this knowledge affected women and men students' approach to Wikipedia assignments.

Turning to social class indicators—measured as whether or not students were the first generation in their family to attend college—we found that compared to first-generation students, those who were not first generation report less value in Wikipedia assignments for learning to write a literature review. These findings suggest that Wikipe-

| Critiqued Article | Peer Review | Small Edit | Significant Contribution | Much more | More | Same | Less | Much less |
|---|---|---|---|---|---|---|---|---|
| Yes | Yes | Yes | Yes | 37 | 97 | 27 | 2 | 5 |
| | | | No | 3 | 4 | 5 | | |
| | | No | Yes | 4 | 14 | 3 | 2 | 1 |
| | | | No | | 9 | 2 | | |
| | No | Yes | Yes | 10 | 20 | 7 | | |
| | | | No | 5 | 9 | 4 | 1 | |
| | | No | Yes | 6 | 4 | 3 | | |
| | | | No | 2 | 3 | 4 | | |
| No | Yes | Yes | Yes | 5 | 23 | 10 | 2 | 2 |
| | | | No | 2 | 1 | 2 | | |
| | | No | Yes | 10 | 8 | 11 | 1 | |
| | | | No | | | 1 | | |
| | No | Yes | Yes | 4 | 14 | 10 | 3 | 2 |
| | | | No | 5 | 17 | 10 | 1 | 1 |
| | | No | Yes | 31 | 44 | 21 | 4 | 5 |

***Figure 3.*** Contextualizing Value of "Learning to Write Clearly for the General Public" Across Assignment Types

dia assignments may be especially effective for helping first-generation students learn to write a literature review.

There were not enough students within other demographic categories to determine significance in this comparison. Future research might seek to include a greater number of students of color to assess if there are other significant variations in learning attitudes across racial and ethnic groups (see Figure 3).

## Other Contextual Factors

Besides social location, there were other contextual factors—including academic discipline, year in college, type of institution, etc., that we found to be correlated with students' assessment of assignments. In terms of current course category/academic discipline, we found that compared to students in the social sciences, those in medical, humanities/arts, and introductory writing courses were more likely to place higher value on Wikipedia assignments, particularly for helping to develop critical thinking skills (medical) and for developing peer review skills (medical, humanities/arts, intro writing). Compared to those in social sciences, students in natural sciences, mathematics, or other/undecided fields were more likely to also report that writing in Wikipedia changed their understanding of concepts related to writing.

| Academic discipline | Much less | Less | Same | More | Much more |
|---|---|---|---|---|---|
| Social Science | 3.70% | 2.47% | 30.86% | 46.91% | 16.05% |
| Humanities / Arts | 4.00% | 8.00% | 22.00% | 42.00% | 24.00% |
| Natural Sciences / Mathematics | 2.11% | 2.11% | 23.16% | 62.11% | 10.53% |
| Medical | | | 24.44% | 46.67% | 28.89% |
| Introductory Writing Course | | | 12.50% | 50.00% | 37.50% |
| Other | 1.49% | 2.99% | 32.84% | 47.76% | 14.93% |

***Figure 4.*** Contextualizing Value of "Learning Digital Literacy" Across Academic Disciplines

The qualitative responses to this question address some of the ways that their understanding changed. In terms of year in college, we found that—compared to freshmen—juniors, seniors, and nontraditional students were more likely to place lower value on Wikipedia assignments for helping to develop technical or computer skills. In addition, compared to freshman, graduate students were less likely to work on things in Wikipedia that were not directly part of their assignment, and less likely to report taking the initiative and being "bold" through Wikipedia assignments (see Figure 4).

These findings suggest that freshmen found Wikipedia assignments more useful than others for developing certain skills, while they may feel less likely to take initiative and explore aspects of Wikipedia that fall outside of the specific bounds of the assignment.

While the type of institution didn't seem to affect students' assessment of assignments, those attending public research universities were less likely than students at all other types of institutions to report the knowledge that the assignment is public affected their approach to the Wikipedia assignment.

## Qualitative Analysis

The post-course survey included a few qualitative questions as well as some qualitative follow-up questions. We did not fully analyze all of the qualitative responses, instead focusing on two of the questions, questions 212 and 213, that were presented back-to-back (see Figure 5). The questions asked: "Before you first edited Wikipedia, what were three adjectives you would have used to describe the space?" and "Now, after you have edited Wikipedia what are three adjectives you would now use to describe the space?"

We created categories for the words, taking an iterative approach that is common in coding and analyzing qualitative data that involved developing categories that surfaced from the data, while also examining

the data for themes developed from the survey data (Saldaña, 2009). Categories were then associated with "positive" and "negative" traits (see Table 2). Results from comparing the three words students associated with Wikipedia before editing to after editing offer four notable shifts in how perceptions of Wikipedia changed after gaining experience editing.

First, the most significant shift is in the increased reliability students placed on Wikipedia after having edited, with an overall indication that editing helped students become more certain that Wikipedia is reliable. We counted 370 words associated with reliability after editing, while only 171 words used prior to editing. Similarly, far fewer words associated Wikipedia as unreliable after editing (*N*=230) than before (*N*=375).

A second notable shift is in the use of words associated with collaboration with more students reporting Wikipedia as collaborative after having edited Wikipedia (*N*=159), while only 57 collaborative words were used to describe Wikipedia prior to editing. The third notable shift was seen in the count of neutral terms before and after editing, with 387 terms using this language before editing, while only 270 terms used neutral words post-editing. This indicates more specific descriptions of Wikipedia post-editing, suggesting students felt they had a better understanding of Wikipedia after gaining editing experience.

Finally, overall, the count of words went from being less positive in their description of Wikipedia before editing (1,011), to more positive after editing (1,343). Negative perceptions were far more limited at both times, although far fewer associated negative words with Wikipedia after gaining editing experience


***Figure 5.*** Pre Assignment Word Cloud

**Table 2.** Q212 and Q213 Word Analysis

| Frequency (N=558) | Before | After |
|---|---|---|
| Informative | 297 | 286 |
| Reliable | 171 | 370 |
| Inclusionary | 56 | 61 |
| Accessible | 253 | 212 |
| Clear | 86 | 113 |
| Dynamic | 22 | 33 |
| Positive social perception | 69 | 109 |
| Collaborative | 57 | 159 |
| ***Total positive*** | ***1,011*** | ***1,343*** |
| *Neutral terms (not "neutrality")* | *387* | *277* |
| Uninformative | 58 | 33 |
| Unreliable | 375 | 230 |
| Exclusionary | 25 | 22 |
| Inaccessible | 46 | 43 |
| Confusing | 60 | 28 |
| Static | 16 | 4 |
| Negative social perception | 49 | 36 |
| ***Total negative*** | ***629*** | ***396*** |

(from 629 to 396). This shift, combined with the decrease in neutral words post-editing, suggests that negative perceptions of Wikipedia may be due to lack of understanding of Wikipedia, since respondents descriptions became more positive and descriptive after gaining experience editing (see Figure 6).

## Focus Group Analysis

In the focus group data, students express three common experiences regarding Wikipedia assignments. First, students share shifting perceptions in the reliability of Wikipedia after being an editor. Second, students reported higher


***Figure 6.*** Post-Assignment Word Cloud

motivation for completing Wikipedia assignments when compared with traditional assignmentsbecause their work was accessible to a public audience. Third, students found the assignment useful for developing their researching and writing skills. Across these three areas, students demonstrate development of digital and information literacy through their engagement with Wikipedia. Students especially expressed this in their shifting perceptions of Wikipedia by demonstrating learning how to assess information for accuracy and in expressing development of research and writing skills.

## Shifting Perceptions

When triangulated with the three-word comparison and survey data results, we found that data suggest overwhelmingly that respondents' perceptions of Wikipedia changed after having edited Wikipedia. While many students expressed having perceived the space as unreliable prior to editing Wikipedia, completing the assignment shifted their perception to show more trust in the reliability of Wikipedia as a source for information.

Through responses about how their perceptions of Wikipedia changed after having been an editor, many students demonstrate information literacy, recognizing when information is needed, and learning to evaluate it effectively (Association of College & Research Libraries 2017). Students express that they now view Wikipedia as an important, relatively reliable source of information, while also demonstrating their learning around how to effectively evaluate information.

Example quotes from focus groups:

> *"Before I always thought you can put, sorry for my word, but you can put bulls**t on it. That's what I always thought about it, that's why my high school*

*teachers ... it's not credible, it's not credible, there's lying on Wikipedia. Now that I was an editor, I was like no there's not, like there is but it was so hard to ... I had to source every sentence. Every paragraph or anything I learned about, because I was like someone's going to flag me down. I was like maybe I will leave it, I was like I don't want to be flagged or I don't want to be a liar online. I was like oh no, so every sentence I did I wanted to have a credible source behind it."*

*"Yeah, in high school, they told me, every teacher told me that Wikipedia was not a reliable source because anyone could edit it. After looking at the process and all that stuff, it can be a valuable source. We found out Wikipedia is really picky with information that goes in."*

*"I didn't know anything about what happened behind the curtains of Wikipedia ... I didn't know, again, there's a huge discussion, it gets reviewed by your peers, other people, Wikipedia, and everyone else. I thought it was you click on edit and you just say whatever you want and somehow you submit it and that was it. I think it to be more credible now knowing how much work goes behind it and it's not just simple as cut and paste from different links so I find it more credible now than I did before. I see myself defending Wikipedia now, I guess."*

## Motivations

"In addition to positive shifts in Wikipedia perceptions after being an editor, students expressed notable benefits of Wikipedia assignments, compared to traditional ones, for increasing their motivation to engage in the assignment as compared to traditional ones." In particular, students were much more motivated to complete the assignments because they saw it as useful beyond the classroom; besides wanting to earn a high grade, students were motivated to complete the assignment well because it would inform a public audience, and not just be seen by their instructor. This sentiment was particularly true for students who felt their area of research was both meaningful to them and notably

Example quotes from focus groups:

*"What is cool about it for me that changed the way I thought about it was, we were talking about the public aspect of it, that people can change what you're doing. But that's a really interesting way to look at it because usually when you do research and you write a paper, if it's not going to be published, which most of the time for just a class, it's not going to be, you do all this*

*work, you submit it and then it just disappears. With this project, the idea is you put your work out there, you put the information out there and then other people can add to it and it's like existing in a conversation."*

*"It makes you want to work harder, I guess. For me, at least, because have an impact. For an essay, it's just for the grade and then you to throw it away. So, there's not that much motivation. I mean, fun to write papers and put your opinion and stuff, but with this like you're actually making a change."*

*"You get one grade in the end for the entire class, so you can't really just do this for a grade. You kind of need to find your own motivation in it, which I agree. It's fun to just write something that's important. It's something that other people will read, it's not just you and the professor."*

*"I found it less daunting, like when the professor assigns me a ten-page research paper or something. I have trouble getting myself to do it sometimes just because I'm like, 'Why?' But this, I was like I'm contributing to something bigger and it's public. So, I felt more motivation to go in and edit it and whatever."*

## Learning Skills

The third significant finding from the focus group data is around the skills students expressed learning through the Wikipedia assignment. Along with information and digital literacy, which was demonstrated throughout, students expressed and demonstrated learning researching and writing skills through being editors for Wikipedia. While some students expressed positively about this experience of developing writing and researching skills, others were more mixed in their feelings about the learning, yet there was consistent signaling of the ways in which the assignment pushed them to develop these skills.

Example quotes from focus groups:

> *"I would say it was helpful, especially in terms of seeing your own bias and the flaws in your writing, because the writing style is so painstaking, that at a certain point that comes pretty quickly, you've looked at the words for so long and the same sources for so long ... This happens with all projects that you work on for a long time, where you get numb to your own writing, but I think it happened especially quickly because you had to be so careful about what you were saying. It was good at the end to have somebody come in at the end and say, 'This sentence doesn't make sense,' or 'You don't need to say this.' Or, 'It's biased."*

*"I guess it helped to look at a concept in a more generalistic, main idea way, so that it's more accessible to people. In class we're expected to be much more detailed in our methodology and what we write about, but here it's like really getting the overall sense of the concept, and being able to translate that into easy language I think is a pretty good takeaway from this experience."*

*"It's a resume-worthy skill at this point. People want you to be able to use Facebook, Twitter. I feel like the direct skill, being trained and editing Wikipedia specifically is a valuable skill."*

*"Like I said before, we're finally, or at least me personally, finally gaining the practice of writing just to commute. I mean, just to communicate. Again, because before writing was just kind of for different things. But Wikipedia is really for getting the idea across and that's why I think it's really valuable. Especially in the business world because people are not going to care how fancy of a wording you use. They're going to care about the content you put in and the easier they can understand it, the better it is."*

## Information Literacy

Finally, students' responses mapped overwhelmingly positively to the Association of College Research Libraries' (ACRL) Information Literacy Framework (http://www.ala.org/acrl/standards/ilframework). In particular, students reflected at length on subjects mapping to "Authority Is Constructed and Contextual," "Information Creation as a Process," "Information Has Value," and "Scholarship as Conversation." Students' understanding of the complexities of systemic biases, hierarchy of information value, and the interplay of different voices within scholarly conversation illustrated deep learning from this exercise. More data are available in the focus group summary, along with preliminary analysis tags.

Example quotes from focus groups:

> *"One thing I realized is, a lot of the stuff that we're writing about is very interconnected ... I would try to link stuff and then it wouldn't work—there would be no page ... it's not random, the information that's missing from Wikipedia. It's a history of the knowledge of the events that have been documented and historicized in the world, and that's what's on Wikipedia right now."*

> *"It raises an awareness of what is good information, what is bad information, so obviously in learning how to correct something that has good information. If you're looking at an article*

*you're conscious, Oh wait, that's not quite right. This source is honestly not very valid. Like, do I believe this information? I think you're a lot more ... you have much more of a questioning mentality and you're a lot more conscious of the validity of the "information that you read."*

*"I think I was more critical of the sources I was using ... because when you're writing an academic paper, you go on JSTOR ... and you find your articles, you read them, you analyze them, but you don't have to ... but it was finding reliable sources that weren't academic because no one had written about it in an academic context ... Because in academic sources, when you go on JSTOR, you know they're reliable, right? ... But now you're assessing their reliability."*

*"I always thought of research as a very solitary thing, like someone in a library basement looking through books and stuff. So, knowing that Wikipedia has this whole community of people who are researching and adding to things just changes how I think about it, I think. I never really thought of it as a collaborative endeavor and now I know that it can be, it's kind of interesting to see it that way."*

## Conclusions

There are innumerable ways to study student learning, each with their advantages, costs, and drawbacks. With hundreds of classes across a wide range of subjects, this study required flexibility, adaptability, and the ability to gather information on a largely heterogeneous population of learners. To approach this complex population, we employed both qualitative and quantitative methods, attempting to "triangulate" understandings of student learning outcomes by addressing multiple types of data at once. We hope to illustrate a clearer picture of the student experience with using Wikipedia-based assignments.

Since there was such a large variety of courses, class "learning outcomes" would be as numerous as the courses themselves. To help make sense of this, we decided early on to try to compare the benefits or "value" of the Wikipedia assignment across this disparate population.

Running an A/B comparison would be virtually impossible with this population. Instead, we focused less on traditional student metrics (as is often employed for large-scale studies, especially in K-12) and attempted to understand the deeper student learning by honing in on the value of the Wikipedia assignment, and how that value is expressed by student work and feedback.

Preliminary quantitative analysis from this study was incredi-

bly positive, as both students and instructors appeared to value the Wikipedia-based assignment overwhelmingly over a "traditional" paper assignment in *every category* queried.

Moreover, students found themselves motivated, more satisfied, and were generally very positive about the Wikipedia assignment. The focus group data helped contextualize the conditions for positive reactions (which were well addressed with the descriptive statistics), in addition to identifying what the valuation, motivation, and general positivity actually produced among student learners. While the survey data offered a lot of clues on what is happening, focus groups allowed us to dig deeper into actual student learning through Wikipedia-based assignments in lieu of traditional assignments.

A variety of students identified Wikipedia assignments as motivating due to a perception that their work was contributing to conversations outside of the classroom and filling gaps of information that were useful for a public audience. Students seemed to employ that motivation to engage in deeper understanding of Wikipedia, knowledge production, and a variety of information literacy skills.

Focus group responses also suggest that students directly engaged concepts outlined in the ACRL framework for information literacy, particularly when engaging understandings of systemic biases, construction of information, and value of information.

Triangulating focus group responses and quantitative survey responses demonstrated mastery in these skills as well.

Although additional research and analysis is required, we believe that there is ample evidence to support students using Wikipedia-based assignments. Not only do students seem more motivated, report higher value, and higher satisfaction with their assignments, but they also actively demonstrate deeper learning in a variety of skills, particularly complex information literacy skills.

## Future Analysis

Currently, we are working on three major research questions, with a potential for a few more, focusing on contexts, skills transfer, and digital literacy. There is ample data to analyze in regard to how student contexts correlate with their attitudes about Wikipedia, the assignment, and perceived value of the assignment.

One of our main areas of focus is analyzing what contextual and demographic factors predict higher attitudes and perceptions of value, with the assumption these create a more robust learning experience. Preliminary results are incredibly positive and suggest strong correlations between some major contextual factors.

We are also interested in the skills students learn and transfer using Wikipedia-based assignments. Evidence suggests that students find the assignments more valuable in developing particular skills, but further analysis will be conducted to triangulate how they understand and apply those skills.

Finally, from preliminary analysis strongly suggests that there is a positive increase in digital literacy when engaging with Wikipedia-based assignments. Although students and instructors overwhelmingly noted finding these assignments more valuable, we have had mixed results with the assessment responses—there were too many variables to verify the data. Instead, like with skills, we plan on digging deeper into the focus group data to better triangulate how students understand source reliability and verifiability of information.

## Future Research

Perhaps one of the most valuable takeaways from this research is how it can help frame future research on Wikipedia-based assignments. We believe there is ample opportunity to expand this research to better understand demographic correlation, information literacy, deeper learning, and deeper understanding of new editor experience on Wikipedia. More data gathered across multiple semesters will help to explore correlations between racial, social, and gender characteristics to understand value across underrepresented groups.

Redesigning interview and survey questions can help pinpoint adoption of particular information literacy skills using the ACRL framework, as well as querying students about deeper learning competencies. Finally, this data could be more valuable for trying to understand college-aged users of Wikipedia if some questions were approached from a more general perspective.

## Authors

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## Software Used

Preliminary statistical analysis was performed in STATA 13 for Mac. Qualitative analysis was performed in NVIVO 10 for Mac.

Data visualization and graphics were created usingTableau 10 under an academic research license.

Surveys were administered using Wiki Education's Dashboard Course Management Software, available on GitHub as WikiEduDashboard.

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# Pre-service Teacher Awareness of Open Educational Resources

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Abstract

The concept of open educational resources (OERs) evolved from the integration of two movements: the open source/free software movement in the late 1990s and the introduction of the Creative Commons licensing system in 2001. UNESCO (2002) coined the term "open educational resource" (p. 6) during the 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries. While the OER movement began with a focus on technology-driven instructional materials, today 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" (William and Flora Hewlett Foundation, 2018). OER continue to grow in popularity, yet awareness of OER from a teacher perspective has not reached universal acceptance.

***Keywords:*** OER, OER movement, pre-service teacher awareness


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# 职前教师对开放教育资源的认知

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摘要

开放教育资源(OER)的概念由两大运动结合演变而来：20世纪90年代末的开源/自由软件运动和2001年的知识共享(Creative Commons) 许可制度引入。联合国教科文组织 (2002年) 在2002年发展中国家高等教育开放课程影响论坛中引入了“开放教育资源”一词(p.6)。虽然OER运动最开始关注的是技术驱动的教学材料，但今天的开放教育资源是“在公共领域存在的，或已在开放许可下发布，允许他人不受限制或在有限限制下免费访问、使用、修改和重组的以任何媒介形式表现的纸质或数字化教学、学习和研究材料”(休利特基金会，2018年)。虽然OER的普及度不断提高，但从教师的角度来看，人们对OER的认知还没有达到普遍接受的程度。

关键词：OER，OER运动，职前教师认知

## Conocimiento previo de los maestros sobre los recursos educativos abiertos

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Resumen

El concepto de Recursos Educativos Abiertos (REA) evolucionó a partir de la integración de dos movimientos: el movimiento de código abierto/software libre a fines de la década de 1990 y la introducción del sistema de licencias Creative Commons en 2001. La UNESCO (2002) acuñó el término “recurso educativo abierto” (p. 6) durante el Foro de 2002 sobre el Impacto del Software Abierto para la Educación Superior en los Países en Desarrollo. Si bien el movimiento de REA comenzó con un enfoque en los materiales de instrucción impulsados por la tecnología, los recursos educativos abiertos de hoy en día son “materiales de enseñanza, aprendizaje e investigación en cualquier medio, digital o de otro tipo,

que residen en el dominio público o se han publicado bajo una licencia abierta. eso permite el acceso, el uso, la adaptación y la redistribución sin costo para otros sin restricciones o con restricciones limitadas" (William y Flora Hewlett Foundation, 2018). Los REA continúan creciendo en popularidad, pero el conocimiento de REA desde la perspectiva de un maestro no ha alcanzado una aceptación universal.

***Palabras Clave:*** REA, movimiento REA, concienciación del profesorado pre-servicio

## Introduction

While most published research reports on PK-12 in-service teacher and higher education instructor open educational resource (OER) awareness levels, a small research team at James Madison University (JMU) is exploring OER awareness among pre-service teachers. This initial research explores the level of OER and copyright awareness JMU pre-service teachers have through their courses, practicums, and student teaching placements and specifically addresses the following three research questions:

**RQ1:** To what extent are JMU undergraduate and graduate students enrolled in the College of Education aware of OER?

**RQ2:** Are pre-service teachers aware of PK-12 OER initiatives?

**RQ3:** Do pre-service teachers understand the licensing side of OER (free-to-use versus openly licensed)?

## Literature Review

The open education movement has the potential to be a significant economic and cultural shift to the current educational environment. According to Rogers' diffusion of innovations theory (2003), "diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system." In the case of OER use (the innovation), the members of the social system include educators and others in educational institutions. Following Rogers' theory (2003), the first stage in the innovation-decision process is to widely introduce the concept of OER to build awareness.

To date, researchers have measured educator awareness of OER at the PK-12 and higher education levels, and this research shows that, while rising, OER awareness is not yet ubiquitous throughout education systems. Allen and Seaman (2017) surveyed PK-12 educators in 584 school districts on their general awareness of OER concepts. Their survey found awareness of

OER and Creative Commons licensing was low, with only 28% responding as "aware" or "very aware." Districts were more likely to know and adopt specific OER materials, with two-thirds of districts aware of at least one full OER course curriculum material and over one-third having actively considered one. Sixteen percent of districts have adopted openly licensed full-course curricula materials. Districts with higher child poverty levels are more likely to adopt OER than those with low child poverty levels. In summary, Allen and Seaman (2017) provided a snapshot of the PK-12 educational environment that pre-service teachers will experience as future educators.

There is a dearth of literature that explores pre-service teacher awareness of OER. Most current literature focuses on practicing teacher knowledge and use of OER. Ramírez-Montoya, Mena, and Rodríguez-Arroyo (2017) discussed how training teachers in digital competence is necessary for preparing teachers to use OER. Training in this area helps teachers build the skills and confidence necessary to access, use, and create OER materials (Ramírez-Montoya et al., 2017).

Kimmons (2014, 2015, 2016) researched the impact of providing in-service teachers immersive training on OER concepts. He surveyed participating teachers before and after training ($n$=80) and found that teachers entered the institutes with limited knowledge of OER and some misconceptions about concepts of fair use and copyright (Kimmons, 2014). Kimmons (2014, 2015) found that training increased teacher knowledge and desire to use OER in their classrooms, helped clear up misconceptions about OER, and helped educators understand how to incorporate OER in their classrooms. Kimmons' survey found that teachers were excited about OER concepts after learning more about them. The research also found that educators were interested in innovating, sharing, and creating OER materials regardless of their years of experience. Kimmons' (2014, 2015, 2016) research demonstrates that providing education on OER topics is useful to increase open education literacy and decreasing misconceptions about OER.

Kimmons (2015, 2016) also surveyed the in-service teachers on their perception of the quality of OER materials compared to traditional copyrighted textbooks. Kimmons (2015) reported that open textbooks were considered higher quality than copyrighted textbooks, and that open–adapted textbooks were of higher quality than open textbooks. In his most recent publication on this topic, Kimmons (2016) used mixed methods to identify PK-12 in-service teachers' perceptions of OER beyond cost considerations. The data collection spanned teachers' perspectives of the potential, and the barriers to OER use both during a series of structured summer OER institutes and after a return to the classroom environment ($n$=30). Researchers collected qualitative data at the end of the institutes, and used those results to create a follow-up survey to "accurately portray the perspectives of institute attendees as a group" (Kimmons, 2016, p. 11).

Conclusions included the potential for openness to help solve pedagogical, economic, and professional issues and also acknowledged barriers at the macro, local, and personal levels.

A smaller, but also important, segment of the educator landscape is students in education programs, or pre-service teachers. Prior to entering careers as educators, pre-service teachers are still learning the basics of pedagogy in their areas of specialization, and they are both students and teachers as they complete their programs of study. To date, research into the awareness levels of pre-service teachers has been much less frequent than research of PK-12 and higher education instructors. Morales and Baker (2018) provided an up-to-date review of the research conducted on perceptions of OER in education; however, pre-service teacher training or awareness was not included in their review.

Despite the limited discussion of pre-service teacher awareness of OER in the literature, many in-service teacher studies hypothesize that introducing these concepts to future educators during teacher training may lead to increased interest, understanding, and likelihood of using OER in their careers (Misra, 2014; Tur, Urbina, & Moreno, 2016; Ramírez-Montoya et al., 2017). While focusing on training for in-service teachers, these studies also indicate a consistent lack of pre-service teacher awareness of OER concepts prior to becoming teachers. After learning about OER concepts, in-service teachers show high levels of interest and confidence in using and even creating OER in their future classrooms. Misra (2014) concluded "that understanding and knowledge about OER at an initial stage of their professional training will help teachers to use it throughout their careers for personal and professional development" (p. 381).

The literature includes an increase in OER awareness among teachers when they used OER during teacher training (Misra, 2014; Tur et al., 2016). Misra (2014) found that training teachers to use OER can help them realize the vast resources available for use in diverse and varied educational settings around the world, and also determined that the lack of awareness and understanding keeps teachers from using OER for educational purposes.

In another in-service teacher study, Kelly (2014) concluded that including OER in teacher education programs is worth exploring. The inclusion of OER materials during pre-service teacher training can positively impact knowledge of OER concepts and materials (Kelly, 2014; Tur et al., 2016; Kwak, 2017).

In one research study, the experiences of pre-service teachers learning to create OER materials in their coursework were explored. Tur et al. (2016) conducted research focused on pre-service teachers who created OER as students in their degree-granting programs for potential inclusion in an education repository. In this study, pre-service teachers were surveyed on OER perceptions and concepts. The researchers found that pre-service teachers had an

overall positive perception of OER once introduced to these concepts and noted the importance of engaging them while they are students to maximize interest and perceived value of OER (Tur et al., 2016). After learning about OER and creating their own resources, 84% of pre-service teachers ($n$=128) responded favorably to wanting to use OER in their future classrooms.

Internationally, there has been a lack of OER training in teacher education programs. Kwak (2017) reinforced the concept that introducing OER in teacher education and professional development is critical to provide guidance in the practical use of OER. The current lack of teacher training on OER concepts in South Korea's education programs is a barrier to in-service teachers using and adopting OER in their classrooms. Kwak (2017) stressed that without proper training on these concepts and skills, OER cannot be used effectively.

The lack of training and awareness of OER is exacerbated by the practice of pre-service teachers utilizing the Internet for lesson planning (Sawyer & Myers, 2018). Platforms such as Pinterest and Teachers Pay Teachers offer many options for both free and paid lessons. In a study conducted between students in two different teacher training programs, Sawyer and Myers (2018) found that students turn to the Internet for lesson planning ideas because the platforms offer anonymity and ease of access. Even though the Internet remains a popular option, the quality of such lessons is suspect, often lacking clear objectives or measurable outcomes (Patton, 2008).

A lack of training and general awareness of OER concepts at all levels for education professionals is a theme found across the literature. The literature shows that introducing these concepts to teachers of any experience level creates interest and desire to use—and even create, OER in their own classroom. The current lack of OER awareness research in pre-service teachers provides ample opportunity to contribute to the knowledge and literature on this topic. Ultimately, this work can inform future researchers and educators as they develop training and professional development in OER for pre-service teachers.

## Analysis

### *Demographics*

The pre-service teacher awareness survey was conducted within the College of Education at JMU. The institution is a large public co-ed University in the mid-Atlantic region and was founded in 1908 as a women's-only teacher preparation school. As one of seven Colleges in the University today, the College of Education continues that legacy. The College of Education offers a five-year Master of Arts in Teaching (MAT) degree program for students interested in teaching certification for grades PK-12 and beyond. Teacher licensure at JMU requires completion of an undergraduate and graduate degree. Once students complete the College of Education undergraduate

degree requirements, they are required to complete the graduate program (5th year) in order to obtain teacher licensure. Throughout the program, students complete courses within either the Early Education program or Middle and Secondary program. Education enrollment numbers for the research year included 1,385 students in Early Education programs and 431 students in Middle and Secondary Education programs.

PK-12 classroom immersion experiences are a core element of the MAT curriculum. Students complete multiple field observations, practicums, and student teaching placements during their five years of study. Students begin the program by completing field observations during their freshman and sophomore years. In their junior through senior years, students participate in several practicum placements; and during their graduate year, students complete two student teaching placements.

### *Design and Methodology*

The research team developed an 11-question survey about pre-service teacher awareness of OER. Researchers used questions adapted from the Babson Survey Research report, *What we teach: K-12 school district curriculum adoption process* (Allen & Seaman, 2017) and Seaman and Seaman's (2017) originally authored *Opening the textbook: U.S. higher education.* The survey items provide insight into respondents' level of education and level of field placement completion, but do not include questions which would reveal personally identifiable information.

While reviewing the Babson Survey Research reports (Allen & Seaman, 2017; Seaman & Seaman, 2017), the JMU research team noted the development process for the OER survey questions used in those reports. Over several successive iterations of the OER survey questions, the research team responsible for modifying the survey items from the *What we teach* report (Allen & Seaman, 2017) revised the questions toward maximizing the respondent's ability to accurately self-report on a topic about which they may have little, or no background knowledge. Relying on this iterative question development process, the JMU research team adopted the format and wording of several survey questions from the *What we teach* (Allen & Seaman, 2017) and *Opening the textbook* (Seaman & Seaman, 2017) reports for use in the pre-service teacher awareness survey. Using the same wording on the pre-service teacher survey also helps situate pre-service teacher awareness of OER with the level of awareness among PK-12 and higher education instructors.

The pre-service teacher survey was designed to collect quantitative responses in the following question formats: select all responses that apply, select a single response, and Likert scale. While the survey design resulted in numerical data, the main methodological approach was descriptive, which enabled the research team to observe various levels of respondent understanding.

To obtain self-selected participants, the researchers emailed all Education students via the College's student

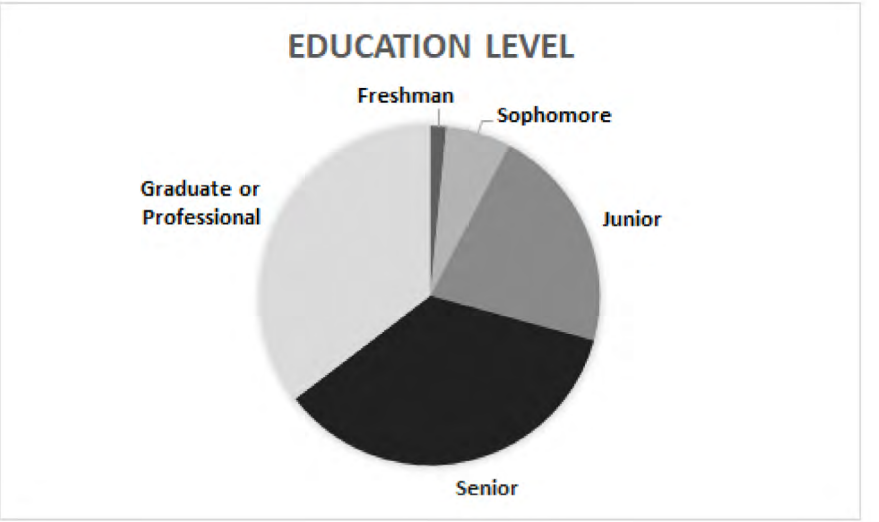


***Figure 1.*** Education Level of Pre-service Teacher Participants

email listserv. The researchers also contacted 19 College of Education faculty to share the survey with their students. The faculty participants were selected to best represent the ratio of students in the various programs. To encourage participation, participants had an opportunity to register to win one of three $5 coffee gift cards. To register for the gift card drawing, participants could click on a link at the end of the survey to enter their contact information, which was entirely separate and in no way connected to the pre-service teacher survey responses. Institutional Review Board (IRB) approval was given for this project.

## Survey Results

### *Survey Items Providing Respondent Background Information*

The survey was open March 12, 2018—April 17, 2018, and 65 students completed the survey (Thompson, Lantz, & Sullivan, 2018). The first four questions on the survey focused on background information. The participants identified their University education level as freshman, sophomore, junior, senior, and graduate or professional students. The majority of responses reflect students enrolled in College of Education programs who have moved beyond general education courses and are focusing on the required courses in the Education degree program (see Figure 1).

Participants were asked which general grade level they planned to teach after graduation, which is the same as their program of study. Of the participants, 73% plan to teach Pre-Kindergarten/Elementary level and 27% plan to teach Middle and Secondary grades. This sample is representative of the enrollment numbers in each program, which have significantly more students enrolled in Early Education than the Middle and Secondary Education program.

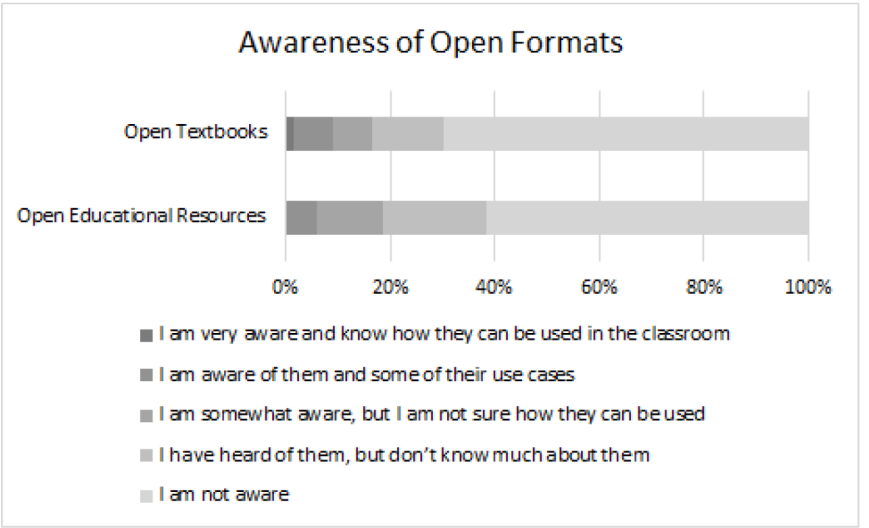


***Figure 2.*** Awareness of Open Formats

Participants also identified which formal field experiences they have completed to date. As they advance, students in the Education program complete multiple comprehensive in-classroom experiences beginning with field observations, progressing to practicum placements, and finishing with student teaching assignments. Of the 65 responses, 8% had completed the first level of field observations, 55% had reached the mid-level of practicum placements, and 37% had experience with student teaching. Graduate students reported the most field experiences, which is consistent with the progression of field experiences within the program.

**RQ1: To what extent are JMU undergraduate and graduate students enrolled in the College of Education aware of OER?**

Researchers asked several survey questions about OER awareness. Two questions on the survey asked participants to situate their awareness of OER on a five-point Likert scale. While the fifth question broadly asked about their awareness of OER, the eighth question specifically asked about their level of awareness of open textbooks. The questions included definitions of OER and open textbooks, respectively. The lowest number of participants responded they are very aware or aware of OER (6%) and open textbooks (9%), while more participants identified as being somewhat aware, or having heard of OER (32%) and open textbooks (21%). In response to both questions, the majority of participants reported being unaware of OER (62%) and open textbooks (70%) (see Figure 2).

Respondents at the practicum level of field placements reported moderate OER awareness (31%) and open textbook awareness (31%). These awareness percentages include all of the responses with any level of aware-

ness, including having heard of OER and open textbooks. Respondents that had reached the highest level of field placements, student teaching, reported higher levels of awareness (54%) than unawareness (46%) of OER. For open textbooks, respondents at the student teaching level reported awareness at 29% and unawareness at 71%.

Two questions on the survey focused on the inclusion of open education resources and/or open textbooks in course work (question 9) or in field experiences (question 10). The answers were separated into four options: (1) Used as required course material; (2) Used as supplemental course material; (3) Have not used; and (4) Don't know. Participants were able to select multiple answers for this question. For example, a participant could select that he or she observed open textbooks being used as both a required material and a supplemental material in his or her field experience.

In their course work, 42 respondents stated that they had used OER as required course material with 57% selecting the broad category of OER and 43% selecting open textbooks specifically. No respondents indicated that they had used both OER and open textbooks as required materials.

Fifty respondents indicated they had used OER or open textbooks as supplemental course material with 62% selecting OER and 38% selecting open textbooks; no respondents choose both OER and open textbooks.

Sixty respondents indicated they had not used OER or open textbooks as course material with 45% selecting OER and 55% selecting open textbooks. Again, no respondents selected both OER and open textbooks in response to having not used OER.

Fifty-six respondents indicated they did not know if OER or open textbooks were used as course material with 59% selecting OER and 41% selecting open textbooks; no respondents choose both OER and open textbooks.

In a follow-up question, students were asked if they had observed OER or open textbooks being used by teachers in their field observations, practicums, or student teaching placements.

Twenty-eight respondents stated that they had observed OER or open textbooks being used as required course material in their field study experiences with 60% selecting OER resources and 40% selecting open textbooks; no respondents choose both OER and open textbooks.

Thirty-nine respondents stated that they had observed OER or open textbooks being used as supplemental course material in their field study experiences with 72% selecting OER resources and 28% selecting open textbooks; no respondents choose both OER and open textbooks.

Fifty-four respondents stated that they had not observed OER or open textbooks being used as course material in their field study experiences with 46% selecting OER resources and 54% selecting open textbooks, no respondents chose both OER and open textbooks.

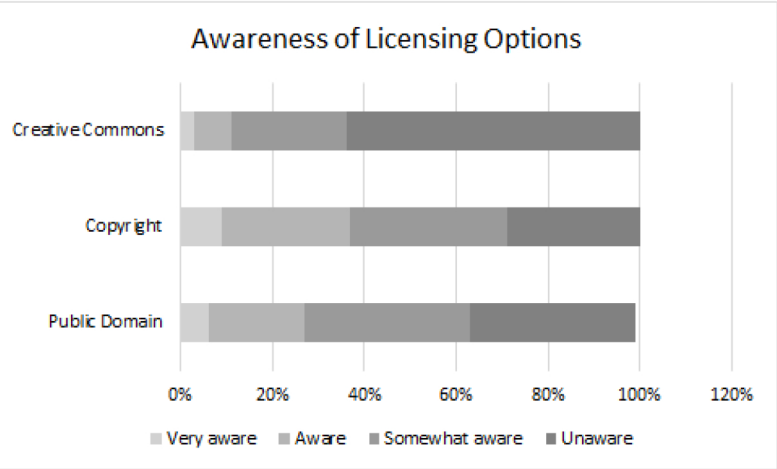


***Figure 3.*** Awareness of Licensing Options

Finally, 53 respondents stated that they did not know if they had observed OER or open textbooks being used as course material in their field study experiences with 51% selecting OER resources and 49% selecting open textbooks, no respondents choose both OER and open textbooks.

**RQ2: Do pre-service teachers understand the licensing side of OER (free-to-use versus openly licensed)?**

Researchers asked one survey question about copyright and licensing. The fourth survey question asked participants to identify their level of awareness of copyright, public domain, and Creative Commons on a four-point Likert scale. On the scale, three of the four values assigned some level of awareness including "very aware," "aware," and "somewhat aware," with the last value listed as "unaware." While the majority of participants had some level of awareness of copyright (71%) and public domain (64%), the majority of participants were unaware of Creative Commons licenses (64%). Participants reported moderate levels of copyright awareness, with 9% identifying as "very aware" and 28% "aware," and public domain awareness, with 6% identifying as "very aware" and 21% "aware." Participants reported much lower Creative Commons awareness, with 3% identifying as "very aware" and 8% "aware" (see Figure 3).

The majority of respondents at the practicum level of field placements indicated awareness of public domain (58%) and copyright (72%). These awareness percentages include all of the responses with any level of awareness, including being somewhat aware. Respondents that had reached the student teaching level reported even higher levels of public domain (75%) and copyright awareness (74%). For Creative Commons, respondents at the practicum level reported awareness at 33%, and respondents at the student teaching level reported slightly higher awareness at 38%.

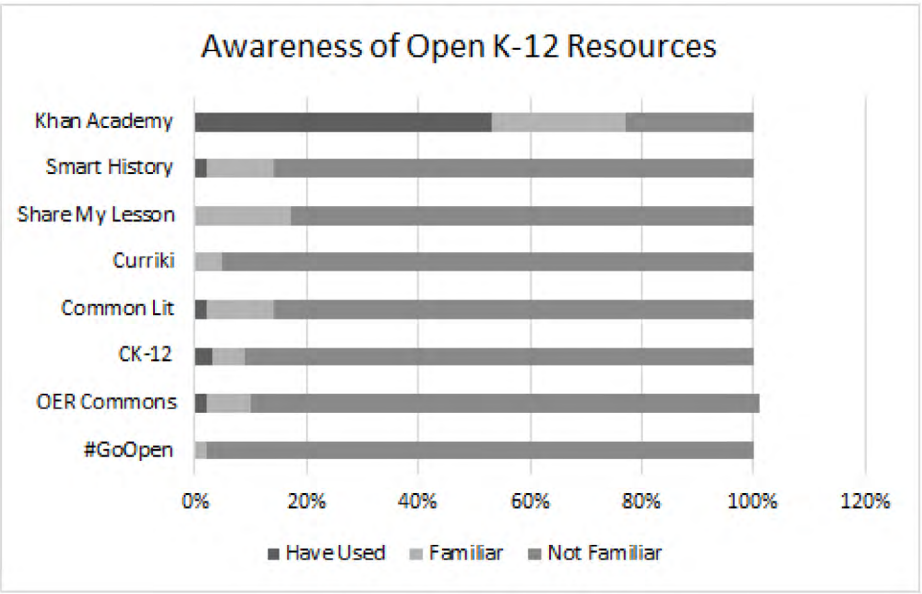


*Figure 4.* Awareness of Open K-12 Resources

**RQ3: Are pre-service teachers aware of PK-12 OER initiatives?**

Researchers asked one survey question about branded PK-12 OER resources and initiatives. The seventh survey question asked participants their level of familiarity with a list of eight specific OER initiatives based on a three-point Likert scale. The familiarity scale ranged from "have used" to "familiar" to "not familiar" with the resources. General familiarity with seven of the OER resources listed—#GoOpen, OER Commons, CK-12, Common Lit, Curriki, Share my Lesson, and Smart History—were low. The familiarity of these seven OER had responses of less than 18% of the participants when combining the total "have used" and "familiar" responses. Khan Academy was the only resource with a more even distribution of responses across the scale. The majority of participants reported they "have used" (53%) Khan Academy, while 24% reported being "familiar" and 23% were "not familiar" with it (see Figure 4).

A moderate number of students at the practicum level reported being familiar with or having used (23%) seven of the eight OER initiatives listed in the survey. Students at the student teaching level reported moderate levels of familiarity with or having used (16%) all eight of the OER initiatives listed. Practicum students indicated they have used Smart History (6%) and Khan Academy (61%), and respondents at the student teacher level indicated they have used OER Commons (4%), CK-12 (4%), CommonLit (4%), and Khan Academy (33%).

**General survey responses.** For one survey question, respondents were asked to choose how they would describe OER to a colleague. The sixth question on the survey included a pre-

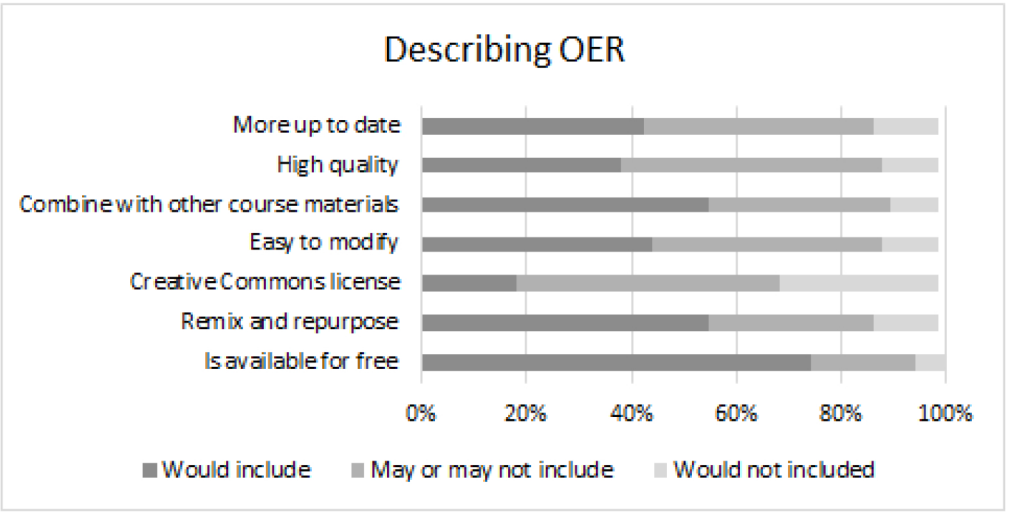


***Figure 5.*** Describing OER

scribed list of descriptions, and respondents were directed to choose whether they "would include," "may or may not include," or "would not include" each option in their description. The list of descriptions contained the following options: *Is available for free, Remix and repurpose, Creative Commons license, Easy to modify, Combine with other course materials, High quality,* and *More up to date*. Only 18% responded that they would include *Creative Commons licenses* in a description of OER, yet 74% would include that *OER are Available for free*. More than half of the respondents would include *Is available for free, Remix and repurpose*, and *Combine with other course material* as descriptions of OER (see Figure 5).

## Discussion

The survey results revealed that JMU pre-service teachers have a greater awareness of copyright and public domain than they do of Creative Commons licensing, and in fact, many respondents would not include *Creative Commons licenses* (30%) in a description of OER. The majority of respondents described OER as being *Available for free*, which can lead to confusion with copyright and fair use rights. Based on these results, pre-service teachers have not grasped the difference between free-to-use materials versus openly licensed materials. The low awareness of *Creative Commons licenses* (36%) aligns with respondents self-reported low level of OER (38%) and open textbook (30%) awareness, which also supports the idea that pre-service teachers do not understand the basic tenets of OERs.

JMU pre-service teachers also have little awareness of many PK-12 OER initiatives. Seven of the eight initiatives listed in question 7 showed less than 18% awareness; the outlier being Khan Academy with 77% of respondents familiar with or having used the materials. Without the reported high awareness of Khan Academy, the

awareness of OER initiatives matches the low level of awareness of OER and open textbooks in general. Allen and Seaman (2017) reported higher levels of awareness of at least one OER product listed in their survey (66%) than their respondents' reported levels of OER awareness (50%). Pre-service teachers also reported higher levels of awareness of at least one OER initiative listed in this survey (85%) versus their reported OER awareness (38%). Educators may be aware of OER products and yet not be aware of the concept of OER. These results indicate that teachers do not require an understanding of OER to recognize the educational value of OER products.

Responses to the four questions on the survey presenting to what extent JMU undergraduate and graduate students are aware of OER and open textbooks indicate confusion among pre-service teachers about the concept of OERs. While the majority of pre-service teachers responded that they are unaware of OER (62%) and open textbooks (70%), a moderate number also responded that they used OER (51%) and open textbooks (43%) as required course materials in at least one JMU class. These findings support previous observations by Allen and Seaman (2017) in which survey respondents struggle to accurately self-report awareness if they have a limited understanding of OER. Pre-service teacher reported observations of OER (61%) and open textbooks (39%) use in external placements was also at odds with the reported lack of awareness of OER and open textbooks.

To attempt to identify the source of respondents' confusion, the researchers looked at the distribution of answers that seemed to indicate a lack of clarity as to where students were encountering and using OER and open textbooks. This confusion is apparent when looking at responses to the question concerning using OER and open textbooks in college courses. Responding to this question, several respondents (32%) indicated they have both used and have not used OER and open textbooks. Twenty nine percent of respondents showed similar levels of confusion by indicating some combination of have used, have not used, and don't know if they have used OER and open textbooks. The confusion was distributed across field placement experiences. In the case of those who indicated they had both used and had not used OER and open textbooks, 40% of those with field observation experience selected this combination of responses, while 52% of those at the practicum level and 41% of those that have reached student teaching selected this combination of responses.

This confusion was not as prevalent, but still continued across questions concerning the use of OER and open textbooks in field experiences. Responding to this question, 23% of participants indicated that they had both used and have not used OER or open textbooks. Thirty-three percent of respondents showed similar levels of confusion by indicating some combination of have used, have not used, and don't know if they have used OER and open textbooks. As with experience within courses, the confusion was

distributed across field placement experiences. In those that indicated that they have and have not used OER 25% have completed practicum placements and 25% had completed their student teaching. No respondents that had solely completed field observations indicated they had and had not used OER in these experiences, which may be due to lack of interaction with curricular materials in these field experiences.

The authors of this study speculated that pre-service teachers may be exposed to OER in their JMU coursework or in their PK-12 field experiences. When the results of the four awareness questions and the PK-12 initiatives questions are reviewed together, the responses indicate that respondents do not understand the concept of OER well enough to identify OER or open textbooks in use. While pre-service teachers may have incidentally encountered OER products, the survey results indicate they are unable to recognize OER at this stage of their education. This lack of awareness may also be attributed to the language used to describe OER. If the researchers and educators in the local area are using different language to describe these resources, then confusion about whether a class or school is using OER is to be expected.

## Limitations

The survey returned more than 100 responses, but many were incomplete and were not included in the final analysis. Researchers anticipated that the subject of open education would be new to this audience and designed the survey questions to include response options like "unaware" and "not familiar," so participants who have not been exposed to OER could still answer all questions. Due to a survey design error, the questions were initially set to "request" response. When the research team realized that participants were not answering all of the questions, they changed the survey to "forced" response for all questions. By requiring responses, the researchers were able to collect 65 completed surveys.

Some participants reported a problem with survey questions 9 and 10. The final survey question (#11) was an open field response, in which several participants noted they wanted, but were unable to, change their responses to question 9 and/or question 10. While these survey questions were set up with the same parameters as earlier, similarly structured Likert-scale survey questions, participants only reported issues recording their responses to questions 9 and 10. Researchers attempted to remedy the issue, but have no way of knowing if all participants that experienced this issue self-reported the error in question 11. In future surveys, the researchers plan to redesign questions 9 and 10 and run several pre-survey tests for errors.

Finally, while the localized survey results are not generalizable, the survey design and methodology can be replicated by anyone wanting to explore OER awareness of pre-service teachers at other institutions.

## Conclusion

While teachers and researchers acknowledge rising levels of OER awareness across the educational community, this research team believes a critical audience is being left out of the research—pre-service teachers. The results of this survey indicate an opportunity to build awareness of OER among pre-service teachers. Building on the results of this survey, planning is underway to improve awareness and dispel confusion around OER concepts and advance pre-service teachers to the second stage of the innovation-decision process when they begin weighing the benefits and barriers to using OER (Rogers, 2005). Locally, the researchers plan to offer classroom and workshop training on OER concepts and use to College of Education faculty and students. This future action plan is based on Kimmons research which found training to be successful for increasing overall knowledge, enthusiasm, perception of value, and likely future use of OER (Kimmons, 2014, 2015, 2016). Similarly, Misra (2014) concluded that early career teachers have more opportunities to use OER throughout their careers. This research team agrees and believes that diffusion of OER as an innovation will position pre-service teachers for success in the economically and culturally changing educational environment.

## Authors

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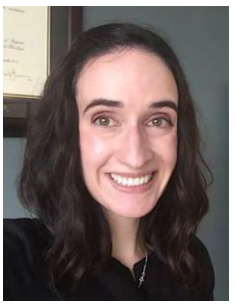

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# Appendix A:
# OER Preservice Teacher Survey Spring 2018

**Identification of Investigators and Purpose of the Study:** You are being asked to participate in a research study conducted by Elizabeth Thompson, Jessica Lantz, and Brian Sullivan from James Madison University. The purpose of this study is to understand preservice teachers' perceptions of Open Education Resources.

**Research Procedures:** This study consists of an online survey that will be administered to individual participants through email or Canvas using Qualtrics (an online survey tool).

You will be asked to provide answers to a series of questions related to your perception of OERs.

**Time Required:** Participation in this study will require less than 10 minutes of your time.

**Risks:** The investigator does not perceive more than minimal risks from your involvement in this study (that is, no risks beyond the risks associated with everyday life).

**Benefits:** There are no direct benefits to participants in this study.

**Confidentiality:** The results of this research will be presented at conferences and published in academic journals. While individual responses are anonymously obtained and recorded online through the Qualtrics software, data is kept in the strictest confidence. No identifiable information will be collected from the participant and no identifiable responses will be presented in the final form of this study. Qualitative data, written responses from participants, and any demographic data will be kept in a secure location on the researchers' password protected computers. Quantitative data, the multiple choice questions from the survey, will be stored on the Open Science Framework platform to be made available to other researchers. The researcher retains the right to use and publish nonidentifiable data. Final aggregate results will be made available to participants upon request.

**Participation and Withdrawal:** Your participation is entirely voluntary. You are free to choose not to participate. Should you choose to participate, you can withdraw at any time without consequences of any kind. However, once your responses have been submitted and anonymously recorded, you will not be able to withdraw from the study.

**Questions about the Study:** If you have questions or concerns during the time of your participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

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Chair, Institutional Review Board James Madison University
+1 (540) 568-2834
cocklede@jmu.edu

## Giving of Consent

I have been given the opportunity to ask questions about this study. I have read this consent and I understand what is being requested of me as a participant in this study. I certify that I am at least 18 years of age. By completing and submitting this anonymous survey, I am consenting to participate in this research.

What best describes your current college education level?

- ○ Junior
- ○ Senior
- ○ Graduate
- ○ Post-grad./profess.
- ○ Other

What field experiences have you completed or are currently completing? (select all that apply)

- ☐ Field observations
- ☐ Practicum placement
- ☐ Student Teaching

What grade level do you plan to teach professionally? (select all that apply)

- ☐ Pre-school
- ☐ Elementary
- ☐ Middle
- ☐ Secondary
- ☐ Other

How aware are you of the following licensing mechanisms?

| | Very aware | Aware | Somewhat aware |
|---|---|---|---|
| Unaware Public Domain | ○ | ○ | ○ |

| | | | |
|---|---|---|---|
| Copyright | ○ | ○ | ○ |
| Creative Commons | ○ | ○ | ○ |

How aware are you of OER? OER is defined as "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others." Unlike traditional copyrighted material, these resources are available for "open" use, which means users can edit, modify, customize, and share them.

○ I am not aware of OER

○ I have heard of OER, but don't know much about them

○ I am somewhat aware of OER but I am not sure how they can be used

○ I am aware of OER and some of their use cases

○ I am very aware of OER and know how they can be used in the classroom

If you were to describe the concept of open resources for education to a colleague, which of the following would you include in your description? (not included, may or may not include, would include)

| | Would include | May or may not include | Not included |
|---|---|---|---|
| Is available for free | ○ | ○ | ○ |
| Has the ability to remix and repurpose | ○ | ○ | ○ |
| Is provided with a Creative Commons license | ○ | ○ | ○ |
| Is easy to modify | ○ | ○ | ○ |
| Is easy to combine with other course materials | ○ | ○ | ○ |

| | | | |
|---|---|---|---|
| Is of high quality | ○ | ○ | ○ |
| Is more up to date than textbooks | ○ | ○ | ○ |

Are you familiar with these examples of OER programs and/or repositories?

| | Have used | Familiar | Not familiar |
|---|---|---|---|
| #GoOpen | ○ | ○ | ○ |
| OER Commons | ○ | ○ | ○ |
| CK-12 | ○ | ○ | ○ |
| CommonLit | ○ | ○ | ○ |
| Curriki | ○ | ○ | ○ |
| Share My Lesson | ○ | ○ | ○ |
| Smart History | ○ | ○ | ○ |
| Khan Academy | ○ | ○ | ○ |

How aware are you of Open Textbooks? Open textbooks are textbooks that are freely available with nonrestrictive licenses. Covering a wide range of disciplines, open textbooks are available to download and print in various file formats from several websites and OER repositories.

○ I am not aware of Open Textbooks

○ I have heard of Open Textbooks, but don't know much about them

- ○ I am somewhat aware of Open Textbooks but I am not sure if they are appropriate for my needs
- ○ I am aware of Open Textbooks and some of their use cases
- ○ I am very aware of Open Textbooks and know how they can be used in the classroom

**Have any of your JMU courses used Open Educational Resources or Open Textbooks in any of the following ways?**

| | Used as required course materials | Used as supplemental course material | Have not used | Don't know |
|---|---|---|---|---|
| Open Educational Resources | ☐ | ☐ | ☐ | ☐ |
| Open Textbooks | ☐ | ☐ | ☐ | ☐ |

**Have you observed any of your field observation, practicum, or student teaching classrooms use Open Educational Resources or Open Textbooks in any of the following ways?**

| | Used as required course materials | Used as supplemental course material | Have not used | Don't know |
|---|---|---|---|---|
| Open Educational Resources | ☐ | ☐ | ☐ | ☐ |
| Open Textbooks | ☐ | ☐ | ☐ | ☐ |

We welcome your comments. Please let us know your thoughts on any of the issues covered in this survey.

Thank you for completing the survey about preservice teachers' perceptions of Open Education Resources.

If you would like to be entered to win one of four $5 Starbucks gift cards, please click here to be taken to the entry form. The survey and the entry form are not connected in any way, so your survey responses cannot be linked to the personal information in your entry form.

# Impact of Open Educational Resources on Course DFWI Rates in Undergraduate Online Education

By Cassandra S. Shaw, Kathleen C. Irwin, Doris Blanton
*American Public University System, USA*

Abstract

The purpose of this study was to determine the relationship between the use of open educational resources (OER) and course DFWI (Drop, Fail, Withdrawal, Incomplete) rates at the undergraduate level of an online university. It was hypothesized there is an impact on DFWI rates when OER exists in online education. In 2017, an online university undertook a university-wide adoption of OER; the effect of this university-wide project had not been examined. The methodology for this study was a *t*-test analysis to evaluate the impact of course DFWI rates from OER in undergraduate online courses in the higher education environment. Data was collected from 2nd quarter 2016 to 1st quarter 2018 from the following undergraduate programs within the School of Business of an online university: Accounting (ACCT), Business Administration (BUSN), Entrepreneurship (ENTR), Hospitality (HOSP), Human Resources Management (HRMT), Management (MGMT), Retail Management (RLMT), and Transportation and Logistics Management (TLMT). This important study contributes to the gap in both literature review and the measurement of any statistically significant difference in course DFWI rates before and after the implementation of OER materials. In addition, an analysis of the return

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on investment by way of the net present value of the costs was examined.

***Keywords:*** OER, Open Educational Resources, Undergraduate, Online Education, DFWI

# 开放教育资源对本科在线教育课程DFWI率的影响

美国公立大学系统
Cassandra S. Shaw, Kathleen C. Irwin, Doris Blanton

## 摘要

本研究旨在确定开放教育资源(OER)使用与在线大学本科课程DFWI率(Drop(退课)、Fail(不合格)、Withdrawal(退课)、Incomplete(未完成))之间的关系。据推测，涉及OER的在线教育会对DFWI率产生影响。2017年，某个在线大学在全校范围内开展项目推广OER；该项目效果还未得到审查。本研究采用的研究方法为，针对高等教育环境下本科在线课程运用OER对课程DFWI率的影响评估的t检验分析。研究数据来自该所在线大学商学院2016年第二季度至2018年第一季度下列本科课程：会计(ACCT)、工商管理(BUSN)、创业学(ENTR)、酒店管理(HOSP)、人力资源管理(HRMT)、管理学(MGMT)、零售管理(RLMT)，和运输和物流管理(TLMT)。这项重要研究有助于弥补文献缺口，并针对OER材料实践前后课程DFWI率的统计显著性差异补充了测量数据。此外，本项研究还通过计算成本的净现值对投资回报率进行了分析。

关键词：OER，开放教育资源，本科生，在线教育，DFWI

## Resumen

El propósito de este estudio fue determinar la relación entre el uso de los Recursos de Educación Abierta (REA) y el DFWI (Dejado, Reprobado, Retirado, Incompleto) en el nivel de pregrado de una universidad en línea. Se planteó la hipótesis de que hay un impacto en las tasas de DFWI cuando existe REA en la educación en línea. En 2017, una universidad en línea llevó a cabo una adopción universitaria de REA; el efecto de este proyecto universitario no había sido examinado. La metodología para este estudio fue un análisis de prueba t para evaluar el impacto de las tasas DFWI del curso de REA en cursos de pregrado en línea en el entorno de educación superior. Los datos se recopilaron desde el 2° trimestre de 2016 hasta el 1er trimestre de 2018 de los siguientes programas de pregrado dentro de la Escuela de Negocios de una universidad en línea: Contabilidad (ACCT), Administración de Empresas (BUSN), Emprendimiento (ENTR), Hotelería (HOSP), Gestión de Recursos Humanos (HRMT), Gerencia (MGMT), Gestión de Mercancías (RLMT), y Gestión de Transportes y Logística (TLMT). Este importante estudio contribuye a la brecha tanto en la revisión de la literatura como a la medición de cualquier diferencia estadística significativa en las tasas de DFWI del curso antes y después de la implementación de los materiales REA. Además, se examinó un análisis del retorno de la inversión por medio del valor neto presente de los costos.


***Palabras Clave:*** *REA, recursos educativos abiertos, pregrado, educación en línea, DFWI*

## Introduction

An initiative in open educational resources (OER) began in an online higher education University within the last two years with the purpose of reducing course materials costs for the University as it pays course materials for students. The researchers embarked on a study to assess the impact of OER on undergraduate course DFWI (Drop, Fail, Withdrawal, Incomplete) rates within the School of Business. Each course converted to OER at different times and because of this, a means-before and a means-after were calculated. Courses were pre-measured, converted, and then post-measured. The course DFWI rates were then evaluated to note any differences using a *t*-test. The researchers also completed an analysis of conversion costs and return on investment (ROI) by way of calculating the net present value (NPV) of the investment. Findings and recommendations are provided as well as suggestions for future research opportunities.

## Literature Review

Little empirical research is available to undergird the hopeful claim of OER champions. OER is in its infancy, and as such, lacks statistical documentation of OER benefits or limitations. OER have been rapidly expanding, understood as an indicator of an emerging revolution in education and learning, yet a gap in the literature reflects a dearth in empirical studies. The overarching effects of OER on student learning outcomes and student retention have also yet to be studied. White and Hemmings (2010) surmised scholars fundamentally collaborated, sharing resources for teaching and learning. However, studies have shown, creating a course with OER resources tends to take 1–1½ times longer to develop versus courses with traditional resources (Flory, 2017) further adding to questions of the value of adopting OER to curriculum and measuring improved student retention. The majority of research focuses on the types of OER materials and several studies were identified dealing with student performance and student persistence.

Textbooks have forever been a part of the traditional educational experience (Berry, Cook, Hill, & Stevens, 2010). Berry et al. (2010) studied student textbook usage and the underlying assumptions students are utilizing course resources designed to further enrich the academic and learning experience. Berry et al. (2010) further discovered about 18% of those students reported nearly always reading texts prior to class experienced academic success, yet 53% of those reported rarely to never reading textbooks prior to class disputing the assumption the students' use of traditional education resources outperform those who choose not to read or are unable to access course materials. Textbook costs over the past 20 years have "increased at twice the inflation rate" (Berry et al., 2010, p. 1) forcing state and federal lawmakers in 2008 to require universities to take reasonable efforts to report course materials, resources, and book costs publically. Ber-

ry's study resonated with Durwin and Sherman's (2008) analysis of the effects of student learning based on the use or lack thereof usage, of textbooks.

Hilton, Gaudet, Clark, Robinson, and Wiley (2013) used a small sample size, discovering when OER was used compared with prior semesters where traditional textbooks were used; student results in tests, learning outcomes, and college persistence was approximately the same or had little change. Grewe and William (2017) examined the impact of enrollment in OER courses and student learning outcomes to surmise the efficacy of the studies. Performance indicated students using OER materials do as well as or better than students enrolled in courses with textbooks, suggesting a positive relationship with OER use and student persistence.

The cost of commercial textbooks is becoming a greater problem; price increasing often beyond student ability to pay (McGreal, 2017). Many students are opting out of purchasing textbooks altogether because of cost (Donachie, 2017). OER promise to obviate demographic, economic, and geographic educational boundaries influencing student persistence (Mosharraf & Taghiyareh, 2016). OER provide the ability to frequently revise materials throughout maturity of the curriculum, reducing obsolescence (Mosharraf & Teghiyareh, 2016). Fischer, Hilton, Robinson, and Wiley (2015) conducted a multi-institutional study of the impact of open textbook adoption on the learning outcomes citing student persistence rates improved based on the benefit of cost savings gained from OER course materials. Fisher et al. (2015) further suggested reduced to low or no-cost OER classes allowed students to increase credit load expediting graduation.

OER and student course outcomes reflect no difference between courses using OER versus those using traditional textbooks for continuing students. Most students consider OER, in the studies completed, as good as or better in quality and engagement as traditional textbooks or course resources/materials liberating those dollars be spent toward additional educational pursuits (Abdul-Alim, 2016; Fischer et al., 2015; Flory, 2017; Ikahihifo, Spring, Rosecrans, & Watson, 2017). OER contributed to the quality of education (McGreal, 2017) along with the value discovered as freedom for self-directed learning, convenience, quality, and open access supplemented to improve student understanding (Islim, Gurel Koybasi, & Cagiltay, 2016).

To date, few formal studies have been conducted comparing student performance and persistence measuring the pre- and post-implementation of OER. Abdul-Alim (2016) conducted a study of 39 colleges in 13 states addressing the costs associated with college attendance relating directly to textbook access, forcing institutions to turn to OER to relieve some financial constraints preventing student persistence. Lovett, Meyer, and Thille's (2008) study measured the effectiveness of test scores comparing a control group and randomly selected online courses. This resulted in no significant difference in student performance, test scores, course persistence, course grade, or

student persistence, to either support or dispute the utilization of OER other than student curriculum cost savings for both student and institution. Alternatively, Hilton and Laman (2012), in a nonexperimental case study, concluded students using OER achieved better grades, lower withdrawals, and scored better on final exams and programmatic persistence.

Feldstein et al. (2012) also found students in OER courses had higher grades, lower failure, and lower withdrawal rates, similar to the Bowen, Chingos, Lack, and Nygrens' (2014) study reflecting on students who used OER scored slightly higher, but the difference was not statistically different.

Fischer et al. (2015) used 10 colleges and over 16,700 post-secondary students in their multi-institutional collaboration and innovation case study and concluded a "pattern across the 15 courses showed almost no significant difference" (p. 165) of student persistence. However, withdrawal rates were lower and completion rates were higher in OER courses. Fischer et al. (2015) is the largest study of its kind thus far and summarized OER courses generally performed as well or better when measuring student learning outcomes and student persistence.

Current gaps in research focused on student persistence in undergraduate business programs exist. Some evidence supports the use of OER can be of particular benefit (Winitzky-Stephens & Pickavance, 2017), but little to no evidence supports or disputes the likelihood of a student passing or withdrawing from a course based on OER materials. In addition, studies do not provide conclusive evidence of the types of materials effective in an OER converted course.

## Research Question and Hypotheses

In this study, the main research question was: Is there an impact of OER on course DFWI rates within the School of Business in online higher education for undergraduate students. The following hypotheses were developed from the main research question.

$H1_0$: No impact of open educational resources exists on course DFWI rates in undergraduate online education.

$H1_A$: An impact of open educational resources exists on course DFWI rates in undergraduate online education.

$H2_0$: No impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI increases.

$H2_A$: An impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI increases.

$H3_0$: No impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases.

$H3_A$: An impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases.

| Course Number | | | |
|---|---|---|---|
| ACCT300 | Financial Accounting | ENTR420 | Social Media to Grow Small Business |
| ACCT302 | Intermediate Accounting II | ENTR498 | Entrepreneurship Senior Capstone |
| ACCT303 | Intermediate Accounting III | HOSP203 | Hotel and Restaurant Purchasing |
| ACCT406 | Managerial/Cost Accounting | HOSP307 | Principles of Cost Control in Foodservice Operations |
| ACCT499 | Senior Seminar in Accounting | HOSP320 | Business and Conference Hospitality Mgmt |
| BUSN120 | Real Estate Principles | HOSP495 | Senior Seminar in Hospitality Management |
| BUSN299 | Applied Business Solutions | HRMT101 | Human Relations Communication |
| BUSN313 | Global and Competitive Strategy | HRMT200 | Human Resource Fundamentals |
| BUSN316 | Fundamentals of Entrepreneurship | HRMT201 | Employee Training and Development |
| BUSN318 | Small Business Management | HRMT202 | Interviewing Fundamentals |
| BUSN320 | Principles of E Business | HRMT411 | Dispute Resolution |
| BUSN331 | Fundamentals of Business Analysis II | HRMT412 | Compensation and Benefits |
| BUSN410 | Critical Thinking Strategies for Business Decisions | HRMT413 | Employment and Labor Relations |
| BUSN412 | Quality Management Systems | HRMT416 | Human Resource Development |
| BUSN415 | Small Business Growth and Development | HRMT419 | Recruitment and Staffing |
| BUSN419 | International Business Management | MGMT201 | Organizational Fundamentals |
| ENTR150 | Idea Generation | MGMT311 | Organizational Behavior |
| ENTR200 | Leadership in Small Business Ventures | MGMT312 | Leadership & Motivation |
| ENTR210 | Entrepreneurs as Leaders | MGMT314 | Management Ethics |
| ENTR300 | Foundations of Entrepreneurship | MGMT315 | Management Communications |
| ENTR310 | The Family Owned Business | MGMT410 | Strategic Management |
| ENTR311 | Business Plan Foundations | MKTG307 | Consumer Behavior |
| ENTR312 | Social Entrepreneurship | MKTG401 | Marketing Strategy |
| ENTR313 | Nonprofit Entrepreneurship | MKTG403 | Marketing Management |
| ENTR315 | Financing a New Venture | MKTG407 | International Marketing |
| ENTR320 | Practical Law for the Entrepreneur | RTMG301 | Retail Innovation |
| ENTR340 | Small Business Customer Service | TLMT312 | Transportation Economics |
| ENTR410 | Money Management for Entrepreneurs | TLMT341 | Logistics Management |
| ENTR415 | Marketing the Successful Small Business | | |

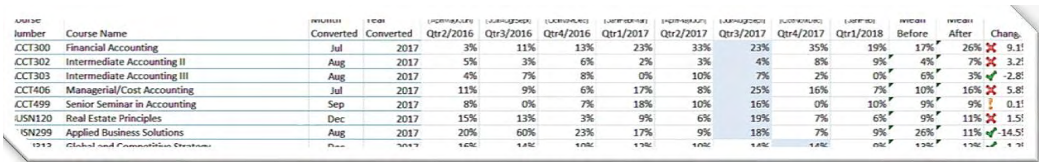
***Figure 1.*** Course Inclusion Listing

## Sample

Course-level DFWI data, course conversion costs, and student registration costs were obtained from the host institution's databases and through Program Director assessment; the data collection period was for eight quarters from 2nd quarter 2016 through 1st quarter 2018. A nonrandom purposeful sampling process was used to isolate courses which had been converted during the calendar years 2016 and 2017 so as to perform an analysis of before and after the conversion to OER. Data were collected from 57 courses in the School of Business across two years (eight quarters from 2nd quarter 2016 to 1st quarter 2018) to include the following subject areas: Accounting (ACCT), Business Administration (BUSN), Entrepreneurship (ENTR), Hospitality (HOSP), Human Resources Management (HRMT), Management (MGMT), Retail Management (RLMT), and Transportation and Logistics Management (TLMT).

## Presentation of the Findings

The main research question was: *Is there an impact of Open Educational Resources (OER) on course DFWI rates within the School of Business in online higher education for undergraduate students?* Using data provided in the University's data storage delivery software, course DFWI rates were collected for each of the time periods and subject areas in each of the areas previously described (shown in Figure 1).



| Course Number | Course Name | Month Converted | Year Converted | Qtr2/2016 | Qtr3/2016 | Qtr4/2016 | Qtr1/2017 | Qtr2/2017 | Qtr3/2017 | Qtr4/2017 | Qtr1/2018 | Mean Before | Mean After | Chang |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACCT300 | Financial Accounting | Jul | 2017 | 3% | 11% | 13% | 23% | 33% | 23% | 35% | 19% | 17% | 26% | 9.1 |
| ACCT302 | Intermediate Accounting II | Aug | 2017 | 5% | 3% | 6% | 2% | 3% | 4% | 8% | 9% | 4% | 7% | 3.2 |
| ACCT303 | Intermediate Accounting III | Aug | 2017 | 4% | 7% | 8% | 0% | 10% | 7% | 2% | 0% | 6% | 3% | -2.8 |
| ACCT406 | Managerial/Cost Accounting | Jul | 2017 | 11% | 9% | 6% | 17% | 8% | 25% | 16% | 7% | 10% | 16% | 5.8 |
| ACCT499 | Senior Seminar in Accounting | Sep | 2017 | 8% | 0% | 7% | 18% | 10% | 16% | 0% | 10% | 9% | 9% | 0.1 |
| BUSN120 | Real Estate Principles | Dec | 2017 | 15% | 13% | 3% | 9% | 6% | 19% | 7% | 6% | 9% | 11% | 1.5 |
| BUSN299 | Applied Business Solutions | Aug | 2017 | 20% | 60% | 23% | 17% | 9% | 18% | 7% | 9% | 26% | 11% | -14.5 |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

***Figure 2.*** Spreadsheet Design/OER Conversion Date

Data were grouped into quarters to facilitate the measurement of the data points over time. Once grouped into quarters, the conversion point to OER was determined for each course and plotted on the spreadsheet (see excerpt in Figure 2).

The analysis was performed by taking the mean before the conversion date and a mean after the conversion date. The change between the two mean values was then examined. A positive, or increase, in the change between means was determined to be negative, indicating the change in course DFWI rates increased. Whereas a negative, or decrease, in the change was determined to be a positive result because course DFWI rates decreased. Any change value between 0% and 1% was determined as flat or inconsequential. Negative change values numbered 25 values or 45% of the total, whereas positive change values numbered 26 values or 46% of the total.

A paired *t*-test was performed to determine if the OER conversion taken impacted course DFWI rates. The outcomes for all courses are shown in Figure 3. The outcome of the paired *t*-test indicated the mean difference in course DFWI rates was not significantly different than zero, $t(56) = -0.51$, two-tailed $p = 0.613$, providing evidence the OER conversions did not impact course DFWI rates. This provided evidence to not reject the null hypothesis $H1_0$ no impact of OER exists on course DFWI rates in undergraduate online education between the mean course DFWI rates before and after the implementation of an OER conversion. Further, the *t*-value is smaller than the *t*-critical value and the null hypothesis cannot be rejected. A paired *t*-test was performed to determine if the OER conversion of negative outcomes taken impacted course DFWI rates. The outcomes are shown in Figure 3.

The outcome of the paired *t*-test indicated the mean difference in course DFWI rates was not significantly different than zero, $t(25) = -7.38$, two-tailed $p = 1.27E\text{-}07$, providing evidence the OER conversions did impact course DFWI rates. This provided evidence to reject the null hypothesis $H2_0$ no impact of OER exists on course DFWI rates in undergraduate online education where an increase in DFWI increases between the mean course DFWI rates before and after the implementation of an OER conversion. Therefore, the alternative hypothesis is accepted: $H2_A$: An impact of OER exists on course DFWI rates in undergraduate online education where an increase in DFWI increases. A paired *t*-test was performed to determine if the OER conversion of positive outcomes taken impacted course DFWI rates. The outcomes are shown in Figure 4.

| | *Mean Before* | *Mean After* |
|---|---|---|
| Mean | 0.097394737 | 0.101038012 |
| Variance | 0.002504592 | 0.002236068 |
| Observations | 57 | 57 |
| Pearson Correlation | 0.382366842 | |
| Hypothesized Mean Difference | 0 | |
| df | 56 | |
| t Stat | -0.50807628 | |
| P(T<=t) one-tail | 0.306697712 | |
| t Critical one-tail | 1.672522303 | |
| P(T<=t) two-tail | 0.613395425 | |
| t Critical two-tail | 2.003240719 | |

***Figure 3.*** *t*-Test: Paired Two Sample for Means

| | *Mean Before* | *Mean After* |
|---|---|---|
| Mean | 0.077073333 | 0.125666667 |
| Variance | 0.001348977 | 0.00225625 |
| Observations | 25 | 25 |
| Pearson Correlation | 0.722796448 | |
| Hypothesized Mean Difference | 0 | |
| df | 24 | |
| t Stat | -7.382156325 | |
| P(T<=t) one-tail | 6.35012E-08 | |
| t Critical one-tail | 1.71088208 | |
| P(T<=t) two-tail | 1.27002E-07 | |
| t Critical two-tail | 2.063898562 | |

***Figure 4.*** *t*-Test: Paired Two Sample for Means for Negative Outcomes

The outcome of the paired *t*-test indicated the mean difference in DFWI rates was not significantly different than zero, $t(26) = 5.09$, two-tailed $p = 2.89E\text{-}05$, providing evidence the OER conversions did impact course DFWI rates. This provided evidence to reject the null hypothesis $H3_0$ no impact of OER exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases between the mean course DFWI rates before and after the implementation of an OER conversion. Therefore, the alternative hypothesis is accepted: $H3_A$: An impact of OER exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases.

| | *Mean Before* | *Mean After* |
|---|---|---|
| Mean | 0.116679487 | 0.077147436 |
| Variance | 0.003336858 | 0.001469454 |
| Observations | 26 | 26 |
| Pearson Correlation | 0.732169857 | |
| Hypothesized Mean Difference | 0 | |
| df | 25 | |
| t Stat | 5.097448182 | |
| P(T<=t) one-tail | 1.44851E-05 | |
| t Critical one-tail | 1.708140761 | |
| P(T<=t) two-tail | 2.89701E-05 | |
| t Critical two-tail | 2.059538553 | |

***Figure 5.*** *t*-Test: Paired Two Sample for Means for Positive Outcomes

In addition to looking at the DFWI rates for the 57 courses, also examined was the cost of implementation for the sample. Of the 57 courses, 17 courses were converted by part-time faculty and 40 were converted by full-time faculty or directors. Of the courses converted by part-time faculty, payment in the amount of $1,000 was administered to each faculty member who participated in the development process. To examine the ROI, it was necessary to estimate the potential cash flow savings from each conversion. The University caps undergraduate textbook costs at $35/text. Using registration data, it was possible to estimate cash flows by course for three years. In addition, a weighted average cost of capital (WACC) as the rate in the NPV calculation is used (see Figure 6).

Based on the rate calculated, the following NPV calculations can be made (see Figure 7). The resulting NPV calculations for the courses converted show positive results for the courses contracted out.

| WACC Calculation | | | Data derived from Mergent Online (4/26/2018) |
|---|---|---|---|
| Market Capitalization | $ | 669,000,000 | |
| Total Debt | $ | 49,632,000 | |
| Free Cash Flow | $ | 2.38 | per share |
| Shares Outstanding | | 16,236,000 | |
| Total FCF | $ | 38,641,680 | |
| Growth rate* | | 15% | https://www.nasdaq.com/symbol/apei/earnings-growth |
| WACC | | 20.38% | |

$$V^L = E + D = \frac{FCF}{WACC - g}$$

***Figure 6.*** WACC Calculation

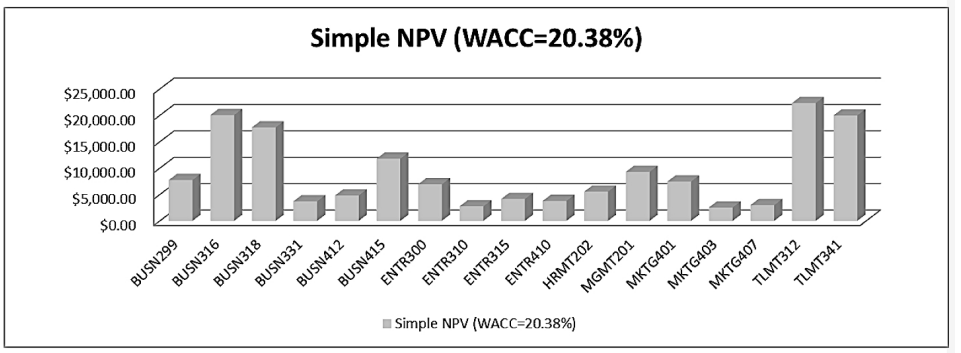



***Figure 7.*** NPV for Part-time Faculty Course Conversions

## Discussion

It is imperative we impart some specific points regarding the results of the findings. In Table 1, we present a summary of the findings.

**Table 1.** Summary of Findings

| Test | *p*-value | F or *t*-value |
|---|---|---|
| Combined, *t*-test | 0.613 | –0.51 |
| Negatives, *t*-test | 1.270E-07 | –7.38 |
| Positives, *t*-test | 2.890E-05 | 5.09 |

As shown, it is not possible to reject the null hypothesis: $H1_0$: no impact of open educational resources exists on course DFWI rates in undergraduate online education. However, $H2_0$: no impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI increases; and $H3_0$: no impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases are rejected. The alternative hypotheses for H2 and H3 are accepted. It was found OER impacted DFWI positively and negatively. Further research is needed to determine other variables affecting these hypotheses.

When we look at the course DFWI rates in groupings, we see the following from the samples collected, starting with the negative sample shown in Figure 8 followed by the positive sample (Figure 9).

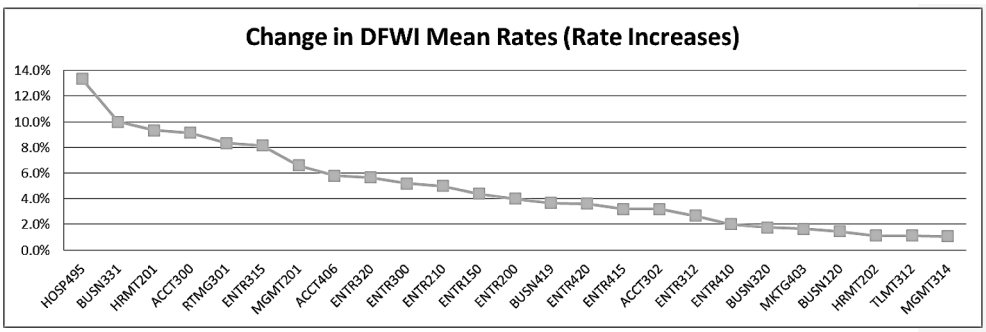



***Figure 8.*** Change in DFWI Rates (Negative Outcomes)

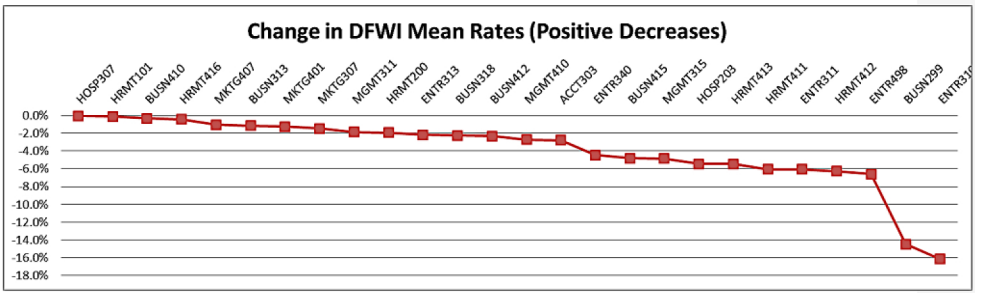



***Figure 9.*** Change in DFWI Rates (Positive Outcomes)

The calculation of NPV has managerial implications outweighing any of the other results found throughout the research study. As shown in the diagram above, each of the courses converted at a cost to the University resulted in a positive NPV. Due to this fact, the University is saving money by moving forward with these conversions, given the other data collected supported OER does not impact retention in either a negative way or a positive way. As indicated in the supporting research, Pawlyshyn, Braddlee, Casper, and Miller (2013) concluded, "although cost savings played a significant role in students' preference for KOCI (OER) courses, students and faculty alike appreciated the improved learning environments" (para. 49).

## Conclusion and Future Research

From the data, we can conclude conversions to OER did not impact the course DFWI rates in online courses in undergraduate online education for the School of Business for H1. H2 and H3 were both significant; however, in opposite directions. Future research would include an examination of various types of OER conversions, a more in-depth cost–profit analysis of the conversion procession, additional data analysis on retention using varied data points, comparison studies between different schools/subjects, and many additional topics which were not examined in this research study. In addition, different types of studies could be performed including qualitative studies or action-based research studies on the topic. In addition, one might want to explore the differences in quantitative courses and their delivery using OER materials versus non-OER developed versions using a traditional textbook with publisher resources.

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# OER and OEP for Access, Equity, Equality, Quality, Inclusiveness, and Empowering Lifelong Learning

By Ebba Ossiannilsson
*International Council for Open and Distance Education (ICDE) Open Educational Resources (OER) Advocacy Committee Chair and ICDE Ambassador for the global advocacy of OERs, Norway*

Abstract

Open educational resources (OERs) are catalysts of lifelong learning (LLL) and continuous professional development (CPD). OERs are used in microlearning and nanolearning by lifelong learners, including those in the workplace. OERs have the potential to expand the access to LLL opportunities, achieve quality in education, and establish legal and political frameworks that promote, social justice, collaboration, and coordinated partnerships. The mandate, visions, missions, global work, and activities of the International Council for Open and Distance Education (ICDE) and its Open Educational Resources (OERs) Advocacy Committee (OERAC) were presented at a symposium during the ICDE Lillehammer Life-


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long Learning Summit 2019. The work of the ICDE and the OERAC is aligned with the United Nations UNESCO Recommendations (2019). Some of their activities involve collaborative projects and visions that were proposed at the Open Education Leadership Summit 2018 (OELS18). In particular, the ICDE and OERAC will respond to proposals regarding policy. Their responses will identify opportunities for developing some proposed projects and activities and for establishing links with existing and emerging projects and trends around the world. Another activity involves developing guidelines for advocacy and best or better practices for OER advocacy in various settings and levels (e.g., macro, meso, micro, and nano levels).

***Keywords:*** continuing professional development (CPD), human resources (HR), International Council for Open and Distance Education (ICDE), leadership, open educational resources (OERs), lifelong learning

# **OER**和**OEP**：获取、公平、平等、质量、包容性和增强终身学习能力

国际开放和远程教育理事会(ICDE) 开放教育资源 (OER) 倡导委员会主席兼挪威ICDE OERs全球宣传大使
Ebba Ossiannilsson

## 摘要

开放教育资源(OERs)有助于促进终身学习(LLL)和持续专业发展(CPD)。终身学习者（包括职场学习者）运用OERs进行微型学习（microlearning）和纳米学习（nanolearning）。OERs拥有巨大潜能，能扩大终身学习机会，提高教育质量，并建立促进社会正义、合作和协调伙伴关系的法律和政治框架。国际开放和远程教育理事会（ICDE)及其开放教育资源倡导委员会（OERAC） 就其任务、愿景、使命、全球工作和活动，在2019年ICDE利勒哈默尔终身学习峰会期间举行的一次专题讨论会上作了介绍。ICDE和OERAC的工作响应了“联合国教科文组织建议”(2019年)。其中一些活动涉及在2018年开放式教育领导峰会 (OELS18)上提出的合作项目和愿景。ICDE和OERAC将会特别对有关政策的建议作出回应，从而为制定一些拟议项目和活动以及对接世界各地新兴项目

和趋势发掘机会。另一项活动涉及在不同场景和不同层面(例如宏观、中观、微观和纳米层面)制定ORE宣传指南和改善或完善宣传做法。

关键词：持续专业发展(CPD)，人力资源(HR)，国际开放和远程教育理事会(ICDE)，领导力，开放教育资源(OERs)，终身学习

# REA y MEA para acceso, equidad, igualdad, calidad, inclusión y potenciación de la educación permanente

Por Ebba Ossiannilsson
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Resumen

Los recursos educativos abiertos (REA) son catalizadores de la educación permanente y de la formación profesional continua. Los REA se utilizan en micro aprendizaje y aprendizaje por aprendices de por vida, incluidos aquellos en el lugar de trabajo. Los REA tienen el potencial de ampliar el acceso a oportunidades de aprendizaje a lo largo de toda la vida, lograr calidad en la educación y establecer marcos legales y políticos que promuevan la justicia social, la colaboración y las asociaciones coordinadas. El mandato, las visiones, las misiones, el trabajo global y las actividades del Consejo Internacional para la Educación Abierta y a Distancia (ICDE) y su Comité de Promoción de los Recursos Educativos Abiertos (OER) se presentaron en un simposio durante la ICDE Lillehammer Lifelong Learning Summit 2019 El trabajo del ICDE y el OERAC están alineados con las Recomendaciones de las Naciones Unidas de la UNESCO (2019). Algunas de sus actividades incluyen proyectos de colaboración y visiones que se propusieron en la Cumbre de Liderazgo de Educación Abierta 2018 (OELS18). En particular, el ICDE y OERAC responderán a las propuestas relativas a la política. Sus respuestas identificarán oportunidades para desarrollar algunos proyectos y actividades propuestos y para establecer vínculos con proyectos y tendencias existentes y emergentes en todo

el mundo. Otra actividad consiste en desarrollar pautas para la promoción y para las mejores prácticas para la promoción de REA en diversos entornos y niveles (por ejemplo, niveles macro, meso, micro y nano).

***Palabras Clave:*** Formación Profesional Continua, Recursos Humanos (RR. HH.), International Council for Open and Distance Education (ICDE), liderazgo, recursos educativos abiertos (REA), educación permanente

## Introduction

It is well recognized that open educational resources (OERs) are catalysts for lifelong learning (LLL), continuous professional development (CPD), and promote social justice. OERs have the potential to expand the access to LLL opportunities, achieve quality in education, and establish legal and political frameworks that promote, inter alia, coordinated partnerships. OERs are frequently used in microlearning in the workplace and in vocational training. OERs can make significant contributions to the United Nations, the United Nations Education Scientific and Cultural Organization (UNESCO), and its sustainability goals (SDG), especially SDG 4 in education, based on its key pillars of access, equity, equality, quality, and inclusion.

It is also well recognized in the research literature that the implementation of OERs and open education at local, regional, and national level has been too slow despite the international initiatives undertaken from the first OER in 2002 to the OER recommendation consultation in 2018. Worldwide research and experience have indicated that the uptake of OERs depends on policies and strategies. Hence, it is a question of leadership and management at all levels within institutions—not only senior leaders but also middle managers and leaders.

This article has its focus on the work and advocacy on OER from the International Council for Open and Distance Education (ICDE) OER Advocacy Committee (OERAC). Its guidelines (ICDE, 2017) include the following statement by the ICDE: "when invited and if possible, OERAC Ambassadors should be prepared to play a role at e.g. ICDE World Conferences, Leadership Summits, Regional Conferences, Expert Seminars or other events relevant for the purpose." Accordingly, the ICDE OERAC hosted and participated in a symposium on the mandate and global work of OERs at the ICDE Lifelong Learning Summit 2019 (LLS2019) in Lillehammer, Norway, on OER and OEP, focusing on access, equality, inclusiveness, and empowerment for life-

long and lifewide learning. In addition, the focus will include leadership in LLL in the digital era. The symposium was held on February 12, 2019. This article is based on the presentation at that symposium where mandates, visions, missions, activities, and a current roadmap of the OERAC were presented and discussed. In addition, the mandates and work of the ICDE OER chairpersons were presented.

During the symposium, the worldwide knowledge and experiences of OERAC were shared in a dialog with the participants. Concrete steps and actions in the latest initiatives and recommendations on OERs were highlighted and discussed. The presentation by each panelist was followed by questions from the audience and the chairperson. During the symposium, there was an interactive dialog with the audience, although the initial speeches were given by the presenters. The following final questions were raised by the presenters:

1. Can OER and OEP contribute to the achievement of the SDG4 in access, equity, equality, quality, inclusiveness, and empowering LLL?
2. If so, how?
3. What actions should be taken?

The present article is a position paper rather than a research paper, as it presents the content and discussions of the ICDE OERAC's symposium during the ICDE Lifelong Learning Summit (LLLS19).

The next section describes the ICDE OERAC, followed by a section on global megatrends and challenges, which are related to the global work and mandate of the OERAC. The UNESCO sustainability goals are then described before open education and a framework for open education are presented. The next section includes the Cape Town open education declaration's 10th anniversary and 10 directions to move open education forward (CPT+10). The following section presents OERs and the concept of the creative commons (CC) before highlighting the global consultation regarding the UNESCO OER recommendations, 2018. Finally, the concluding section includes recommendations for further activities.

## The OER Advocacy Committee

The OERAC[1] was launched at the 27th ICDE World Conference in Toronto in October 2017. The aim was the global advocacy of OER and the reinforcement and support for the ICDE chairpersons of OERs, who work to increase the global recognition of OER and to provide policy support for the uptake, use, and reuse of OERs.

OER Advocates support UNESCO OER's recommendations and goals. OERAC was granted a two-year mandate until the end of 2019. The committee includes global representatives of higher education from Australia, Barbados, China, France, India, Ireland, Sweden, Turkey, and the United States. All members of the ICDE Advocacy

1 www.icde.org/icde-oer-advocacy-committee.

Committee are appointed as ambassadors for the global advocacy of OER. The author of the present paper was appointed chair of the committee. The signum and the logotype of the ICDE OERAC are shown in Figure 1.


***Figure 1.*** ICDE OERAC Signum and Logotype

According to the ICDE guidelines, the mandate of the OERAC is as follows:

1. The advocacy is for OER.
2. Applications for a membership in the ICDE OERAC can be made by an expert ICDE member who has the record and capacity to contribute significantly to the advocacy of OER.
3. Members are appointed ICDE OER ambassadors by the ICDE Executive Committee.
4. When appropriate, members of the committee should seek collaboration with OER Chairs and relevant stakeholders to achieve synergy in OER advocacy.
5. The ICDE OER ambassador is not a funded position, but it provides an extra profile to the holder by expressing ICDE's interest in his/her voice for OER and underlining his/her reputation.
6. ICDE OER ambassadors are bound to establish a network among themselves in which they and their teams collaborate and to which experts in the subject area from other institutions may be admitted.
7. ICDE OER ambassadors, both individually and jointly, are expected to plan OER advocacy actions.
8. When invited and if possible, ambassadors should be prepared to play a role at events such as ICDE world conferences, leadership summits, regional conferences, expert seminars, and other relevant events.
9. ICDE OER ambassadors, both individually and jointly, are expected to plan OER advocacy actions.
10. The Chair of the ICDE OAC suggests activities in collaboration with the ICDE Secretariat. The ICDE OER ambassadors are independent, and they will inform ICDE of their activities through a brief annual report.

Figure 2 shows the OERAC webpage, and Figure 3 shows its LinkedIn page.

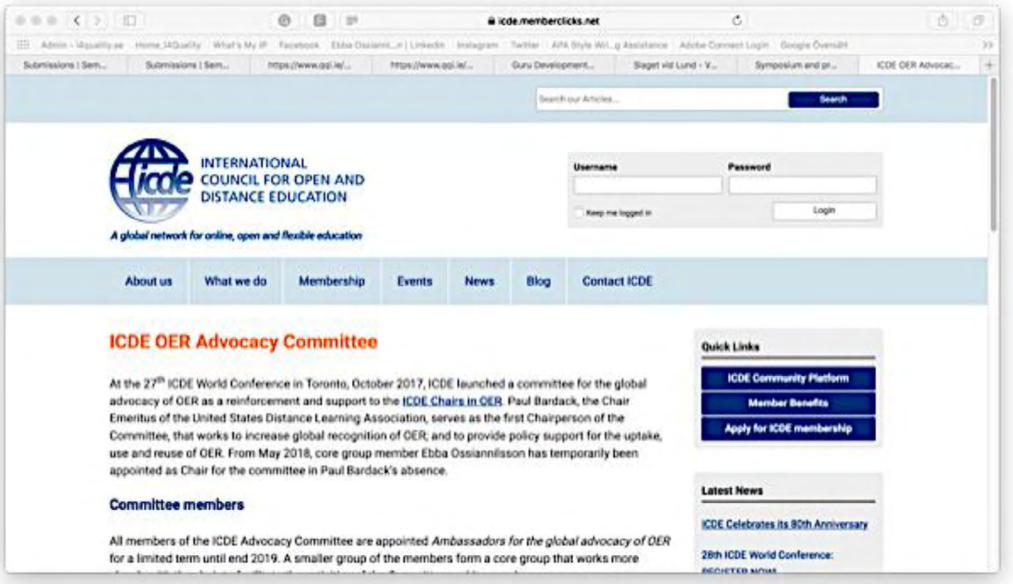


***Figure 2.*** ICDE OERAC Webpage

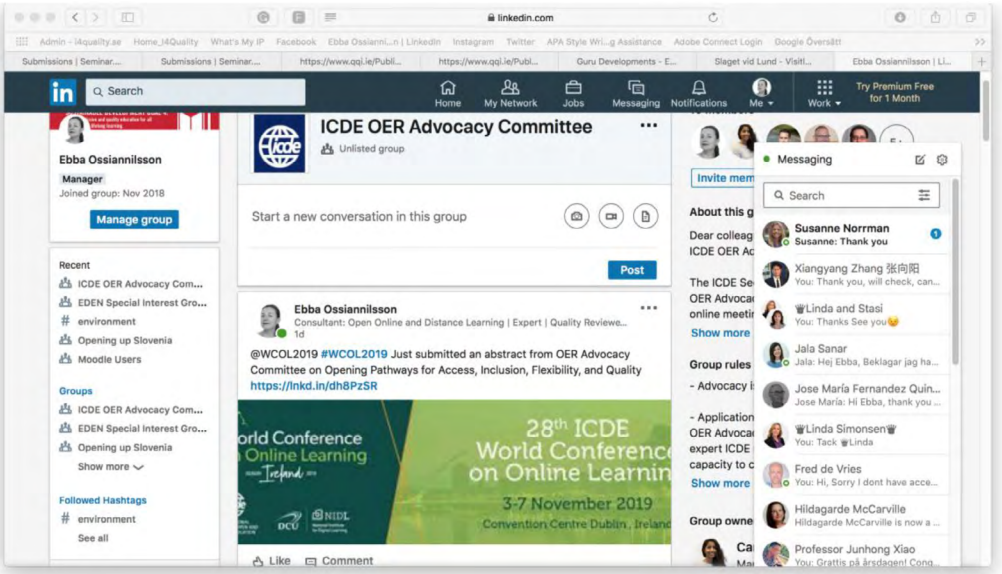


***Figure 3.*** ICDE OERAC LinkedIn Page

The work of the ICDE OERAC is aligned with the UNESCO Recommendations (2018). The OERAC will also respond to the global UNESCO consultation on the OER recommendations in 2018 (UNESCO, 2018), to be published in 2019. Furthermore, some activities are underway in the collaborative proj-

ects and visions proposed at the Open Education Leadership Summit in 2018 (OELS18, December 2018). In particular, the ICDE OERAC is responding to the OELS18 proposals regarding policy. These responses will identify opportunities for developing some of the proposed projects and activities and for establishing links with existing or emerging projects and trends around the world. The ICDE therefore will be positioned to support and expand some of the projects and visions proposed at OELS18. Another activity is the development of guidelines for advocacy and the best or better practices in OER advocacy in various settings and levels (e.g., macro, meso, micro, and nano levels).

A main purpose of the contribution to the ICDE Lillehammer Summit on Lifelong Learning 2019 was the dissemination of knowledge about the OERAC to the OER community. Hence, ICDE blogposts were published before the conference on February 5, 2019 (Ossiannilsson, 2019a) and on February 27, 2019 (Ossiannilsson, 2019b). The presentation by ICDE LLLS 2019 was shared on social media: LinkedIn, Facebook, Twitter, Google+, and the author's blog (Ossiannilsson, 2019c).

The OERAC is currently mapping best practices for the implementation of policies regarding OER advocacy around the world. Some examples of the work done so far by the OERAC are the following: (1) developed and implemented a roadmap and action plan for short-term, mid-term, and long-term actions; (2) a white paper on the guidelines on micro, meso, and macro levels will be presented at the ICDE World Conference in Dublin in November 2019. Blogposts, where the OERAC's contributions to conferences have been published. The OERAC's activities include participation in international conferences, such as the OECL2018, OEB2018, ICDE Lillehammer 2019, OEW2019, and ICDE World Conference Dublin 2019. Regarding the latter, a paper titled, "Opening Pathways for Access, Inclusion, Flexibility, and Quality" has been submitted (Ossiannilsson, Glapa-Grosskalk, Peachey, & Zhang, submitted). These pathways range from the departmental and unit levels to the regional, national, and even global levels. In this proposed session, the authors will share examples of how the concept of open, the use of OER, as well as the policies and strategies involving OER are represented and advocated in a variety of educational contexts around the globe.

The session will elaborate the concept of "open" and its many definitions, explore its initiation from the ground up. In addition, the paper will consider ways to implement this change as well as the governance and policies required to ensure a robust open organization. Finally, advocacy for a regional OER project will be shared, and examples of regional projects that resulted from successful advocacy will be provided. To date, there has been no organized effort to document and disseminate the best practices in OER advocacy or its implementation at different levels in various organizations.

Before the main issue in OER is discussed, the following section will outline some global megatrends and challenges, the United Nations and UNESCO Sustainability Goals (SDG), and the challenges of open education for universities in modernizing higher education.

## Global Megatrends and Challenges

The Visionary Innovation Research Group (Frost & Sullivan, n.d.) has presented visionary thinking on the most important trends and topics that influence the world both today and in the future. Based on extensive research and rigorous analysis, the team discusses thought-provoking facts and scenarios in the next decade, which societies and companies must consider. Their viewpoints are substantiated by market value estimates, opportunity analyses, and case studies on groundbreaking ideas and breakthrough concepts that have led to redefining practices in businesses today. They foresee megatrends (Figure 4) that will have direct effects on education, such as the future of mobility, connectivity, convergence, business models, and social trends as well as economic trends, as the global economy is changing radically and the focus is shifting to the eastern part of the globe. Here, rapid transformation and development are ongoing.

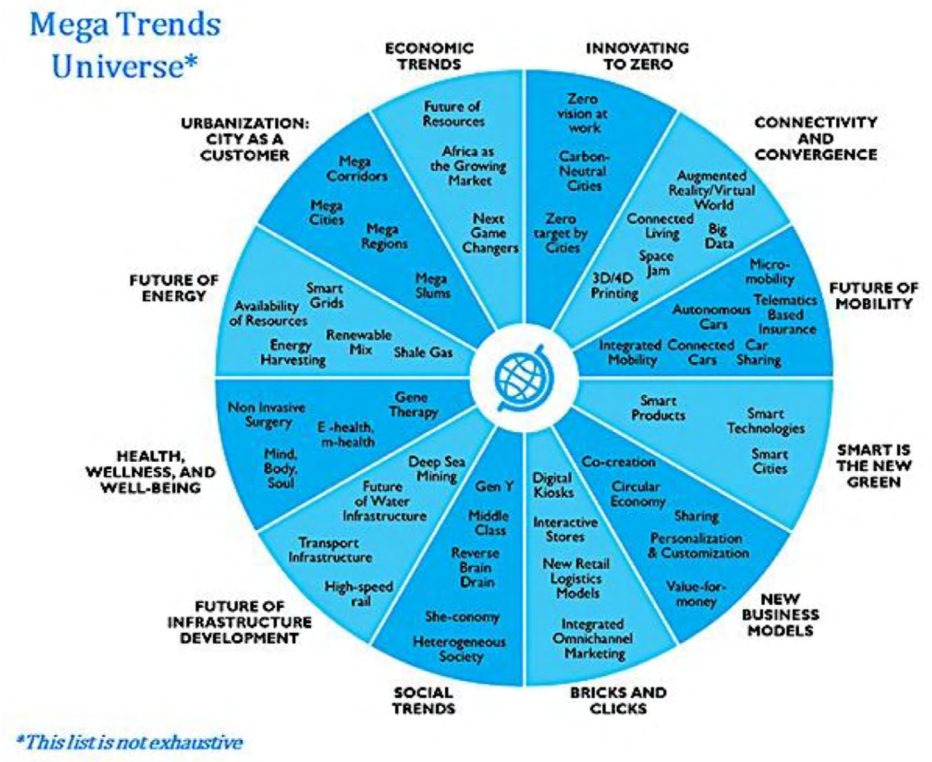


***Figure 4.*** The Mega Trends Universe

In addition, global megatrends are spreading throughout the world. According to KPMG's Future State 2030 (KPMG, n.d.), these global megatrends will continue to shape governments (Figure 5). They pointed out that as we shape the world, the world is shaping us. They emphasized that global megatrends are related to individuals and society, the physical environment, and the global economy. Notably, people are the focus as well as the ways in which individuals and societies respond or do not respond to global challenges.


***Figure 5.*** Zooming Out to the World

Schwab and Davis (2018), Schwab (2016), and the World Economic Forum (2019) during the Davos conference in 2019 also pointed in the direction of the fourth industrial revolution. Schwab and Davis (2018) argued that the fourth industrial revolution is changing everything from the way we relate to each other, the work we do, the way our economies work, and what it means to be human. We cannot let the brave new world that technology is currently creating simply emerge. We all need to help shape the future in which we want to live. However, Schwab and Davis question what we need to know and how to achieve it. These authors pointed out that the fourth industrial revolution is not as much about technology and digitization as it is about a social revolution. They argued that it will transform the way we live, work, earn, communicate, collaborate, and relate to each other. Furthermore, this transformation is toward social justice, and the emotional, emphatic, identity, "just for me," just in time, and personal concerns and considerations.

## Unesco Sustainability Development Goals

Among the 17 United Nations and UNESCO Sustainable Development Goals (SDG), the SDG 4 is especially dedicated to education. When the SDG was launched, it was decided that education plays a large role in all the other SDGs. SDG 4 has 10 targets, each of which encompasses many different aspects of education. Seven targets are the expected outcomes (4.1–4.7), and three targets are the means of achieving these targets (4a–4c).

4.1 Universal primary and secondary education

4.2 Early childhood development and universal pre-primary education

4.3 Equal access to technical, vocational, and higher education

4.4 Relevant skills for decent work

4.5 Gender equality and inclusion

4.6 Universal youth literacy

4.7 Education for sustainable development and global citizenship

In addition, three means of implementation are specified:

4.a Effective learning environments

4.b Scholarships

4.c Teachers and educators

Across the globe, open education continues to move into the mainstream. UNESCO emphasizes the role of opening up education to reach several of its sustainable development goals. SDG4 specifically highlights access, equity, equality, inclusiveness, quality, LLL, and mainstreaming the many elements of open education (Figure 6). The SDG 4 emphasizes that the inclusive use of OER will support increased access along the LLL continuum.


***Figure 6.*** SDG4 and Its Key Objectives

## Global Trends and Challenges in Education

The four main global challenges and trends are globalization, changing demography, increased digitalization, and technological development, as described above. Hence, there are tremendous challenges for education, as it also needs to be redefined. The role of education is and has always been to educate people to enable them to solve problems both now and in the future. In the current context, the role of

education is to educate people to solve social and global problems that we do not yet know about using methods that are not yet invented. Therefore, we cannot use yesterday's methods to educate today's students for an unknown future that is unpredictable.

The big questions for education, which are usually the focus of international conferences in the areas of education, LLL, and open online learning, are the following:

1. What is the future of online education?
2. How can online education contribute to better futures?
3. What is required to harness the potential of online education?
4. What are the implications of online learning for educational leaders?
5. How should governments and policymakers respond to online education?

These questions include several subthemes, such as the following: reimaging online education for better futures; expanding access, openness, and flexibility; promoting equity, diversity, and inclusion; innovative learning designs for student success; open pathways and new credentials for LLL.

The challenges in higher education concern its modernization, which will be conducted mainly through the practice of open education to foster the uptake of open education, its culture, and the use of OERs in the ecosystem of open education. The aims of higher education must be to expand the access to education and to promote inclusion according to the digital education action plan (European Commission, 2018). In addition, the results of a study by the Organisation for Economic Co-operation and Development (OECD) on the affordances of digital technology emphasized cultural and symbolic concerns, networking, communication, and cyberinfrastructure (Pedro, 2012).

## Open Education and the Open Education Framework

Open education is an umbrella term under which different understandings of open education can be accommodated. Globally, open education continues to move into the mainstream. UNESCO emphasizes the role of opening up education to reach several of its sustainable development goals. SDG4 specifically concerns access, equity, equality, inclusiveness, quality, and LLL. Mainstreaming the many elements of open education, including the use of OERs, will support the increased access along the LLL continuum (Weller, Jordan, DeVries, & Rolfe, 2018).

The broad access to knowledge (A2K) movement embraces many strategies in addition to open education, including the open access to research and data as well as copyright reform. Broad alliances are formed with movements seeking openness in other ways, including free and open source software, open government, and open culture.

The open education community considers itself part of a larger movement that supports sharing and the use of CC in the digital era. As the open education movement moves into the next decade, we should consider how to explore and leverage these connections to achieve shared goals (CPT+10, 2017).

Through open education, each individual at every stage in life and career development could have appropriate and meaningful educational opportunities available to them (Biswas-Diener & Jhangiani, 2017; Bliss, & Smith, 2017; Butcher, 2011, 2015). These include access to content, courses, support, assessment, and certification in ways that are flexible and accommodate diverse needs. Barriers such as entry requirements or unaffordable costs are reduced or eliminated. Open access publishing requirements, for example, have become formal policy in Europe. Open universities and policies regarding OER are expanding in Africa. In addition, the growth of the OER Universitas consortium (OERu) and the launch of Z-degrees based on OER and student demand have been implemented in the United States and Canada. Global organizations such as the Creative Commons and the Open Education Consortium being together activists, scholars, and practitioners from around the world to strengthen the global network (Ossiannilsson et al., submitted).

In Europe, particularly in higher education, opening up education does not refer specifically to the opening up of educational materials under an open license. Neither does it mean the availability of open access research in repositories. However, these two aspects can and should be included in the broad concept of open education. Indeed, open education is becoming more important in European higher education because digital technologies are a main driver of the modernization of educational systems. The use of digital technologies in teaching and learning is no longer limited to open universities or virtual universities. It has spread throughout all types of institutions, both traditional and avant-garde.

Also in Europe, the European Research Center (JRC) presented a support framework for higher education institutions (HEI) to open up education (Inamorato dos Santos, Punie, & Castaño-Muñoz, 2016) (Figure 7). This framework is based on a wide definition of the term "open education," which includes different uses to promote transparency and a holistic approach to practice. It goes beyond OERs, Massive Open Online Courses (MOOCs), and open access to embrace the 10 dimensions of open education. They are divided into the four transversal dimensions, i.e. strategy, technology, leadership, and quality, the ten course dimensions, i.e. content, pedagogy, recognition, collaboration, research, and access. The framework could be used as a tool by HEI staff to help them make strategic decisions about pedagogical approaches, collaboration between individuals and institutions, recognition of nonformal learning, and different ways of making content available. Because contemporary open education is

mainly enabled by ICTs, there virtually limitless potential for innovation and outreach, which would contribute to the modernization of higher education in Europe (Inamorato dos Santos et al., 2016).

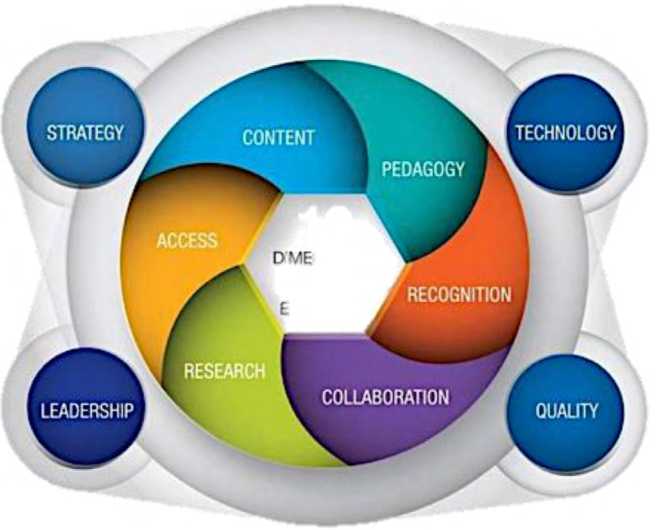


***Figure 7.*** Open Education Framework (Inamorato dos Santos et al., 2016)

## CPT+10

The 10th anniversary of the Cape Town Open Education Declaration was celebrated in 2017. On this occasion, the directions to move open education forward, the CPD+ 2017, was launched.

Over the last decade, much of the open education movement has been focused on the creation and adoption of OERs. Some of the most exciting frontiers in open education are in open pedagogy, which is widely understood to consist of teaching and learning practices enabled by the ability to retain, reuse, revise, remix, and redistribute educational materials (Wiley & Hilton, 2018). The open environment empowers educators to step away from the confines of static textbooks and traditional assignments, opening the door to imaginative, collaborative, and engaging educational experiences that help transform teaching and learning (CPD+, 2017).

Moving beyond the textbook has been at the core of the open education movement from its beginning. However, over the last decade, some OER efforts have been driven in the opposite direction. Promoting open textbooks that look, feel, and serve like traditional books has proven to be a highly successful adoption strategy in certain contexts. These efforts have made essential progress in expanding the use and adoption of OERs. However, the open education movement should remain conscious

that the strategy of equating OERs with textbooks constrains the imaginations of teachers and learners with regard to the potentials of modern, technology-enhanced open learning materials. CPT +10 specified 10 directions:

1. Communicating open; taking the message of open education to the mainstream.
2. Empowering the next generation; the open education movement must put the next generation at its core.
3. Connecting with other open movements; open education can grow stronger through collaboration with allied movements.
4. Open education for development; unlocking new opportunities for education in support of development.
5. Open pedagogy; harnessing the power of open in teaching and learning practices.
6. Thinking outside the institution; enabling everyone everywhere to learn anything.
7. Data and analytics: exploring the intersection of open content, open data, and open learning.
8. Beyond the textbook: building the open learning materials of the future.
9. Opening up publicly funded resources; publicly funded educational resources should be openly licensed by default.
10. Copyright reform for education: copyright reform and open education advocacy are two sides of the same coin.

## Open Educational Resources

OERs are teaching, learning, and research materials in any medium, digital, or otherwise, that resides in the public domain or has been released under an open license that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions (Commonwealth of Learning, 2017a; UNESCO, n.d.). The Hewlett Foundation defined OERs as teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and repurposing by other (The William and Flora Hewlett Foundation, n.d) definition OERs include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques that are used to support the access to knowledge (Atkins, Brown, & Hammond, 2007). Figure 8 below shows UNESCO's Global Open Educational Resources logo.

There are several other definitions, such as those given in the OECD, The Cape Town Declaration, WikiEducator, and OER Commons. An overview of the definitions of OER and their relationships are presented in Table 1.

Both OERs and MOOCs facilitate learners and academics in participating effectively in the changing inter-


*Figure 8.* **UNESCO's** Open Educational Resources logo

**Table 1.** An Overview of the Definitions of OER and Their Relationships

| | Open copyright license required | Right of access, adaptation, and republication | Non-discriminatory (rights given to everyone, everywhere) | Does not limit use or form (does not include NonCommercial limitations) |
|---|---|---|---|---|
| Hewlett Foundation | ✓ | ✓ | ✓ | ✓ |
| OECD | | ✓ | | |
| UNESCO | ✓ | ✓ | ✓ | ✓ |
| Cape Town Declaration | ✓ | ✓ | ✓ | |
| Wikieducator OER Handbook | | ✓ | ✓ | ✓ |
| OER Commons | | ✓ | ✓ | ✓ |

national environment (Commonwealth of Learning, 2017b). Similarly, as the use of social media connects people, teachers and learners are updated by using OERs and MOOCs. Learners can use the best resources and knowledge from international professionals and researchers across the globe. Through OERs that can be retained, reused, revised, remixed, and redistributed, and even sold for commercial use (Wiley, n.d.), learners can contextualize and adapt to their own learning context. Hence, teachers do not need to reinvent the wheel time and time again by reproducing learning materials. Instead, they can use both time and resources for deeper learning and reflection (Ossiannilsson & Abeywardena, forthcoming). Both MOOCs and OERs could be used in a wide variety of ways, such as the following (Contact North, 2018):

1. Continuing professional development (CPD)
2. Teasers
3. Marketing and branding
4. Recruitment of new students
5. Learning resources in ordinary courses

6. Updating and "just for me" learning here and now
7. Informal and formal learning, which today are increasingly blurred

### *UNESCO Recommendations 2018*

In 2018, UNESCO held a global consultation on the forthcoming UNESCO OER recommendations. The recommendations build on previous work, as those in 2012 (UNESCO, 2018), the Second OER world conference in Ljubljana 2017 (UNESCO, 2017), and the ministerial statement at Ljubljana conference (2017). The following was emphasized:

> ***"to reinforce international collaboration in the field of Open Educational Resources (OER)" and that "a recommendation could be an essential tool to strengthen the implementation of national and international legislation, policies and strategies in this field, as well as to enhance international cooperation on the use of Open Educational Resources (OER) in support of Sustainable Development Goal 4 Education"*** **(UNESCO, 2018)**

Three directions were highlighted in the global consultation on the forthcoming UNESCO OER recommendations (2018):

1. Based on the present study, it is clear that a Recommendation on International Collaboration on OERs is both desirable and feasible. Such a new UNESCO normative instrument is desirable because education is diversifying rapidly in all parts of the world while at the same time, the usage, creation, and availability of OERs have become global as well as regional.
2. The advantage of a recommendation is that it is flexible and meant to allow for contextualization. However, a framework for OERs delivery for international cooperation toward further and extended capacity building is missing, and a recommendation should build on decades of work in developing and implementing OERs-related policies and actions.
3. It will rely on tools developed over the years that have helped to deliver OERs criteria and procedures. The events, documents, and surveys conducted in this study clearly demonstrated that a majority of those most familiar with OERs firmly support the move to a standard setting.

### *Creative Commons*

A CC license is one of several public copyright licenses that enable the free distribution of an otherwise copyrighted "work." A CC license is used when an author wants to give other people the right to share, use, or build on a work that he or she (that author) has created (Creative Commons, n.d.). CC provides an author with flexibility: for example, he or she might choose to allow only

noncommercial uses of a given work. The CC license protects people who use or redistribute an author's work from copyright infringement as long as they abide by the conditions that are specified in the license by which the author distributes the work (Wikipedia, n.d.). Creators choose the set of four conditions they wish to apply to their work (Figure 9).

Attribution (BY). All CC licenses require that others who use your work in any way must give you credit the way you request, but not in a way that suggests you endorse them or their use. If they want to use your work without giving you credit or for endorsement purposes, they must get your permission first.

ShareAlike (SA). Lets others copy, distribute, display, perform, and modify your work, as long as they distribute any modified work on the same terms. If they want to distribute modified works under other terms, they must get your permission first.

Noncommercial (NC). Lets others copy, distribute, display, perform, and (unless you have chosen NoDerivatives) modify and use your work for any purpose other than commercial unless they get your permission first.

NoDerivatives (ND). Lets others copy, distribute, display, and perform only original copies of your work. If they want to modify your work, they must get your permission first.

***Figure 9.*** The Four Conditions of Creative Commons (CC)

The four conditions BY, SA, NC, and ND can be combined in six ways that define what they allow and how open or closed they are, as shown in Figure 10. All six variations begin with CC BY. As shown in Figure 10, the most open is Public Domain (PD) and CC BY and CC SA. The most closed ones are copyright and all rights reserved, but CC BY, CC NC, and CC ND are also closed.

### *The Five Rs According to Wiley (n.d.)*

The terms "open content" and "OERs" are used to describe any copyrightable work (traditionally excludes software, which is described using other terms, such as "open source") that is licensed in a manner that provides users with free and perpetual permission to engage in the 5R activities according to Wiley (n.d.). The five Rs are Retain, Reuse, Revise, Remix, and Redistribute. The terms and their implementation are illustrated in Table 2.

### *Finding Open Content*

An interesting initiative by Open Education (OE) Africa is the Finding

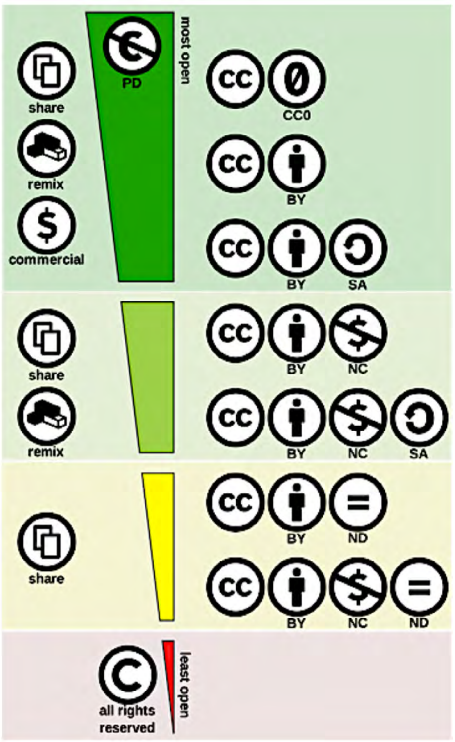


**Figure 10.** The Six Variations of Creative Commons, What They Allow, and How Open or Closed They Are.

**Table 2.** What Can I Do with OERs?

Open content is licensed in a way that grants users the permission to:

| | |
|---|---|
| **Retain** | Make, own, and control copies of the content (e.g., download, duplicate, store, and manage) |
| **Reuse** | Use the content in a wide range of ways (e.g., in a class, in a study group, on a website, in a video) |
| **Revise** | Adapt, adjust, modify, or alter the content (e.g., translate the content into another language) |
| **Remix** | Combine the original or revised content with other material to create something new (e.g., incorporate the content into a mashup) |
| **Redistribute** | Share copies of the original content, your revisions, or your remixes with others (e.g., post a copy of the content online for others to download) |

This material is based on original writing by David Wiley, which was published freely under a Creative Commons Attribution 4.0 license at: Defining the "Open" in Open Content and Open Educational Resources.

Open Content Tutorial (OER Africa, 2019). There is no requirement to log in or register; the user simply clicks on the link. There are videos and interactive elements, so an Internet connection is required. The tutorial includes the following:

1. A search strategy for open content
2. What is open licensing?
3. What is open content?
4. How to search for open content using Google
5. How to conduct more effective online searches
6. How to search for open content using CC search
7. How to search for open content in YouTube
8. How to search for content in open repositories
9. How to evaluate open content

## Conclusion

It is well recognized that countries and institutions who have strategies for implementing OERs and or CC licensing strategies as part of the rationale and vision are more prepared and have better conditions for the digital transformation of education than others are. The strategies for using OERs are crucial facilitators of the modernization of higher education and the digital transformation of education (Wiley & Hilton, 2018). OERs are a fruitful global academic collaboration in teaching and learning, and they demonstrate the growth of networking and collaboration. The most important issue could be that taxpayers should have a voice in ensuring that the global goals of UNESCO Education for All are achieved, including the SDG4's key issues of access, equity, equality, inclusion, quality, and LLL (Ossiannilsson, 2018).

At the ICDE Lillehammer conference, an LLL roadmap was developed, which focused on three levels of action in line with the UNESCO OER recommendations in 2019:

1. Government: support
2. Employers and educational leaders: implementation
3. Educators: deliver

At the Open Education Week 2019, Stephen Downes (2019, March 05) emphasized taking a quick look at the future of OER, which could yield guidelines to address further quality concerns by the OERAC:

4. Need to think in terms of data and networks
5. Need to think in terms of environment and experiences, not just content
6. Need to learn to cross create cooperatives, such as not on demand (i.e., not necessarily) collaboration

## Author

**Professor Dr. Ebba Ossiannilsson** is the International Council for Open and Distance Education (ICDE) Open Educational Resources (OER) Advocacy Committee Chair and ICDE Ambassador for the global advocacy of OERs. In addition, she is a member of the ICDE Global Quality Network Europe, and she is on the advisory board for the ICDE strategy plan 2020–2022. She is an independent researcher, expert, advisor, consultant, and quality reviewer in the fields of open online flexible and distance learning, including e-learning and technology-enabled learning (TEL), (OOFAT), which include OERs and Massive Open Online Courses (MOOCs). Her focus is on quality, innovation, leadership, personal learning, and learning "just for me." Since 2000, she has worked at Lund University in Sweden. In addition, she is a consultant and quality reviewer at several prestigious national universities.

Ossiannilsson is the Vice President of the Swedish Association for Distance Education (SADE) and the Vice President of the Swedish Organization for E-Competence (REK). She is a member of the European Distance and Elearning Network (EDEN) Executive Committee and was awarded the title of EDEN Fellow in 2014. She became an Open Education Europa Fellow in 2015. In 2018, she was awarded the title of the Council of EDEN Fellow. For EDEN, she also Chair the Special Interest Group on TEL and quality enhancement (EDEN SIG GEL QE).

Ossiannilsson earned her Ph.D. at Oulu University, Finland, in 2012 with a dissertation titled: Benchmarking e-learning in higher education: lessons learned from international projects. Her dissertation has had a very large outreach and has been cited often. Ossiannilsson has more than 200 publications in peer-reviewed journals and books, as well as technical reports.

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# Creating Faculty Professional Development on OER

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Abstract

A Campus Textbook Affordability Grant was awarded to an instructional designer to create a professional development program for faculty. Twelve university instructors and teaching assistants participated in the program over one academic year. Workshops offered information about textbook affordability, open educational resources (OERs), and Creative Common Copyright. Additional support was provided for the instructors to either revise a course using OER, publish their own course material as an OER, or to collaboratively write a textbook to fill a gap in the university's curriculum. At the end of the program, the total textbook material savings was $22k for one semester. Surveys were sent to program participants and the students in their revised courses as part of a formative evaluation of the program. Feedback indicated that participants felt the program was effective at helping them choose and utilize low-cost course materials and that students felt the materials were as effective as traditional materials.

***Keywords:*** Open educational resources, OER, textbook affordability, faculty professional development

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# 针对开放教育资源的教师专业发展创造

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## 摘要

一名教学设计师被授予一项校园课本可负担性补助金，用于为教师创建专业发展计划。十二名大学教师和教学助理在一个学年里参与了该计划。开展的不同讨论会提供了有关课本可负担性，开放教育资源（OER）和创造性共同版权方面的信息。此外还为教师提供了额外支持，用于使用OER修改课程、发布其在OER上的课程资源、或是集体编写课本，以填补大学课程空白。在计划完成的最后，一学期的所有课程材料一共节省了22，000美元。计划参与者和学生在其修订后的课程中填写了调查，以作为部分极具重要性的计划评价。调查反馈显示，参与者认为计划有效帮助其选择并使用低成本课程资料，学生则认为这些材料和传统材料一样有效。
关键词：开放教育资源，OER，课本可负担性，教师专业发展

## Resumen

La beca de asequibilidad para libros de texto del campus se otorgó a un diseñador de instrucción para crear un programa de desarrollo profesional para profesores. Doce instructores universitarios y asistentes de enseñanza participaron en el programa durante un año académico. Los talleres ofrecieron información sobre la asequibilidad de los libros de texto, los Recursos educativos abiertos (OER, por sus siglas en inglés) y el Creative Common Copyright. Se brindó apoyo adicional para que los instructores revisen un curso utilizando REA, publiquen su propio material del curso como REA o escriban un libro de texto en colaboración para llenar un vacío en el currículo de la universidad. Al final del programa, el ahorro total de material en los libros de texto fue de $22 mil por un semestre. Las encuestas se enviaron a los participantes del pro-

grama y a los estudiantes en sus cursos revisados como parte de una evaluación formativa del programa. Los comentarios indicaron que los participantes consideraron que el programa fue efectivo para ayudarlos a elegir y utilizar materiales de bajo costo y que los estudiantes consideraron que los materiales eran tan efectivos como los materiales tradicionales.

***Palabras Clave:*** Recursos educativos abiertos, REA, asequibilidad de libros de texto, desarrollo profesional docente

## Introduction

### *Creating Faculty Professional Development on OER*

The rising cost of textbooks is a widely discussed topic at university and college campuses across the nation. Student movements have encouraged institutions to examine their textbook policies and to educate faculty about the financial burden that the cost of textbooks can often place on students. The hashtag movement *#textbookbroke* has propelled students to share their stories and challenges surrounding the ancillary costs of higher education. Libraries, bookstores, instructional designers, and administrators are working to raise awareness and create professional development programming around this issue. One potential solution is the use of open educational resources (OERs), digital course materials that are created under a Creative Commons copyright that allows for the reuse, and often revision, of the materials. These materials are low-to-no cost and can be accessed anywhere with an Internet connection.

The challenge with implementing these materials as a solution to textbook affordability is that faculty, who are often feeling overworked and pressured for time, struggle to find the resources they need to completely redesign their courses to include new texts and materials. Many institutions recognize the burden this places on faculty and are willing to offset this challenge with compensation in the form of course release, stipends, grants, or other funding. While time for course revision is not the only challenge of implementing OER as a solution to rising textbook costs, it can be one that is the easiest to address. By creating compensation models for faculty, those responsible for professional development can both educate and encourage faculty to implement textbook affordability solutions into their own courses.

## Review of the Literature

### *Textbook Affordability*

The cost of textbooks has continued to rise with the cost of tuition. Textbook costs have increased on average of 6% a year, while tuition has increased on average 7% a year since 2002 (Government Accountability Office (GAO), 2013). Textbook costs are adding to students' financial burden, which can be a barrier to pursuing or continuing higher education. Some students have reported feeling like they have to choose between buying groceries or a required textbook for a course (Christie, Pollitz, & Middleton, 2009). The authors of this paper conducted surveys regarding textbook affordability and OER awareness in the Minnesota State Colleges and Universities system. Students reported similar information to previous research (Kinskey, King, & Miller, 2018). Over half of students surveyed reported that they have chosen not to purchase a required textbook during their college career. Despite students reporting that they did not find physical printed textbooks worth the price, students believed their grade would suffer from not purchasing a required textbook.

### *Open Educational Resources*

OERs are materials that exist either in the public domain or under a Creative Commons copyright. These materials are available for use, and under certain licenses, OER can be adapted by educators to meet the needs of their course. These open materials can be used as low-to-no cost replacements in lieu of traditional textbooks (Masterman, 2016; Wiley, Bliss, & McEwen, 2014). OERs include complete courses and textbooks and supplementary materials (e.g., modules, videos, worksheets, articles, quizzes, etc.).

OER greatly reduce or eliminate the cost of expensive textbooks. However, some instructors are completely unfamiliar with OER as an option or have reservations regarding adopting OER materials to replace their costly textbook. One common concern regarding OER is that the material is not comparable or as high quality as traditional textbooks. A review of nine studies evaluating the efficacy of OER found that students who used OER did just as well as, and in some cases even better than, students who were in courses that used traditional textbooks (Hilton, 2016).

### *Course Reserves*

One alternative to OER to reduce the burden of textbook costs on students is the use of library course reserves (Celik & Peck, 2016). Some traditional educational material may be placed in a library's course reserve, which allows students to check out course materials, such as the course textbook. Copyright law places restrictions on the materials that can be placed on course reserve. Materials may be available to reserve digitally or physically, which requires students to read the book in the library for a limited amount of time. This can be inconvenient for students if only one textbook is available on reserve and someone else is currently using it.

Textbook reserves have a positive impact on students, but not all courses have their required materials in a reserve. Additionally, the limitations and limited time with a textbook may deter students from utilizing a textbook reserve and purchase the textbook instead.

### *Professional Development*

OER professional development for faculty and textbook affordability generally center on both raising awareness and on locating suitable resources. Most programs offer a grant or stipend to compensate faculty for the time investment of converting course materials. The cost of the funding ranges from $1,000 to 3,000 depending on the institution. Librarians, instructional designers, and faculty development centers coordinate the professional development programming that includes topics such as Creative Commons Copyright, the 5 Rs of OER, and Open Pedagogy (Belikov & Bodily, 2016; Bjork, Stanforth, Wood, & Robison, 2019; Karunanayaka, Naidu, Rajendra, & Ratnayake, 2015; Nann, Hess, Norris, & Raible, 2017; Xu, 2018).

## Program Background

### *The Grant*

In the 2017–2018 academic year, an instructional designer at a medium-sized public comprehensive university in the Mid-West received $25,000 in grant funding to create a professional development program for university faculty on OER. The grant program was offered by the Minnesota State Colleges and Universities system office as part of an annual effort to provide seed-funding for Campus Textbook Affordability projects. Grant proposals were reviewed by a team of peers from across the Minnesota State system for merit, sustainability, and innovation.

Starting in the fall of 2017, a graduate student was hired to serve as a grant-specific project manager for the professional development program created by the instructional designer. The instructional designer and the graduate assistant distributed a call for proposals to participate in a year-long OER pilot program whereby faculty would adopt or create OER into one or more courses and receive $500 compensation for the work required to meet the program requirements.

Funding was allotted for 12 faculty participants and the program was also open to graduate students who were currently serving as teaching assistants (TAs) or the instructors of record for a course.

### *The Program*

The grant program consisted of two phases which included raising awareness and then implementing change in the form of created or adopted OER. In addition to creating marketing material for the program, the instructional designer and graduate assistant interviewed students around campus to gather their individual stories about how the textbook costs have impacted their lives. This series of video interviews was then edited together to create one cohesive story about the views

of students on the university campus about textbook and textbook affordability. This video was placed on the program website and used to promote the pilot program, and, OER in general. <https://mediaspace.minnstate.edu/media/OER+video/0_96kbxok1>

Twelve faculty applied and were accepted into the pilot program. The program itself was divided into four modules, each focusing on a different aspect of OER: *Why Open?*; *Intro to Open Licensing*; *Remixing OERs*; and *Publishing Your Own OER*. To receive the stipend, the faculty participants were required to (a) attend the four workshop sessions; (b) complete all assigned work in the learning management system (such as a *Why Open?* Essay and an OER material discovery worksheet); and (c) to either contribute to a collaborative OER writing project, publish their own course materials as OER, or to convert one of their own courses to OER.

After the initial meeting in the fall semester, the cohort was divided into groups based on their desired approach to the OER project. Four faculty members chose to contribute to one of the two collaborative OER writing projects, a graduate student handbook and a public speaking guide. Three faculty members converted their course materials—such as lectures, readings, and assessments to published OER. The remaining five chose to convert existing courses to using OER rather than traditional textbooks.

All participating faculty cited lack of time as a concern about completing any of the chosen projects. The program graduate assistant served as a point of contact, mentor, and coach for those wanting to locate or publish OER in order to mitigate this challenge. The instructional designer served as a guide and proponent of the program and OER in general to the university at large as part of an ongoing effort to raise awareness and promote culture change around textbook affordability.

As part of the grant requirements, a programmatic evaluation was conducted to determine the effectiveness of the program and the scope of the savings to students. An anonymous online survey was distributed to the faculty participants of the professional development program. A second anonymous online survey was distributed to the students in the revised courses to determine their feedback on the use of OER in place of traditional materials.

## Methodology

### *Participants*

In the 2017–2018 academic year, 12 instructors self-selected to enroll in a professional development cohort through the institution's Center for Excellence in Teaching and Learning. Five (42%) of the participants were male and seven (58%) were female. Four (33%) participants were TAs and eight (67%) were full-time faculty. All six academic colleges at this institution were represented by the participants:

- College of Arts and Humanities (25%);
- College of Allied Health and

Nursing (8%);

- College of Social and Behavioral Science (33%);
- College of Business (8%);
- College of Science, Engineering, and Technology (8%);
- College of Education (17%).

All but three were instructors of record teaching their own courses that academic year. Three of the TAs were assisting other instructors of record and planned to teach the following academic year.

### *Data Collection*

A qualitative research study was planned as part of the formative evaluation process for this program and for the purposes of reporting to the grant board. Qualitative data were collected from both faculty participants and their students through two online anonymous attitudinal surveys. Institutional Research Board permission was sought and granted to complete this study.

Faculty participants were asked to sign consent forms at the beginning of the course if they agreed to participate in the study and to distribute the student survey to students in the courses they revised to include OER. Attitudinal surveys were designed for both faculty participants and their students. Example questions from the faculty participant survey include:

- *How effective was this program at preparing you to adopt or create Open Educational Resources in your own course(s)?*
- *What is your biggest barrier to OER adoption or creation?*

Faculty participants sent out the online, anonymous survey to students in their classes revised to include OER. Students were asked questions about their experience using the material and about their perspectives on digital course materials in general. Example questions from the student attitudinal survey include:

- *How would you rate the quality of the texts used for this course?*
- *Does the free cost of the OER material used in this class make up for any shortcomings it may have?*

### *Data Analysis*

The qualitative data were reviewed by the research team to identify themes and specific comments or trends that would indicate both program success and areas for improvement for subsequent workshops.

## Results

### *Faculty Survey*

All faculty survey participants ($n$ = 9) rated the OER professional development program as above average in quality. They cited the information about Creative Commons copyright and finding OER as the most helpful information they received during the program. The biggest barrier to OER implementation according to half of the respondents was finding time to both search for material and to revise their course with OER. All but one respondent was familiar with the term OER prior to

entering the program. All participants indicated that the OER professional development program was very effective at preparing them to adopt or create OER in their own courses. Four respondents created their own OER resources to be used in their courses and shared with the community and four adapted currently available OER materials. One participant adopted free library materials for their course that could not be classified as OER but still reduced the cost of the course materials. The specific concerns for finding and using OER included:

- finding suitable current resources of high quality;
- acceptance of OER by administration and colleagues;
- uncertainty about copyright and intellectual property;
- lack of institutional support for OER;
- lack of time to convert courses.

The most commonly used OER materials by the participants were videos and images followed by podcasts and individual course modules.

### *Student Survey*

The student survey was sent to the students in courses taught by the OER professional development program participants to gauge their responses to the inclusion of OER or low-cost course material ($n = 59$). The respondents were asked to identify ways that they have been impacted by the cost of textbooks (see Table 1).

To answer the question of what actions the participants had taken as a result of textbook costs, 70% indicated that they had not purchased a required textbook due to the cost. A small percentage (10%) indicated that they earned a poor grade due to not purchasing an expensive textbook, and 20% indicated that they had not registered for a specific course due to textbook costs. When asked what percentage of their textbooks were not used enough to justify the costs, 31% of respondents indicated that at least 40% of their textbooks were not used enough to justify the cost.

If cost was not a factor, 62% of participants stated that they would prefer both digital and print copies of their textbooks. For those that preferred print copies only (30%), the primary reason stated for that preference is the ability to highlight and take notes on the pages.

The majority (77%) of student respondents buy only one textbook per course and 67% spent less than $20 total on the course for which they were being surveyed. The average cost spent on textbooks per semester for the participants was $200.

Eighty-three percent of the participants rated the OER materials of similar quality to traditional textbooks used in other courses.

The vast majority (82%) of participants indicated that they were likely to register for a course using OER materials in the future.

All participants agreed that they were satisfied with the OER materi-

**Table 1.** *In Which of the Following Ways Has the Cost of Textbooks Influenced You?*

| # | Responses | % | Count |
|---|---|---|---|
| **1** | Bought used copies from the campus bookstore | 13.56% | 8 |
| **2** | Book bought from a source other than the campus bookstore | 11.86% | 7 |
| **3** | Bought a digital version of the textbook | 10.17% | 6 |
| **4** | Bought the digital textbook chapters needed to the course | 5.08% | 3 |
| **5** | Rented printed textbooks | 16.95% | 10 |
| **6** | Rented digital textbooks | 5.08% | 3 |
| **7** | Used a reserved copy from the campus library | 3.39% | 2 |
| **8** | Used an inter-library loan | 1.69% | 1 |
| **9** | Shared books with classmates | 13.56% | 8 |
| **10** | Downloaded textbook from the Internet | 5.08% | 3 |
| **11** | Sold my used textbooks | 11.86% | 7 |
| **12** | The cost of textbooks hasn't led me to attempt to reduce textbooks costs (I have purchased them at the regular cost) | 1.69% | 1 |
| | Total | 100% | 59 |

al used in their respective courses and that the no-cost nature of the material made up for any shortcomings.

### *Cost Savings*

The estimated savings of the courses revised through participation in the professional development cohort for one semester each is $22,671, almost the amount of the original grant. The cost savings will continue to increase as more courses are converted, and OER materials are reused in subsequent semesters.

Below is a breakdown of the individual cost savings per course:

- The Business professor saved students $197 each ($7,486 saved total in one semester).

- The Early Childhood professor saved students $80 each ($2,125 saved total in one semester).
- The Special Education professor saved students $77 each ($2,310 saved total in one semester).
- The Social Work professor saved students $85 each ($850 saved total in one semester).
- The Mass Communications professor saved students $22 each ($990 saved total in one semester).

In addition, a brand-new Graduate Student Handbook was created by the cohort and published under Creative Commons licensing, so that other schools around the system could adapt and remix the handbook as needed. While this resource did not save students money, it did provide a proof of concept for collaboratively contributing and publishing an Open Resource.

### *Implications*

Faculty participants in the OER professional development cohort found the program useful and helpful in revising their own courses to include OER materials or other low-cost options. By revising at least one of their courses, they collaboratively saved almost the amount of the grant over one semester. The results of the survey and anecdotal evidence collected by the program facilitator indicate that faculty members feel additional compensation is needed in order for them to dedicate the time to a major course revision using OER or low-cost course material.

This is a foundational problem for development staff, as a wide variety of options does not exist for funding programs such as this one, particularly for university faculty. Funding for OER professional development programs has generally come from state allocations for the purpose of OER adoption, larger Department of Education grants, or projects like Achieving the Dream, which focuses on Community and Technical Colleges. Institutions looking to create professional development around the topic of OER, or hoping to increase OER adoption or creation, need to first determine whether the faculty should be compensated above their regular salary, and if so, where that funding will come from. Furthermore, what restrictions or barriers exist to compensating faculty, such as bargaining unit contracts, should be investigated and identified before starting a search for funding.

As an example, universities within the Minnstate system, under the Inter-faculty Organization bargaining unit, are unable to provide faculty stipends, or flat-rate compensation for a task. Duty days, which are work days paid as a daily percentage of a faculty member's salary, is the only acceptable form of compensation. Because this method can include a wide range of dollar amounts, depending on the faculty who participate, careful budgeting must be made for this type of compensation.

In addition to compensation, professional development programs aimed at lowering the cost of textbooks

via the integration of OER materials must consider their ability to provide adequate support for locating and vetting OER materials. Cooperation with the institution library or instructional design team is recommended, if experts in this area are available. Institutions without these resources are encouraged to reach out to fellow institutions to form partnerships around OER use and creation. Regular accountability meetings should be held to provide a forum for participants to ask questions, receive guidance, and address challenges. These meetings do not need to be location-bound and can easily be held via video-conference software, furthering the possibility of cross-institutional partnerships.

There are additional concerns regarding the acceptance of OER publishing and use as part of the Tenure and Promotion process for new faculty. There appears to be no standard on whether OER creation or revision of courses to include OER material will serve as qualifying, documentable activities for a tenure and promotion request. The tide is slowly turning as the scholarship of teaching and learning on the topic of OER creation and adoption is being more accepted by administration as acceptable service and scholarly work. Empirical research studies in the area of OER use is a wide-open field that has opened the door for larger conversations around OER acceptance for tenure and promotion considerations. At the institution in this study, the acceptability of activities around OER creation or adoption for tenure and promotion largely depended on the academic deans, but was allowed by the bargaining unit contract.

## Conclusion

Time and awareness are the most frequently cited barriers by faculty when asked about revising courses to include OER materials. Professional development programs for faculty that provide resources and support in addition to monetary compensation can be a first step to building a campus culture that considers the issues of textbook affordability and the possible solutions represented by OER.

Under this grant program, the faculty participants made significant changes to at least one course in terms of textbook and material cost and they created a collaboratively written Graduate Student Handbook that is now distributed to all incoming graduate students and available for other institutions to download and use as a template.

In one semester, the participants saved $22K with their course material revisions—almost the cost of the original grant.

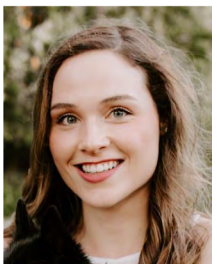
Results from participant and student surveys showed that the program was perceived as effective at helping faculty revise their courses with lower cost material and that students perceived as adequate replacements for traditional textbooks.

The responses from the student survey participants indicated that they have concerns about textbook costs and affordability and they find the OER ma-

terials a viable alternative, even if they prefer printed material for note taking and study habits.

Future programming has been revised to include higher stipends for participants and reduction in meeting times for the cohort, to provide faculty with more time to work on their course revisions. Additional grant funding will be sought to continue to provide financial support for the cohort. A textbook affordability fair for the campus at large is planned for the spring semesters and an analysis, of course, cost will be conducted (course material cost x course enrollment). Implications for other institutions looking to implement an OER or textbook affordability initiative include the importance of support for finding materials, such as an instructional designer or librarian familiar with both OER materials and Creative Commons Copyright, and incentives for compensating faculty for their time.

## Authors



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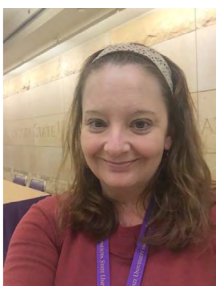

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