Evaluation of Open Educational Resources Among Students in Blended Research Methods and Statistics Coursework

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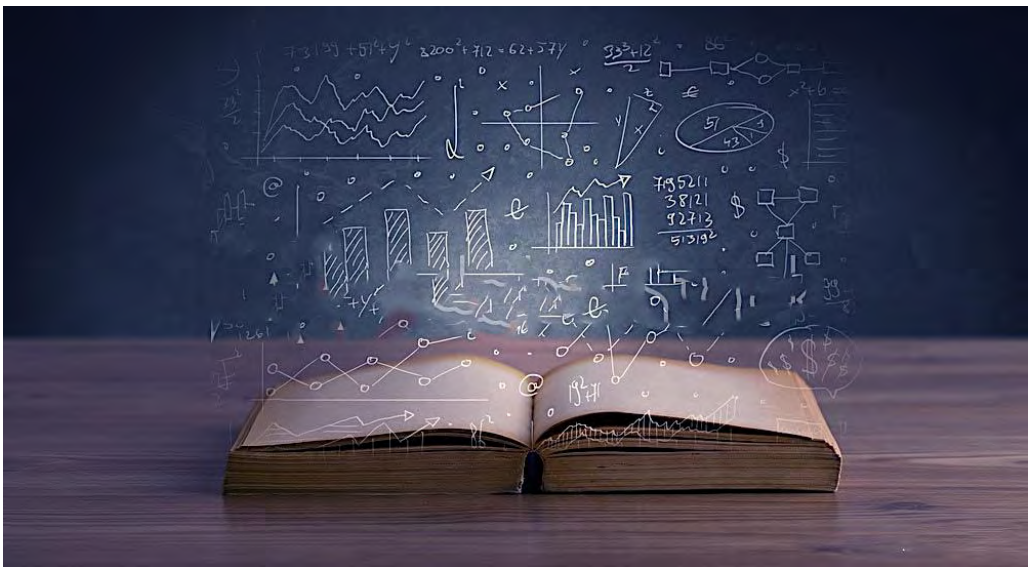

Abstract

This article presents relevant research and a preliminary investigation of Open Educational Resources (OER). The authors of this study utilized OER to replace a traditional textbook in a two-course blended research methods and statistics sequence for working adult undergraduate psychology students. The authors aimed to consider student satisfaction with OER, and more importantly, to see if OER produced different grades when compared to prior course sections taught with a traditional textbook. Twenty students consented to participate in an online satisfaction survey. Qualitatively, participants reported that OER were concise, relevant to coursework, applicable, and had strong visual presentations. Quantitatively, grades significantly improved following implementation of OER. Although grades improved when OER replaced a textbook, this finding should be interpreted with caution. Limitations of this evaluation include a small sample size and self-reporting biases. These results provide preliminary evidence that students may ben-

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efit from implementation of OER. However, ongoing research into the perceptions, challenges, and effectiveness of OER is necessary.

Keywords: open educational resources (OER), research and statistics, applied psychology

Author note: This research was conducted at Albright College

Evaluación de recursos educativos abiertos entre estudiantes de métodos de investigación combinados y cursos de estadística

Resumen

Este artículo presenta una investigación relevante y una investigación preliminar de los Recursos Educativos Abiertos (REA). Los autores de este estudio utilizaron REA para reemplazar el libro de texto tradicional en una secuencia combinada de métodos de investigación y estadísticas de dos cursos para estudiantes adultos de psicología que trabajan. Los autores tenían como objetivo considerar la satisfacción de los estudiantes con los REA y, lo que es más importante, ver si los REA producían calificaciones diferentes en comparación con las secciones de cursos anteriores que se enseñaban con un libro de texto tradicional. Veinte estudiantes dieron su consentimiento para participar en una encuesta de satisfacción en línea. Cualitativamente, los participantes informaron que los REA eran concisos, relevantes para el trabajo del curso, aplicables y tenían presentaciones visuales sólidas. Cuantitativamente, las calificaciones mejoraron significativamente después de la implementación de REA. Aunque las calificaciones mejoraron cuando REA reemplazó a un libro de texto, este hallazgo debe interpretarse con cautela. Las limitaciones de esta evaluación incluyen el pequeño tamaño de la muestra y los sesgos de autoinforme. Estos resultados proporcionan evidencia preliminar de que los estudiantes pueden beneficiarse de la implementación de REA. Sin embargo, es necesaria una investigación continua sobre las percepciones, los desafíos y la eficacia de los REA.

Palabras clave: recursos educativos abiertos, investigación y estadística, psicología aplicada

混合研究方法与统计学课程学生对开放教育资源的评价

摘要

本文展示了开放教育资源（OER）相关研究并提出一项初步探究。作者在混合研究方法与统计学课程中使用OER代替传统课本，对象为在职成人本科心理学学生。作者旨在考量学生对OER的满意度，更重要的是，与使用传统课本的课程部分相比，OER是否会让学生取得不同的学习成绩。20名学生同意参与网络满意度调查。定性来看，参与者汇报认为OER内容简洁、与课程相关、可应用、并具备强烈的视觉效果。定量来看，在执行OER之后学生成绩显著提高。尽管用OER取代课本后成绩有所提升，但这一研究发现应进行慎重诠释。该评价的限制包括样本量小和自我汇报偏差。结果就学生可能从OER学习中获益提供了初步证明。然而，有关OER的感知、挑战及有效性的持续研究是必要的。

关键词：开放教育资源，研究与统计，应用心理学

Introduction

This article presents the process and preliminary investigation of Open Educational Resources (OER) replacing a textbook in a two-course blended research methods and statistics sequence for working adult undergraduate psychology students. We taught students in four sections replacing a textbook with OER, which are "high quality educational materials" that are "freely licensed, remixable learning resources" (https://hewlett.org/strategy/open-education/#overview, para. 1).

OER are very versatile and can be changed to fit an instructor's lesson plan or classroom needs (Ikahihifo et al., 2017). Creative Commons Licensing allows instructors to modify materials to fit their courses (Kinskey et al., 2018). The acceptance of open textbooks is rapidly gaining appreciation, most notably in the field of psychology, which has been a forerunner in the OER movement (Robinson-Keilig, 2017). With the growing number of OER available, it is difficult to determine the quality and credibility of the material. The perception and willingness to use OER may be affected by the perceived quality of the material (Ikahihifo et al., 2017). Gerung (2017) conducted an extensive comparison of psychology students using OER versus traditional textbooks (with over 2200 students recruited from six different schools). This research indicated that while OER may be viewed favorably by students, and viewed as more applicable

to life than traditional textbooks, in two studies, students using OER did worse on a quiz than those using the traditional textbook. In fact, although students did not do as well on quizzes, their self-perception of learning was higher than those using traditional textbooks. Following Gerung's (2017) conclusion that student perception does not always equate to measured learning, the study described in this article focused on one OER implementation in a blended research methods and statistics sequence. This evaluation aimed to consider student satisfaction with OER, and more importantly, to see if OER produced different outcomes when compared to prior course sections taught with a traditional textbook.

Research on OER

Past research has focused on cost, student satisfaction, and quality of materials. Ikahihifo et al. (2017) hypothesized that costs for institutions and students who adopt OER for an online or hybrid class would be significantly reduced. Researchers recruited 11 faculty members in different fields of study at Reynolds Community College to adopt and regularly use OER in their classes. Most classes used open digital textbooks via OpenStax, which gave the students the option to pay for a printed version. At the end of the semester, students were asked via email to complete a survey based on their experiences. Students rated their perception of the quality level of the OER used during the course and their level of engagement with the OER compared to traditional course materials. The majority of responses (n = 206) were positive, with 54.9% (113 students) rating their experience as a 5 (excellent), and about 39% (81 students) rating their perception of the OER's quality as good to favorable. Only 12 students (less than 6%) considered the OER's quality to be less than traditional course materials.

Students regarded OER as favorable for several reasons. The first was the ease of use of OER (Ikahihifo et al., 2017). Students found it was easier to adapt their resources to different subjects and classes and that the materials were tailored to their courses. When asked to rate their level of engagement with OER, 74% found OER to be more engaging than traditional textbooks. Ikahihifo et al. (2017) suggested, based on the cost of comparable course materials, that students and the institution saved $34,000 in that trial semester.

Kinskey et al. (2018) surveyed 209 students in the Minnesota state system to assess attitudes towards various resources. They found that 58.6% of respondents had avoided purchasing textbooks due to cost in the past, and that 85% of participants had taken courses in which a text was required but was not needed (for a variety of reasons, including instructor not assigning readings and students not needing the textbook to complete assignments). Students responded to different types of resources and indicated having similar attitudes (mostly neutral) to traditional textbooks, online textbooks, and OER. When asked to identify what they liked about OER, they mentioned cost, ease

of having materials within their learning management system, and ability to interact with the materials. The negatives of OER for these participants included needing to access them online, not enjoying reading online, and not being able to highlight or underline. Quality of materials was also viewed as a potential concern.

Comprehensively investigating both satisfaction and learning outcomes, Hilton (2016) compiled 16 studies that examined the perceptions of OER by college students and professors and how well OER affected students' learning outcomes. Studies analyzed included those published in peer-review journals where OER were the primary learning materials and those that included perceptions of students and instructors of OER quality and their educational outcomes (Hilton, 2016). Over 46,000 students participated in the 16 studies analyzed by Hilton (2016). In the nine studies pertaining to OER efficacy, only one yielded results of a lower learning outcome. Three of the nine significantly favored OER, three showed no difference, and two did not report statistics. The analysis of these studies has limitations that should be noted. For example, the studies' utilization of OER in the courses varied in each study; some printed out digital textbooks to use in a more traditional manner, while others used completely digital resources.

While Hilton (2016) looked at OER research in a variety of courses, Lovett et al. (2008) specifically investigated OER implementation in statistics education through the Open Learning Initiative (OLI) of Carnegie Mellon University. OLI involved designing web-based courses that facilitate learning without an instructor (or to complement traditional face-to-face instruction). Although over a decade ago, this research might be relevant to implementation of OER in statistics. Lovett et al. (2008) conducted three studies in Fall 2005, Spring 2006, and Spring 2007 to assess the effectiveness of an OLI statistics course offered completely online or in hybrid format. All studies involved comparison with student performance in a traditional statistics course. The third study also involved the assessment of an accelerated learning hypothesis that argued that in a hybrid OLI statistics course, students would learn just as much in a significantly shorter amount of time compared to students taking the same statistics course in a traditional format during a full semester. For all three studies, no significant differences were found in test scores for the OLI course students and traditional course students. However, in the third study, students who took the accelerated hybrid OLI statistics course learned as much or more in eight weeks than the students who took the traditional course that spanned fifteen weeks. The students in the accelerated hybrid OLI course also retained as much information as those who took the traditional course. The authors argue that hybrid OLI courses facilitate more effective and efficient learning in accelerated courses. They posit that this is because the students who took the accelerated hybrid OLI statistics course

were better prepared for the face-to-face class meetings than is typically the case. This higher level of preparedness was facilitated by active student engagement in the multiple practice and comprehension checking opportunities that were offered prior to the class meetings. The students also received immediate and tailored feedback on their work, which allowed for self-reflection of understanding of the material. As a result, this preparedness allowed for a more efficient and effective use of the students' time with the instructor during class meetings (Lovett et al., 2008).

Most recently, Magro and Tabaei (2020) surveyed 66 students enrolled in eight different sections of psychology courses at Touro University that were using OER textbooks. Although this was part of a larger pilot program that also investigated the role of the library in OER implementation, the findings regarding the student outcomes were most meaningful. A majority of students (68%) preferred the quality of the OER textbook over the commercial textbook. Further, when the students' grades in courses using OER were compared to students' grades previous to OER implementation, the students enrolled in the courses using OER had higher grades. This study also provided corroboration of previous findings by Hilton et. al (2016) in which students in courses using OER may achieve higher grades than those students who took the same course using a commercial textbook.

In a similar study, though in chemistry and not psychology coursework, Springer (2019) investigated several factors related to OER adoption. Most relevant to this literature review, Springer (2019) investigated student perception and student performance, comparing final grades (homework, examinations) from those taught with OER (n = 22) and those taught with a textbook (n =16) in a chemistry course at a small, rural community college. Although this grade comparison revealed significant differences between grades with slightly higher grades for the OER group, the small sample size does not allow for a significant effect size or the ability to make a firm conclusion about the comparison. Springer (2019) suggested that these data at least indicate that learning outcomes were not adversely affected by OER implementation. Regarding perception of OER, students felt that OER seemed as high quality as a textbook (but did not see the textbook used in the comparison group). Students varied on perception of usability of OER, with some expressing concerns about the time it took to "load" the customized OER materials used in this study.

Blended Research Design and Statistics Course

There is evidence that, in spite of potential challenges, students often have neutral or even positive responses to OER (Farrow et al., 2015; Islim & Cagiltay, 2016; Kinskey et al., 2018; Springer, 2019), and that most preliminary studies of OER have not found lower learning outcomes (Hilton, 2016; Lovett et al., 2008; Springer, 2019). Due to the risks (in quality and student satisfaction) of moving forward in OER imple-

mentation without formal evaluation of materials, this study investigated student response to implementation of OER in a two-part, blended research methods and statistics sequence in an accelerated program for working adult undergraduate students en-route to earning their Bachelor of Science in Applied Psychology.

In this program, research methods and statistics coursework is taught in two sequenced courses (with a grade after each course). The learning objectives encompass concepts from research methods and statistics for behavioral sciences (Table 1). Integrating these two content areas has resulted in higher learning outcomes and improved exit assessments of research skills when compared to non-integrated coursework (Barron & Apple, 2014) and higher psychology concentration achievement test scores (ACAT) compared to the national norm (Pliske et al., 2015). Our OER included two open textbooks, one for research methods (see Price et al., 2017) and one focused more heavily on quantitative analysis (see VassarStats Concepts and Implications of Inferential Statistics at http://vassarstats.net/textbook/). In addition, a research methods chapter from the NOBA collection was utilized (see http://nobaproject.com). Readings from these open textbooks were required for each of the 10 weeks of the course. Readings were embedded in the learning management system that linked directly to the required readings. The Price et al. textbook and the NOBA chapter could also be downloaded or printed as PDFs. This provided the students with multiple ways to interact with the materials that best suited their preferences.

Table 1. Course Objectives in Sequence

Course Objectives Related to Research Methods:

Students will be able to

- **CO1:** Identify and define different research methods, including their advantages and disadvantages, so that you can discriminate between good science and opinion (i.e., fact or fiction) (APA Goals 2 and 3).
- **CO2:** Execute critical thinking skills in relation to experimental methodology (APA Goals 2 and 3).
- **CO3:** Employ APA writing style for all sections of a research paper, in preparation for the Applied Research Project (APA Goals 2 and 7).
- **CO4:** Construct a soundly designed research question to investigate a topic of interest (APA Goal 2).

Course Objectives Related to Quantitative Methods:

Students will be able to

- **CO5:** Distinguish between the two broad types of statistics: inferential and descriptive (APA Goal 2).

- **CO6:** Calculate descriptive statistics: tables, graphs and measures of central tendency and variability (APA Goal 2).
- **CO7:** Recognize the probabilistic basis of inferential statistics (APA Goal 2).
- **CO8:** Compute various inferential procedures (APA Goal 2).
- **CO9:** Distinguish which statistical procedure is appropriate for particular research designs.
- **CO10:** Execute the steps in hypothesis testing and be able to interpret the results (APA Goal 2).
- **CO11:** Demonstrate proficiency in SPSS (APA Goals 2 and 6).

Methods

Participants

The four sections of our blended Research Methods and Statistics course, taught by three different faculty members, followed an identical structure of incorporating OER in a learning management system. All students received an email invitation asking them to take a survey on their experience with OER following completion of their course. Twenty students consented to participate in an online quantitative and qualitative satisfaction survey evaluating OER. As this survey was similar to a course evaluation, the students were not asked to provide demographic information to assure anonymity.

Materials and Procedure

First, students received an email invitation to complete the evaluation after their final meeting of their course. Interested students clicked on the web link and were directed to an online survey. They read and indicated their consent on an informed consent page. Then, participants completed the survey, which involved rating their satisfaction on several closed- and open-ended questions that allowed them to describe their experiences (survey questions and responses are in Table 2). Finally, participants read a debriefing statement. This entire process occurred online.

Results

Student Satisfaction

Regarding quantitative questions, responses were predominantly positive (Table 2). For open-ended questions, responses were also generally positive (selected participant quotes are in Table 3). Prominent themes in student responses were identified through phenomenological analysis, utilizing the process outlined by Creswell and Poth (2018). This method involves compiling a list of statements that participants used to describe their experience and organizing the important statements into commonly experienced themes. Themes identified as "strengths" were that the OER used were *concise, relevant to coursework,* and *applicable* and had *strong visual presentations*. Conversely the themes expressed as "weaknesses" included the students' desire to hold an actual textbook.

Table 2. Responses to close-ended survey questions

The research methods readings for this course were:				
	Strongly agree	Agree	Disagree	Strongly disagree
Helpful.	30% (6)	55% (11)	5% (1)	10% (2)
Adequate to help me understand materials.	40% (8)	40% (8)	20% (4)	0% (0)
Confusing.	10.53% (2)	21.05% (4)	57.89% (11)	10.53% (2)
Too long.	5% (1)	10% (2)	65% (13)	20% (4)
Detailed enough to understand course content.	25% (5)	50% (10)	25% (5)	0% (0)
Appropriately matched with course content	35% (7)	60% (12)	5% (1)	0% (0)
The statistics readings for this course were:				
	Strongly agree	Agree	Disagree	Strongly disagree
Helpful.	25% (5)	50% (10)	15% (3)	10% (2)
Adequate to help me understand materials.	20% (4)	45% (9)	20% (4)	15% (3)
Confusing.	5.26% (1)	42.11% (8)	42.11% (8)	10.53% (2)
Too long.	0% (0)	10% (2)	65% (13)	25% (5)
Detailed enough to understand course content.	15% (3)	40% (8)	30% (6)	15% (3)
Appropriately matched with course content.	25% (5)	60% (12)	5% (1)	10% (2)

*Percentages represent percent of those participants who answered each question. Number of participants who indicated each response appears in parentheses following the percentage.

Table 3. Selected Student Quotes about OER

The readings were brief and relevant to the topics covered in class.
The readings did help me when I was confused or didn't understand a concept.
It was very helpful and easy to read for a subject that I thought was going to be impossible to figure out!
The readings were relevant to the topics discussed in classes and provided additional information to gain a greater understanding of the material.
I appreciated that the readings were not "unnecessarily" excessive.

Grade Assessment

To assess whether final learning outcomes are affected by the implementation of OER, the authors also compared final grades of students who utilized OER to the most recent groups of students who utilized the traditional textbook (prior to OER implementation). As noted, this coursework is split into two blended courses, so grades were analyzed for the first and second halves (Table 4). Grades for both halves included points for participation, homework assignments, and examinations. Regarding the first half of the course sequence, an independent-samples *t*-test found that grades improved following implementation of OER, $t(54) = 2.081$, $p = .04$. The average percentage grade for students taught with OER ($M = 95.56$, $SD = 5.21$) was slightly higher than the average of those taught just prior to OER implementation, using a traditional textbook ($M = 92.03$, $SD = 7.46$). Regarding the second half of the course sequence (which includes a cumulative final examination), an independent-samples *t*-test found that grades improved following implementation of OER ($t(54) = 2.239$, $p = .029$). The average grade for students taught with OER ($M = 93.02$, $SD = 6.05$) was slightly higher than the average of those taught just prior to OER implementation, using a traditional textbook ($M = 87.76$, $SD = 11.23$).

Table 4. Results of Independent Sample t-Tests

Dependent Variable	M	SD	t	p
First Half of Course Sequence				
Grades before OER	92.03	7.46	2.081	.04
Grades after OER	95.56	5.21		
Second Half of Course Sequence				
Grades before OER	87.76	11.23	2.239	.02
Grades after OER	93.02	6.05		

Discussion

These results provide preliminary evidence that students may experience satisfaction and possible academic benefits from implementation of OER and free online resources. Students were generally positive in their responses to questions about OER in this course, although most questions indicated that a small group of students did not like the chosen materials (Table 2). Other studies have found that students have neutral or positive responses to OER in terms of satisfaction and perceived effectiveness (Farrow et al., 2015; Islim & Cagiltay, 2016; Kinskey et al., 2018; Magro & Tabaei, 2020; Springer, 2019).

Although grades improved when OER replaced a textbook for assigned readings (similar to most studies included by Hilton, 2016 and the third of Lovett et al.'s, 2008 three studies), we interpret this finding with caution because many other factors could explain this difference (e.g., possible instructional changes, differences in class size, improvements in utilization of the learning management system), and these comparison groups were not the result of random assignment. Further study in the area of impact of OER on final grades is necessary to ensure that a transition to OER does not adversely affect grades or learning of course competencies. These authors echo Springer's (2019) concern of small sample size, preventing firm statements about the grade comparison. This study and the Springer (2019) study both demonstrate methods for evaluation during OER implementation that can be used to evaluate transitions to OER, making sure that the transition does not have a negative effect on learning. Both studies also provide ongoing support of OER consistent with findings of studies with larger sample sizes (e.g., Hilton, 2016).

Some faculty members might face difficulties with OER. For example, depending on the source, links might need to be checked and updated. There might be difficulty finding sources in more specific or obscure content area. Finally, some students may simply prefer a traditional textbook, which occurred for a small number of students in this research (although readers should note that the current study included adult learners and students of different age groups who might have different experiences). Kinskey et al. (2018) had similar findings that highlight concerns with OER with regard to the challenges of changing/disappearing resources and difficulty with accessibility,

Limitations of this evaluation include a small sample size and self-reporting biases. In addition, student perception (the primary focus of this research) does not indicate the quality of materials. It might also be the case that the chosen OER materials allowed for more effective teaching, thus improving student performance. For the grade comparison, groups were not randomly assigned. Additionally, although grades were used for a comparison and assignments were designed to assess learning of course objectives, grades are not the only measure of true learned knowledge. Finally, demographic information

was not requested to protect participant anonymity and student comfort in giving honest responses, so we have limited information about the sample, other than indicating that this was a sample of working adult students.

Relevant to the limitations of this study (and Springer, 2019), Grimaldi et al. (2019) suggested that studies that find positive effects of OER should be interpreted with caution (especially those with small sample sizes). They further argued that researchers examining effectiveness of OER should take into account textbook access rate prior to implementing OER. According to the results of their studies testing the access hypothesis, the higher the access rate for traditional textbooks prior to the implementation of OER, the more difficult it is to find significant effects of OER.

This study provides some support that OER and free online resources might not affect learning or grades (also found by Hilton, 2016), and provides some student response data that indicate that, other than some limitations, some students prefer OER and free online materials that are matched to course objectives. Specific to the focus of this study, implementing OER in research methods and statistics, this study and that of Lovett et al. (2008) provide preliminary evidence to support OER in these courses, although implementation should be evaluated. Research should continue to delve into student (and faculty) perception of OER, identifying and managing challenges, and ongoing assessment of student learning.

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