

Comparative Analysis of an Open Educational Resource Textbook and Commercial Textbook on Student Outcomes in an Online Nursing Course

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ABSTRACT

There is a growing body of research on the benefits of using open educational resources (OER) in higher education, and their impact on student outcomes. However, there is only one study on outcomes data related to the use of OER in undergraduate online nursing education.

This study aimed to determine if there was a difference in undergraduate nursing student outcomes for courses utilizing a teacher-developed OER textbook compared to courses utilizing a commercial textbook (CT). A retrospective grade review study design was used to identify discussion forum, assignment, and final grades for all students enrolled in an online nursing course. The sample included 160 students; 84 from seven sections that utilized the teacher-developed OER, and 78 from six sections that utilized a traditional CT. Descriptive and bivariate analysis found statistically significant differences in mean scores for one of three assignments

in the course ($p = .04$, $d = .33$), with the OER scores ($M = 89.46$) being higher than the traditional textbook group ($M = 85.70$). For the remaining assignments, there was no statistically significant difference in assignment ($p < .05$), discussion forum ($p < .05$), or final grades ($p < .05$).

This study addressed the current gap in knowledge related to outcomes when using OER in online undergraduate nursing education courses. Based on the results of this study, the use of OER offered similar outcomes compared to the CT.

Keywords: Open Educational Resources (OER); learning outcomes; nursing; online education

Análisis comparativo de un libro de texto de recursos educativos abiertos y un libro de texto comercial sobre los resultados de los estudiantes en un curso de enfermería en línea

RESUMEN

Existe un creciente cuerpo de investigación sobre los beneficios del uso de recursos educativos abiertos (REA) en la educación superior y su impacto en los resultados de los estudiantes. Sin embargo, solo hay un estudio sobre datos de resultados relacionados con el uso de REA en la educación universitaria en enfermería en línea.

Este estudio tuvo como objetivo determinar si había una diferencia en los resultados de los estudiantes de enfermería de pregrado para los cursos que utilizan un libro de texto REA desarrollado por el maestro en comparación con los cursos que utilizan un libro de texto comercial (CT). Se utilizó un diseño de estudio de revisión de calificaciones retrospectivo para identificar el foro de discusión, la asignación y las calificaciones finales para todos los estudiantes inscritos en un curso de enfermería en línea. La muestra incluyó a 160 estudiantes; 84 de 7 secciones que utilizaron el maestro desarrollaron REA, y 78 de 6 secciones que utilizaron el CT tradicional. El análisis descriptivo y bivariado encontró diferencias estadísticamente significativas en las puntuaciones medias para una de las tres tareas del curso ($p = .04$, $d = .33$), siendo las puntuaciones de REA ($M = 89.46$) más altas que las del grupo de libros de texto tradicionales ($M = 85.70$). Para las asignaciones restantes, no hubo

diferencia estadísticamente significativa en la asignación ($p < .05$), foro de discusión ($p < .05$) o calificaciones finales ($p < .05$). Este estudio abordó la brecha actual en el conocimiento relacionado con los resultados cuando se utilizan REA en cursos de educación en enfermería de pregrado en línea. Según los resultados de este estudio, el uso de REA ofreció resultados similares en comparación con la TC.

Palabras clave: REA; Recursos Educativos Abiertos; los resultados del aprendizaje; enfermería; educación en línea

比较分析网络护理课程中开放教育资源课本与商业课本对学生结果产生的影响

摘要

越来越多的研究聚焦于高等教育中使用开放教育资源（OER）的益处，以及对学生结果产生的影响。然而，仅有一项研究聚焦于本科生网络护理教育中OER使用产生的结果数据。本文旨在确定，就课程使用由教师开发的OER课本或使用商业课本（CT）而言，本科护理专业学生的结果是否存在不同。使用一项回溯性成绩评定研究设计，以识别一门网络护理课程中所有学生的论坛、作业和最终成绩。样本包括160名学生，其中84人来自使用由教师开发OER的7个课程部分，78人来自使用传统CT的6个课程部分。描述性分析与二元变量分析发现，三项课程作业中有一项的平均得分存在显著差异（ $p = .04$, $d = .33$ ），其中OER分数（ $M = 89.46$ ）高于传统课本组（ $M = 85.70$ ）。其余课程作业中不论是作业（ $p < .05$ ）、论坛（ $p < .05$ ）或最终成绩（ $p < .05$ ）均未发现显著差距。本研究填补了当前有关网络本科护理教育课程中使用OER所得结果的研究空白。基于本研究得出的结果，使用OER与使用CT所得出的学生结果相似。

关键词：OER，开放教育资源，学习结果，护理，网络教育

Introduction

Textbook fees represent a significant portion of college costs (Hilton et al., 2014) and signify a sizable barrier to secondary education, especially for those with lower incomes. The Florida Virtual Campus (2019) survey of more than 21,000 students on textbook and course materials found 43.8% spent more than \$300 and 13.8% over \$500 in 2018. These high costs led to students choosing not to purchase required textbooks (64.2%), taking fewer courses (42.8%), not registering for a specific course (42.5%), earning a poor grade (35.6%), and dropping a course (22.9%). High textbook costs have many adverse impacts, including delayed graduation (Fischer et al., 2015) and higher student debt (Jhangiani & Jhangiani, 2017). Furthermore, Cuttler (2019) found that half of commercial textbooks (CT) were not used enough to justify the purchase. These findings suggest students may decide not to purchase a textbook in the future, resulting in poor engagement in a course, poor performance, dropping courses, and delaying graduation.

One solution to improving access to higher education and reducing college costs is to replace costly CT with Open Educational Resources (OER). OER are resources (textbooks, workbooks, images, videos, music, podcasts, etc.) faculty can integrate into courses at either low or no cost to the student. OER can be found in the public domain or available under an open license, such as Creative Commons. Open licensing gives users the option to revise, redis-

tribute, remix, reuse, and retain the content for future use (United Nations Education Scientific and Cultural Organization [UNESCO], 2019). OER use in higher education has the potential to save students a considerable amount of money without compromising student learning.

Literature Review

In 2002, UNESCO was the first international organization to coin the term OER in support of open courseware for higher education (UNESCO, 2019). A major benefit of using OER is the ability to reuse, remix, and distribute (among others) the content freely, as most resources are openly licensed with Creative Commons. Imberman and Fiddler (2019) found that OER with Creative Commons licensing allowed faculty to share content freely, update outdated content, translate to different languages, and create resources that became “living artifacts.” Furthermore, Cuttler (2019) found that OER quality was, in part, due to Creative Commons licensing, where content can be remixed, making it easier to align content with course goals. Student PIRG (2018) studied textbook costs for 40 public and private two- and four-year colleges and found substitution of 10 core introductory courses with OER could save students \$1.5 billion annually.

In addition to cost savings, OER are available digitally on the first day of class and can be printed at low cost by the student. Students have unlimited digital access to OER after the course

ends. Brandle et al. (2019) found 70% (n = 886) accessed the OER before the class began and 90% by the first week of class. Similarly, Agnihotri et al. (2017) found students performed better in class with instant access to course materials. Creating an instant access OER helps students who either entered the course late or did not purchase their textbook in advance.

Integration of OER in higher education in the United States has been widely supported by state and federal governments for over a decade. Since 2009, 29 states have either passed laws supporting and facilitating the use of OER in higher education or have bills pending in the legislature (SPARC, 2020). In 2019, the Affordable College Textbook Act was introduced in Congress to reduce the cost of textbooks by expanding the use of OER in higher education (Library of Congress, 2019). Immediate access to course materials has the potential for students to be more engaged in the course, use resources to complete coursework, and ultimately enhance student learning.

Course-Level Outcomes Studies

A growing body of research has been conducted on the outcomes of using OER in higher education. Winitzky-Stephens and Pickavance (2017) conducted a multi-level analysis that included course-level outcomes from 37 general education courses, each with both CT and OER sections. Their results found no statistically significant differences in grades between CT and OER courses.

Hilton's (2016, 2019) and Clinton and Khan's (2019) syntheses of literature reveal some mixed results, though overall, OER offers similar or greater learning gains compared to CT. Hilton (2016, 2019) aggregated data from 25 peer-reviewed studies conducted between 2002–2018; 11 studies favored OER over CT, 10 found either no statistical difference or mixed results. One study favored the CT, although it had confounding variables that may have impacted the outcome. The remaining three studies did not elaborate on the statistical significance. Earlier study designs lacked control for teacher and student effect; Hilton (2019) explained that significant results may disappear when such variables are not controlled. Clinton and Khan's (2019) analyses of 22 studies between 2012 and 2019 found no significant differences between OER and CT in learning outcomes.

Grewe and Preston Davis (2017) compared OER to CT to determine change in student achievement in an online history course by controlling for student effect (prior academic achievement, GPA). Such controls led to a significant outcome with students performing as well or better using OER compared to CT. Engler and Shedlosky-Shoemaker (2019) examined mastery of content in two face-to-face (FTF) introductory psychology courses over two semesters, one class using an OER, one using a CT. In an effort to control for student effect, as suggested by Grewe and Preston Davis (2017), the study controlled for GPA, total college credits, and SAT scores. The researchers also controlled for teacher effect by

using the same experienced instructor for both cohorts. The study found no significant differences in mastery of content for students using the OER. Additional studies (Colvard et al., 2018; Cuttler, 2019; Delgado et al., 2019) controlled for student differences (academic achievement, Pell grant and financial aid recipients, underserved populations) and teacher effect (Allen et al., 2018; Engler & Shedlosky-Shoemaker, 2019; Jhangiani et al., 2018) confirming previous findings supporting adoption of OER. Controlling for both teacher and student differences leads to more compelling results.

Throughput rates (an aggregate of drop, withdrawal, and grades $\geq C$) can be considered a measure of student success as they impact time to graduation. It is unknown whether OER are responsible for impacting throughput rates, although recent research finds OER courses have comparable or improved throughput rates than CT. Hilton et al. (2016) investigated throughput rates for an Associate of Science degree program using a teacher developed OER for FTF and online/hybrid classes. Retrospective throughput rate data was analyzed from the college's institutional research database for OER and CT cohorts over four semesters. The results found OER throughput rates performed better than CT in all course types. Students were less likely to drop out and were more successful in their course. Fialkowski et al. (2019) also examined throughput rates for an introductory nutrition class using an OER developed for the institution. One difference from Hilton et al. (2016) involved controlling for teacher

effect. Results confirm previous findings. Analysis was not completed between FTF and online cohorts.

Croteau (2017) examined the impact of OER in a university system including 14 institutions, 27 courses, and 3847 students. Measures included drop/fail/withdraw rate (DFW), completion rates, and final/exam/assessment grades. All measures (except for final grades for one college) found that OER offered similar learning gains and performed comparable to CT. Lawrence and Lester (2018) found improved DFW rates, although the authors noted some concern that previous to the study, similar reductions in DFW rates occurred. Nevertheless, continued research on DFW/throughput rates and engagement in OER may further explain the variables that impact student learning and success. One may hypothesize that students who are engaged in an OER course with immediate access to resources will tend not to drop or withdraw and pass the class.

Grimaldi et al. (2019) reported on 42 studies that conducted direct comparisons of grades between OER and non-OER courses. Their analysis found that OER performed equally to CT. In another large funded project conducted as a part of the Achieving the Dream's Open Educational Resources Degree Initiative, the team worked toward scaling OER usage and tracked implementation, student outcomes, and cost-savings (Griffiths et al., 2020). Their aim was to increase college affordability and student success through OER degrees and/or pathways. The initiative involved 38

colleges nationwide, 600 courses, and approximately 160,000 students. Students benefitted from the OER degree initiative by having unrestricted access to course materials, earned more college credit, and saved about \$10.7 million in course resources costs. Instructors reported that OER positively impacted their pedagogical practice in terms of how they presented material to students. While the authors stated a broad range of disciplines were covered in the initiative, specific disciplines such as nursing were not mentioned.

There are limited research studies presenting outcomes data related to the use of OER in nursing education, and more specifically online RN to BSN nursing education. Riley and Carmack (2020) investigated the impact of OER on final course grades in an online informatics course in an RN to BSN program. The OER consisted of journal articles, videos, and federal guidelines about informatics found on the Internet. Results found a statistically significant increase (1.9%) in course grades in the OER cohort. No further OER research on outcomes in undergraduate online nursing education has been published.

The present study was conducted to determine the difference in outcomes in grades between courses utilizing a teacher-developed OER and a CT to answer three research questions and hypotheses:

1. Is there a difference in assignment grades between a course that uses a traditional commercial nursing education textbook and a course that uses OER exclusively?
 - a. H: There will be no statistically significant differences in assignment grades between the two groups.
2. Is there a difference in online class discussion forum grades between a course that uses a traditional commercial nursing education textbook and a course that uses OER exclusively?
 - a. H: There will be no statistically significant difference in discussion forum grades between the two groups.
3. Is there a difference in final grades between a course that uses a traditional commercial nursing education textbook and a course that uses OER exclusively?
 - a. H: There will be no statistically significant difference in final grades between the two groups.

Methodology

A retrospective design was used to examine differences in course grades for nursing students enrolled in OER courses compared to those enrolled in courses using a CT during Spring, Summer, and Fall semesters in 2019.

The original study design controlled for student effect by obtaining student demographic data, grant and financial aid data, GPA, time spent using resources, preference for digital/print resources, and a pre/post-test to assess learning gains. Due to poor student

response to a call to participate in the study, the retrospective study design was necessary.

OER

For the purposes of this study, OER is defined as free course resources that can be accessed in the virtual classroom on the first day of class. The OER can also be accessed online at the textbook host site, downloaded to the student's computer and various reading platforms, or printed by a student, college bookstore, or online marketplace.

Creation of the OER for the present study was a result of an OER initiative from New York State. The State University of New York (SUNY) received \$4 million between 2017 and 2020 to invest in OER adoption and creation (SUNY OER Services, 2020). The OER textbook was created by the Principle Investigator for an online RN to BSN (baccalaureate level) course at a four-year public institution.

The OER is a 138-page text containing six chapters with a CC-BY Creative Commons license. OER content covers all course topics and learning activities. The OER contains substantially more depth and breadth of course topics compared to the CT. Additionally, some chapters contain content that was not covered in the CT. Each chapter shares links to external websites to offer additional learning opportunities. Images and videos are shared throughout the OER to make it more visually appealing, in hopes of engaging students while using the resource. The OER was

peer reviewed by the School of Nursing Curriculum Committee prior to use in this study.

The online class is open to students five days prior to class start. Students can click on selected chapters in the classroom or click on a link that takes them to the [SUNY Textbooks website](#) where students can read the entire text online, download it to their computer or e-book reader, or purchase a print copy from an online marketplace for \$15 (a substantial cost savings from the \$77 CT price). Students also have the option to purchase a print copy from the college bookstore.

Sample and Setting

The sample for this study included 160 nursing students enrolled in an online RN to BSN course during the spring (six sections), summer (two sections), and fall (five sections) semesters in 2019. Seven-week sections are offered twice per semester, with multiple sections running simultaneously. Students used the CT in the Spring semester and the OER in the Summer and Fall semesters.

All courses were delivered via the same learning management system (Moodle) with identical instructional designs. There were no curricular changes during the study period and all sections used the same standardized instruments (discussion forum and assignment grading rubrics). According to Russell (2015), instructional design and mode of delivery can influence student learning outcomes; thus, maintaining the same measurements is necessary for accurate reporting.

To control for teacher effect, the same three instructors taught all sections of the courses throughout the study period. These instructors have taught the course for several years and were proficient in the content. Moreover, each instructor taught similar numbers of students in the CT and OER groups. It is important to note the Principal Investigator of this study was one of the three instructors.

Data Collection

After Institutional Review Board approval, assignment, discussion forum, and final grades from all students enrolled during the study period were retrieved after the courses ended. All data were de-identified.

Measurement

The course requires students to participate in four discussion forums. Each discussion forum requires students to answer a set of questions for their initial post. Students need to respond to two peer posts by (1) reflecting on their peers' work and (2) answering two questions. All students in all sections were graded using the same discussion forum grading rubric. There were no changes to the discussion forum questions or grading rubric during the study period. Discussion forum grades are measured using numerical values (0-100).

The course required students to complete three written assignments. Two were written papers on professional role development and nursing theory. The third assignment was an annotated bibliography on a professional nursing

role. All students in all sections were graded using the same grading rubric. There were no changes to assignment expectations or grading rubrics during the study period. Assignment grades are measured using numerical values (0-100).

Final grades were measured using the numerical value (0-100) for each student.

Data Analysis

Data were analyzed in SPSS Version 26.0 for Windows. Checks of data integrity included cleaning for missing data, checking test assumptions, and identifying extreme outliers. Initial data cleaning identified that two students were missing data for more than half of the coursework. These students disappeared from their courses without withdrawing. The decision was made to delete them from the sample.

Data from 160 nursing students were analyzed for this study. Of those, 78 (48.8%) were enrolled in courses that utilized the traditional textbook, and 82 (51.2%) were enrolled in the strictly OER courses. Three instructors taught the sections of courses with distributions as follows: 57 (35%, 24 OER and 33 traditional) taught by Instructor #1, 61 (38.1%, 35 OER and 26 traditional) by Instructor #2, and 42 (26.3%, 23 OER and 19 traditional) by Instructor #3.

Results

Research Question One: *Is there a difference in assignment grades between a course that uses a traditional commer-*

cial nursing education textbook and a course that uses OER exclusively?

Assignment #1 is a written paper on professional role development. One outlier was identified. The outlier was a student in the traditional group that had received a zero for this assignment for non-completion. This data point was removed during analysis, which then revealed a normal distribution. After removing the zero, the min/max ranged from 62-100, for this assignment ($M = 86.85$). The mean score for the traditional textbook group ($n = 77$, $M = 88.04$) was slightly higher than the OER group ($n = 82$, $M = 85.73$). An independent sample t-test was completed and found no statistically significant difference between the assignment scores for students in the OER and traditional textbook groups ($p = .08$) (See Table 1).

Assignment #2 is an annotated bibliography. For this assignment, scores less than 45 were identified as extreme outliers. One student in the traditional textbook group fit these criteria for extended lateness with submission, and was therefore deleted from the analysis of this assignment. Data from 159 students were analyzed for this assignment. The min/max ranged from 45-100 for this assignment. An independent sample t-test was completed and revealed a statistically significant difference ($p = .04$) between the mean assignment scores for students in the OER ($n = 82$, $M = 89.46$) and traditional textbook groups ($n = 77$, $M = 85.70$). The OER scores were significantly higher than those of the traditional textbook group, with a small to medium effect size ($d = .33$).

The final assignment (Assignment #3) is a scholarly paper on nursing theory. For this assignment, a normal distribution was created on a Q-Q plot by filtering out students with scores ranging 0-55, which were found to be extreme outliers. This accounted for one traditional student that achieved a low score (55) for lateness. After removing the outlier, the min/max ranged from 65-100 for this assignment. An independent sample t-test revealed no statistically significant difference ($p = .24$) between the mean assignment scores for students in the OER ($n = 82$, $M = 91.81$) and traditional textbook groups ($n = 77$, $M = 90.36$). The OER scores were slightly higher than those of the traditional textbook group. A second analysis was performed without removing the data from the one traditional student with the low score (55), which further revealed no statistically significant difference ($p = .14$) between grades in the OER ($n = 82$, $M = 91.81$) and traditional groups ($n = 78$, $M = 89.88$).

Research Question Two: *Is there a difference in online class discussion forum grades between a course that uses a traditional commercial nursing education textbook and a course that uses OER exclusively?*

In this course, there are four weeks of graded discussion forums. For the first discussion forum, no outliers were identified, with a fairly normal distribution on a Q-Q plot. The min/max ranged from 57-100, for this assignment ($M = 86.85$). The mean score for the traditional textbook group ($n = 78$, $M = 91.27$) was slightly lower than

Table 1. Assignment Grades

Assignment	Course type	N	M	SD	SEM	p
Assign #1	Traditional	77	88.04	7.39	.84	.08
	OER	82	85.73	9.07	1.00	
Assign #2	Traditional	77	85.70	10.67	1.22	.04
	OER	82	89.46	11.69	1.29	
Assign #3	Traditional	77	90.36	7.60	.87	.24/.14
	OER	82	91.81	7.93	.88	

the OER group ($n = 82$, $M = 92.89$). An independent samples t-test was completed and found no statistically significant difference between the assignment scores for students in the OER and traditional textbook groups ($p = .24$).

The second discussion forum revealed several low grades with a min/max ranged from 39-100 ($M = 90.09$). The two lowest scores for both groups were identical (39 and 42), while for the outliers on a Q-Q plot, the scores remained for the initial analysis. The mean score for the traditional textbook group ($n = 78$, $M = 88.97$) was slightly lower than the OER group ($n = 82$, $M = 91.16$). An independent samples t-test was completed and no statistically significant difference between the assignment scores for students in the OER and traditional textbook groups was found ($p = .23$).

Analysis of discussion forum #3 identified two outlier scores among the grades of students in the traditional textbook group (32 and 34). These low grades were due to lateness and lack of participation. Therefore, these grades

were removed from the final analysis for this discussion ($n = 158$). The min/max ranged from 64-100 ($M = 92.96$). The mean score for the traditional textbook group ($n = 76$, $M = 91.92$) was slightly lower than the OER group ($n = 82$, $M = 93.91$). An independent samples t-test was completed and no statistically significant difference between the assignment scores for students in the OER and traditional textbook groups was found ($p = .13$).

For the final discussion forum, one student in each group received a 0 for a grade for non-completion. Therefore, those data were removed from analysis ($n = 158$). After removing the outliers, the min/max ranged from 65-100 for this assignment. An independent samples t-test revealed no statistically significant difference ($p = .92$) between the mean assignment scores for students in the OER ($n = 81$, $M = 96.06$) and traditional textbook groups ($n = 77$, $M = 95.95$). The OER scores were slightly higher than those of the traditional textbook group (See Table 2).

Table 2. Discussion Forum Grades

Variable	Course type	N	M	SD	SEM	p
Discussion #1	Traditional	78	91.27	7.93	.90	.24
	OER	82	92.89	9.30	1.03	
Discussion #2	Traditional	78	88.97	12.03	1.36	.23
	OER	82	91.16	11.01	1.22	
Discussion #3	Traditional	76	91.92	8.95	1.03	.13
	OER	82	93.91	7.68	.85	
Discussion #4	Traditional	77	95.95	6.46	.74	.92
	OER	81	96.06	7.14	.79	

Research Question Three: *Is there a difference in final grades between a course that uses a traditional commercial nursing education textbook and a course that uses OER exclusively?*

Final grades ranged from 63-99 across all sections, with a mean grade of 89.68 (*SD* 6.33). One student grade (63) in the traditional group was identified as an outlier. The initial analysis included all student grades ($n = 160$). An independent samples t-test revealed no statistically significant difference (p

$= .22$) between the mean assignment scores for students in the OER ($n = 82$, $M = 90.28$) and traditional textbook groups ($n = 78$, $M = 89.04$). The OER scores were slightly higher than those of the traditional textbook group. A second analysis was performed without removing the data from the one traditional student ($n = 159$) with the low score (63), which further revealed no statistically significant difference ($p = .34$) between grades in the OER ($n = 82$, $M = 90.28$) and traditional groups ($n = 77$, $M = 89.38$) (See Table 3).

Table 3. Final Grades

Variable	Course type	N	M	SD	SEM	p
Final Grades	Traditional	78	89.04	6.50	.74	.22/.34
	OER	82	90.28	6.14	.68	

To control for teacher effect, the same instructors taught all sections of the courses. A two-way ANOVA was conducted to determine the influence

of the instructor on student grades. The Tukey post-hoc test revealed no significant pairwise differences between all grades and the instructor, other than

Discussion #1 (See Table 4). Instructor #3's total mean score was significantly higher than that of both Instructor #1 and #2. It is important to note that Instructor #3 was an adjunct instructor, and not the researcher for this study.

Table 4. Interaction Effects Between Instructor and Grades

Grade Type	Instructor #1	Instructor #2	Instructor #3		
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>F</i>	<i>P</i>
Assignment #1	84.25(8.45)	87.41(8.27)	89.49(7.49)	.559	.573
Assignment #2	83.82(12.83)	91.07(7.59)	87.84(12.33)	.653	.522
Assignment #3	89.88(7.28)	91.05(8.26)	92.85(7.59)	.397	.673
Final Grades	87.16(6.67)	90.28(6.05)	92.21(5.01)	.404	.669
Discussion #1	89.25(8.64)	91.05(8.75)	97.16(6.21)	5.507	.005
Discussion #2	86.72(11.60)	90.61(11.50)	93.84(10.32)	1.239	.292
Discussion #3	90.63(8.15)	92.15(10.50)	96.02(8.06)	1.413	.247
Discussion #4	94.46(7.71)	96.20(6.03)	97.88(6.09)	1.033	.359

Discussion

Findings from this retrospective study found that a teacher-developed OER for an online nursing course can provide similar student learning outcomes compared to CT. Students that utilized solely OER content had discussion forum, assignments, and final grades that were statistically similar to grades for students that utilized solely CT content. While the OER cohort earned statistically significant higher grades for Assignment 2 ($p = .04$), it is important to note that students utilized less OER content for this assignment compared to other assignments. Assignment 2 required students to search the literature for five articles to write an annotated bibliography on a

professional nursing role. Some content about professional nursing roles was reviewed in the OER, such as certifications and interpersonal skills, although much of the bibliography content came from the literature.

An overwhelming majority of studies conducted over nearly two decades reveal OER performs as well as or better than CT. Study findings are consistent with numerous other studies (Allen et al., 2015; Clinton, 2019; Croteau, 2017; Engler & Shedlosky-Shoemaker, 2019). For example, students in an online history course performed better using OER than CT (Grewe & Preston Davis, 2017). It is important to note this study controlled for student achievement, whereas this current study had no student controls. Cuttler

(2019) found online students (compared to classroom) had more difficulty using the OER to answer exam and assignment questions. These results can be related to how the OER was organized, such as glossary, index, or the overall organization of content. The OER readings for the courses used in this study were organized clearly, with one chapter assigned each week.

Findings are supported by Riley and Carmack's (2020) study investigating final grade outcomes in an online RN to BSN informatics course. The OER cohort earned higher final grades compared to CT. The OER in this study was not teacher-developed, but a combination of Internet resources and scholarly journal articles.

For a more exhaustive list of research studies supporting adoption of OER into secondary education, see Hilton (2016, 2019), Clinton and Khan (2019), and Grimaldi et al. (2019).

Integrating an OER into this online RN to BSN course was especially helpful to the student population. The majority of the students are non-traditional, with most working full-time as registered nurses and managing family responsibilities. Students did not need to plan ahead to order a textbook, they were able to complete all course activities using required resources, and having instant, free access to the OER reduced students' cost of college. It is estimated that a total of \$12,320 in CT costs was saved during the study period.

Limitations

While the results of the present study are encouraging, it is important to note that there are several limitations to consider. Due to the retrospective design of the study, we were unable to control for student effect, such as GPA, experience with technology, being a Pell grant recipient, demographics, etc. These student-specific effects may have a significant impact on outcomes data.

This study investigated the use of OER in one course in one online RN-BSN program. While similar findings have been seen in previous research, the findings cannot be generalized to other settings. Since this course moved away from a CT to OER, there was no opportunity for random assignment to different groups. Had students had the opportunity to choose between course types, the results may have been different.

Since the Principal Investigator for this study was also an instructor for some of the sections of the course, it is possible that her interest may have had undue influence on course grades. However, the use of three different instructors to teach sections was utilized to minimize this risk. While this study controlled for teacher effect, there are limitations to how each instructor runs the class and interacts with students. For example, there can be variance in how often online instructors answer email, respond to questions, and post announcements and in the quality and frequency of feedback (Grewe & Davis, 2017).

Two of the sections used for analysis were offered in the summer. Summer session students may take fewer classes and earn higher grades, which could skew the data. Lastly, the OER content created for this course was in its first edition compared to the CT, which was in its eighth edition. While the OER content offered considerably more depth and breadth of content related to course objectives, the CT offered additional content that was not available in the OER, such as case studies and discussion forum questions at the end of each chapter. The resources offered different pedagogical approaches, literature, charts, and images, which could have impacted learning outcomes.

Conclusion

The main findings of this study show similar learning gains between OER and CT. This study shares timely knowledge about the use of OER in undergraduate online nursing education, a discipline with minimal OER outcomes data. At a time when competition for nursing program enrollment is high, nursing faculty have an essential tool, the adoption and creation of OER, to attract students to

their institution. OER has the potential to retain students by offering free OER on the first day of class. When students can quickly access all required course materials, students may conceivably be more vested in their course and choose not to drop or withdraw, leading to college success.

Colleges also have the potential to benefit from OER adoption. Courses utilizing OER can potentially create environments where students are motivated to learn and can afford to learn, leading to higher enrollment and additional tuition and fees. Supporting faculty to develop and adopt OER content is an essential component to expanding OER usage in higher education.

Recommendations

Future research should investigate the use of the OER developed for this online course in other RN to BSN programs. Prospective designs and those that allow for randomization of students into experimental and control groups should be utilized. Allowing control for student effects such as GPA, experience with technology, being a Pell grants and/or financial aid recipient, and demographics is also important.

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