

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 statistical significant difference in course DFWI rates before and after the implementation of OER materials. In addition, an analysis of the return on investment by way of net present value of the costs was examined.

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

开放教育□源□本科在□教育□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□源(OER)使用与在线大学本科□程 DFWI 率(Drop(退课)、Fail(不合格)、Withdrawal(退课)、Incomplete(未完成))之□的关系。据推□, 涉及 OER 的在线教育会□ DFWI 率□生影响。2017 年, 某个在□大学在全校范围内开展项目推广 OER ; □□目效果还未得到□□。本研究采用的研究方法为, 针对高等教育□境下本科在□□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□大学商学院 2016 年第二季度至 2018 年第一季度下列本科□程: 会□(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□和物流管理(TLMT)。□□重要研究有助于弥补文献缺口, 并针对 OER 材料实践前后□程 DFWI 率的□□显著性差异补充了测量数据。此外, 本项研究□通过计算成本的□□□对投□回□率□行了分析。

关□□ : OER, 开放教育□源, 本科生, 在□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 was 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 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 Open Educational Resources (OER) champions. Open Educational Resources is in its infancy, and as such, lacks statistical documentation of OER benefits or limitations. Open Educational Resources have been rapidly expanding, understood as an indicator of an emerging revolution in education and learning, yet a gap in 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 to 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. Berry'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 Williams (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). Open Educational Resources promise to obviate demographic, economic, and geographic educational boundaries influencing student persistence (Mosharraf & Taghiyareh, 2016). Open Educational Resources 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.

Open Educational Resources 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; Fisher, Hilton, Robinson, & Wiley, 2015; Flory, 2017; Ikahihifo, Spring, Rosecrans, & Watson, 2017). Open Educational Resources contributed to 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 Koybassi, & 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. Lovette, 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 non-experimental case study, concluded students using OER achieved better grades, lower withdrawals, and scored better on final exams and programmatic persistence.

Feldstein, Martin, Hudson, Warren, Hilton, and Wiley (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, Hilton, Robinson, and Wiley (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 Open Educational Resources (OER) on course DFWI (Drop, Fail, Withdrawal, Incomplete) rates within the School of Business in online higher education for undergraduate students. The following hypotheses were developed from the main research question.

H1₀: 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.

H2₀: 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.

H3₀: 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.

Sample

Course level DFWI (Drop, Fail, Withdrawal, Incomplete) 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 Open Educational Resources. 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	
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

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*).

Number	Course Name	Converted	Converted	Qtr2/2016	Qtr3/2016	Qtr4/2016	Qtr1/2017	Qtr2/2017	Qtr3/2017	Qtr4/2017	Qtr1/2018	Before	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%

Figure 2. Spreadsheet Design/OER Conversion Date

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 zero and one percent 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-tail $p = 0.613$, 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 open educational resources exists on course DFWI rates in undergraduate online education between 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.

	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

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-tail $p = 1.27E-07$, providing evidence the OER conversions did impact course DFWI rates. This provided evidence to reject the null hypothesis $H2_0$ no impact of open educational resources exists on course

DFWI rates in undergraduate online education where an increase in DFWI increases between mean course DFWI rates before and after the implementation of an OER conversion. Therefore, the alternative hypothesis is accepted: H_{2A} : An impact of open educational resources 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*.

	<i>Mean Before</i>	<i>Mean After</i>
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-tail $p = 2.89E-05$, providing evidence the OER conversions did impact course DFWI rates. This provided evidence to reject the null hypothesis H_{3_0} no impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases between mean course DFWI rates before and after the implementation of an OER conversion. Therefore, the alternative hypothesis is accepted: H_{3A} : An impact of open educational resources exists on course DFWI rates in undergraduate online education where an increase in DFWI decreases.

	<i>Mean Before</i>	<i>Mean After</i>
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 return on investment, 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 net present value (NPV) calculation is used (see *Figure 6*).

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	$V^L = E + D = \frac{FCF}{WACC - g}$	
Shares Outstanding	16,236,000		
Total FCF	\$ 38,641,680		
Growth rate*	15%		https://www.nasdaq.com/symbol/apei/earnings-growth
WACC	20.38%		

Figure 6. WACC Calculation

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

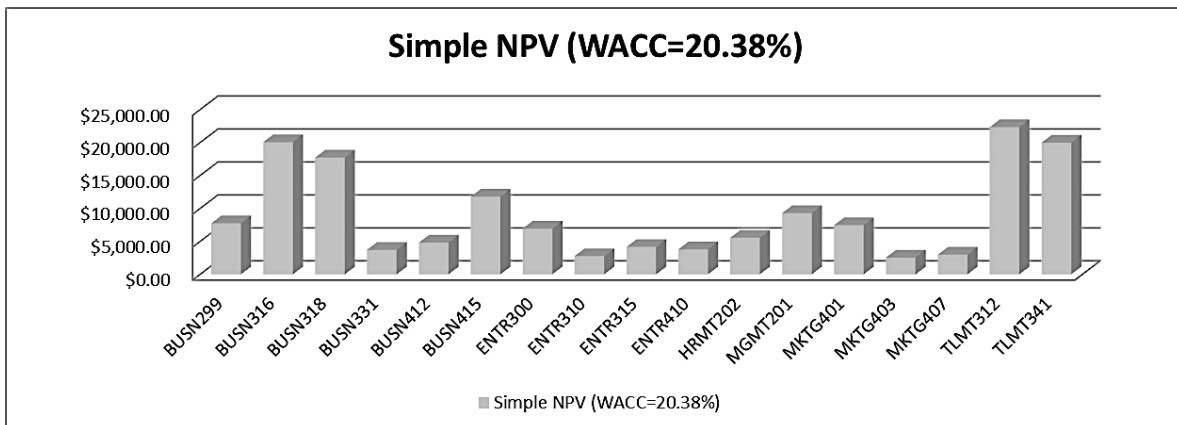


Figure 7. Net Present Value for Part-time Faculty Course Conversions

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	<i>p</i> Value	F or <i>t</i> Value
Combined, <i>t</i> -test	.613	- .51
Negatives, <i>t</i> -test	1.270E-07	-7.38
Positives, <i>t</i> -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*).

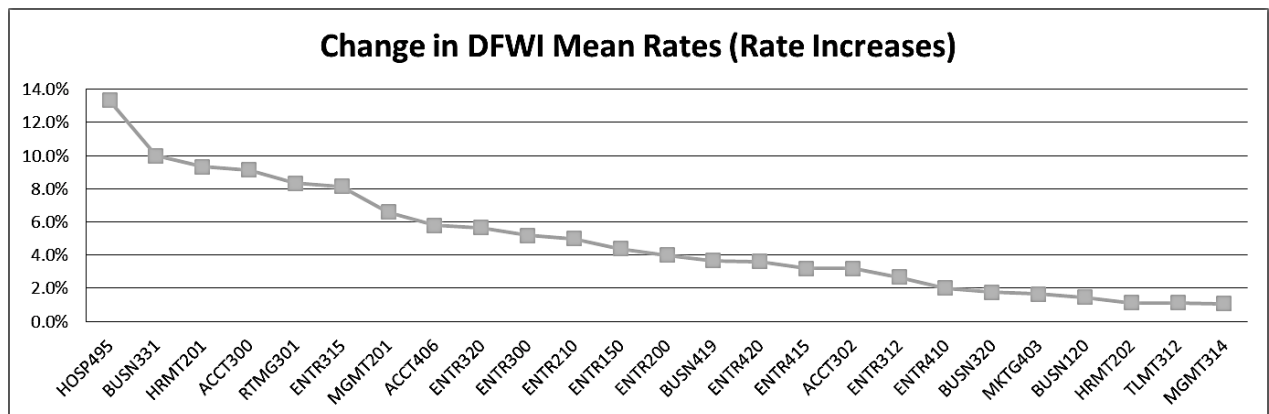


Figure 8. Change in DFWI Rates (Negative Outcomes)

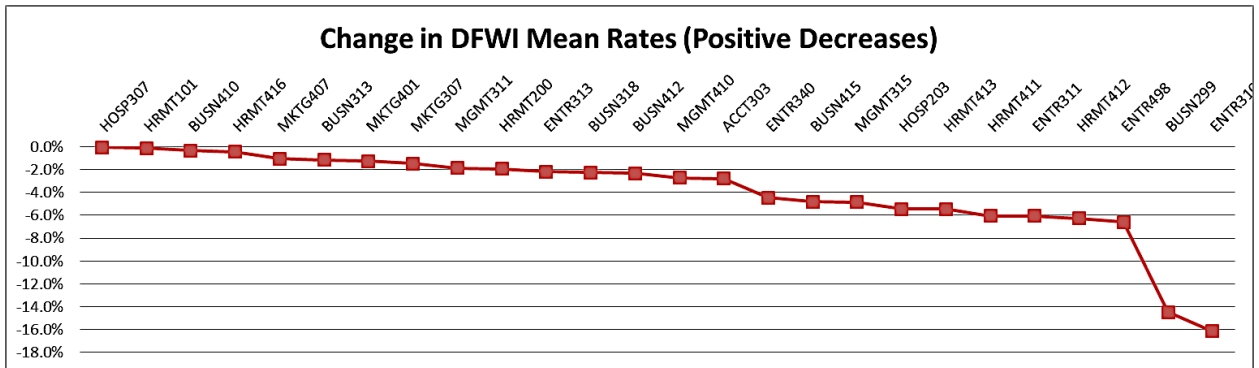


Figure 9. Change in DFWI Rates (Positive Outcomes)

The calculation of net present value 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 vs non-OER developed versions using a traditional textbook with publisher resources.

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Dr. Cassandra S. Shaw is the Program Director for the BA and MA Entrepreneurship Programs at American Public University; she has been with the University since 2007. Dr. Shaw received a Bachelor's degree from Florida State University, a Master's degree from University of Phoenix, and a Ph.D. from Capella University and worked in Business and Management for over 15 years and traveled the United States as a National Trainer; she has been in academia since 2005. Dr. Shaw is involved in higher education research, specifically with online learning.



Dr. Kathleen Irwin currently holds a doctorate in Organization and Management from Capella University. Dr. Irwin has been teaching on the graduate and undergraduate levels for the past 19 years. She has been with American Public University System for a little over 5 years and is currently the Program Director for Business Administration. In her role at APUS, she manages the curriculum in three degree programs and works with 13 full-time faculty developers.



Dr. Doris Blanton. Originally from the Central Valley/Fresno, California, Dr. Doris Blanton earned her undergraduate degree in Business Administration from Dickinson State University, ND; her Masters of Arts - Organizational Management from the University of Phoenix, Fresno, CA, and her Doctorate in Management in Organizational Leadership from University of Phoenix online. Recently she earned her certificate in professional coaching. The variety of her learning and teaching environments has fully contributed to her nimbleness working with a diversity of students and professionals at various learning levels and styles.