IRRODL
THE INTERNATIONAL REVIEW OF RESEARCH IN OPEN AND DISTRIBUTED LEARNING

Vol 21 No 1

January 2020

International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Editorial – Volume 21, Issue 1

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Welcome to my first editorial, the new year, and a new decade. This first issue of 2020 provides an array of research dissemination, literature reviews, field notes, and a book review. Additionally, this issue marks the recent, unanimous UNESCO Recommendation on OER adoption at the 40th General Conference. This OER Recommendation supports the UN's Sustainable Development Goal 4 (quality education) and further enables the achievement of the other 16 development goals. UNESCO recommendations occur infrequently, and this commitment lays a firm foundation for renewed national educational system vigour through the economies of scale that openness in education provides.

Moving from this global view, IRRODL readers may consider the following articles as part of their professional learning in this new year. There are five research articles that cover the topics of MOOCs, OER textbooks, and aspects of online learning. The first article, "Studying Learner Behavior in Online Courses With Free-Certificate Coupons: Results From Two Case Studies," provides research results that examines the role of incentives and MOOCs. As pricing models for MOOCs are still evolving, these case studies examine pricing structures and the effects upon learners' participation and the manner in which they participate. This research by **Littenberg-Tobias**, **Ruipérez-Valiente**, and **Reich** reveals that both price elasticity and commitment through a certificate track contributed to the case study results.

"The Relationships Between Self-Efficacy, Task Value, and Self-Regulated Learning Strategies in Massive Open Online Courses" is a quantitative study that furthers the understanding of student learning within a MOOC. **Lee**, **Watson,** and **Watson** apply a social cognitive perspective to learning within a small MOOC that revealed both self-efficacy and task value are significant predictors of students' self-regulated learning strategies. A statistically significant difference also occurred in the use of self-regulated learning strategies between students possessing low and high self-efficacy. The authors also discovered statistical significance among self-regulated learning scores and task value.

Anderson and **Cuttler** provide a perception comparison of open and conventional psychology textbooks by both online and on-campus university students. The results uncovered student offsetting cost strategies, reading preferences in textbook formats (print versus digital versus both when cost is not a factor) and differences in their ratings of the importance of various textbook elements (immediate access, price, etc.).The results also indicate a preference for open digital textbooks over paid printed textbooks, not only related to the cost. "Open to Open? An Exploration of Textbook Preferences and Strategies to Offset Textbook Costs for Online Versus On-Campus Students" provides suggestions for future research in this area of the benefits and consequences of using open textbooks within higher education.

The next study examines correlational factors of online PhD students technological and relational subfactors as they relate to the student success subfactors of persistence, successful completion, and gains in knowledge and skills. The results provide descriptive statistics, and the predictability and effects of technological and relational factors upon doctoral success. **Lee**, **Chang,** and **Bryan**'s "Doctoral Students' Learning Success in Online-Based Leadership Programs: Intersection with Technological and Relational Factors" concludes with a discussion of the role of relational connectedness within educational leadership doctoral programs.

And lastly, **Duran**'s phenomenological study, "Distance Learners' Experiences of Silence Online: A Phenomenological Inquiry," explores silence online as a lived experience. Her study reveals a complex understanding of such silence, in part enacted purposefully, and illuminating that online silence and voice may coexist. This research helps to reframe the role of online silence and its significance for learners and educators alike.

Populating our Research Notes is a study completed by **Risquez**, **McAvinia**, **Desmond**, **Bruen**, **Ryan,** and **Coughlan** that interviewed Irish higher education OER stakeholders. They inquired about the move from the previous national repository to a decentralized model that relies on institutional research repositories. Applying a mixed methods approach, these researchers share the findings of the surveys and focus groups. Participants identified present challenges to this devolved model and the researchers suggest a blended approach to repository use. The article, "Towards a Devolved Model of Management of OER? The Case of the Irish Higher Education Sector," provides a thoughtful look at OER management as part of the unfolding of openness in education.

For this first issue of the new decade, two literature reviews have been included. The first review, "Open and Shut: Open Access in Hybrid Educational Technology Journals 2010 – 2017," examines a 7-year span and included over 8,400 journal articles. **Costello**, **Farrelly,** and **Murphy**'s meta-analysis reveals that research behind paywalls continues to be firmly in place and that open access publishing continues to be seldom pursued by scholars. Additionally, complexity and costs of legal open access publishing may be constraining the accessibility of research dissemination. For the second review, **Fiock** created helpful tables to present literature findings in "Designing a Community of Inquiry in Online Courses." When considering the cognitive, teaching, and social presences as part of an online course, instructional designers and online educators will appreciate Fiock's table design ease that she has populated with numerous research insights.

There are also two contributions to our Notes From the Field section. **Clements**, **West,** and **Hunsaker** provide answers to microcreditial questions ranging from how to get started with open badges to the technologies that assist with such initiatives. Based on the history of badges and experiences with such microcreditials, the authors provide a framework and guiding steps to support the implementation of open badges. The authors certainly answer many implementation questions in "Getting Started with Open Badges and Open Microcredentials." The second contribution provides a design framework and best practices, both pedagogical and within an institution, of adaptive courseware, adaptive learning and learning analytics. The inclusion of screenshots further the points made by **Cavanagh**, **Chen**, **Lahcen**, and **Paradiso** in the field note "Constructing a Design Framework and Pedagogical Approach for Adaptive Learning in Higher Education: A Practitioner's Perspective."

Book reviews provide a helpful synopsis of recent publications, and **Faulconer** penned her thoughts of the edited book, *High-Impact Practices in Online Education*. As an online instructor and scholar of learning and teaching, her summary and comments enable IRRODL readers the opportunity to consider the merits of this new contribution to the pedagogy of online education.

I encourage you to delve in and explore this newest issue from IRRODL.

International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Studying Learner Behavior in Online Courses With Free-Certificate Coupons: Results From Two Case Studies

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Abstract

The relationship between pricing and learning behavior is an important topic in research on massive open online courses (MOOCs). We report on two case studies where cohorts of learners were offered coupons for free certificates to explore how price reductions might influence behavior in MOOC-based online learning settings. In Case Study 1, we compare participation and certification rates between courses with and without free-certificate coupons. In the courses with a free-certificate track, participants signed up for the verified-certificate track at higher rates, and completion rates among verified students were higher than in the paid-certificate track courses. In Case Study 2, we compare learner behavior within the same courses by whether they received access to a free-certificate track. Access to free certificates was associated with lower certification rates, but overall, certification rates remained high, particularly among those who viewed the courses. These findings suggest that some incentives, other than simply the cost of paying for a verified-certificate track, may motivate learners to complete MOOCs.

Keywords: massive open online courses, MOOCs, online learning, price elasticity, distance learning, free coupons, learning analytics

Introduction

From the outset of massive open online courses (MOOCs), pricing was one of the field's most challenging problems. Although most MOOCs started out as free, they could not remain so indefinitely without a revenue stream (Dellarocas & Van Alstyne, 2013), and MOOC providers needed to experiment with different pricing models (Bonvillian & Singer, 2013). In the literature, several different pricing strategies have been suggested. For example, Baker and Passmore (2016) review a set of business strategies (cross-subsidy, third-party, "freemium," and nonmonetary) and explain how these can be applied to MOOC settings. Another proposal is to use subscription models instead of having users pay for a single certificate (Kung & Yang, 2018). Finally, many MOOC providers now offer online master's degrees and other credential programs where certain content, assessments, support services, and credential eligibility requires a fee (Reich & Ruipérez-Valiente, 2019). As MOOC pricing evolves, new questions emerge about price sensitivity: What price will consumers pay to participate in MOOCs, and to what extent does introducing pricing structures change who participates in a course and how they participate?

In this work, we present two online learning case studies situated within MOOC-based technologies. In the first one (N = 50,453 registrants), we conduct an exploratory study into how coupons might influence learner behavior in courses targeted at educators. The providers in the first case study hosted seven instances of four different courses on the edX platform over a three-year period, where basic services were available for free, and users could pay a premium for more advanced features. In two courses and five instances, learners could access all course materials for free, but they could only earn a certificate if they upgraded to a certificate-eligible track on the edX platform, called the "verified" track, and completed all course requirements. Learners who did not purchase a verified track are referred to as *auditors*. In the other two courses, a donor sponsored an initiative to make a coupon code available to all learners to make the verified track free. By comparing participant behavior in the two free-certificate-eligible courses to the other course offerings, we make some preliminary investigations into how MOOC consumers respond to discounts, subject to the limitations of cross-sectional research.

In the second case study (N = 474 registrants), we examine an online professional certification program on quantum computing that used Open edX software. The courses in the certification program had high-quality content and a higher price, and they targeted professional learners. They were restricted to learners who pay the course fees. One cohort of learners was able to access the program for free because the courses were sponsored by their employer. This group of free-certificate track–eligible learners will be used as a comparison group for the rest of learners who paid for the quantum computing courses. Our overall objectives are, first, to compare in each of the case studies the potential effect on engagement and completion of being able to obtain certificates without having to make a financial investment in a course and, second, to make some cross-case observations.

The remainder of the article is organized as follows. The "Background" section reviews related work on education, price elasticity, and commitment devices. The "Methods" section describes the context and design of each study, research questions, and data collection. The "Results" section delves into the results of each case study. And the "Discussion" section finalizes the paper with discussion, limitations, and directions for future work.

Background

This work builds on two ideas from economics and marketing research—*elasticity* and *commitment devices*—that have received limited attention in the literature on MOOCs and other consumer-oriented online learning experiences.

Elasticity refers to the slope of a demand curve in a basic supply–demand model. In some domains, goods are inelastic or minimally sensitive to price; demand declines slowly as price increases (e.g., gasoline). In the case of elastic demand, demand declines very rapidly as price increases (and vice versa). Studies of higher education have found that student demand for higher education is highly elastic (Heller, 1997; Leslie & Brinkman, 1987). Moreover, tuition subsidies can dramatically improve college attendance and graduation rates. For example, a study of the Social Security benefit program, which provided college tuition subsidies for students with deceased parents, found that a US$1,000 subsidy increased college attendance by four percentage points and educational attainment by 0.16 years (Dynarski, 2001). Another study found that students who just met the high school grade point average eligibility cutoff for an in-state college tuition subsidy took more credit hours and were more likely to graduate than comparable students just below the cutoff (Henry, Rubenstein, & Bugler, 2004).

Although extensive work has been done in higher education to calculate the optimum value of tuition fees (Bryan & Whipple, 1995), these ideas have not been extensively applied to MOOCs. Studies of MOOCs have explored other influences on students' demand for courses. One study used Google Trends and the Baidu Index for China to build a model that could act as a proxy for MOOC demand (Tong & Li, 2018). The authors found that higher unemployment promoted MOOC demand and that in OECD countries, higher education participation was also positively correlated with MOOC demand. These findings might be a starting point from which to adapt pricing according to MOOC demand. It would be favorable for the providers if the price of every course could be optimized so that the highest willingness to pay (WTP) of a majority of the students meets the lowest willingness to accept (WTA) of the provider (Shi, Li, Haller, & Campbell, 2018). Experiments with coupons and variable pricing can help measure consumer price sensitivity in this new sector.

Behavioral economics researchers have also noted that financial investments can serve as *commitment devices* (Rogers, Milkman, & Volpp, 2014). A commitment device is a voluntary constraint on future choices to encourage a specific behavior. The theory is that consumers are trying to reduce what economists call *hyperbolic discounting*: the tendency to value short-term rewards more than long-term gains (Laibson, 1997; Rabin & O'Donoghue, 1999). By investing in a commitment device, consumers make the short-term rewards more expensive, making it more likely they will engage in behavior that creates long-term gains (John, 2019).

Educational costs, for example, the cost of a course certificate, are potentially effective commitment devices. By prepaying for a course certificate, learners increase the cost of quitting the course. Additionally, they may also be motivated to finish the course to avoid a "sunk cost" (Garland, 1990) due to the negative emotions associated with paying for something they do not end up using. However, if the penalty selected

by the consumer is too low, then the commitment device is unlikely to be strong enough to alter immediate preference for short-term rewards (John, 2019).

Research on the effect of education costs as commitment devices have been mixed. On the one hand, one study found that students just above the threshold for receiving full scholarships for in-state universities had lower college completion rates than students who were just below the full scholarship threshold and thus were less likely to attend in-state universities (Cohodes & Goodman, 2014). The authors of that study also posit that scholarships encouraged students to attend lower-quality schools, which may have affected completion rates. In another study, students were randomized into free, large-discount, small-discount, and no-discount conditions for an extracurricular tutorial at a Dutch university (Ketel, Linde, Oosterbeek, & van der Klaauw, 2016). The study did not find any significant relationship between receiving the course for free or at a discount and students' attendance or grades.

Within MOOCs, purchasing entry into a certificate-eligible track substantially increases completion rates. For example, in HarvardX and MITx courses, completion rates among participants averages 7.7%, but completion rates for verified participants average 60% (Chuang & Ho, 2016). However, few studies have explored whether the amount paid for a course, rather than simply having access to a verified track, is related to course engagement and completion. One empirical study used a Web crawler to mine all prices and characteristics of edX courses (Shi et al., 2018). The authors found a positive correlation between price and the number of registrants, which may indicate that a higher price might bring about more registrations, as society often uses price as a proxy of quality (Armstrong, 2014). However, they did not find a correlation between course persistence or completion rates, which would indicate that a small variance in price may not have as strong an effect as a commitment device (Shi et al., 2018).

One possibility is that the act of signing up to earn a certificate in a MOOC, rather than the cost for it, may be a factor that increases completion rates. Koch and Nafziger (2016) argue that setting a goal creates a *reference point*, an expectation for our future selves that makes under-performance painful. Signing up for a certificate track in a MOOC makes this expectation about their future selves explicit. When learners sign up for a certificate track, they set explicit expectations that can be later used toward motivating themselves to complete the course.

Using coupons to manipulate the price of a course can disentangle the incentivizing effect of certificate attainment from the financial investment of the learner in the course, separating the value of attempting to earn a recognized certificate from the cost of signing up for a certificate-eligible track. If the cost of a certificate acts as a strong commitment device, verified-track purchases should be positively correlated with persistence among consumers, and if the cost of a certificate is a weak commitment device, then persistence should be weakly correlated with paying for a certificate-eligible track. The two case studies in this article examine instances where specific cohorts of learners had access to coupons, which allowed them to earn a verified certificate without investing money in the course. By comparing these learners with learners in the same or similar courses, we can estimate the extent that paying for a certificate-eligible track changes its potency as a commitment device.

Methodology

Context and Study Design

Case study 1. In the first case study, we capitalized on a philanthropic intervention of a coupon for free certificates in two courses that were offered by an instructional design team, which had offered similar courses without the intervention. We examined seven total course instances—two courses with the intervention and five instances of the other two courses without the intervention. Across all seven course runs, there were 43,526 unique user identifiers, of which only 4% (N = 1,673) registered for courses in both conditions. As a result, we treat these conditions in our analyses as separate samples.

In the course instances with the intervention (N = 7,053 registrants), philanthropists funded a coupon code, available to all registrants, which they could use to upgrade to a free verified certificate. Links to access the coupon code were distributed through e-mail messages and the course platform. In the course instances without the intervention (N = 43,400 registrants), participants could upgrade to the verified-certificate track for US$49. Upgrading to the verified track did not provide any additional access to content or features. However, upgrading did allow participants to earn a verified certificate if they self-reported completion of at least 60% of the course assignments and verified their identity.

Although the intervention was applied in different sets of courses, all of the courses developed by this instructional design team shared a similar pedagogical structure and participant profile. These courses were targeted at education professionals, including teachers and school leaders, librarians, principals, and system administrators. Within each unit of a course, learners watched expert presentations from course faculty, viewed case videos about schools engaging in innovation efforts, participated in activities and assignments that encouraged learners to learn about their own contexts, and took steps to launch initiatives to improve teaching and learning. These courses were offered through the edX platform and were free for participants to access. The course did not offer any additional academic or professional development credit; however, some teachers did report earning credit independently through their school or district. As a result, the only direct benefit that participants received from completing the course was a certificate of completion. Participants did receive indirect benefits from participating in the courses such as connecting with other educators and learning about new resources.

The instructional philosophy of the courses was to try to serve both learners who might only have a few minutes to browse or a few hours to explore and others that have more substantial time to fully complete a course and earn a certificate. For instance, these courses typically began with videos that summarized the most important ideas from the course in a few minutes, and subsequent course materials built upon these core ideas. A casual browser might benefit from a burst of inspiration, while a more devoted learner would develop new skills and understandings. As a result, the instructional staff worked not just to increase certification rate but to shift the entire distribution of participants toward greater activity.

Case study 2. MIT xPRO is an independent initiative from the Massachusetts Institute of Technology (MIT) that uses Open edX software to teach private courses to professionals on topics that are emerging and have high industry appeal. Applications of Quantum Computing in MIT xPRO (QCx) is a professional certification program that focuses on the core principles, business implications, and implementation of quantum computing. This program targets professionals who are interested in learning the basis of quantum computing and how it can be applied to different contexts. Courses are designed to be four weeks long with a learner time commitment of three to five hours per week spent viewing videos, reading content, completing practice activities, and working on application/project assignments. The courses are self-paced, and most deadlines are flexible. Prior knowledge of quantum mechanics is helpful but not required. The fees to take the four QCx courses were US$3,900. If courses were taken separately, the price was US$1,700 for each one.

The four courses of the first iteration of this program took place between April 2018 and October 2018 with 133 unique users and 474 users by course. These courses were sponsored by IBM Research, and as part of the agreement, IBM was able to provide free access to these courses to some of their employees; we describe this cohort of IBM employees who accessed these courses for free as *brand ambassadors*. Brand ambassadors (N = 32 unique users, 127 users by course) were able to earn a certificate without having to pay the required course fees. To the best of our knowledge, we are not aware of any incentives or penalties offered by IBM related to course completion that could bias the results. The rest of the participants (N = 101 unique users, 347 users by course) were mainly researchers, managers, or executives working in industries that could benefit from the application of quantum computing topics. To the best of our knowledge, no other participants' companies offered incentives or subsidies for participating in the courses, and only learners who worked for IBM Research were able to participate in the courses for free.

In order to be consistent with our methodology in Case Study 1, and because participants could register for each course separately, we use user by course as the unit of analysis in all of our analyses.

Comparisons across cases. The two cases explored in this paper differ in terms of course content, types of participants, and pricing strategies. In Case Study 1, the courses were targeted at educators, and the cost of participating in the certificate-eligible track was nominal (US$49). The opportunity to earn a free certificate was offered in two courses and was available to all learners. In Case Study 2, the courses were designed as an online professional certification program on quantum computing, with all four courses costing US$3,900, and entry was restricted to only those who paid the course fees.

However, because both courses used Open edX and thus shared a similar data structure, we were able to analyze the same variables within each set of courses. Additionally, the stark differences in the value of the coupons between the two case studies allow us to explore the extent that the amount of price reduction is related to changes in learner behavior. Finally, by analyzing cases in two very different contexts, we can infer more generalizable principles than if we examined case studies within similar contexts (Yin, 2003).

Research Questions

1. How did eligibility for a free-certificate track affect the percentage of students who verified for the courses (Case Study 1 only) and the demographics of those participants?

2. How did eligibility for a free-certificate track affect participants' intentions to participate in the course as reported on entrance surveys?

3. Accounting for differences in course content and length, did free-certificate track participants have different outcomes than paid-certificate track participants in the following:

    - number of events in the course,
    - number of videos watched,
    - number of days participating in course,
    - course grades, or
    - completing the course (e.g., earning a 60% or higher in the course)?

Data and Methods

We downloaded the standard edX data packages and log files for all the courses from the respective MITx and MIT xPRO case studies. Since both platforms run on the Open edX learning environment, we were able to use *edx2bigquery* data processing scripts (Lopez, Seaton, Ang, Tingley, & Chuang, 2017) to arrange the data in a person-course data set that contains columns regarding course activity and completion of the learner with the course. The person-course data set also contains a column representing the modal country of the user (based on IP address). Additionally, we merged in participant gender, date of birth, and level of education, which were collected when participants registered for the platform.

Both courses administered entrance surveys to all course participants. Using participants' unique identifiers, we were able to merge their survey responses with the person-course data set. For this analysis, we focus on survey questions on intentions to participate in the course as reported in the entrance surveys. Although participants' intentions have historically not been strong predictors of MOOC course participation (Campbell, Gibbs, Najafi, & Severinski, 2014), we chose to analyze intentions because we were interested in comparing participants' mind-sets on the outset of the course to detect possible differences in intentions. Response rates for the entrance surveys were 60% among verified participants in Case Study 1 and 51% across all learners in Case Study 2.

In the first case study, we flagged whether each user signed up for the verified track. In the second case study, where all users were in a verified track, we flagged whether each user was an IBM brand ambassador and could access the course for free. For each user, we identified whether the user earned a certificate, the number of events in the course, the number of videos watched, the number of active days, and the user's course grade. To account for different content and course lengths in the study, we calculated *z*-scores for each of the course activities within each individual course. This method, which is often used in studies comparing student performance in different academic courses (e.g., see Blazar, 2018), allows for comparisons across courses without having to make the assumption that distributions are equivalent across courses. One challenge in analyzing MOOC data is that a large percentage of participants who register never click into the course, leading to a lot of zero values for course outcomes. As a result, in both analyses, we

restricted the regression analyses to participants who viewed (i.e., clicked into the course) the course at least once during the time the course was active (Case Study 1, N = 21,497; and Case Study 2, N = 408).

For Case Study 1, we compared the within-course standardized difference between verified participants and auditors (i.e., participants who did not sign up for the verified track) in the five paid-certificate track courses to the same difference in the two courses with the free-certificate track coupons, controlling for gender, age, level of education, and whether the user was in the United States. The relative difference between paid and free verification is represented in the regression model by the interaction between verification and course cost (i.e., was a free-certificate track coupon available to learners?). If the financial investment of a certificate affected participation, we would expect that the difference in participation and completion between verified and auditing participants would be smaller in the free-certificate-track courses than in the courses without coupons. Alternatively, if signing up for a verified track was itself an incentive, perhaps because it served as a *reference point* for a future self, we would expect to observe little difference in the gap between verified and non-verified track learners in paid and free-certificate-track courses.

For Case Study 2, we compared the within-course standardized differences in activity between participants who paid the verification fee and the IBM brand ambassadors who could enroll in the courses for free, controlling for gender, age, level of education, and whether the user was in the United States. If the financial investment of a certificate affected participation, we would expect the participants who accessed course content for free to have lower levels of course activity and course completion than those who had paid to access the course content. Alternatively, if signing up to earn certificate alone was a sufficient incentive to encourage completion, perhaps because it served as a *reference point* for a future self, we would expect to observe few differences between paying and nonpaying students.

Results

Case Study 1 Results

In Case Study 1, offering coupons for free-certificate track eligibility was associated with more students signing up for a verified certificate. In the paid-certificate track courses, 3% of participants paid for the verified track (N = 1,439), which allowed them to earn a verified certificate—similar to the overall percentage of verified users in MITx and HarvardX courses (Chuang & Ho, 2016). In the free-certificate-track courses, the percentage of users who signed up for the verified track was 13% (N = 950), four times the rate of the paid-certificate track courses. Table 1 presents the demographics of verified participants in the free-certificate-track and paid-certificate-track courses from Case Study 1. Verified participants in the free-certificate-track courses were more likely to be from the United States (p < .001), but no significant differences by age, gender, or level of education were observed.

Table 1

Case Study 1: Demographics of Verified Users in Free- and Paid-Certificate-Track Courses

	Paid certificate (%)	Free certificate (%)
Female	55	56
Male	45	44
< 30	15	15
30-39	31	34
40-49	32	29
50-59	18	18
60-69	4	4
70+	1	0
High school or less	3	3
Associate's degree	2	1
Bachelor's degree	27	25
Master's degree	59	60
Doctoral degree	9	12
In United States	37	57
Outside United States	63	43

Learners in both the courses with the free-certificate track and courses with only a paid-certificate track had similar intentions to participate in the course. On the pre-survey, participants were asked what proportion of course assessment they intended to complete on a labeled four-point scale, where a four indicated "all assessments." Verified learners in the free-certificate track courses were similarly likely to report that they intended to complete all assessments (76% for paid-certificate track vs. 75% for free-certificate track), while auditors in both tracks were less likely to report that they intended to complete all assessments (53% for paid-certificate track vs. 44% for free-certificate track; see Figure 1). Using an analysis of variance (ANOVA) model, we found significant differences between groups of learners in intentions to complete assessments, with post hoc tests indicating significant mean differences between the verified learners and auditors in both the paid-certificate (3.37 vs. 3.73, $p < .001$) and free-certificate-eligible-track courses (3.20 vs. 3.72, $p < .001$) but not between the two groups of verified learners ($p > .1$).

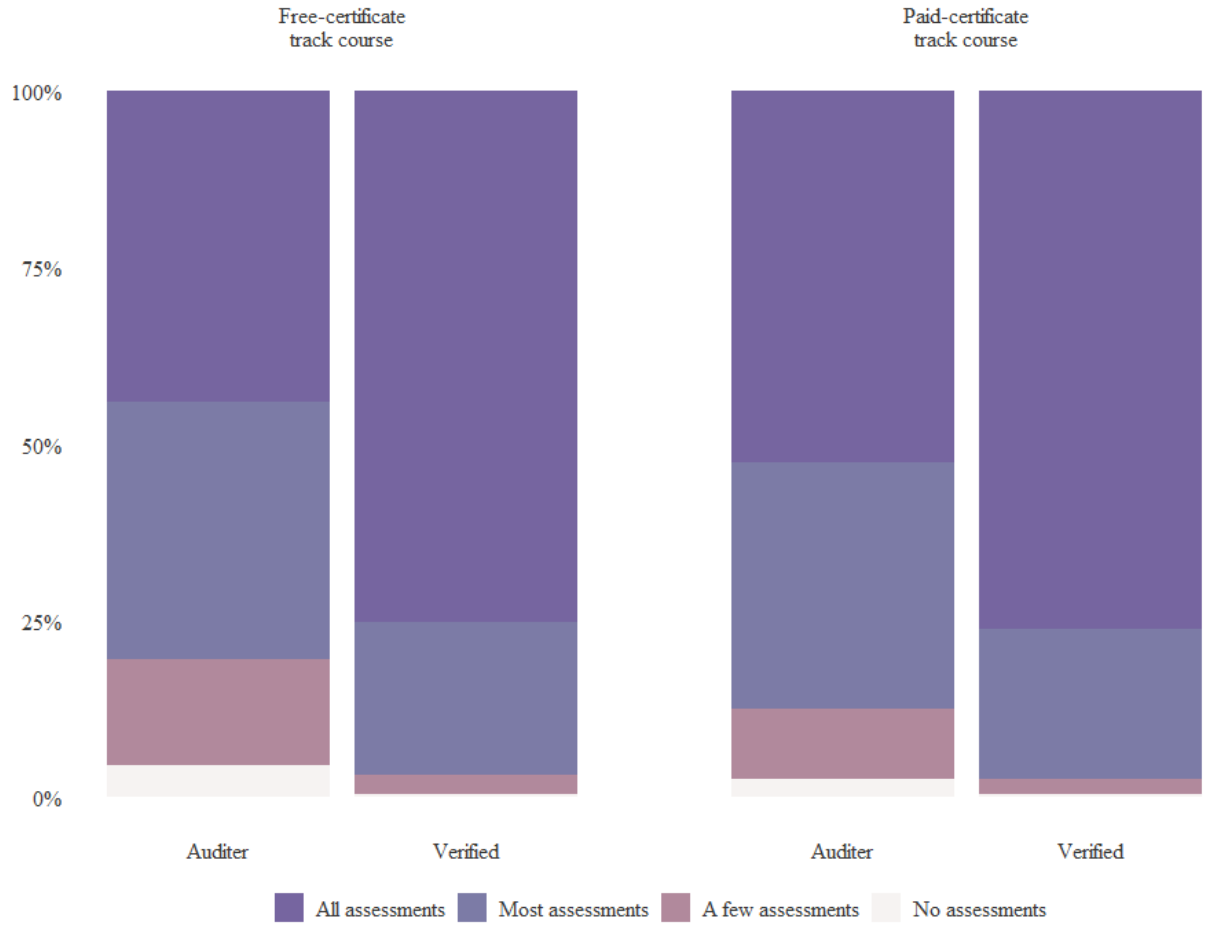

Figure 1. Case study 1: Assessment completion intentions on entrance survey.

The regression results for course participation indicators and grades are reported in Figure 2. Verified students had higher engagement in the courses than auditors. Compared with auditors, verified students recorded 1.75 standard deviation (SD) more events ($p < .001$), watched 1.62 SD more videos ($p < .001$), and spent 1.75 SD more days in the course ($p < .001$). Verified students also had course grades that were 1.35 SDs higher than auditors ($p < .001$). Because outcomes were standardized within courses, the value of a 1 SD difference varied by course. On average, a 1 SD increase was the equivalent of 288 more events, 10 more videos watched, 4 more active days, and a 31-point increase in grades. The full regression tables for all analyses can be found in the appendix.

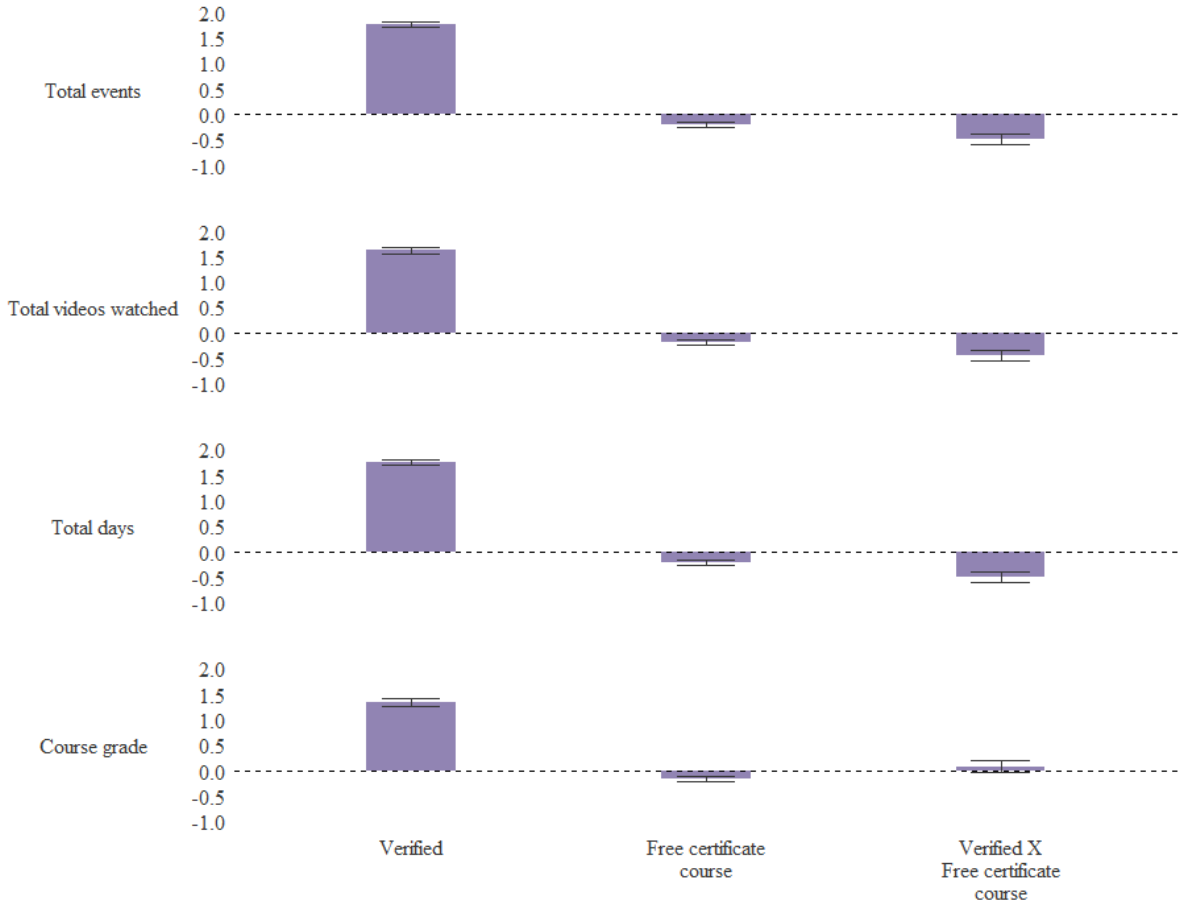

Figure 2. Case study 1: Regression estimates.

Additionally, verified students in the free-certificate track courses continued to have higher levels of course engagement than students who audited the course, but the difference between these two groups was significantly smaller in the free-certificate-track course than in the paid-certificate-track courses. On average, the difference between verified and auditing students was 0.51 to 0.45 SDs smaller in the free-certificate-track course than in the paid-certificate-track courses ($p < .001$). The differences in course grades were greater, but not statistically significantly, in the free-certificate-track course than in the paid-certificate-track courses (0.075 SDs, $p > .1$).

Course completion rates were higher in the free-certificate-track courses than in the paid-certificate-track courses. In the free-certificate-track courses, 47% of verified students passed the course ($N = 442$) and earned a certificate, while 41% earned a certificate in the paid-certificate-track courses ($N = 593$, $p < .05$). Overall, there was less activity in the course when learners could access free certificates but also slightly higher rates of certification.

Case Study 2 Results

Table 2 presents the demographic characteristics of participants in Case Study 2 by certificate track (N = 474). Participants who were eligible for a free-certificate track were more likely to be female, have an advanced degree (particularly a doctoral degree), and be over the age of 50 ($p < .001$), and they were slightly more likely to be in the United States, although this difference was not statistically significant ($p > .1$).

Table 2

Case Study 2: Demographics of Verified Users in Free- and Paid-Certificate-Track Courses

	Paid certificate (%)	Free certificate (%)
Female	8	27
Male	92	73
< 30	12	0
30-39	32	21
40-49	37	39
50-59	9	36
60-69	5	4
70+	4	0
High school or less	3	0
Associate's degree	0	0
Bachelor's degree	21	7
Master's degree	45	21
Doctoral degree	31	72
In United States	59	63
Outside United States	41	37

On entrance surveys, learners in the free-certificate track were slightly less likely than those in the paid-certificate track to say that "earning a certificate" was an important motivation for completing the course ($p < .1$). Yet for many participants in the free-certificate track, earning a certificate was an important motivator; 37% said that earning a certificate was a "very" or "extremely" important motivation for them in participating in the QCx courses, compared with 48% of those in the paid-certificate track (Figure 3).

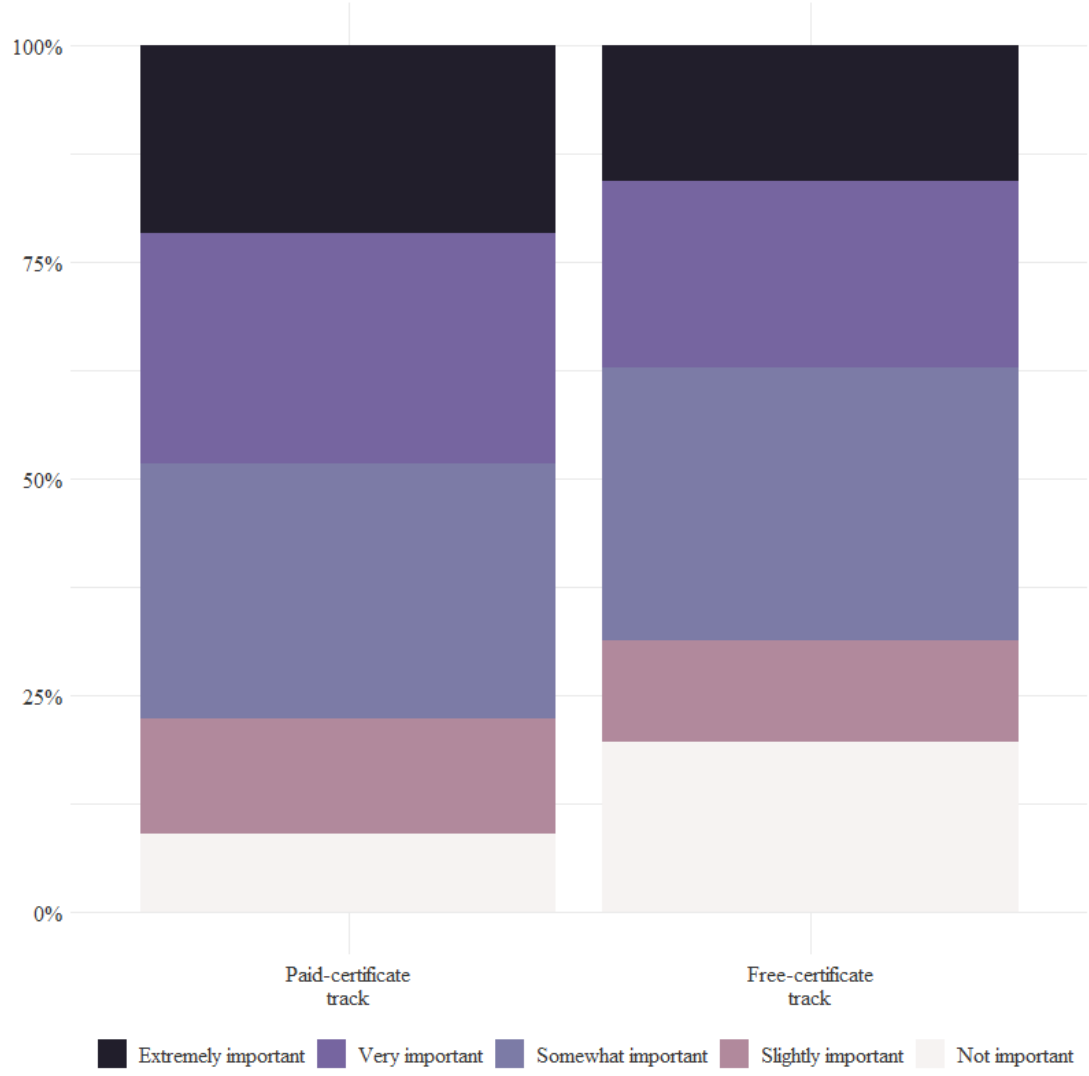

Figure 3. Case study 2: Importance of earning a certificate on entrance survey.

The regression results for Case Study 2 are reported in Figure 4. Learners in the free-certificate track had, on average, 0.44 SD fewer events than students in the paid-certificate track ($p < .05$). Free-certificate track students also watched fewer videos (0.25 SDs) and had fewer active days (0.20 SDs), although the differences were not statistically significant ($p > .1$). No meaningful difference was found in course grades between students in the two tracks (0.05 SDs, $p > .1$). As in Case Study 1, the value of a 1 SD difference varied by course. On average, a 1 SD increase was the difference of 3,763 events, 12 videos watched, 39 days in the course, and a 6.3-point increase in grades.

Although completion rates were generally high, students in the free-certificate track had lower completion rates (50%) than those who paid for a certificate (77%, $p < .001$). However, a significant portion of non-completers among free-certificate track students never clicked into the course (26%, $N = 33$). When

restricted to only those learners who had clicked into the course, the gap in completion was smaller (68%–85%, $p < .001$).

As we found in Case Study 1, in Case Study 2, free-certificate-track coupons were associated with lower overall learner activity compared with learners who paid the course fees. However, in this case study, we did observe lower—though not remarkably so—completion rates. Consequently, the possibility of earning certificates for free might somewhat diminish learners' motivation to be highly active in the course; however, even those who were in the free-certificate track participated and completed the course at relatively high rates.

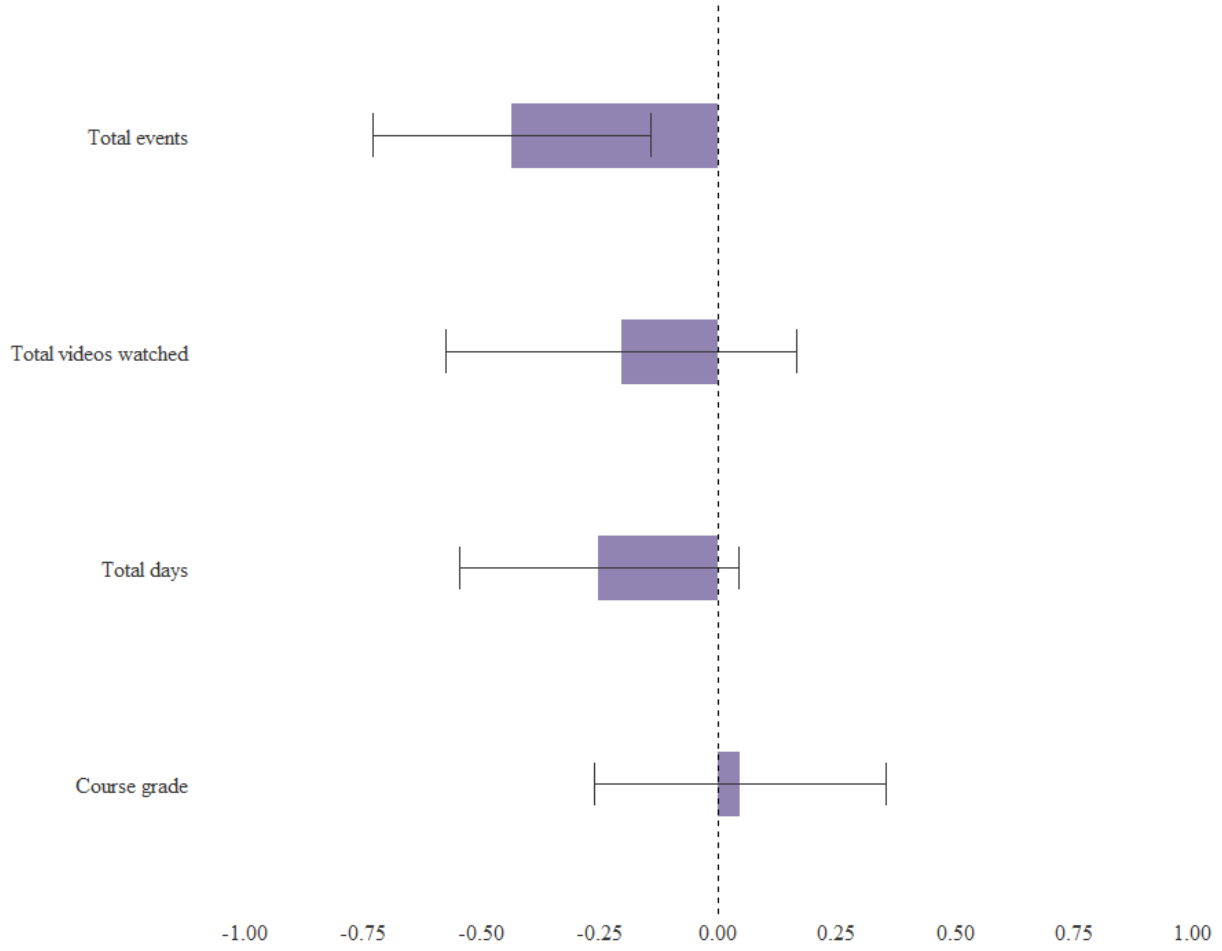

Figure 4. Regression estimates for Case Study 2.

Discussion

This work reports on a pair of online learning case studies, where participants had the opportunity to earn a free certificate, to explore how the price of a certificate is associated with changes in student enrollment

and activity. Specifically, we were interested in whether reducing the cost of a certificate to $0 would be linked to an increase in the number and type of students who enrolled in a verified track. We also examined whether participants who did not pay for a certificate were less engaged in the course since they lacked the commitment device of having invested money.

Our findings suggest that consumers of MOOC-based technologies are price-sensitive; a reduction of only US$49 in cost was linked to a quadrupling in the percent of verified registration in Case Study 1. Additionally, in Case Study 2, when the cost of the course was US$3,900, more women, participants over the age of 50, and participants in the United States participated in the free-certificate track than in the paid-certificate track. This suggests that these participants may be particularly price-sensitive and thus more likely to sign up for a certificate track if it is free.

Our findings also suggest that the opportunity to earn a certificate, whether or not the learner invests in the course, may serve as its own commitment device. In Case Study 1, participants reported that motivation to participate in the courses were similar across the paid- and free-certificate-track courses, and the completion rates were almost identical. In Case Study 2, while both intentions to earn a certificate and completion rates were lower in the free-certificate track than in the paid-certificate track, still more than half of the participants completed the course. Although course participation was lower among students in the free-certificate track, in both case studies, participation and completion among verified students in the free-certificate track was very high. We might view the process of signing up for a verified certificate and financial investment in the course as two separate mechanisms for encouraging commitment within an online course. The fact that we observed similar trends in both case studies, despite the vast differences in settings, suggests that similar underlying mechanisms may be responsible for promoting course participation. Participants may be influenced not only by the amount of money they invest in a course but also by concern for not meeting the *reference point*—that is, the expectations they set for themselves (Koch & Nafziger, 2016)—by signing up for the certificate track.

These findings suggest that offering free-certificate coupons can be an effective way to increase participation in online learning. This may be especially useful for groups of learners who are particularly price-sensitive, such as low-income learners, and who may not be willing or able to pay the full price for a certificate. MOOC instructional designers may wish to experiment with offering free or discounted certificates to such leaners to encourage wider participation in their courses and encourage completion. These findings may also be relevant to other open and distant learning contexts where course developers seek to maximize participation among underserved and price-sensitive groups of participants.

The findings of our study have a number of limitations. The first is that our case studies are observational in nature. Participants were not randomly assigned to receive coupons for free-certificate tracks. In Case Study 1, *all* participants in two courses were offered the opportunity to redeem a coupon to sign up for the verified track. In Case Study 2, a select group of participants were given access to the course for free because their employer sponsored the course. As a result, participants in the free-certificate-track condition in both case studies may have had systematically different backgrounds and motivations than those in the paid-certificate-track condition. Although we controlled for demographic differences in our statistical models, the two groups possibly differed in other unobserved characteristics.

Our study provides cross-sectional evidence that can motivate further work that supports more robust causal inference. Researchers should identify how consumers of MOOC-based technologies respond to different incentives across different courses and contexts. Experimental designs could randomly assign registrants to receive a coupon by e-mail or in the courseware, or a more sophisticated design could be used across a set of courses that is randomized at the course level. However, in using such designs, researchers may need to consider ways to minimize the disruption of having only some students in the course receive a subsidized certificate. More nuanced approaches might randomly assign students to receive coupons for part of the cost to see if there is an optimization point that substantially reduces cost while including a small, symbolic investment as a commitment device. Researchers may also want to experiment with conditions where signing up for a certificate is explicitly tied to *reference point* expectations language to measure the potency of *reference points as* commitment devices.

As governments and workforce development systems turn to online learning to support lifelong learners, better understandings of how consumers of MOOC-based technologies respond to different financial incentives can help organizations effectively target resources to optimize educational attainment.

Acknowledgements

We gratefully acknowledge the financial support of our generous donors, the instructional design teams that develop these courses, and the learners and participants in this study.

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Appendix

Table A1

Regression Results for Case Study 1

	Dependent variable			
	No. events (1)	No. videos (2)	No. days (3)	Course grade (4)
Verified	1.754***	1.618***	1.751***	1.347***
	(0.029)	(0.030)	(0.030)	(0.038)
Female	0.007	−0.033*	−0.013	0.059*
	(0.014)	(0.015)	(0.015)	(0.023)
30-39	0.010	−0.001	0.077	0.020
	(0.050)	(0.053)	(0.053)	(0.079)
40-49	0.035	0.035	0.062*	0.015
	(0.029)	(0.031)	(0.031)	(0.046)
50-59	0.058	0.081*	0.082**	0.010
	(0.030)	(0.031)	(0.031)	(0.048)
60-69	0.084*	0.091*	0.070	0.020
	(0.039)	(0.041)	(0.041)	(0.060)
70+	0.074***	0.089***	0.095***	0.028
	(0.021)	(0.022)	(0.022)	(0.034)
Associate's degree	0.095***	0.102***	0.114***	−0.001
	(0.022)	(0.024)	(0.024)	(0.036)
Bachelor's degree	0.173***	0.203***	0.207***	0.052
	(0.026)	(0.028)	(0.028)	(0.042)
Master's degree	0.240***	0.302***	0.260***	0.066
	(0.041)	(0.043)	(0.043)	(0.066)
Doctoral degree	0.391***	0.498***	0.531***	−0.077
	(0.082)	(0.087)	(0.087)	(0.117)
In United States	0.068***	0.029	0.021	0.077**
	(0.017)	(0.017)	(0.017)	(0.026)
Free-certificate course	−0.205***	−0.197***	−0.203***	0.161***
	(0.025)	(0.026)	(0.026)	(0.029)
Verified-certificate course	−0.487***	−0.447***	−0.510***	0.075
	(0.051)	(0.054)	(0.054)	(0.058)
Constant	−0.299***	−0.271***	−0.286***	0.234***
	(0.030)	(0.032)	(0.032)	(0.048)
Observations	15,243	15,243	15,243	6,506
R^2	0.239	0.199	0.222	0.262
Adjusted R^2	0.238	0.198	0.221	0.261
Residual SE	0.876	0.922	0.923	0.910
F statistic	341.546***	270.118***	309.626***	164.776***

Note. SE = standard error. * p < .05. ** p < .01. *** p < .001.

Table A2

Regression Results for Case Study 2

	Dependent variable			
	No. events	No. videos	No. days	Course grade
	(1)	(2)	(3)	(4)
Free certificate	−0.436**	−0.204	−0.253	0.045
	(0.146)	(0.185)	(0.147)	(0.154)
Female	−0.290	−0.177	−0.314	0.227
	(0.172)	(0.199)	(0.174)	(0.183)
30-39	−0.556*	−0.476*	0.682**	0.404*
	(0.226)	(0.225)	(0.227)	(0.205)
40-49	−0.443*	−0.442*	0.604**	0.226
	(0.223)	(0.223)	(0.224)	(0.202)
50-59	0.187	−0.169	0.106	0.195
	(0.247)	(0.251)	(0.249)	(0.228)
60-69	0.071	−0.655	0.501	0.679
	(0.340)	(0.355)	(0.342)	(0.388)
70+	−0.222	−0.576	−0.445	0.232
	(0.413)	(0.406)	(0.415)	(0.419)
Associate's degree	−0.533	0.094	0.658	0.209
	(1.052)	(1.034)	(1.059)	(0.935)
Bachelor's degree	0.332	−0.172	1.367**	0.157
	(0.522)	(0.514)	(0.525)	(0.465)
Master's degree	0.130	0.128	1.372**	0.208
	(0.515)	(0.507)	(0.518)	(0.458)
Doctoral degree	0.056	0.091	1.458**	0.435
	(0.521)	(0.514)	(0.524)	(0.465)
In United States	0.514***	0.044	0.460***	0.165
	(0.114)	(0.123)	(0.115)	(0.111)
Constant	0.092	0.406	−1.035*	−0.513
	(0.471)	(0.463)	(0.474)	(0.419)
Observations	320	268	320	261
R^2	0.164	0.053	0.114	0.108
Adjusted R^2	0.131	0.008	0.080	0.065
Residual *SE*	0.941	0.925	0.947	0.836
F statistic	5.017***	1.190	3.307***	2.504**

Note. SE = standard error.

* p < .05. ** p < .01. *** p < .001.


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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

The Relationships Between Self-Efficacy, Task Value, and Self-Regulated Learning Strategies in Massive Open Online Courses

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Abstract

This study examines the relationships between self-efficacy, task value, and the use of self-regulated learning strategies by massive open online course (MOOC) learners from a social cognitive perspective. A total of 184 participants who enrolled in two MOOCs completed surveys. The results of Pearson's correlation analysis show a positive correlation between self-efficacy and the use of self-regulated learning strategies, as well as a positive correlation between task value and the use of self-regulated learning strategies. The results of hierarchical multiple regression analysis show that self-efficacy and task value are significant predictors of the use of self-regulated learning strategies. There was a statistically significant difference in the use of self-regulated learning strategies between learners who possessed high self-efficacy and those who possessed low self-efficacy. In addition, learners who had high task value showed statistically significant higher average self-regulated learning scores than those who had low task value. Implications and future research directions are discussed based on the findings.

Keywords: self-regulated learning, self-efficacy, task value, massive open online courses, MOOCs, social cognitive perspective

Introduction

Since the evolution of open educational resources (OER), massive open online courses (MOOCs) have emerged as a new platform for online learning. MOOCs differ from traditional online courses, which "charge tuition, carry credit and limit enrollment to a few dozen to ensure interaction with instructors" (Pappano, 2012, p. 2), in several aspects; for example, MOOCs provide open access to education regardless of learners' previous experiences (Milligan & Littlejohn, 2016), and their course structures consist of lecture videos, auto-graded quizzes, and online discussion forums (Glance, Forsey, & Riley, 2013). In MOOCs, more than 1 million learners from all over the world are put into an online space where they complete tasks at their preferred pace (Johnson, Becker, Estrada, & Freeman, 2014). However, in MOOCs, there is a lack of interaction between instructors and learners, as well as the availability of significant learner support. These unique characteristics of MOOCs require learners to have an ability to self-regulate their own learning more than in traditional online courses.

Self-regulated learning (SRL) has been regarded as one of the vital factors positively affecting learners' success in traditional online learning environments (Cho & Shen, 2013). In a recent systematic literature review study by Lee, Watson, and Watson (2019), it has been revealed that SRL positively influences learning in MOOCs as well. In addition, a broad range of learners participating in MOOCs commonly display self-efficacy and task value, as well as employ several SRL strategies to succeed in MOOCs (Lee et al., 2019). However, little is known about the relationships between self-efficacy, task value, and the use of SRL strategies in MOOCs. Studies on SRL in traditional online learning environments have shown that there are positive relationships between self-efficacy and the use of SRL strategies (e.g., Artino & Stephens, 2006). Task value is also positively related to the use of SRL strategies (Hsu, 1997). These findings provide instructors and instructional designers with new insights on how to design online courses to support learners' self-regulation in terms of motivation and SRL strategies (e.g., Artino, 2008).

Several MOOC design principles or guidelines have been suggested as ways to support MOOC learners' SRL (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). However, most have underestimated the motivational aspects of SRL such as self-efficacy and task value. For example, Nawrot and Doucet (2014) only focus on how to support MOOC learners' time management. This might be attributed to the use of different theoretical frameworks of SRL in the initial stage of research on SRL in MOOCs, such as Zimmerman and Pons's (1986) model, which focuses on other dimensions of SRL including seeking information (Lee et al., 2019) and the lack of understanding of the relationships among components of SRL. Therefore, the present study employed Zimmerman's (1989) social cognitive model, which has been widely used to examine the relationships in traditional online learning environments.

The purpose of this study is to examine the relationships between self-efficacy, task value, and SRL strategies in MOOCs from a social cognitive perspective.

Literature Review

SRL Strategies, Self-Efficacy, and Task Value in Traditional Online Learning Environments

SRL is generally defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p.14). SRL has been identified as a vital factor in positively influencing learners' success in online learning environments (Cho & Jonassen, 2009; Dabbagh & Kitsantas, 2005). In a recent review of literature on SRL in online higher education settings published from 2004 to 2014, it was identified that SRL strategies, specifically time management, metacognition, effort regulation, and critical thinking, were positively correlated with academic outcomes (Broadbent & Poon, 2015). In addition to SRL strategies, self-efficacy and task value have been regarded as important motivational beliefs for online learners' success. Self-efficacy refers to "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, p. 71). The findings of review studies on self-efficacy in online settings indicate that self-efficacy is positively related to academic performance in online learning environments (Hodges, 2008; Tsai, Chuang, Liang, & Tsai, 2011). Task value is defined as "students' evaluation of how interesting, how important, and how useful the task is" (Pintrich, Smith, Garcia, & McKeachie, 1993, p. 11). The results of empirical studies show that task value is a positive predictor of learners' satisfaction with online courses (Artino, 2007a; Lee, 2002), as well as perceived learning and intentions to enroll in future online courses (Artino, 2007a).

Social Cognitive Models of SRL

With the importance of these factors in online learning environments, the relationships among them have received attention from researchers from a social cognitive perspective. According to social cognitive models of SRL, self-regulation is viewed as a triadic relationship among three processes: personal, behavioral, and environmental (Zimmerman, 1989). The models have been reinterpreted by researchers to fit with online environments because of social cognitive models of SRL being identified as applicable in several empirical studies on online learning environments (e.g., Artino, 2007b). According to researchers' reinterpretations of social cognitive models of SRL (Cho, Demei, & Laffey, 2010; Wang & Lin, 2007), motivational factors, specifically self-efficacy and task value, are commonly identified as personal influences on learning in online settings. Self-efficacy is especially emphasized as a key variable by social cognitive theorists (e.g., Bandura, 1986; Zimmerman, 1989). In addition, the use of SRL strategies, including cognitive and meta-cognitive strategies, is commonly found as a behavioral factor. Suggested environmental factors include peer/teacher feedback, modeling, achievement (Wang & Lin, 2007), social presence, and sense of community (Cho et al., 2010).

The Relationships Between SRL Strategies, Self-Efficacy, and Task Value in Traditional Online Learning Environments

Using social cognitive models of SRL as a theoretical framework, initial studies on SRL in traditional online learning environments have mainly explored the relationships between self-efficacy, task value, and SRL strategies (Artino, 2007b). They started with the aim of discerning whether relationships found in face-to-face classroom settings are generalizable to online courses (Whipp & Chiarelli, 2004). The findings of

several studies on SRL in the context of middle school and college classrooms show students' self-efficacy and task value to be positively related to their use of SRL strategies (e.g., Pintrich, 1999; Pintrich & De Groot, 1990). Based on these findings, Pintrich (1999) has concluded that self-efficacy and task value help students promote and sustain SRL. The role of self-efficacy and task value in self-regulatory processes is also shown in Zimmerman's (2002) model of three cyclical phases of SRL proposed from a social cognitive perspective. For instance, in the first phase of self-regulatory processes, students' self-efficacy and task value start with the use of learning strategies, including goal setting and strategic planning (Zimmerman, 2002).

The findings of studies on SRL in traditional online learning environments parallel those in face-to-face classroom, indicating that self-efficacy is positively related to the use of SRL strategies (e.g., Artino & Jones, 2012; Artino & Stephens, 2006; Cho & Shen, 2013; Joo, Bong, & Choi, 2000; Shea & Bidjerano, 2010). For example, Cho and Shen (2013) found positive correlations between self-efficacy and SRL strategies, including metacognitive regulation and interaction regulation, by administering surveys with 64 students who were taking an online course delivered via Blackboard. Shea and Bidjerano (2010) also discovered a positive correlation between self-efficacy and effort regulation strategy through the analysis of survey responses of 2,418 students who had taken online courses. These findings show that the more self-efficacious students are, the more likely they are to use SRL strategies in traditional online courses. In addition, it was revealed that online learners' self-efficacy was a significantly positive predictor of their use of cognitive strategies (Artino & Jones, 2012; Joo et al., 2000). These findings align with the finding that students' self-efficacy beliefs are a predictor of how they behave (Pajares, 2002).

Task value is also positively related to the use of SRL strategies in traditional online learning settings (e.g., Artino & Jones, 2012; Artino & Stephens, 2006; Hsu, 1997). For example, Hsu (1997) found positive correlations between task value and metacognition, time and environment management, and effort regulation and help-seeking strategies in 169 online learners. Artino and Stephens (2006) also discovered positive correlations between online learners' task value and their use of cognitive strategies, including elaboration and critical thinking, and metacognitive strategies. The more students believe that tasks in online courses are interesting, important, or useful, the more likely they are to use SRL strategies. In addition, study findings show that task value is a significantly positive predictor of use of SRL strategies (Artino & Jones, 2012; Artino & Stephens, 2006). For example, task value has been revealed as a significant positive predictor of elaboration, critical thinking, and metacognition strategies (Artino & Stephens, 2006).

The relationships between self-efficacy, task value, and use of SRL strategies found in traditional online learning settings offer new insights on how to design online courses to support students' SRL. Online course instructors, as well as instructional designers, recognize that SRL is important for students to succeed in online learning (Kim & Bonk, 2006). However, little has been found about how to support online learners' SRL. Based on study findings about the relationships between self-efficacy, task value, and use of SRL strategies, the importance of roles that motivation such as self-efficacy and task value play in SRL processes (Pintrich, 1999; Schunk & Zimmerman, 1998) as well as how they relate to use of SRL strategies have been considered in designing online courses. For example, Artino (2008) provided online instructors with practical guidelines for supporting students' SRL based on the findings of empirical studies between 1995 and 2007. One of the guidelines was to develop and support students' self-efficacy, clarifying task relevance and design activities that are grounded in authentic problems to generate interest.

SRL Strategies, Self-Efficacy, and Task Value in MOOCs

Since the evolution of OER, MOOCs have emerged as a new platform for online learning. MOOCs are different from traditional online courses in several aspects. They provide open access to education for all applicants regardless of their previous qualifications or experiences (Milligan & Littlejohn, 2016), typically without registration fees, except for learners pursuing verified certification (Schulze, 2014). In addition, MOOCs promote online learning at a massive scale by attracting millions of learners (Milligan & Littlejohn, 2016). In terms of course structure, most MOOCs consist of lecture videos, auto-graded quizzes, and online discussion forums (Glance et al., 2013). A broad range of learners with different backgrounds enroll in MOOCs with diverse motivations. They complete tasks in MOOCs at their preferred pace without following linear learning paths (Johnson et al., 2014). However, individual learners who take MOOCs should be more autonomous than those who take traditional online courses. This is because they need to determine which learning activities they will participate in and when and how they will complete them (Milligan & Littlejohn, 2016). The lack of instructor support (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017) as well as limited social interaction (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014) require learners to have an ability to self-regulate their own learning in MOOCs.

A recent systematic review on empirical studies on SRL in MOOCs has demonstrated the importance of SRL, showing that it has positive effects on MOOC learning (Lee et al., 2019). In the review, it was revealed that a broad range of MOOC learners have self-efficacy and task value beliefs and employ several SRL strategies such as time management. In a recent study, 6,335 MOOC learners reported high self-efficacy and task value scores and high critical thinking scores in the Motivated Strategies for Learning Questionnaire (MSLQ) (Alario-Hoyos, Estévez-Ayres, Pérez-Sanagustín, Kloos, & Fernández-Panadero, 2017). In addition, learners who completed a MOOC reported that effort regulation strategy was the most important SRL strategy to succeed in a MOOC (Kizilcec, Pérez-Sanagustín, & Maldonado, 2016). Although self-efficacy, task value, and SRL strategies have been commonly identified in empirical studies on MOOCs, little has been known about the relationships among them.

The relationships between self-efficacy, task value, and use of SRL strategies could provide new insights on how to design MOOCs to support learners' self-regulation with MOOC instructors and instructional designers as they did in traditional online learning environments. Several MOOC design principles or guidelines have been suggested to better support MOOC learners' self-regulation (e.g., Milligan & Griffin, 2016; Nawrot & Doucet, 2014). However, motivational aspects of SRL such as self-efficacy and task value have been underestimated in supporting learners' SRL in MOOC environments. This might be attributed to the use of different theoretical frameworks of SRL (Lee et al., 2019), such as Zimmerman and Pons's (1986) model that mainly focuses on other dimensions of SRL strategies including seeking information, and the lack of research on the relationships among components of SRL in MOOCs. Therefore, the present study addresses this gap by adopting Zimmerman's (1989) social cognitive model of SRL, which has been widely used in traditional online learning environments.

The research questions and hypotheses in this study were as follows:

RQ1. Are there relationships between learners' self-efficacy and their use of SRL strategies in MOOCs?

H1. Self-efficacy will positively correlate with the use of SRL strategies of MOOC learners.

H2. Self-efficacy will significantly predict MOOC learners' use of SRL strategies.

H3. There will be a significant difference in the use of SRL strategies between MOOC learners with high self-efficacy and those with low self-efficacy.

RQ2. Are there relationships between learners' task value and their use of SRL strategies in MOOCs?

H4. Task value will positively correlate with the use of SRL strategies of MOOC learners.

H5. Task value will significantly predict MOOC learners' use of SRL strategies.

H6. There will be a significant difference in the use of SRL strategies between MOOC learners with high task value and those with low task value.

Methods

Study Setting

This study was conducted on two self-paced probability MOOCs. The courses were offered by a large Midwestern university on the edX platform. The first MOOC, titled Probability: Basic Concepts & Discrete Random Variables, provided an introduction to mathematical probability. The second MOOC, titled Probability: Distribution Models & Continuous Random Variables, addressed continuous random variables and probability distribution models. The MOOCs were fully delivered online, and the same professor taught both. Each MOOC consisted of six units with video lectures, quizzes, examples, and practice activities. The units were designed to be completed according to the suggested schedule of one unit per week. However, students could study and complete each unit at their own pace. They could enroll in each MOOC anytime for free. If they wanted to earn a verified certificate, they could pay a small fee. The research team had no affiliation with the MOOC instructor or the edX platform institution.

Instruments

A total of seven self-efficacy items and six task value items from the MSLQ were used (Pintrich et al., 1991). MSLQ is one of the most well-known instruments used to measure online learners' self-efficacy and task value, as shown in literature reviews of SRL in traditional online settings (Artino, 2007b; Broadbent & Poon, 2015). Therefore, it has been increasingly used in MOOC environments (e.g., Alario-Hoyos et al., 2017). The items were slightly modified to better fit with MOOC environments. For example, the item "I'm confident I can do an excellent job on the assignments and tests in this course" was modified to "I'm confident I can do an excellent job on the assignments and quizzes in this MOOC." The items were rated on a 7-point Likert scale ranging from "not at all true of me" to "very true of me." In this study, the reliability with Cronbach's α values of self-efficacy and task value were .91 and .87, respectively.

The use of SRL strategies was measured by the Online Self-Regulated Learning Questionnaire (OSLQ) from Barnard, Lan, To, Paton, and Lai (2009), which consists of 24 items with a 5-point Likert scale ranging from "strongly agree" to "strongly disagree." The OSLQ has been widely used to measure students' SRL strategies in traditional online learning settings (e.g., Barnard-Brak, Paton, & Lan, 2010). Researchers have recently used it to measure students' use of SRL strategies in MOOC environments (e.g., Ohan & Sinclair, 2016). The OSLQ consists of six subscales: environment structuring, goal setting, time management, help seeking, task strategies, and self-evaluation. In the items, the word *online courses* was changed to *MOOC* to better fit MOOC environments. The reliability with Cronbach's α values of OSLQ in this study was .93. The content validity of self-efficacy items, task value items, and OSLQ was verified through content-related evidence by two professors of educational technology who evaluated the modified items and decided whether they adequately represented the content domain. According to Johnson and Christensen (2017), content-related evidence is "validity evidence based on a judgement of the degree to which the items, tasks, or questions on a test adequately represent the construct domain of interest" (p. 172) and must be done by experts.

Recruitment and Respondents

Once Institutional Review Board approval was granted, a survey link was posted on the MOOCs' message boards by the MOOC instructor as an announcement. Students were asked to complete the survey while taking the MOOCs if they were interested in participating in this study. The survey was voluntary, and there was no incentive for students to complete it. The survey responses were collected in 2018 from the spring semester through the fall semester.

A total of 13,465 learners enrolled in the two probability MOOCs. Of the 13,465 learners, 242 responded to the survey. However, 50 people skipped at least one question about self-efficacy, task value, and OSLQ. Their responses were excluded from data analysis. In addition, eight outliers were detected and removed. Finally, 184 learners from 37 countries completed the survey. The age of 184 learners ranged from 18 to 66 years and above: 60 learners were 18-25 years of age (32.6%); 56 learners were 26-35 years of age (30.4%); 38 learners were 36-45 years of age (20.7%); 12 learners were 46-55 years of age (6.5%); 13 learners were 56-65 years of age (7.1%); and 5 learners were over 66 years of age (2.7%). In terms of gender, 130 learners were male (70.7%) and 54 learners were female (29.3%).

Data Analysis

The data sets were analyzed by using SPSS statistical software. In order to test hypotheses 1 and 4, Pearson's correlation analysis was conducted. Hierarchical multiple regression analysis was conducted to test hypotheses 2 and 5. Since Zimmerman's (1989) social cognitive model of SRL emphasizes self-efficacy as a key variable positively affecting self-regulatory processes, a hierarchical multiple regression model where the order of the predictor variables is determined based on the theory was used. In order to test hypotheses 3 and 6, two separate independent sample *t*-tests were conducted. All assumptions for Pearson's correlation, multiple linear regression, and independent sample *t*-test were checked and satisfied. They are represented in the following section.

Results

Results of Pearson's Correlation Analysis

All assumptions for Pearson's correlation were first checked and met. The Kolmogorov–Smirnov and Shapiro–Wilk tests results showed that the residuals were normally distributed ($p > .05$). Scatterplot graphs confirmed a linear relationship between self-efficacy, task value, and SRL strategies. The Breusch–Pagan test (Breusch & Pagan, 1979) result showed no homoscedasticity ($p > .05$). Scatterplot graphs also confirmed that homoscedasticity did not exist.

The results of Pearson's correlation analysis showed that self-efficacy was positively related to probability MOOC learners' use of SRL strategies ($r = .36$, $p < .01$), which supports hypothesis 1. Pearson's correlation analysis was also revealed that task value was positively related to probability MOOC learners' use of SRL strategies ($r = .45$, $p < .01$), which supports hypothesis 4. Table 1 represents descriptive statistics and the results of Pearson correlation analysis.

Table 1

Means, Standard Deviations, and Pearson's Correlations for Self-Efficacy, Task Value, and Self-Regulated Learning

Variable	*M*	*SD*	Self-efficacy	Task value	SRL
Self-efficacy	5.35	.95	—	.52**	.36**
Task value	5.92	.78	.52**	—	.45**
SRL	3.54	.68	.36**	.45**	—

Note. *M* = mean; *SD* = standard deviation; SRL = self-regulated learning.
** $p < .01$.

The Results of Hierarchical Multiple Regression Analysis

Two-step hierarchical multiple regression analysis was carried out with an entrance level of 0.05 and an exclusion level of 0.10 to test hypotheses 2 and 5. Prior to conducting hierarchical multiple regression analysis, all assumptions for multiple linear regression were checked and met. As shown in Pearson's correlation analysis, normality and linearity were met, and there was no homoscedasticity. Multicollinearity was checked by variance inflation factor values, which were lower than 10, indicating no strong correlation between self-efficacy and task value. Finally, the Durbin–Watson statistic was 1.71, indicating that there were no independent errors by the residuals.

The results of hierarchical multiple regression analysis are shown in Table 2. In model 1, self-efficacy was entered based on Zimmerman's (1989) social cognitive model of SRL, which emphasizes the importance of self-efficacy. Model 1 was statistically significant ($F(1, 182) = 27.18$, $p < .01$) and accounted for

approximately 13% of the variance of SRL strategies (R^2 = .13, adjusted R^2 = .13). Self-efficacy was found to be a significant predictor of SRL strategies (β = .36, p < .05). Model 2 including task value was statistically significant ($F(2, 181) = 25.78$, p < .01) and accounted for approximately 21% of the variance of SRL strategies (R^2 = .22, adjusted R^2 = .21). Task value (β = .36, p < .05) and self-efficacy (β = .17, p < .05) were all found to be significant predictors of SRL strategies. Therefore, both hypothesis 2 and hypothesis 5 are supported.

Table 2

Results of Hierarchical Multiple Regression Analysis

Variable	Model 1			Model 2		
	B	*SE*	β	B	*SE*	β
Self-efficacy	.26	.05	.36**	.12	.06	.17**
Task value				.30	.07	.36**
R^2			.20			.22
Adjusted R^2			.20			.21
ΔR^2			.13			.01
F			27.18*			25.78*

Note. B = unstandardized beta; *SE* = standard error.
* p < .01. ** p < .05.

The Results of Independent Sample *t*-Test

Before testing hypotheses 3 and 6, all assumptions for the independent sample *t*-test were checked. The Kolmogorov–Smirnov test and the Shapiro–Wilk test results showed that the residuals were normally distributed (p > .05). The assumption of homogeneity of variance was met by Levene's test of equality of variances (F = 2.21, p > .05; F = 3.07, p > .05). MOOC learners were divided into three level groups according to percentile based on their self-efficacy and task value scores: the low group was below the 25th percentile; the medium group was between the 25th and the 75th percentile; the high group was above the 75th percentile.

As shown in Table 3, the results of an independent sample *t*-test indicated a statistically significant difference in the average total scores of SRL between probability MOOC learners who had high levels of self-efficacy (M = 6.61, SD = .34) and those who had low levels of self-efficacy (M = 4.15, SD = .44), $t(87) = -5.31$, p = .00. Hence, hypothesis 3 is supported.

Table 3

Results of Independent Sample t-Test and Descriptive Statistics for Self-Regulated Learning Scores by Self-Efficacy Levels

	Self-efficacy level									
	Low self-efficacy			High self-efficacy			95% CI for mean difference	*t*	*df*	*p*
	M	*SD*	*n*	*M*	*SD*	*n*				
SRL	4.15	0.44	49	6.61	0.34	40	−.98, −.45	−5.31	87	.00*

Note. *M* = mean; *SD* = standard deviation; 95% CI = 95% confidence interval; SRL = self-regulated learning.
* p <.05.

In addition, there was a statistically significant difference in the mean scores of SRL between probability MOOC learners who had high task value (M = 6.86, SD = .14) and those who had low task value (M = 4.83, SD = .38), $t(91) = -6.00$, p = .00. Therefore, hypothesis 6 is supported. Table 4 shows the results of the independent sample t-test for SRL scores by task value levels.

Table 4

Results of Independent Sample t-Test and Descriptive Statistics for Self-Regulated Learning Scores by Task Value Levels

	Task value level									
	Low task value			High task value			95% CI for mean difference	*t*	*df*	*p*
	M	*SD*	*n*	*M*	*SD*	*n*				
SRL	4.83	0.38	43	6.86	0.14	50	−1.09, −.55	−6.00	91	.00*

Note. *M* = mean; *SD* = standard deviation; 95% CI = 95% confidence interval; SRL = self-regulated learning.
* p <.05.

Discussion

This study examined the relationships between self-efficacy, task value, and the use of SRL strategies in MOOCs using Zimmerman's (1989) social cognitive model of SRL. The understanding of the relationships between self-efficacy, task value, and SRL strategies in MOOCs is still nascent, which has resulted in limited application in MOOC design and teaching to support self-regulation of MOOC learners with heterogenous

backgrounds and experiences. This study marks the first step in applying a social cognitive model of SRL to MOOC environments and extending the relationships found in traditional online courses to MOOCs.

RQ1. Are There Relationships Between Learners' Self-Efficacy and Their Use of SRL Strategies in MOOCs?

The study findings demonstrate that self-efficacy was positively associated with the use of SRL strategies in two probability MOOCS as found in traditional online learning settings. A positive correlation between self-efficacy and the use of SRL strategies in the MOOCs is consistent with findings of previous studies on SRL in traditional online courses (e.g., Cho & Shen, 2013; Shea & Bidjerano, 2010). The more that probability MOOC learners are self-efficacious, the more likely they are to use SRL strategies. In model 1 of hierarchical multiple regression, it was revealed that self-efficacy significantly and positively predicted the use of SRL strategies of the probability MOOC learners. When task value was added in model 2, self-efficacy was still a significant predictor of the use of SRL strategies in the MOOCS. These study findings are congruent with previous study findings showing self-efficacy as a significant predictor of SRL strategies in traditional online courses (Artino & Jones, 2012; Joo et al., 2000). In addition, the statistically significant higher average SRL scores of the probability MOOC learners with high self-efficacy support Pintrich's (1999) assertation that self-efficacy promotes SRL behaviors. In summary, although there are differences between traditional online courses and MOOCs such as course structure (e.g., Glance et al., 2013), positive relationships between self-efficacy and SRL strategies found in previous studies on traditional online courses extended to the context of MOOCs studied here. Self-efficacy positively affected use of SRL strategies in the probability MOOC learners, which indicates self-efficacy playing a key role in promoting learners' SRL strategies in MOOCs.

RQ2. Are There Relationships Between Learners' Task Value and Their Use of SRL Strategies in MOOCs?

Task value was positively related to the use of SRL strategies in two probability MOOCs, as found in traditional online course settings. There was a positive correlation between task value and the use of SRL strategies in the probability MOOCs studied here, which is congruent with previous research findings in traditional online courses (e.g., Artino & Stephens, 2006; Hsu, 1997). Students who believed that the materials in the two probability MOOCs were useful and that understanding the MOOC subjects was important were more likely to use SRL strategies. In model 2 of hierarchical multiple regression, it was revealed that task value significantly and positively predicted the MOOC learners' use of SRL strategies. These findings are consistent with those from earlier studies showing that task value is a significant predictor of SRL strategies in traditional online courses (Artino & Jones, 2012; Artino & Stephens, 2006; Joo et al., 2000). In addition, the statistically significant higher average SRL scores of the probability MOOC learners with high task value support Pintrich's (1999) assertation that task value fosters SRL behaviors. In summary, despite differences between traditional online courses and MOOCs, such as openness (Schulze, 2014) and course goals (Perna et al., 2014), the positive relationships between task value and SRL strategies found in previous studies on traditional online learning settings (e.g., Artino & Jones, 2012; Artino & Stephens, 2006) extended to the context of MOOCs studied here. Task value positively affected use of SRL strategies in the two probability MOOC learners, which indicates the importance of task value to promote learners' SRL strategies in MOOCs.

Implications for Practice

The results reported here have practical implications. MOOCs differ from traditional online courses in several aspects, such as lectures formatted as short videos, formative quizzes, and online forums (Glance et al., 2013). The relationships between self-efficacy and SRL strategies found in this study suggest that, considering the unique characteristics of MOOCs, MOOC practitioners should help learners improve their self-efficacy. For example, MOOC instructors could regularly show learners their learning progress through system-generated e-mail notifications as self-perceptions of progress improve learners' self-efficacy beliefs (Ertmer, Newby, & MacDougall, 1996). In addition, as Hodges (2016) has suggested, MOOC instructors could provide persuasive feedback on quizzes rather than simple feedback such as "correct" or "incorrect" in order to better develop learners' self-efficacy. The relations between task value and SRL strategies found here suggest that MOOC instructors or instructional designers should help learners improve their task value or keep their task value high. There is a need to improve the instructional design quality of MOOCs based on instructional design principles (Margaryan, Bianco, & Littlejohn, 2015), which helps MOOC learners place a value on high quality MOOC resources or activities.

Limitations and Future Research

This study has a number of limitations. First, only a single topic of probability was investigated, although across two MOOCs. Other MOOCs on the same topic as well as on different topics should be further explored for a better understanding of the relationships between MOOC learners' self-efficacy, task value, and SRL strategies. Second, the scope of this study was limited to relationships between self-efficacy and task value as personal variables and SRL strategy as a behavioral variable in the framework of Zimmerman's (1989) social cognitive model of SRL. Future research should explore other behavioral variables and environmental variables, as well as the relationships among them. Third, the data in this study were derived from self-reported questionnaires. Although these methods have been widely used in empirical research on SRL in traditional online settings (Artino, 2007b), the employment of qualitative methods could enrich the findings of this study by more deeply exploring individuals' use of SRL strategies and their relation to users' self-efficacy and task value beliefs. Finally, this study investigated only the total SRL scores of MOOC learners. Future research should examine SRL subscales to better understand the differences in the use of SRL strategies among MOOC learners with different levels of self-efficacy and task value.

Conclusions

This study investigated the relationships between self-efficacy, task value, and SRL strategies of MOOC learners from a social cognitive perspective. The results of this study show positive relationships between self-efficacy and SRL strategies in two probability MOOCs. In addition, positive relationships between task value and SRL strategies were found in the two MOOCs. This study sheds new light on research on MOOCs by revealing the applicability of using a social cognitive model of SRL (Zimmerman, 1989) in MOOCs and providing empirical evidence on the relationships between self-efficacy, task value, and SRL strategies in MOOCs. In addition, the findings of the present study highlight the key role of learners' self-efficacy and task value in self-regulatory processes in MOOCs and the necessity of supporting them.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Open to Open? An Exploration of Textbook Preferences and Strategies to Offset Textbook Costs for Online Versus On-Campus Students

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Abstract

As open textbook initiatives are on the rise, a burgeoning literature has begun exploring student perceptions of openly licensed textbooks used in higher education. Most of this research has lacked consideration of potential differences in the perceptions of online and on-campus students and has failed to include a control group of students using traditional textbooks. Therefore, the authors employed a 2 x 2 design to directly compare perceptions of online students with on-campus students assigned either open or traditional textbooks. Students (N = 925) enrolled in multiple sections of psychology courses at a midsized R1 institution completed a survey on their perceptions of their particular book's format and features, as well as strategies they typically employ to offset the cost of expensive course materials. The results revealed that online and on-campus students report disparate strategies for offsetting the high costs of textbooks, different preferences in textbook formats (print versus digital versus both) when cost is not a factor, and differences in their ratings of the importance of various textbook features. Moreover, the results indicate that the use of open textbooks may increase preference for free digital textbooks over paid printed textbooks. Based on these results, the authors suggest that campuses might consider providing customized support to different student populations as open textbook initiatives gain in popularity on university campuses. Additionally, they suggest that prior exposure to open textbooks may increase students' willingness to use openly licensed materials in future courses. They recommend future research on this question, using a longitudinal within-subjects designs.

Keywords: open educational resources, open textbooks, online education, distance education

Introduction

In 2015, Washington State University (WSU)—a midsized R1 institution—created the Course Materials Cost Reduction Task Force to address concerns voiced by the associated student body about the high cost of course materials. This task force is part of a larger trend in higher education, as administrators, students, and faculty have become increasingly concerned about the rise in the cost of course materials. An *NBC News* study in 2015 showed that textbook prices had increased 1,041% since 1977, far outstripping inflation in the Consumer Price Index (Popken, 2015). Surveys suggest that this cost inflation negatively impacts student success; notably, in 2016 the Florida Virtual Campus survey of some 22,000 students found that 66.6% had opted not to purchase a required textbook at some point due to cost, 37% reported earning a poor grade due to cost of course materials, 19.8% reported failing a course, and 47.6% indicated that they had occasionally or frequently taken fewer courses due to cost (Florida Virtual Campus, 2016).

In response to these concerns, WSU organized the Course Materials Cost Reduction Task Force to communicate with key stakeholders on campus. The task force collaborated with university libraries and online education units to offer small-grant stipends to faculty members who wanted to reorganize courses around low-cost course materials or open educational resources (OER). OER were identified by the campus as openly licensed and freely available course materials that could be adopted, adapted, and integrated into courses (UNESCO, 2017). Overall, the task force issued recommendations to faculty to work with the campus bookstore and libraries to identify lower-cost options for students. As a public land-grant institution, WSU considered these measures a natural extension of its mission to open educational opportunities to underprivileged groups. The university comprises a central campus as well as four regional campuses and an online education program that attracts some 30,000 students. Depending on the campus, multicultural students comprise between 23% and 39% of the university's overall population. Some 1,680 incoming freshmen were first-generation students in 2017—an increase over previous years. Moreover, 1,879 of those who attend WSU are international students who have come from more than 100 countries. These demographics suggest a diverse student body with subpopulations that may be particularly sensitive to inflated course material costs.

As the affordability initiative has grown at WSU, interest has increased in understanding the differing needs of the students at the university. Previous researchers have attended to perceptions of students with respect to OER and digital texts but few have considered the needs of students receiving degrees as part of an online education program and how they may differ from those of students in an on-campus program. Certainly, some have suggested that student populations have different sensitivities when it comes to the cost of course materials. For instance, Petrides, Middleton-Detzner, Walling, and Weiss (2011) and Hilton, Robinson, Wiley, and Ackerman (2014) demonstrated that textbooks can be more expensive than tuition for community college students, meaning that this group is particularly keen to find solutions to cost inflation. The implication in this work is that non-traditional students with greater financial needs and work obligations may benefit more from the use of OER. The present study intends to further consider the needs of online and on-campus students using open digital and traditional commercial print course materials in their classes.

More specifically, of interest for this study were differences in the perceptions of online and on-campus students toward their course materials after using either open or traditional texts. By distinguishing responses between online and on-campus students, this study intends to provide generalizable information to institutions of higher education wishing to support diverse student groups by providing OER.

Literature Review

To date, studies on student use of OER have focused primarily on course outcomes and reported perceptions of OER. While studies on course outcomes have generally involved comparisons of students using OER with those using traditional course materials, much of the research on students' perceptions has lacked a comparison group of students using (and rating) traditional texts. Moreover, little research has differentiated between online and on-campus students. That said, in John Hilton's (2016) review of 16 studies on OER outcomes, he found little difference between performance indicators for students using OER and those using traditional texts. Similarly, numerous studies on student perceptions of OER have found majorities of students reporting that they rate OER equal to or better in quality compared to the traditional textbooks that they've previously used (Bliss, Robinson, Hilton, & Wiley, 2013; Feldstein et al., 2012; Hilton, 2016; Jhangiani & Jhangiani, 2017). In perception studies, students often cite affordability, presentation, accessibility, convenience, relevance, searchability, and portability as reasons for preferring OER over traditional print textbooks (Cooney, 2017; Feldstein et al., 2012; Hendricks, Reinsberg, & Rieger, 2017; Jhangiani & Jhangiani, 2017; Lindshield & Adhikari, 2013; Ozdemir & Hendricks, 2017; Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011). Affordability typically tops the list of reasons why students prefer OER.

Some studies of performance in OER courses have asked students to comment specifically on their preferences for print versus digital resources. This question is relevant to the instructors who construct OER because these materials are typically delivered in digital format, although it is almost always possible to print the materials on demand. Students' preferences for print or digital content can be mixed, but a substantial number report preferring print resources over digital ones. Petrides and colleagues (2011) found in their analysis of the Community College Open Textbook Project that 77% of students preferred print resources, though they also praised the affordability and portability of OER. Illowsky, Hilton, Whiting, and Ackerman (2016) found that 48% of students using an open statistics textbook preferred to purchase a print copy, and 61% chose to print sections for class. Jhangiani and Jhangiani (2017) similarly found that 44% of students at post-secondary institutions in British Columbia preferred to use print material exclusively in class, while 16% preferred digital only. Jhangiani, Dastur, Le Grand, and Penner (2018) also focused on the print versus digital question in their recent study and found that students rated print OER more highly than digital OER or traditional course materials. These findings substantiated other studies that have not focused on OER exclusively but showed a preference among students for reading print as opposed to digital texts, although course outcomes did not differ markedly between the formats. Reasons often cited for disliking digital texts included difficulty in highlighting and annotating, quality concerns, and increased distraction in digital environments (Millar & Schrier, 2015; Rockinson-Szapkiw, Courduff, Carter, & Bennett, 2013; Shepperd, Grace, & Koch, 2008; Woody, Daniel, & Baker, 2010).

Studies on student use of OER have, by and large, chosen not to consider online students in contrast to on-campus students, but some have hinted at the diverse populations served by open resources and resulting differences in student outcomes and perceptions. For instance, Colvard, Watson, and Park (2018) recently reported that students receiving financial aid, part-time students, and ethnic minorities benefited more from OER than those not receiving financial aid, full-time students, and white students. Further, in their study of OER use at Virginia State University, Feldstein and colleagues (2012) found that 70% of students preferred to read their textbook on a laptop or computer—an outcome that the authors found intriguing given that many were urban commuter students. The students in this study also reported that the leading barrier for accessing the OER was an inconsistent wireless connection. This barrier is substantial and speaks to the unique needs of students in the Virginia State study. Buzzetto-More, Guy, and Elobaid (2007) similarly spoke to the specialized needs of certain student populations when they remarked on the use of digital textbooks by students at historically black colleges and universities (HBCU). The HBCU students who responded to the survey had little prior experience with digital books, and the authors suggested that student backgrounds should be taken into account when providing course materials.

This research, while not directly applicable, provides a background for the present study, which will consider differences and similarities in online and on-campus students' perceptions of open and traditional textbooks at WSU. More specifically, the present study aimed to (1) compare strategies to offset textbook costs in online versus on-campus students, (2) compare online and on-campus students' preferences for digital versus print textbooks, (3) compare online and on-campus students' ratings of the importance of various textbook features (e.g., price, immediate access, portability, etc.). Further, the study included comparison groups of online and on-campus students using traditional textbooks to permit for exploration of the potential impacts of using open versus traditional textbooks on these preferences (Aim 2) and ratings (Aim 3).

Method

Procedure

The Office of Research Assurances found this study to be exempt from the need for Institutional Review Board review. A large sample of undergraduate students (N = 1,133) were asked to complete an anonymous online survey in the Fall 2017 and Spring 2018 semesters. The survey required approximately 10–15 minutes to complete and students in sections with a response rate of 75% or higher were given a small number of bonus points.

Materials

Demographics. Participants were asked to input their age and indicate their gender, minority status, and status as a first-generation student. Further, they were asked to indicate their year of university, the number of courses they were currently enrolled in, and their overall GPA.

Strategies to offset textbook costs. Participants were asked, "In which of the following ways has the cost of textbooks influenced you? (Check all that apply.)" This was followed by the 13 strategies to offset textbook costs shown in Table 2. Next, they were asked, "How often have you taken the following actions as a result of textbook costs?" The five strategies shown in Table 3 were presented and participants were asked to respond to each option using a scale with the following response options: 0 = Never (0 Times), 1 = Rarely (1-2 Times), 2 = Sometimes (3-5 Times), 3 = Often (6-10 Times), and 4 = Very Often (More than 10 Times).

Preferences for print versus digital textbooks. Students who were assigned traditional textbooks could opt to purchase either a print or digital copy of their textbook. While only digital copies of the open textbooks were provided, students could print PDF versions of these textbooks. To determine how many used each option, participants were asked if they used a printed or digital copy of their assigned textbook or if they used both. They were then asked, "In general, would you rather have a free digital textbook or pay for a printed textbook?" As shown in Table 4, they were given three options for their response (free digital text, paid printed text, or no preference). Next, they were asked, "Assume cost is not a factor. Which of the following textbook formats would you prefer?" Once again, they were given three response options (print, digital, or both). Students who responded with the print option were asked to indicate the reason(s) for their preference for printed textbooks. They were provided with the list of six options (shown in the upper portion of Table 5) and were instructed to check all that applied. Students who responded with the digital option were asked to indicate the reason(s) for their preference for using digital textbooks. They were provided with a list of six options (shown in the lower portion of Table 5) and were instructed to check all that applied.

Finally, students in classes using open textbooks were asked to indicate how strongly they agreed with the statement, "I would have preferred to purchase a traditional textbook for this course," and students in classes using traditional textbooks were asked to indicate how strongly they agreed with the statement, "I would have preferred a free digital textbook for this course." All students were given a scale ranging from 1 = Strongly disagree to 5 = Strongly agree, to indicate their level of agreement.

Importance of textbook features. Participants were asked, "How important to you are the following features of your textbook?" They were shown the six options displayed in Table 6 and for each were asked to rate its importance using a scale ranging from 1 = Of no importance at all to 5 = Absolutely essential.

Design

A 2 x 2 between-subjects cross-sectional design was used to compare the responses of students assigned two different types of textbooks (traditional versus open) in two different types of learning environments (on-campus versus online). There was a total of three open textbooks and three traditional textbooks used in 15 different sections of various psychology classes.

Participants

A total of 925 undergraduate psychology students completed the online survey, representing an overall response rate of 81.6%. Participants ranged in age from 18 to 65 (M = 24.45, SE = 0.25) and were predominantly female (82.2%) and Caucasian (74.3%). On average students were taking 4.80 (SE = 0.83) courses and reported an average GPA of 3.25 (SE = 0.02).

Of the 925 students who completed the survey, 363 were on-campus and were assigned a traditional textbook, 203 were on-campus and were assigned an open textbook, 181 were online students assigned a traditional textbook, and 178 were online students assigned an open textbook. Demographic and other sample characteristics for each of the four groups are provided in Table 1. As shown in the table, there was a higher percentage of females and first-generation students in the online classes than in the on-campus classes, and online students were significantly older and earned a significantly higher income than on-campus students. Online students and students assigned traditional textbooks were enrolled in significantly fewer courses than on-campus students and those assigned open textbooks, respectively. Finally, online students and those assigned open textbooks were more advanced in their education than on-campus students and those assigned traditional textbooks. Given these potentially confounding differences, gender, income, first-generation status, age, year in university, and number of currently enrolled courses will be entered as covariates in analyses involving comparisons of these groups.

Results

Strategies to Offset Textbook Costs

In order to determine whether online students report different strategies to offset textbook costs than students taking classes on campus, the overall percentages of online and on-campus students who endorsed particular strategies were computed. Hierarchical logistic regression analyses were then used to compare each set of percentages after statistically controlling for the potentially confounding differences in the demographic characteristics of these groups. As indicated in Table 2, online students were less likely than on-campus students to report purchasing used copies of textbooks from the campus bookstore, opting not to use a textbook, or sharing a textbook with a classmate. In contrast, online students were more likely than on-campus students to report buying from a source other than the campus store and renting a digital textbook.

Table 1

Demographic Characteristics of the Four Groups

	On campus		Online		Main effects and interactions					
	Traditional	Open	Traditional	Open	Main Effect textbook			Main effect environment		
	N = 363	*N* = 203	*N* = 181	*N* = 178	χ^2	*p*	OR	χ^2	*p*	OR
% Female	79.3%	80.1%	87.3%	85.3%	0.41	.84	0.96	6.62	.01	0.61
							Interaction	0.28	.59	1.23
% Caucasian	76.3%	70.2%	75.7%	73.7%	2.21	.14	0.79	0.17	.68	0.94
							Interaction	0.40	.53	0.82
% 1st Generation	29.3%	32.5%	49.7%	38.6%	0.64	.42	1.12	18.43	< .001	1.84
							Interaction	4.43	.04	0.55
					Main effect textbook			Main effect environment		
					F	*p*	η_p^2	*F*	*p*	η_p^2
Age	20.31 (0.30)	20.97 (0.40)	30.96 (0.42)	30.07 (0.42)	0.09	.78	.000	650.73	< .001	.42
							Interaction	4.05	.04	.004
University Year	2.92 (0.05)	3.29 (0.07)	3.13 (0.08)	3.48 (0.08)	26.54	< .001	.03	8.37	.004	.009
							Interaction	0.03	.87	.000
# of Courses	5.10 (0.13)	5.94 (0.17)	3.79 (0.18)	3.91 (0.18)	8.58	.003	.009	103.40	< .001	.10
							Interaction	4.80	.03	.005
GPA	3.26 (0.03)	3.21 (0.04)	3.28 (0.04)	3.24 (0.04)	1.09	.30	.001	0.59	.44	.001
							Interaction	0.004	.95	.000
Income/Week	$150.04	$217.81	$431.91	$473.31	1.86	.17	.002	25.63	< .001	.03
	(33.13)	(42.62)	(48.76)	(47.93)			*Interaction*	0.11	.74	.000

Note. Percentages are presented for nominal variables. Means are presented with standard errors in parentheses for continuous variables. OR = odds ratio, η_p^2 = partial eta squared (effect size indicator).

Table 2

Comparisons of the Strategies Used to Offset Textbook Costs Endorsed by Online Versus On- Campus Students

	On campus (N = 566)	Online (N = 359)	χ^2	p	ΔR^2
Bought used copies from campus store	77.6%	59.3%	5.96	.01	.009
Rented printed text	64.8%	60.7%	0.01	.91	.000
Bought from source other than campus store	61.0%	75.8%	6.62	.01	.01
Bought a digital version	47.7%	43.2%	3.41	.06	.006
Didn't use a textbook	44.9%	12%	22.02	< .001	.03
Sold my used textbook	34.6%	27.6%	0.73	.39	.002
Shared a book with classmate	33.6%	6.7%	26.22	< .001	.04
Rented a digital text	25.4%	37.3%	11.17	< .001	.018
Downloaded a text from the internet	23.7%	15.6%	0.23	.63	.001
Used a library reserved copy	8.8%	3.9%	2.92	.09	.008
Nothing; I've purchase them at regular cost	2.8%	5%	2.13	.14	.009
Used an interlibrary loan	2.3%	1.4%	1.73	.19	.012
Stole my textbook	0.5%	0.6%	0.19	.66	.003

Note. Percentages represent overall percentages (without effects of covariates removed); χ^2 = chi-square statistic for the difference between the groups after controlling for potentially confounding demographic characteristics (gender, age, income, first-generation status, year in university, number of courses); ΔR^2 = change in R^2 associated with adding learning environment to the hierarchical logistic regression models (i.e., effect size indicator).

A multivariate analysis of covariance (MANCOVA) was used next to compare how frequently online versus on-campus students reported engaging in various strategies, while controlling for the potentially confounding demographic variables. The results revealed a significant overall difference in the two groups, Wilks $\lambda = 0.93$, $F = 12.95$, $p < .001$, $\eta_p^2 = .07$. As depicted in Table 3, on-campus students reported not purchasing the required textbook significantly more often than online students. In contrast, online students reported not registering for specific courses significantly more frequently than on-campus students.

Table 3

Comparisons of the Frequency of Engaging in Various Strategies to Offset Textbook Costs in Online Versus On-Campus Students

	On campus (N = 511)	Online (N = 325)	F	p	η_p^2
Not purchased the required textbook	1.51 (0.06)	0.75 (0.05)	43.37	< .001	.05
Earned a poor grade because I could not afford to buy the textbook	0.59 (0.05)	0.45 (0.06)	2.52	.11	.003
Not registered for a specific course	0.31 (0.04)	0.56 (0.06)	8.62	.003	.01
Taken fewer courses	0.35 (0.04)	0.49 (0.06)	3.25	.07	.004
Dropped or withdrawn from a course	0.24 (0.03)	0.32 (0.05)	1.34	.25	.002

Note. Marginal means (with effects of covariates removed) are presented with standard errors in parentheses; 0 indicates a response of never, 1 indicates a response of rarely (1-2 times), and 2 indicates a response of sometimes (3-5 times). *F* statistics represent comparisons of the two groups after controlling for differences in demographic characteristics (gender, age, first-generation status, year in university, number of courses); η_p^2 = partial eta squared (effect size indicator).

Textbook Preferences

In order to determine whether there were differences in the formats of textbooks students in the four groups used, and differences in their preferences for digital versus print textbooks, the overall percentages of students in each group who endorsed each option were first computed. Hierarchical logistic regression analyses were then used to examine the main effects of learning environment (on-campus versus online), the main effects of textbook type assigned (traditional versus open), as well as environment x textbook type interactions, after controlling for the potentially confounding differences in the demographic characteristics of the four groups.

Table 4 shows the overall percentages and the results of the hierarchical logistic regression analyses used to compare these percentages. Not surprisingly, students who were assigned open textbooks were 40 times (1/0.025) less likely to report using printed textbooks and were 31.50 times more likely to report using a digital format than those assigned traditional textbooks. Further, on-campus students were 3.33 times (1/0.30) less likely than online students to report using both formats (see upper portion of Table 4).

While there were no significant differences in online and on-campus students' general textbook format preferences, overall students reported preferring a free digital textbook to a paid printed textbook (see middle portion of Table 4). The results further revealed that students assigned open textbooks were 2.07 times more likely to report preferring a free digital textbook and were 2.63 times (1/0.38) less likely to report preferring to pay for a printed textbook than students assigned traditional textbooks.

Assuming cost was not a factor, most students reported preferring printed textbooks (see lower portion of Table 4). However, students in classes using open textbooks were 1.88 times (1/0.53) less likely to report

preferring printed textbooks, were 1.58 times more likely to report preferring digital textbooks, and were 1.61 times more likely to report preferring both formats than students in classes using traditional textbooks. Finally, on-campus students were 1.58 times more likely to report preferring printed textbooks and were 1.79 times less likely to report preferring both formats than online students.

Table 4

Use of and Preferences for Digital Versus Printed Textbooks Across the Four Groups

	On campus		Online		Main effects and interactions					
	Traditional	Open	Traditional	Open	Main effect textbook			Main effect environment		
	N = 353	*N* = 138	*N* = 181	*N* = 177	χ^2	*p*	OR	χ^2	*p*	OR
Format used										
Print	81.9%	7.9%	73.5%	8.5%	265.85	< .001	0.025	0.15	.70	0.90
							Interaction	1.17	.28	0.62
Digital	15.9%	87.1%	12.7%	77.4%	278.89	< .001	31.50	4.34	.04	1.78
							Interaction	0.83	.36	1.45
Both	2.3%	5.0%	13.8%	14.1%	0.83	.36	1.29	10.51	.001	0.30
							Interaction	1.03	.31	1.83
General preference										
Paid print	16.8%	5.9%	21.0%	9.0%	15.31	< .001	0.38	0.15	.70	1.00
							Interaction	0.20	.65	0.80
Free digital	78.2%	88.1%	69.1%%	86.4%	13.29	< .001	2.07	1.70	.19	1.40
							Interaction	0.72	.40	0.72
No preference	5.0%	6.0%	9.9%	4.5%	0.17	.67	0.88	2.51	.11	0.53
							Interaction	3.82	.051	3.30
Preferred format if cost not a factor										
Print	68.8%	53.2%	59.1%	46.0%	18.61	< .001	0.53	5.07	0.02	1.58
							Interaction	0.28	.60	0.85
Digital	15.5%	19.9%	12.2%	21.0%	5.78	.02	1.58	0.00	.98	1.01
							Interaction	0.55	.46	0.75
Both	15.7%	26.9%	28.7%	33.0%	7.97	.005	1.61	6.74	.009	0.56
							Interaction	1.78	.53	1.89

Note. Percentages represent overall percentages (without effects of covariates removed). χ^2 = Wald chi-square statistic for main effects and interactions after controlling for potentially confounding demographic characteristics (gender, age, income, first-generation status, year in university, number of courses). OR = odds ratio.

The students who indicated that they would prefer a printed textbook if cost was not a factor were selected and their reasons for this preference were examined. As shown in the upper portion of Table 5, the majority indicated that they found printed textbooks more convenient to read, easier to write and highlight in, and easier to move to different pages and sections. As shown in the table, hierarchical logistic regression analyses (controlling for differences in demographic characteristics of the groups) indicated there was a great deal of similarity in the four groups' reasons for preferring printed textbooks. The primary difference was that online students were more likely than on-campus students to indicate a preference for printed textbooks because they like to keep a printed copy for later use.

Next, the students who indicated they would prefer a digital textbook if cost were not a factor were selected and the reasons for their preference were examined. As displayed in the lower portion of Table 5, most reported liking that they can access digital textbooks anywhere, that they find it easier to search for terms and other information, they find digital textbooks to be more environmentally friendly, and they find it easier to move to different pages/sections. There were no significant differences in the four groups' reasons for preferring digital textbooks.

Table 5

Reason for Preference (Assuming Cost Is Not a Factor)

	On campus		Online		Main effects and interactions					
	Traditional	Open	Traditional	Open	Main effect textbook			Main effect environment		
Reasons prefer printed	*N* = 249	*N* = 107	*N* = 107	*N* = 81	χ^2	*p*	OR	χ^2	*p*	OR
More convenient to read	85.9%	79.4%	74.8%	82.7%	0.00	.99	1.00	0.00	.99	1.00
						Interaction		3.58	.06	1.74
To write in and/or highlight	78.3%	73.8%	67.3%	75.3%	0.03	.87	1.04	0.69	.41	1.30
						Interaction		1.62	.20	0.56
Easier to move to different pages/sections	78.3%	72.0%	74.8%	85.2%	0.01	.91	1.03	0.17	.68	1.15
						Interaction		3.97	.05	0.37
To keep printed copy for later use	34.1%	27.1%	47.7%	55.6%	0.14	.71	0.93	4.76	.03	0.54
						Interaction		0.08	.77	0.66
Some digital texts are not compatible with my print disability solutions	4.8%	7.5%	6.5%	8.6%	0.19	.66	1.18	1.14	.28	0.58
						Interaction		0.03	.87	0.88
Don't have access to technology to use digital texts	2.0%	1.9%	3.7%	4.9%	0.48	0.49	1.50	1.97	.16	0.35
						Interaction		0.02	.89	1.18
Reasons prefer digital	*N* = 56	*N* = 40	*N* = 22	*N* = 37	χ^2	*p*	OR	χ^2	*p*	OR
Can access it anywhere	80.4%	82.5%	90.9%	89.2%	0.03	.85	1.10	1.52	.22	0.36
						Interaction		0.00	.96	1.05
Easier to search for terms and other information	76.8%	70.0%	90.9%	83.8%	1.05	.31	0.63	4.26	.04	0.23
						Interaction		0.06	.80	1.30
More cost effective	62.5%	57.5%	81.8%	75.7%	0.48	.49	0.76	0.96	.33	0.57
						Interaction		0.02	.88	1.13
More environmentally friendly	64.3%	60.0%	68.2%	62.2%	0.52	.47	0.76	0.00	.98	1.01
						Interaction		0.00	.96	1.04
Easier to move to different pages/sections	51.8%	47.5%	63.6%	54.1%	0.00	.99	1.00	1.07	.30	0.59
						Interaction		0.00	.99	1.00
More accustomed to reading online	44.6%	32.5%	50.0%	51.4%	1.81	.18	0.60	2.55	.11	0.44
						Interaction		0.92	.76	0.80

Note. Percentages represent overall percentages (without effects of covariates removed). χ^2 = Wald chi-square statistic for main effects and interactions after controlling for potentially confounding demographic characteristics (gender, age, income, first-generation status, year in university, number of courses). OR = odds ratio.

The group of students assigned an open textbook was then selected and independent samples *t*-tests were used to compare on-campus and online students' responses to the statement, "I would have preferred to purchase a traditional textbook for this course." The results revealed no significant differences in on-campus (M = 2.05, SE = .09) and online (M = 2.05, SE = .10) students' ratings, t = 0.01, p = .99, d = 0. Next, the group of students assigned a traditional textbook was selected and independent samples *t*-tests were used to compare on-campus and online students' responses to the statement, "I would have preferred a free digital textbook for this course." The results revealed that on-campus students gave significantly stronger ratings of agreement (M = 4.06, SE = .06) than online students (M = 3.68, SE = .10), t = -3.38, p < .001, d = 0.30.

Importance of Textbook Features

Finally, a MANCOVA was used to compare the four groups of students' ratings on the importance of various textbook features. As before, this analysis was done while controlling for potentially confounding demographic variables. The results revealed a significant overall main effect of environment (on-campus versus online), Wilks λ = 0.96, F = 4.59, p < .001, η_p^2 = .04, but no main effect of textbook type (open versus traditional), Wilks λ = 0.99, F = 0.38, p = .89, η_p^2 = .004, and no environment x textbook interaction, Wilks λ = 0.99, F = 0.74, p = .62, η_p^2 = .007. As shown in Table 6, the results of follow-up, one-way analyses of covariance (ANCOVAs) on the main effect of environment revealed that online students rated the importance of immediate access, convenience and portability, ability to print, and ability to keep forever significantly higher than did on-campus students.

Table 6

Ratings of the Importance of Various Features of Textbooks across the Four Groups

	On campus		Online				
	Traditional	Open	Traditional	Open	Main effect environment		
	N = 147	N = 186	N = 163	N = 161			
					F	p	η_p^2
Immediate access	3.96 (0.07)	4.07 (0.07)	4.23 (0.70)	4.24 (0.07)	7.07	.008	.01
Price	4.01 (0.09)	4.02 (0.08)	4.00 (0.08)	4.06 (0.08)	0.01	.92	.000
Convenience & portability	3.84 (0.08)	3.87 (0.07)	4.15 (0.08)	4.09 (0.07)	8.57	.004	.01
Ability to print	3.03 (0.11)	2.97 (0.10)	3.21 (0.11)	3.35 (0.11)	4.73	.03	.007
Ability to keep forever	2.49 (0.11)	2.39 (0.10)	2.68 (0.11)	2.76 (0.11)	4.59	.03	.007
Ability to share it	2.52 (0.10)	2.44 (0.09)	2.19 (0.10)	2.37 (0.10)	2.88	.09	.004

Note. Marginal means (with effects of covariates controlled) are presented with standard errors in parentheses. 1 indicates no importance at all, 2 indicates of little importance, 3 indicates of average importance, 4 indicates very important, 5 indicates absolutely essential. F statistics represent comparisons of the two groups after controlling for differences in demographic characteristics (gender, age, first-generation status, year in university, number of courses). η_p^2 = partial eta squared (effect size indicator).

Discussion

This study corroborated previous studies showing the detrimental impacts of the high costs of course materials and the heavy use of strategies to offset these costs. However, this study further explicated these results by showing that online and on-campus students may have separate strategies for avoiding high costs, with on-campus students more frequently skipping out on purchasing expensive textbooks and online students more frequently skipping out on specific courses. Online students also proved more likely than on-campus students to purchase textbooks from non-bookstore vendors and to rent textbooks, while on-campus students were more likely than online students to report buying used copies from the campus bookstore and sharing books with classmates. These disparate strategies are understandable given the demographics and context at hand. Students working online have less immediate access to instructors, campus bookstores, and classmates. As such, online students may depend more on the explanations provided by textbooks and have fewer opportunities to purchase used copies and share textbook costs with their peers. Therefore, while both groups reported heavy use of strategies to offset high textbook costs, differences in learning environments may affect the options available for students to adopt specific strategies.

Results of this study align with previous work by showing students' preferences for both free digital texts and print resources (if cost were not a factor). Because the study collected responses from students using different types of textbooks (traditional and open), it not only provided insight about the needs of online and on-campus students, it also provided insight about how students respond in general to course materials in different formats. Not surprisingly, students who used an open textbook were 40 times less likely to report utilizing the option to print their textbook and 31.5 times more likely to report having used their textbook in its native digital format than students who were assigned traditional textbooks. Of greater interest, students who were assigned open textbooks were two times more likely to report preferring a free digital textbook and 2.63 times less likely to prefer a printed textbook than students assigned a traditional textbook. Students in classes using open textbooks were also more likely to report preferring digital textbooks over printed textbooks, assuming cost is not a factor. These results showing overall preferences for free digital materials are understandable, given students' sensitivity to cost in both on-campus and online contexts. However, the results also suggest that students may develop different preferences following exposure to open textbooks. That is, students may be more open to the use of open textbooks after they have experience with them. This finding should be examined more closely in future research using a longitudinal within-subjects design.

Although general preferences for print and digital materials did not vary as a function of the learning environment, differences in online and on-campus students' preferences emerged when they were asked to assume cost was not a factor. Specifically, when cost was not a factor, on-campus students were 1.58 times more likely than online students to report preferring printed textbooks, while online students were 1.78 times more likely than on-campus students to report preferring using both formats in their courses. Nevertheless, online students assigned a traditional textbook gave lower ratings of agreement to the statement, "I would have preferred a free digital textbook for this course," than on-campus students assigned a traditional textbook, and online students rated the ability to print as a more important feature than on-campus students. These findings may be explained, in part, by the students' unique contexts.

Online students may find themselves with a greater proliferation of online content that they must juggle while studying and completing assessments. As a result, they may show a greater preference for mixed material types out of convenience and due to a lack of—or discomfort with—multiple screen interfaces. These findings underscore the importance of ensuring that online students have the option to use OER in both digital and printed formats. When it came to course materials, online students also placed a greater emphasis than on-campus students on the ability to keep the materials forever, and on immediate access, convenience, and portability. These differences may be explained by increased planning and foresight in the more mature cohort of online students, delays online students often experience in receiving their course materials from the campus bookstore, as well as differences in convenient access to instructors. These differences may also reflect differences in lifestyle that makes convenience and portability more important to the older, higher-earning students who predominated in the online courses examined in this study.

Limitations and Strengths

Confounding factors in this study included gender, income, first-generation status, age, year in university, and number of courses in which students had enrolled. These factors were accounted for in analyses but merit mention. Instructors as a confounding factor could not be accounted for in this study due to insufficient information in surveys; however, because multiple textbooks were used in the study, the relative strength or weakness of the textbook likely acted less as a confounding factor than it might have in one-to-one OER and traditional textbook comparisons. An additional strength of this study was its 2 x 2 design, which permitted comparisons between groups using traditional and open textbooks. The survey instrument used in the study also reached a fairly sizeable group of students, and the incentive used to motivate participation produced a high response rate, indicative of less biased results. However, additional studies could examine perceptions of a still larger pool of students on and off campus—including students taking courses in other disciplines and at other institutions of higher education.

Conclusion

This study supported previous findings, showing the negative impacts of the high costs of course materials and students' preferences for print materials (if costs were no barrier). The study was unique in showing the differing needs of online and on-campus students, with online students proving to be less likely than on-campus students to opt out of purchasing a textbook and more likely to opt out of specific courses. These students also rated having immediate access to course materials, convenience and portability, the ability to print, and the ability to keep materials forever as significantly more important than on-campus students. Once again, these findings highlight the need to allocate resources to support students who are reliant on print or have a predilection toward studying with print.

The inclusion of comparison groups of students using traditional textbooks in this study further afforded the opportunity to explore potential impacts of open textbook usage, revealing that students who had used OER were more desirous of using digital content as compared to students who had used traditional texts. These results suggest that open textbooks may make students more open to engaging with digital textbooks,

and/or that some reluctance to digital textbooks may stem from a lack of experience with that format. Future research might therefore productively investigate the impact on student preferences of having been exposed to OER. More generally, this study illustrates how campuses can continue supporting students with diverse needs, and how OER researchers can continue to study perceptions and impacts in diverse student groups.

Acknowledgements

The authors thank the William and Flora Hewlett Foundation and the Open Education Group for sponsoring the OER fellowship that supported this work, and John Hilton, III, for his guidance and review of a draft of this manuscript.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Doctoral Students' Learning Success in Online-Based Leadership Programs: Intersection with Technological and Relational Factors

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Abstract

This study examines how technological and relational factors independently and interactively predict the perceived learning success of doctoral students enrolled in online-based leadership programs offered in the United States. The 73-item Online Learning Success Scale (OLSS) was constructed, based on existing instruments, and administered online to collect self-reported data on three primary variables: student learning success (SLS), relational factors (RF), and technological factors (TF). The SLS variable focuses on the gain of knowledge and skills, persistence, and self-efficacy; the RF on the student-student relationship, the student-faculty relationship, and the student-non-teaching staff relationship; and the TF on the ease of use, flexibility, and usefulness. In total, 210 student responses from 26 online-based leadership doctoral programs in the United States were used in the final analysis. The results demonstrate that RF and TF separately and together predict SLS. A multiple regression analysis indicates that, while all dimensions of TF and RF are significant predictors of SLS, the strongest predictor of SLS is the student-faculty relationship. This study suggests that building relationships with faculty and peers is critical to leadership doctoral students' learning success, even in online-based programs that offer effective technological support.

Keywords: online education, online learning success, leadership doctoral program, technological factors, relational factors

Introduction

Student learning success (SLS) is everyone's business in higher education. Learning success among doctoral students in growing online programs is a particular concern for three reasons. First, doctoral student completion, an indicator of learning success, is known to be at a lower rate than other educational endeavors. The PhD Completion Project evaluated doctoral completion rates and attrition patterns across major universities in the United States and Canada and found that only 56.6% of students completed their programs with the lowest completion rates occurring in the social sciences and humanities (Sowell, Zhang, Redd, & King, 2008). Considering that each individual and institution embarking on the PhD journey is investing significant time, money, and intellectual resources, unsuccessful doctoral learning means a substantial waste of resources to the students themselves, their families, the faculty and staff of the institutions, and the intellectual community as a whole.

Second, online degree-granting programs, particularly at the graduate level, are growing significantly in the United States. According to the National Center for Education Statistics (2018), 31.7% of students enrolled in degree-granting postsecondary institutions in 2016 were engaged in distance or online education, either partially or fully. For graduate students, this percentage increased to 36.8%. In 2017, 239 online leadership doctoral programs were offered in the United States, according to our website search of all 50 state departments of education. Online programs provide convenience to graduate students who, while maintaining their work responsibilities, learn anywhere at any time through technology-facilitated tools such as discussion boards, web conferencing, blogging, and social networks (Alammary, Sheard, & Carbone, 2014; Hill, 2012). Online-based education is regarded as the future of higher education, and an increasing number of institutions include online programs in their long-term strategic planning (Allen, Seaman, Poulin, & Straut, 2016; Bayne, Gallagher, & Lamb, 2014). Despite the fact that online-based learning creates different challenges to the learning success of students than face-to-face learning (Kennedy, Terrell, & Lohle, 2015; Lambie, Hayes, Griffith, Limberg, & Mullen, 2014; Rockinson-Szapkiw, Wendt, Whighting, & Nisbet, 2016), the impact of technology on doctoral SLS has not been fully explored.

Third, although the modality of instruction changes, student learning needs based on relationships do not disappear even in online environments. For example, social support from family, friends, and peers has a positive impact on academic self-regulation (Akyol & Garrison, 2011; Williams, Wall, & Fish, 2019) and student learning even in technology-facilitated environments (Gardner, 2009; Garrison, 2007; Lee, 2014). Students still seek timely feedback, encouragement, and openness as they explore new concepts through productive online dialogue with peers and instructors (Bolliger & Halupa, 2012; Kumar, 2014). In addition, interactions with staff are indicators of service quality and have a direct impact on student loyalty and satisfaction (Martínez-Argüelles & Batalla-Busquets, 2016; Ravindran & Kalpana, 2012).

Considering these problems, this study intends to explore how technological factors (TF) and relational factors (RF) predict doctoral SLS in U.S. online-based leadership programs. The purpose of this study is explored with the following research questions:

1. How do technological factors and relational factors separately and interactively predict doctoral student learning success in online-based leadership programs?

2. Which subfactors of the technological and relational factors are the best predictors of doctoral student learning success in online-based leadership programs?

Theoretical Framework

Three constructs—technological factors (TF), relational factors (RF), and student learning success (SLS)—make up the theoretical framework of this study. The relationship among these constructs is represented as follows:

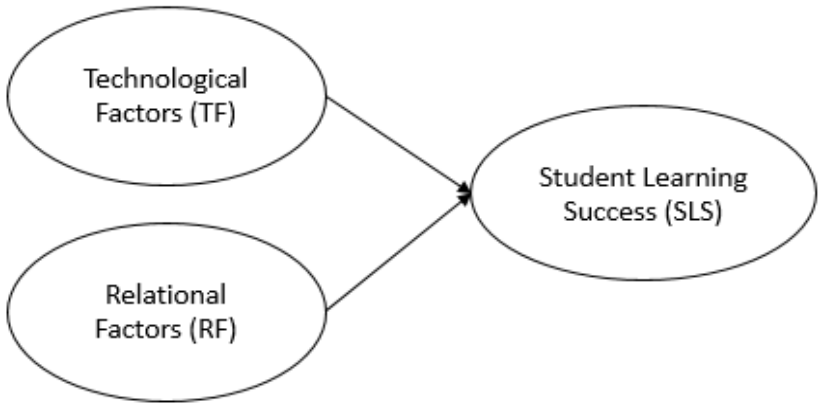

Figure 1. Relationship among the three constructs of this study.

Technological Factors

Colleges and universities use technology at various degrees to create online learning environments. Some instruction is delivered fully online, heavily relying on embedded technological features, while others use technology to complement face-to-face instruction. Despite some variations, the common thread is a focus on technology as an integral means of providing instruction. A review of the literature highlights three aspects of technology-facilitated instruction: flexibility, usefulness, and ease of use (Arbaugh, 2000; Bures, Abrami, & Amundsen, 2000; Hart, 2012).

Flexibility, the first technological subfactor, allows students to pursue degrees across geographical, cultural, professional, and generational borders (Bolliger & Halupa, 2012; Sampson, Leonard, Ballenger, & Coleman, 2010). Although doctoral students in online-based programs require discipline and independence to be academically successful, these potential challenges are outweighed by the convenience of utilizing technology to access quality conversations with professors and peers from a distance, while balancing work obligations and family responsibilities with a flexible schedule of academics (Erichsen, Bolliger, & Halupa, 2014; Garrison, 2007). Arbaugh (2000) argued that online learning transcending time and location

restriction would enable participants to reach levels of relational intimacy comparable to face-to-face groups, albeit over a longer time period.

Usefulness, the second technological subfactor, refers to the degree to which the technology can enrich and enhance the learning experience (Davis, 1989). Both usefulness and accessibility contribute to the effectiveness of technology (Edmunds, Thorpe, & Conole, 2012; Joo, Lim, & Kim, 2011). A study by Edmunds, Thorpe, and Conole (2012) of 421 university students in the United Kingdom found that the perceived usefulness of technology predicted the actual use of technology for work, school, and social reasons. Arbaugh's (2000) student satisfaction study discovered that graduate management education students who believed technology was valuable and perceived it to be easy to use were more likely to engage in technology for their degree work.

Ease of use, the third technological subfactor, refers to the degree to which technology can be used without undue effort or distraction (Davis, 1989). Ease of use was determined as a critical element affecting student acceptance of technology. A study of technology as a method of course delivery in a study of 136 students in a full-time online-based college program found that student attitude was the most important determinant of the acceptance of technology as a learning tool (Cheung & Vogel, 2013). A positive mindset about technology as a flexible, valuable, and easy-to-use resource motivates toward intentional use of as a means of developing relationships (Davis, 1989; Edmunds et al., 2012; Joo et al., 2011).

Relational Factors

Educational theorists have historically pointed to the integration of academics with social involvement and engagement as critical to student retention up to and including graduation (Tinto, 1999). The community of inquiry framework emphasizes the importance of social presence even when technology is used for learning. It is argued that the social, cognitive, and teaching presence interactively create deep meaning in an academic environment that is mediated by technology (Akyol & Garrison, 2011; Arbaugh et al., 2008; Garrison, 2007; Lai, 2015; Shea & Bidjerano, 2009). The online delivery of instruction does not negate the need for building a sense of school community to increase student satisfaction and retention, but simply changes the methods used to interact (Roach & Lemasters, 2006). As RF, three types of relationships were examined for this study: student-student, student-faculty, and student-non-teaching staff.

Student-student interaction, the first relational subfactor, is considered critical to the individual cognitive development of students in an online higher education environment according to Shea and Bidjerano (2009). A study of graduates' reflections on an online-based doctorate in educational technology determined that well-selected readings, open-ended questions, and guided conversations were influential in promoting interaction between students and critical thinking about the subject matter (Fuller, Risner, Lowder, Hart, & Bachenheimer, 2014). A quantitative content analysis of discussion board messages from two groups of college students found that the online discussion board was an effective means of developing community, which enabled individual members to reason through the topics and construct thought (Lee, 2014).

Student-faculty interaction, the second relational subfactor, has been determined to be the most critical aspect of student satisfaction. The qualities being sought after by the students included timely feedback and responsiveness to questions, attentiveness, encouragement, and sincerity (Bolliger & Halupa, 2012). A study of second-year doctoral students found that 90% of the students credited the instructors for facilitating productive dialogue and providing timely feedback that encouraged the exploration of new concepts (Kumar, 2014). In addition, the student-faculty interaction also influences the future enrollment of the program because their satisfaction is translated into their willingness to recommend the program to others (Martínez-Argüelles & Batalla-Busquets, 2016).

The last relational subfactor, student to non-teaching staff, was also found to be as important to overall satisfaction within online-based higher education programs. Contact personnel in departments such as registration and records are an influencing consideration in student evaluation of the service quality of the university. This satisfaction in service quality leads to the retention and success of students (Ravindran & Kalpana, 2012; Sohail & Shaikh, 2004).

Student Learning Success

The success of the doctoral student is typically culminated by the completion of the dissertation and the attainment of the doctoral degree. However, a deeper exploration of student success addresses academic achievement; engagement in educationally purposeful activities; satisfaction; acquisition of desired knowledge, skills, and competencies; persistence; attainment of educational objectives; and post-college performance (Im & Kang, 2019; Kuh, Kinzie, Schuh, & Whitt, 2010). While educational "success" has been broadly and often studied, York, Gibson, and Rankin (2015) acknowledged a lack of comprehensive instrumentation for measuring success outside of academic achievements such as grades, GPA, and degree attainment. This study created a tool to focus on three specific indicators to predict SLS, or perceived success, in doctoral endeavors by focusing on the gain of knowledge and skills, self-efficacy, and persistence. All of these are shown to lead to degree completion, which is the ultimate measure of student success (Gardner, 2009; Ivankova & Stick, 2007; Lambie et al., 2014).

Beyond the earned degree, success for doctoral programs is defined as the gain of knowledge and skills which will allow the student to think critically and creatively (Gardner, 2009). A survey of 131 graduate students found that students who actively engaged in the online learning community both socially and cognitively had a greater sense of perceived scholarship that contributed to their course success (Rockinson-Szapkiw et al., 2016). For doctoral students, active engagement in learning, resulting in the perceived gain of knowledge and skills, is considered critical to developing self-efficacy.

Successful completers of doctoral programs are likely to be students who believe in their own ability to conduct empirical research and successfully write research findings. An exploratory investigation of PhD education students found the self-efficacy of students increased with the completion of classes and involvement in research opportunities (Lambie et al., 2014). Bandura (1997) equates self-efficacy with a person's choices, goals, expended effort, and willingness to persist in the face of adversity. Self-efficacy can cause students to either obstruct their own progress through self-destructive stress or raise a student above

the academic demands to reach accomplishments beyond what they thought they could do (Bures et al., 2000; Lee & Mao, 2016).

Persistence, leading to degree completion, is considered a measure of institutional and programmatic success. The rate of doctoral students who fail to earn their PhDs is approximately 50% in the social science, humanities, and educational arenas. This number goes 10% to 15% higher for students enrolled in technology-based programs (Kennedy et al., 2015). In an online-based learning environment, mentoring and faculty support allow the doctoral student to persist in independently conducting, analyzing, and presenting research in completion of the doctoral program (Ampaw & Jaeger, 2012; Erichsen et al., 2014).

In summary, the theoretical framework of this study connects three constructs: TF, RF, and SLS. The first construct, TF, which serves as an independent variable, consists of three subfactors: flexibility, usefulness, and ease of use. The second construct, RF, also serves as an independent variable and focuses on student-student, student-faculty, and student-non-teaching staff relationship. Finally, the construct of SLS, the dependent variable, consists of three subfactors: gain of knowledge and skills, successful completion, and persistence. The relationship between this dependent variable of SLS and two independent variables—TF and RF—was established based on the studies discussed in this section.

Methods

This correlational study engaged 210 doctoral students from 26 online-based leadership doctoral programs in the United States. This section describes the context, participants, instruments, and data collection and analysis in detail.

Context and Participants

This study involved doctoral students from programs that offer a PhD, EdD, or PsyD with "leadership" in their degree titles and that deliver instruction in fully or partially online environments. All leadership doctoral programs in U.S. higher education institutions were identified, drawing upon doctoral program directories, compiled and shared by individual leadership scholars or organizations, and websites of all 50 state higher education agencies. Website information on each program was examined to determine if learning was delivered online. If not readily identified, further investigation was done, including an examination of course catalogs or schedules. It must be recognized that, while extensive, the Web search was only as accurate as the information provided on the website of each university. The demographics of the respondents are summarized in Table 1.

Table 1

Participant Demographics (N = 210)

Category	Characteristic	Frequency (%)
Gender	Male	70 (33)
	Female	140 (67)
Age	20-29	15 (7)
	30-39	70 (33)
	40-49	64 (31)
	50-59	53 (25)
	60+	8 (4)
Status	First year	54 (26)
	Midway through coursework	70 (33)
	Dissertation phase	68 (32)
	Dissertation completed	18 (9)
Degree	PhD	36 (17)
	EdD	169 (81)
	PsyD	5 (2)
Discipline	Education	183 (87)
	Business/Management	15 (7)
	Other leadership	12 (6)
Delivery	100% online	54 (26)
	Blended instruction: 50% or more online	96 (46)
	Primarily face-to-face classroom instruction	57 (27)
	Other	3 (1)

Instruments

The "Online Learning Success Scale (OLSS)" was constructed, drawing upon nine existing scales listed in the "References" column in Table 2. OLSS measures three major variables: technological factors, relational factors, and student learning success with three subfactors for each variable (see the "Factors" and "Subfactors" columns in Table 2). Some conceptual categories and questions were modified to measure the constructs intended for the study and doctoral leadership contexts. Cronbach's alpha was used to measure the reliability of each variable of the final OLSS (see the "Reliability Coefficients" column in Table 2). The reliability values of the factors ranged from .936 to .949, and those of the subfactors ranged from .857 to .967.

The first independent variable, TF, consists of three subfactors: (a) usefulness, (b) flexibility, and (c) ease of use. "Usefulness" refers to the positive impact of the online delivery system on students' learning and doctoral experience; "flexibility" to the advantages of using a technological tool to overcome time and geographic limitations; and "ease of use" to the minimal effort involved in engaging within an online platform. The second independent variable, RF, consists of three subfactors: (a) student-student

relationship, (b) student-faculty relationship, and (c) student-non-teaching staff relationship. "Student-student relationship" refers to students' connectedness with their peers and the feeling of community within their leadership program; "student-faculty" to students' connectedness and ability to communicate with faculty; and "student-non-teaching staff relationship" to students' connectedness with and perceived helpfulness of the non-teaching staff.

The dependent variable, SLS, consists of three subfactors, (a) gain of knowledge and skills, (b) self-efficacy, and (c) persistence. "Gain of knowledge and skills" refers to students' perceived gain of knowledge and skills pertaining to leadership; "self-efficacy" to their ability to apply their knowledge and skills to their leadership practice and to conduct original research; and "persistence" to their commitment to finishing the program in their current institution.

Table 2

Online Learning Success Scale Information and Reliability Coefficients

Constructs	Subfactors	References	No. of items	Reliability coefficients
Technological Factors (TF)				.949
	Usefulness (TF_US)	Student satisfaction scale (Arbaugh, 2000)	6	.895
	Flexibility (TF_FL)	Student satisfaction scale (Arbaugh, 2000)	6	.887
	Ease of Use (TF_EU)	Student satisfaction with e-learning instrument (Bures et al., 2000)	10	.901
Relational Factors (RF)				.948
	Student-Student (RF_SS)	Classroom community scale (Rovai, 2002); Community of inquiry (Akyol & Garrison, 2011)	11	.967
	Student-Faculty (RF_SF)	Student-faculty communication questionnaire (Liu, Rau, & Schulz, 2014); Six elements of measuring relationships (Cho & Auger, 2013)	8	.892
	Student-Non-Teaching Staff (RF_SN)	Six elements of measuring relationships (Cho & Auger, 2013)	8	.966
Student Learning Success (SLS)				.936

Gain of Knowledge and Skills (SLS_KS)	Alavi's perceived student learning scale (Alavi, 1994; Williams, Duray, & Reddy, 2006)	6	.857
Self-Efficacy (SLS_SE)	Foundation practice self-efficacy scale (Holden, Anastas, & Meenaghan, 2003)	7	.869
Persistence (SLS_PE)	College persistence questionnaire (Davidson, Beck, & Milligan, 2009)	11	.901

Data Collection and Analyses

The OLSS was transposed in Qualtrics, an online survey software for collecting data. An introduction, containing the link to the survey, was sent via email to a comprehensive list of 239 online-based leadership doctoral program directors in three rounds of distribution with one reminder for each round. Program directors who accepted the participation invitation sent the survey link to their students and recent graduates. Directors who did not act on our invitation either did not communicate with the researchers at all or cited various reasons for their decline, such as institution IRB rules, too many study requests, program not beginning until the next year, lack of program participation, and lack of online components in the program.

Initially, 276 respondents participated in the survey. Two respondents did not consent to participate and 39 indicated that they were not currently enrolled in a doctoral leadership program. Of the remaining responses, 210 fully completed responses from 26 programs were included in the final analysis. Participants responded to the survey statements using a 5-point Likert scale with the rating of 5 meaning strong agreement with the statement. Examples of survey statements include: "I can apply critical thinking skills within the context of leadership practice"; "Small group online activities improve the quality of my education in the doctoral program"; "Getting to know the other students gave me a sense of belonging in the doctoral program."

Descriptive statistics were applied for the initial analysis of three variables: TF, RF, and SLS. The normality of the data used in the analysis was confirmed, and Pearson correlation coefficients, which are used when the data are parametric and normally distributed, were analyzed to examine the relationship among these variables. A multiple linear regression analysis was also used to identify the effects of TF and RF on SLS in online-based doctoral leadership programs. The statistical analysis of data collected from the study was conducted with Statistical Package for the Social Sciences (SPSS) 21.0 program.

Results

This section reports three types of results: descriptive statistics, predictability of TF and RF on SLS, and effects of technological and relational subfactors on SLS.

Descriptive Statistics

Various subdivisions of 210 responses to the survey represent slightly different pictures of SLS, RF, and TF. Table 3 provides means and standard deviations of these three variables by gender, age, instruction delivery model, and students' status; however, no statistical significance could be tested due to significantly unequal sizes of subdivisions.

Although there were no significant mean differences in gender, age, delivery model, and students' status, the mean scores of the TF differ by delivery models: 100% online model (4.01), blended model (3.86), and primarily face-to-face (3.42). In terms of RF, the mean score of 100% online students was 3.87, lower than the mean score of 4.21 of respondents in blended and face-to-face programs. The similar importance of the RF for respondents in blended and face-to-face programs was reinforced through text answers provided in the survey.

Table 3

Means and Standard Deviations of the Three Variables (SLS, TF, and RF)

Group	Characteristic	Frequency (%)	SLS		TF		RF	
			Mean	SD	Mean	SD	Mean	SD
Gender	Male	70 (33.3)	4.40	.48	3.77	.79	4.21	.58
	Female	140 (66.7)	4.36	.45	3.79	.66	4.08	.56
Age	20-29	15 (7.1)	4.35	.41	3.64	.70	3.91	.47
	30-39	70 (33.3)	4.26	.49	3.67	.74	4.00	.56
	40-49	64 (30.5)	4.46	.44	3.86	.66	4.25	.58
	50-59	53 (25.2)	4.40	.45	3.80	.71	4.16	.56
	60+	8 (3.8)	4.54	.38	4.26	.49	4.35	.43
Delivery model	100% online	54 (25.7)	4.28	.48	4.01	.63	3.87	.59
	Blended	96 (45.7)	4.39	.45	3.86	.62	4.21	.54
	Primarily face-to-face	57 (27.1)	4.43	.45	3.42	.77	4.21	.54
	Other	3 (1.4)	4.48	.34	3.83	.64	4.23	.27
Status in coursework	First year	54 (25.7)	4.24	.48	3.69	.70	4.14	.55
	Mid-coursework	70 (33.3)	4.38	.43	3.62	.73	4.11	.54
	Dissertation phase	68 (32.4)	4.44	.48	3.92	.66	4.06	.62
	Dissertation completed	18 (8.6)	4.51	.34	4.17	.52	4.17	.48

Note. SLS (student learning success), TF (technological factor), RF (relational factor).

To investigate the relationships among TF, RF, and SLS, Pearson's correlation coefficients were calculated. Table 4 presents the correlation coefficients for the subvariables of the three main variables: i.e., TF, RF, and SLS. The correlational results from the survey indicated that all subfactors in SLS were significantly correlated with all subfactors of both TF and RF in a positive direction except for two subvariables. Namely, correlations between the flexibility of TF and the student-student relationship of RF (r = .052) and between the flexibility of TF and the student-faculty relationship of RF (r = .13) were not statistically significant. Moreover, stronger correlations were found between RF and SLS compared to between TF and SLS. The most significant positive correlation was noted between the persistence of SLS and the student-faculty relationship of RF (r = .777, p <. 01).

Table 4

Correlations of the Three Variables (SLS, TF, and RF)

		1	2	3	4	5	6	7	8	9
SLS_KS	1	1								
SLS_SE	2	.708**	1							
SLS_PE	3	.641**	.573**	1						
TF_US	4	.297**	.341**	.367**	1					
TF_FL	5	.215**	.237*	.168*	.619**	1				
TF_EU	6	.282**	.321**	.259**	.784**	.730**	1			
RF_SS	7	.413**	.355**	.566**	.195**	0.052	.221**	1		
RF_SF	8	.438**	.391**	.777**	.295**	0.13	.199**	.478**	1	
RF_SN	9	.319**	.269**	.470**	.339**	.168*	.280**	.273**	.451**	1
M		4.36	4.37	4.39	3.68	3.97	3.69	4.23	4.11	4.02
SD		.53	.48	.56	.78	.84	.72	.74	.67	.78

Note. SLS (student learning success), TF (technological factors), RF (relational factors), KS (gain of knowledge and skills), SE (self-efficacy), PE (persistence), US (usefulness), FL (flexibility), EU (ease of use), SS (student-student), SF (student-faculty), SN (student-non-teaching staff).
*p < .05, **p < .01

The significant correlations among the variables do not mean that all the variables have casual relationships, and thus it is necessary to undertake regression analysis to examine the relationships among the variables.

Predictability of Technological and Relational Factors on Student Learning Success

This section presents the results of Research Question 1: How do technological factors and relational factors separately and interactively predict doctoral student learning success in online-based leadership programs? Multiple regression analysis was conducted to determine if technological and relational factors affected student learning success significantly in terms of gain of knowledge and skills, self-efficacy, and persistence.

According to the results of the multiple regression analysis, TF and RF together significantly predicted SLS (R^2 =.465, F = 89.903, p = .000). Moreover, TF and RF respectively affected SLS significantly. RF (t = 11.382, p = .000) especially affected SLS more significantly than TF (t = 3.209, p = .002). In addition, if a variance inflation factor (VIF) is 10 or more, it is assumed that there is a multicollinearity (Kutner, Nachtsheim, & Neter, 2004), and thus there is no multicollinearity between TF and RF (VIF < 10; see Table 5).

Table 5

Effects of Technological and Relational Factors on Student Learning Success

Independent variables	Unstandardized coefficient		Standardized coefficient	t	p	VIF
	B	Std. error	β			
(Constant)	1.924	.187		10.271	.000	
Technological factors (TF)	.112	.035	.172	3.209**	.002	1.106
Relational factors (RF)	.491	.043	.609	11.382***	.000	1.106
F			89.903***			
R^2(adj. R^2)			.465(.460)			

**p < .01, ***p < .001

Effects of Technological and Relational Subfactors on Student Learning Success

This section reports on the results in response to Research Question 2: Which subfactors of the technological and relational factors are the best predictors of doctoral student learning success in online-based leadership programs? To identify which subfactors of the technological and relational factors were the best predictors of student learning success, another multiple regression analysis was performed.

According to the results of the multiple regression analysis, all the subfactors of both TF and RF predicted SLS significantly (R^2 =.500, F = 33.867, p = .000). However, the technological subfactors—usefulness, flexibility, and ease of use—and one relational subfactor between the student and the non-teaching staff separately did not predict SLS. Only two of the relational subfactors, namely student-student relationship (t = 4.436, p = .000) and student-faculty relationship (t = 6.591, p = .000), were statistically significant regarding the effects on SLS. The student-faculty relationship particularly was the best predictor of SLS (t = 6.591, p = .000). There is no multicollinearity between the subfactors of the TF and the RF (VIF < 10; see Table 6).

Table 6

Effects of Subfactors of Both Technological and Relational Factors on Student Learning Success

Independent variables		Unstandardized coefficient		Standardized coefficient	*t*	*p*	VIF
		B	Std. Error	*β*			
(Constant)		1.871	.188		9.972	.000	
Technological factors (TF)	Usefulness (TF_US)	.066	.048	.114	1.373	.171	2.791
	Flexibility (TF_FL)	.024	.040	.044	.602	.548	2.198
	Ease of Use (TF_EU)	.034	.060	.053	.566	.572	3.611
Relational factors (RF)	Student-Student (RF_SS)	.160	.036	.258	4.436***	.000	1.376
	Student-Faculty (RF_SF)	.278	.042	.409	6.591***	.000	1.562
	Student-Non-teaching Staff (RF_SN)	.054	.034	.093	1.607	.110	1.356
F				33.867***			
R^2(adj. R^2)				.500(.485)			

***$p < .001$

Discussion and Conclusion

Faced with the increasing importance of distance learning as a preferred means of obtaining a degree at the graduate levels, including the doctoral level (National Center for Education Statistics, 2018), all higher education institutions and programs must consider the impact of technology and relationships, individually and interactively, within the online environment. The intent of this study was to determine how TF and RF related to the SLS of students engaged in the U.S. doctoral leadership programs.

An analysis of the data collected from this study found that significant correlations exist, which confirms the importance of both technology and human relationships in the learning success of doctoral students in online-based learning environments. Persistence, students' determination to continue to completion, is most significantly related to RF for respondents from blended or 100% online programs. This result corresponds with similar studies that have established connectedness and social integration as critical to the likelihood of doctoral students persisting within the coursework and candidacy stages of the program (Kennedy et al., 2015; Martínez-Argüelles & Batalla-Busquets, 2016; Rockinson-Szapkiw et al., 2016).

Another finding indicates that all three RF (student-student, student-faculty, and student-non-teaching staff) were collectively and separately better predictors than the TF for doctoral SLS. Whether the success is defined as a gain of knowledge and skills, self-efficacy, or persistence, these results concur with similar studies (Kennedy et al., 2015; Lambie et al., 2014; Rockinson-Szapkiw et al., 2016). Interviews with doctoral students at a research-intensive university in New Zealand found that technology was an effective means of facilitating the development of learning communities to construct meaningful knowledge and share individual experiences (Lai, 2015).

Technology is important, but it seems to be a means to the end of student learning, secondary to relationships. Our study found that the student-faculty relationship was the subfactor with the strongest predicting power to SLS. The instructor is the pivotal participant in the online learning experience, helping to facilitate productive dialogue, encouraging the exploration of new concepts, and providing timely feedback (Augustsson & Jaldemark, 2013; Kumar, 2014). An integrated literature review by Hart (2012) identified connectedness, belonging, and support as important factors that went beyond the content to motivating students to overcome hardships and persist in the online-based environment. A grounded theory study of students in a limited-residency program found that the greatest factor for not completing the doctoral work, especially in the dissertation phase, was a lack of supportive interaction (Kennedy et al., 2015).

This is not to negate the correlation of TF with student success. Of the three subfactors of SLS, self-efficacy correlated most significantly with the TF of blended or online learning. One explanation is that this study surveyed doctoral students who have already experienced academic success. A meta-analysis of within-person self-efficacy found that self-efficacy was a product of past performance rather than a predictor of future performance (Sitzmann & Yeo, 2013). The self-efficacy of doctoral students then increases as courses are completed and aligned with research opportunities (Lambie et al., 2014). The very definition of self-efficacy involves the ability of an individual to identify the contexts for which the individual has the skills and ability to succeed (Celik & Yesilyurt, 2013). There is an integration of knowledge and skills that doctoral leadership programs should be aware of to create successful technology-based learning opportunities that are associated with increased self-efficacy.

In summary, the results from this study lead to a conclusion that both TF and RF predict learning success as perceived by students enrolled in online-based doctoral leadership programs in the United States. The study found that RF predict SLS better than TF, particularly the student-faculty relationship. Distance education programs must purposefully develop support systems, such as the cohort model, that encourage

connectedness and social integration (Kennedy et al., 2015; Williams et al., 2019). Administrators, faculty, and staff of distance education programs must be prepared to facilitate communication using technology, and understand the importance of timely responses to students at all phases of the doctoral program (Gardner, 2009; Rockinson-Szapkiw et al., 2016).

This study has several limitations that might have affected the findings. Regarding the program and participant selection, the study had limited data caused by several uncontrollable conditions. Information on the individual institution websites was often incomplete or outdated, which made it difficult to accurately determine the online nature of the programs. This difficulty was compounded by the whole spectrum of terms that can be used that describe an online program (Anohina, 2005). In addition, a good number of eligible programs or participants were inaccessible due to their institutional or programmatic constraints and unresponsiveness of directors or student participants.

While this study found no difference by gender, status, or age, there was a gender imbalance with two-thirds of the respondents being female. A review of the literature finds mixed results with regards to gender and relational preference. A study of 12 online-based graduate courses found that female students felt more connected with their peers and perceived that they learned more than their male counterparts in the courses, while a study of students in Taiwan found that the differences were related to status in the college program (Hung, Chou, Chen, & Own, 2010; Rovai & Baker, 2005). Other studies, like this one, found no differences in the success or satisfaction of students by gender, status, or age (Cho & Kim, 2013; Martin, 2005). Lastly, this study engaged only programs based in the United States, creating an issue of the difficulty of generalization. However, similar studies in different contexts also have concluded that relationships are the critical factor in the success of students in the online-based educational environment (Fuller et al., 2014; Lai, 2015; Roach & Lemasters, 2006; Sohail & Shaikh, 2004).

Based on these limitations, further study is recommended to engage a more balanced set of participants by gender, age, and degree type. Secondly, further study could expand the research beyond the leadership discipline or the U.S. context, between disciplines, or among different contexts. Thirdly, qualitative studies around online doctoral leadership programs could provide a holistic understanding of programs and doctoral SLS by gaining multiple perspectives from program directors, faculty, students, and alumni beyond pre-selected variables such as TF and RF.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Distance Learners' Experiences of Silence Online: A Phenomenological Inquiry

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Abstract

Although learner silence in face-to-face classrooms has been the topic of considerable research interest, relatively little investigation has been done into learners' experience of silence in distance education. Guided by a phenomenology of practice approach, this study explores the lived experiences of online silence, using interview data gathered from 12 graduate students who were engaged in cohort-based distance learning.

Iterative rounds of a whole-part-whole interpretive process were used to identify key themes that emerged regarding the participants' lived experiences. The findings highlight that silence is a complex, multifaceted phenomenon that was both enacted and received by the participants. Speaking out online was done carefully, sometimes with partial voice and sometimes in fuller voice, sometimes as an obligation and other times with a sense of spontaneity and connection.

The six themes that emerged were as follows: (a) learners enact purposeful silence; (b) learners absorb silence from others; (c) learners perceive, and use, silence as demarcation; (d) learners experience silence within voice; (e) learners use deliberate, complex strategies while engaging in online discourse; and (f) learners hear each other in a trusted community. These six themes give new understandings to the experience of online silence. They reflect the multifaceted and nuanced aspects of the phenomenon and have implications for distance education instructors, learners, and curriculum developers.

Keywords: distance education, silence, phenomenology of practice, learner experience, online communication, cohort

Introduction

> I expect to meet some people here. No one is here, yet. I start "talking." No one responds. Where do my words go? I feel alone. (Adams & van Manen, 2006, p. 10)

Social constructivist approaches to learning assert that interaction is a fundamental requirement for the development of community, the creation of meaning, and the promotion of learning (Bates, 2015; Conrad, 2014). In many distance education courses, the majority of interaction occurs in asynchronous, text-based discussion forums. Instructors and students post messages and respond to other people's postings, resulting in a threaded discussion. In these threaded discussions, if an instructor or learner does not post or is delayed in responding to another's post, the absence of communication comes across as silence (Xin & Feenberg, 2006).

Silence from learners can be distressing, and the underlying reasons for the silence may be difficult for instructors to interpret (Beaudoin, 2002; Benfield, 2000). When silence occurs online, members of the learning community may be left to wonder whether the silence is indicative of agreement, disinterest, absence, uncertainty, or alienation (Gradinaru, 2016; Xin & Feenberg, 2006). A body of research has centred on learners who are engaged in online discussions without visibly posting in them. These learners have at times been referred to as *lurkers* (Beaudoin, 2002; Taylor, 2002). Kreijns, Kirschner, and Jochems (2003) describe a parasitic form of lurking called *social loafing*. Other researchers ascribe more positive descriptors for students engaged in this behaviour, including *witness learners* (Fritz, 1997) and *vicarious interactors* (Sutton, 2001); there is evidence that these learners are cognitively engaged in the discussion even if they do not interact with others online.

When the topic of silence online appears in the literature, it is most commonly presented as an emergent theme from a different primary research focus, such as a focus on factors that influence participation in online learning activities (cf. Antonacci, 2011; Brown, 2011; Conrad, 2002). One exception is found in the work of Zembylas and Vrasidas (2007), who concluded that while online silences arise from learner nonparticipation, confusion, and marginalization, silence is also a by-product of thoughtful reflection. Further investigation into the "meaning and significance of silence in online education" (Zembylas & Vrasidas, 2007, p. 20) is needed.

The purpose of the present research study is to understand the experience, embodiment, and meaning of online silence as a phenomenon lived by online graduate distance learners. The research question was as follows: *What are the lived experiences of online silence for learners who are members of distance learning communities?* This question emerged from the author's own experiences of online silence as a distance learner and a distance educator.

Research Methodology

The study was guided by phenomenology of practice (van Manen, 1990, 2014), a hermeneutic (interpretive) phenomenology used to explore phenomenological questions that arise out of daily occupational

experiences (van Manen, 2011, 2014). Researchers using this approach are descriptive interpreters (Koro-Ljungberg, Yendol-Hoppey, Smith, & Hayes, 2009).

Phenomenological inquiry involves the use of *reduction* (van Manen, 2011), which is the deliberate setting aside of one's own expectations and attitudes in order to focus on the lived experiences of the participants. In Husserlian phenomenology, reduction is known as *epoché* or *bracketing* (LeVasseur, 2003; van Manen, 2014). van Manen (2011) differentiates various approaches to reduction, including the eidetic reduction and the hermeneutic reduction.

The *eidetic reduction* (also known as *eidos* or *essence*) focuses on the researcher reflectively becoming aware of aspects of the phenomenon that make it unique from other experiences. The aim of the eidetic reduction is not a universal generalization about the phenomenon but an exploration of possible meanings that are by nature incomplete and tentative (van Manen, 2014). Part of completing the eidetic reduction is to explore variations on the phenomenon by comparing it "with other related but different phenomena" (van Manen, 2014, p. 230).

Similar to the concept of bracketing, the *hermeneutic reduction* requires researchers to reflectively give attention to any assumptions that emerge when writing a manuscript, including not interpreting emerging themes too quickly. The researcher needs to mindfully and actively set aside personal understandings of the phenomenon to focus on the participants' lived experiences (van Manen, 2014). The researcher's role is to explore how the phenomenon is experienced in the participants' everyday lives and to write a text that provides readers with a deeper understanding of the phenomenon under investigation (Vagle, 2014; van Manen, 1990).

Participants

Ethical approval for the study and recruitment strategy was obtained from the Research Ethics Board at Athabasca University. Potential participants were given a written description of the study and an informed consent letter for signature to inform them as to the purpose of the study, assurance of confidentiality, and acknowledgement that they could withdraw participation at any time without penalty or consequence.

Inclusion criteria were that participants

1. were learners in a cohort-based postsecondary distance education course or program of study that had an expectation of participation in asynchronous, text-based discussion as a significant component of the interaction;

2. had completed at least two online courses that required the use of asynchronous, text-based discussion; and

3. were distance education students at the time of the initial interview.

Exclusion criteria were that participants could not be students in online classes taught by the author, nor could they be peer members of the author's doctoral program cohort.

Recruitment occurred through personal contacts (n = 3) and by approaching instructors in online courses taught at a western Canadian university (n = 9). In total, 12 participants were recruited, an appropriate number for phenomenological research (Creswell, 2013; Dukes, 1984). Self-reported demographic data were collected to guide ongoing purposive sampling and to ensure that a range of voices was included (Angen, 2000). Demographic characteristics of the participant group are summarized in Table 1.

Table 1

Demographic Characteristics of Participants

		n (%)	
Age range	40-49	50-59	60-69
	6 (50)	4 (33.3)	2 (16.7)
Discipline	Education	Business administration	Health management
	10 (83.3)	1 (8.3)	1 (8.3)
Time as a distance learner	1-< 5 years	5-9 years	> 9 years
	7 (58.3)	3 (25)	2 (16.7)
Sex	Male	Female	
	3 (25)	9 (75)	
Program of study	Master's degree	Doctorate	
	2 (16.7)	10 (83.3)	

Trustworthiness

This study incorporated the following elements (Angen, 2000) to support the trustworthiness of the findings:

1. **Alignment of research question, approach, and method.** The research question is phenomenological in nature. The method followed phenomenological analysis of participant interviews, with the main knowledge producers being the participants (Koro-Ljungberg et al., 2009).

2. **Trustworthiness of transcriptions.** The researcher used repeated confirmations to ensure transcription accuracy, including member checking.

3. **Peer review.** The researcher engaged in ongoing peer review with a fellow phenomenological researcher, meeting regularly to critically discuss the methodology and unfolding research process.

4. **Dissident perspectives.** Some participants in the study offered "outlier" or dissident experiences from those described by most other participants. Differing voices add richness to the data and increase the trustworthiness of the findings (Bazeley, 2009; McPherson & Thorne, 2006).

Data-Gathering Methods

Prior to beginning data collection, the researcher initiated keeping a reflexive journal to (a) explore her own experiences and expectations around the nature and meaning of online silence (groundwork for the hermeneutic reduction), and (b) compare the essential nature of silence to related experiences such as loneliness and quietude (groundwork for the eidetic reduction).

The primary data-gathering method was open-ended, loosely structured oral interviews, which were audio recorded. The interviews were conducted by phone, video call, or in person, based on each participant's preference. One follow-up interview was conducted by e-mail.

Two of the participants did not have a second interview (one did not respond to requests to schedule the second interview; the other was travelling out of the country and was unavailable during the time remaining for gathering data). Data were therefore gathered from a total of 22 interviews. Initial interviews were approximately one hour in duration; follow-up interviews were approximately 30 minutes.

The interviews were conversational in nature but grounded by the main research question with an aim to elicit personal life vignettes that illustrated the participants' own experiences of silence online, known as lived experience descriptions (van Manen, 2014). Subsequent interviews provided an opportunity to probe more deeply into experiences that were touched on in the first interview and on nascent topics emerging from early stages of the iterative process of interpreting the data (Vagle, 2014). The second interview also functioned as a means of prolonging engagement with the participants, adding to trustworthiness (Creswell, 2013).

The researcher manually transcribed each interview. Participants were given the option of reviewing the interview transcripts to check for accuracy and to correct transcription errors if needed. Five participants (41.7%) chose to review their transcripts, one participant filled in some words or phrases in the transcript that had been difficult to understand on the audio recording, another added a few additional comments and minor points of clarification, and the other three participants had no suggestions for changes to their transcripts. The researcher assigned each participant a pseudonym to maintain confidentiality.

The researcher used the following iterative process, modified from Vagle (2014), to engage with and interpret the data:

1. Reorient to the interview transcript by reading it holistically.

2. Reread the interview transcript line by line, taking notes and marking noteworthy excerpts.
3. Compose a lengthy reflective journal entry.
4. Repeat steps 1, 2, and 3 for additional interview transcripts as they became available.
5. Craft follow-up questions for subsequent participant interviews.
6. Complete a second line-by-line reading to begin to articulate meanings.
7. Complete reflective journal entries for each interview based on new insights gleaned from step 6.
8. Complete a third line-by-line reading to further articulate each part identified in step 6 for each participant.
9. Begin to coalesce the voices of multiple participants around specific topics as possible precursors to larger themes.
10. Repeat steps 8 and 9 to identify themes and give these themes preliminary titles.

This iterative process of interpreting the data required careful writing and rewriting in alternating processes of reflection and action. During the reflective processes, the researcher attended to the hermeneutic reduction by (a) asking herself if the patterns emerging in the data were consistent with what she would have expected to find, and (b) paying particular attention to lived experience descriptions that were unexpected, gave new insights, or were divergent in nature from what other participants had described. Exploring the unexpected and divergent experiences through writing and reflection in steps 7 through 10 was a means of furthering the eidetic reduction. In step 9, the researcher wrote descriptions of 16 different emerging topics and reflected on which parts of them were essential aspects of the participants' experiences of silence online (examples of these emerging topics include *authenticity*, *authority*, *conflict*, *feeling safe*, *muting voice*, and *telling personal stories*). In step 10, the researcher distilled these topics into themes, carefully selecting precise wording. Selected examples of participant quotes that support each theme are provided in Table 2.

Table 2

Selected Participant Quotes

Quote	Theme
"I allow myself to use silence to selectively engage with the things that really speak out to me." (Tamara) "I tend to watch a bit before I contribute. I'll read other posts. What are they saying? Are they thinking the same way I am?" (Frances) "There are times that I might scribe something based on my first instinct, but after taking some time to reflect on it, I choose not to post it ... I don't want to be seen as somebody who can't regulate their emotions." (Becca)	Learners enact purposeful silence.

"When it's silent, I wonder whether or not I've been heard. Or if I said something that someone seriously disagrees with or is upset with and doesn't know how to respond to." (Naomi) "You put something up and people don't respond. You go on to another post, and they've got 12, 15 replies, and you're sitting out there all alone ... That silence devalues what I contributed." (Frances) "Of anybody in the class, if you're asking a question, the teacher should be the one responding." (Mark) "If you don't get a response on forums, that's just normal." (Thomas)	Learners absorb silence from others.
"If you challenge some professors with something that's super brand new, or you bring in a different point of view that isn't part of their construct, they don't necessarily want to consider it." (Naomi) "When I feel like I'm in a safe place within my community ... it's easier for me to break through the silence and feel confident to share." (Tamara) "Sometimes we got off on small tangents. We were exploring the boundaries ... In our minds, we were moving [the discussion] forward. In the professor's mind, we were off task ... It was a really interesting dichotomy between us taking ownership, and her calling it back and saying, 'No, no, no! This isn't how we do this.'" (Naomi)	Learners perceive, and use, silence as demarcation.
"I'm in a same-sex relationship and I would never post that online, because I'm not sure how that's received at the other end of the world. I am much less descriptive about gender pronouns, keeping that a little more nebulous. I won't show that part of myself in the online discussion." (Jane) "When [an instructor's] answer doesn't really answer your question ... it's a response, but it was a silence, if you know what I mean." (Frances)	Learners experience silence within voice.
"I want to give each person the time and merit that they deserve. When a post is more than 750 words, I disengage from that, because I get annoyed that it is so long. I try to reply back to people that post somewhere between 200 and 400 words. I really focus on giving them a good response." (Karen) "If you put it in writing, there's a record of it, right? So I always wanted to be careful that what I wrote was accurate." (Katrina) "Sometimes posting first means you just dump what's on your brain right away. Whereas going in later on forced you to read everyone else's posts, and assimilate their thoughts, and try to get a response." (Mandy)	Learners use deliberate, complex strategies while engaging in online discourse.
"There were times that I was excited to go in, because there was a really, really good conversation going on between myself and a couple other people. I was just really interested in their responses." (Katrina) "You start talking about real things that happen in the workplace, that you would never talk about publicly ... Even the teachers would share some very personal experiences that would help to foster that idea of safety." (Mark) "There's a sense that we are trying to help each other through and looking out for each other." (Jonathon)	Learners hear each other in a trusted community.

Findings: Six Themes of Learner Experience of Silence Online

Following data collection and the iterative process of interpreting the findings, six themes emerged regarding the learners' experiences of silence online: (a) learners enact purposeful silence; (b) learners absorb silence from others; (c) learners perceive, and use, silence as demarcation; (d) learners experience silence within voice; (e) learners use deliberate, complex strategies while engaging in online discourse; and

(f) learners hear each other in a trusted community. These six themes reflect the complex, sometimes nuanced, aspects of the participants' experiences of silence and voice online.

The first two themes reflect participants' experiences of silence itself. The third and fourth themes address areas of transition between voice and silence. Finally, the last two themes address participants' experiences of coming out of silence to speak out online. The six themes together capture descriptions of the participants' rich lived experiences of being silent themselves, receiving silence from others, and speaking out online either in muted or full voices.

Theme 1: Learners Enact Purposeful Silence

Participants described times when they were aware that they were being silent online. When participants kept silence, they did so intentionally, with purpose. The silent times were not quiet or passive times; rather, participants described being busy in thought or action during these times.

Participants frequently chose to enact silence for one of two distinct but overlapping reasons, which can be considered as *silence as means of* and *silence as time for*. When participants used online silence as *means of,* they used it as an intentional method of accomplishing something else, such as balancing priorities, identifying learning needs, preventing poorly thought-out ideas from being posted, avoiding redundancy in the discussion threads, maintaining professional etiquette, and regulating their emotions. Enacting silence online was also at times a means of "biting one's tongue" to prevent conflict from escalating. This use of silence in the presence of conflict is similar to that identified by Conrad (2002).

During other times, participants enacted silence online in order to allow *time for* other things to happen. Participants described being silent online as they took time to complete course-related activities not visible on the forum, such as doing research, playing with ideas, crafting responses in preparation to post, reading course materials, and observing and listening.

Silence online was also a time for participants to be watchful and ensure understanding of the direction the dialogue was headed before they posted—that is, to ensure that the voice they were adding was a harmonious one. This behaviour parallels Gradinaru's (2016) observation that silences occur in online communities when members are disinclined to express a viewpoint that does not align with the majority.

Theme 2: Learners Absorb Silence From Others

Participants described a wide variety of feelings they experienced when they met silence online from other people. Many of the participants described the experience of silence from others as being unpleasant and lingering, while a few others acknowledged the silence but dismissed its effect on them. The verb *absorb* used in this theme's title captures the nature of both of these experiences. The *New Oxford American Dictionary*'s (Apple, Inc., 2016) definition of *absorb* includes the idea of taking something in and then either soaking it up (lingering) or reducing the effect or intensity of it (dismissing the effect).

Silence coming from others online could produce feelings of awkwardness and uncertainty or wondering if one had said something that caused offense. These times of meeting silence from others could be a source of feeling devalued, isolated, frustrated, or discouraged. Silences from others were particularly noted during

small-group work and when the discussion related to high-stakes assignments—findings echoed in other research (Mattsson, Karlsson, & Lindström, 2008; Mico-Wentworth, 2014).

Not all online silences from others were met with negativity. Some participants described feeling neutral about silences online, that the silence was either expected or of no consequence; others commented that silences coming from others online were a source of building resilience.

Many of the participants described silence from instructors as being particularly memorable. The participants generally held instructors in high regard as persons of authority—regard that was sometimes lost if the instructor failed to answer a direct question or answered it in a manner that left the learner feeling unheard or effectively silenced.

During periods of learner conflict online, participants spoke of wanting instructors to step in to mediate. Participants valued clarity on expectations for the number of posts and expressed appreciation when instructors spoke out to keep the dialogue on task and to offer additional ideas or references for the group to consider. The importance of the instructor role in setting a respectful tone of dialogue online, defining clear expectations, and maintaining a regular presence in the learning environment to encourage learners and redirect dialogue when needed is supported by other research (Bates, 2015; Coppola, Hiltz, & Rotter, 2002; Weaver & Albion, 2005).

Theme 3: Learners Perceive, and Use, Silence as Demarcation

The third theme that emerged was one of silence being experienced as a border—that is, a demarcation between distinct spaces. This theme manifested in two ways: one was experienced as participants prepared to speak out, and another came into play as the online discussion unfolded. Participants described experiencing silence as something that needed to be crossed over as a means to enter the discussion. Once participants were engaged in the discussion, they described silence as a boundary that defined and contained appropriate decorum and content within the online forums; it was a responsive action towards others who crossed lines of acceptable behaviour.

Participants made decisions whether to cross the borders of silence into zones of participation for different reasons, and with varied motivations and differing levels of willingness behind them. They expressed differing feelings brought on while making this crossing. Some participants felt safe doing this. Some revealed that they felt more comfortable speaking out in the online classroom than in a bricks-and-mortar one. Several of the participants described how familiarity with the discussion topic eased their crossing out of silence and made it feel easier to participate, a finding supported by others (Hew, Cheung, & Ng, 2010; Tu & McIsaac, 2010).

Participants described certain border crossings out of silence as being effortful, intimidating, or daunting. Some participants emphasized that they would have preferred to stay silent but that they felt "pushed" to speak out on in a discussion by course requirements mandating a certain number of posts. These participants wanted to be able to interact with course content without being required to interact with other participants. The idea that students do learn by reading messages posted by others, even if they do not respond to them, is corroborated by Antonacci (2011) and Sutton (2001).

Silence as boundary enforcement. Silence was also used to demarcate boundary lines within the online discourse. This manifestation of silence is a variation on silence as a *means of,* as discussed in the first theme—specifically, participants enacted silence online as a means of enforcing norms of social and academic behaviour in the discussion forums.

Silence was used in the online discussion forum as a way to contain conversation and behaviour, and this use of silence was implicitly recognized and understood by the participants. It was in essence an online version of giving people "the silent treatment." Boundary lines of silence were put up by both instructors and learners to maintain appropriate academic behaviour and discourse.

At times, the participants experienced instructors using silence as a means of steering a discussion away from particular topics or tangents, a strategy that was sometimes contested by the learners. Many online courses are designed following social constructivist principles, which encourage learners to become cocreators of knowledge (Bates, 2015; Rovai, 2004). The aim is a transition from the instructor's voice being the one of authority to the learners finding their own voices. At times, this process unfolded in awkward, rough movement patterns between those whose voices might be silenced and those whose voices might be allowed to prevail in the online discussion.

Theme 4: Learners Experience Silence Within Voice

Another theme that emerged was that it is possible for silence to exist *within* voice online. *Silence* and *voice* are not two distinct and opposing entities. Participants frequently described instances of holding some things back or being ambiguous in their online posts, in effect "muffling" their voices online. Participants also described scenarios in which they felt the presence of silence lingering, despite having received responses from others.

These participant experiences highlight that silence and voice are not binary opposites. Silence and voice can coexist; silence can be present within voice online. Muñoz (2014) reflects that "what we experience and describe as 'silence' is often, in fact, written or spoken activity that leaves something relevant unsaid" (p. 15). This aspect of online silence was manifest in participants being nonspecific about personal details that may be criticized by others, glossing over topics that might be controversial or might spark strong reactions from others, or not committing to a firm position on a topic. Yet, it was also present when an unhelpful response from an instructor made participants feel that they had not truly been listened to, or "heard," as well as when learners experienced the words of another person, which did not reflect how they were feeling or thinking, being put into their mouths. When a representative spoke out as if on behalf of the whole group, the voices of the silently dissenting others were drowned out or silenced by the words of one.

Collectively, these examples contribute to the theme of lived experiences that are neither fully silence nor voice. To the casual reader, a dialogue may appear to be occurring in the discussion threads that are unfolding, but silence is present, concealed by the visible written words.

Theme 5: Learners Use Deliberate, Complex Strategies While Engaging in Online Discourse

Coming out of silence to engage in online discourse was not something that was done lightly by the participants, who deliberated about the numbers of posts they should make and the threads to which they would reply; only then did they carefully craft the content of their responses. This theme relates to experiences with the mechanics of entering and sustaining online discourse.

Participants deliberated on a variety of factors in the process of composing posts, including maintaining professionalism, offering content of value, and using strategies to engage their peers and further the dialogue. As they monitored the unfolding dialogue, participants were aware of which of their cohort members met only the minimum expectations for participation. Some described meeting the targets for the minimal number of posts as a way of managing the competing priorities of the demands of their courses, work, and homelife.

While some of the participants recounted writing posts as a stressful process, others found composing their thoughts in writing to be easier than speaking them out loud. Participants more readily responded when they felt passionate about a topic and when they felt they could add a meaningful contribution to the discussion.

The participants described how they went about selecting discussion threads to which to respond. The level of connection they had with the other person posting, the amount of authority that a certain voice carried in the online classroom, social courtesy, and the length and format of the post awaiting a reply all contributed to decisions the participants made about whether or not to reply to a specific post. Participants explicitly or implicitly spoke of voices that they perceived as carrying authority in the online discussions, including those of the instructor and peers who had relevant life experience or a clear vision of how a group project might unfold.

Participants described making considered deliberations in crafting the content and tone of their posts. They recounted efforts to maintain a professional tone in their writing, to use strategies intended to encourage responses from others, and to add value to the dialogue. The perceived permanency of the written comments shaped awareness of how posts were crafted. Participants also described strategies they used to extend dialogue in the discussion threads. Continuation of dialogue was important for the participants to feel that the online discussion was a beneficial one. Comments that merely stated agreement or shared a phatic anecdote did not sufficiently further the discussion. Participants appreciated responses that built on points that they had raised and contained one or two new ideas for consideration. They described being disinclined to respond to rambling or overly lengthy posts.

Theme 6: Learners Hear Each Other in a Trusted Community

Participants described the asynchronous online dialogue as feeling stilted and awkward at times, yet they also described moments that the discourse transcended temporal and spatial disruption to feel more natural, even spirited and playful. In these transcendent moments, participants felt that their voices had been truly heard online. These moments occurred when the online learning community was functioning well and its members were supporting each other and contributing to the dialogue, as well as when learners

could talk about subjects online that they could not talk about in their day-to-day lives because no one was interested.

Participants described experiences they had in the asynchronous discussion that gave them an energized, connected feeling. These experiences were memorable ones for the participants, who described them as times of spontaneity, fun, and excitement that felt less stilted and more like a real-time conversation. Sometimes these moments involved a topic that was energizing and interesting to the participants. Other times, instructors elicited these moments through the skilled use of technology, such as by posting short, recently made videos that added immediacy and personality to the online environment.

Participants described feeling heard online when others responded to them by building on specific points they had raised, addressed them by name in the forum, recognized their expertise, and wrote replies that were thoughtful and respectful. Some participants described their efforts to attend to posts that had not received any replies out of concern for the feelings of the post's author. Participants felt an overall feeling of safety in the online environment of the discussion forums.

When online spaces have dialogue that feels spontaneous, natural, spirited, and open, and the online environment feels like a safe communal place where one can share ideas and be heard, online silence can be transcended.

Implications for Distance Education

While the findings of a phenomenological study are not meant to be generalized, van Manen (2014) argues that they should "foster and strengthen...thoughtful and tactful action" (p. 15). Some of this study's findings may be helpful for those in the distance education community, including educators, learners, and curriculum developers.

Recognizing that learners enact purposeful silences may help instructors to recognize that though learner silence online may appear as nonparticipation, learners may be busy with a great deal of course-related activity during those silences, as described by this study's participants. Learners described being engaged in activities such as researching, reflecting, composing thoughtful posts, and following the ongoing discussion with interest. Participants in this study did not criticize "lurking" behaviour in others and offered reasons for why they might elect to watch or listen without posting.

All members of distance learning communities should be mindful that the word *lurking*, while commonly used, is not a neutral word. Indeed, the word has negative connotations; the *New Oxford American English Dictionary* (Apple, Inc., 2016) defines a *lurker* as one who is waiting "in ambush for something" or one who is present in a barely discernable but "unpleasant" and "threatening" manner. Recognizing the negative undercurrent in the word, instructors and learners may choose to use alternate words, such as *listening* or *vicarious interacting*, that have more positive implications.

Learners who experience silence from others may have mixed reactions to that silence. At times, silence from others may be innocuous, but other times, silences feel demeaning. A strong message from the findings

is that participants valued hearing the instructor's voice, especially when the interactions were timely and helped to further the learning. Participants looked for instructor intervention when conflict emerged online. They appreciated instructor proficiency with the learning management system and instructor innovations that added immediacy to the dialogue, such as posting just-in-time videos that clarified teaching points or offered encouragement.

The theme of silence being present within voice raises several recommendations for distance instructors and learners. Instructors and learners should ensure they have "heard" the intent of questions that are posed to them and that the answers they provide address the intended question. Learners may feel unintentionally silenced by answers they receive that do not specifically address the questions they asked. Instructors and learners who are contributing to teaching presence need to be mindful to listen for silences online—that is, to pay attention to things that may be "unsaid" and reflect on whether or not some action is needed to allow learners to speak with full voices.

Instructors should be aware that the action of speaking out in online discussions is not done lightly. Learners described putting a great deal of thought into crafting their posts and monitoring their word choices. Curriculum designers may also need to rethink mandatory requirements for posting frequency. Several of the learners in this study remarked that they felt pressure at times to speak out even when they had nothing of value to contribute. At times, they felt that they were not allowed to learn just by listening and following the ongoing dialogue. Creative curriculum design should allow learners choice in which dialogues they engage, allow them to discuss topics that are both meaningful and relevant to their learning needs and context, and allow for times of learning through listening and vicarious interaction. When learners feel safe and heard in the online community, they feel freer to take risks in expressing their ideas. In this study, feelings of spontaneity and responsiveness heightened engagement and helped the online dialogue to feel more like a face-to-face conversation.

Finally, the theme of silence as demarcation invites members of distance learning communities to reflect on when they have intentionally or unintentionally drawn "boundary lines" in online classrooms. What norms are being enforced by those boundaries? As online discourse unfolds, are there certain ideas or voices being silenced that perhaps do not need to be? These are not easy questions to answer; they will require ongoing reflection by members of the learning community.

Limitations and Delimitations

Limitations of this study include limitations of the approach. By its nature, phenomenology does not generate findings that are generalizable to a larger population, nor is the intent to generate theory or conceptual models to explain the phenomena under study. Delimitations are that the study does not include instructor perspectives on online silence, although instructors are a key component of the online learning environment. The study also excluded the experience of silence during massive open online courses and other non-cohort-based distance programs of study. It also did not intentionally seek out voices of learners from demographic groups at risk of marginalization. These boundaries contained the scope of the proposed research and create opportunities for future research.

Conclusion

The aim of this phenomenology of practice study was to gain new insights into, and a more thoughtful understanding of, distance learners' experiences of silence online. The six emergent themes described in this study reinforce that silence online is a complex and polymorphous entity. Silence online is not merely the absence of visible participation. When distance learners enact and encounter silence online, they experience a dynamic and shape-shifting phenomenon. At times, online learners may be silent, but they also use silence, they break through silence, and having broken through it, they may meet it again in the online discussion forums.

Silence may be a time of observing and listening, as well as a means of deferring actions that are visible in the online environment in order to do something else. Learners experience silence as both a means and an end for enforcing decorum and appropriate speech in the discussion forums.

Silence and voice are not distinct opposites. Silence can linger in textual voice; written words may mask the silence of truths left unspoken. Learners may use vague or imprecise words to tread between silence and voice, expressing certain carefully selected words or thoughts but intentionally keeping others left unsaid. Poorly chosen words posted in an inattentive response can sting their recipient as silence. Yet despite the polymorphous properties of online silence, it can be transcended by strength of connection, responsiveness, and a feeling of safety in the online environment.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Towards a Devolved Model of Management of OER? The Case of the Irish Higher Education Sector

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Abstract

This paper reports on the research findings from a national project examining the issues in creating, sharing, using, and reusing open educational resources (OER) in the context of the development of open education in Ireland. One important aspect of the research was to investigate the potential for using existing institutional research repository infrastructure for the purpose of ingesting, managing, and discovering OER produced by academics. This approach would imply a move from previous strategy around a centralised repository at the national level to a devolved model that relies on institutional research repositories. The opportunities and potential barriers to the adoption of this approach were explored through an online survey and focus groups with academics from a range of higher education institutions (HEIs). Also, a focus group of institutional repository managers was convened to discuss the potential of the institutional repositories with those leading their development. Analysis of the data indicates that the devolved approach to institutions would be possible if the right supports and protocols were put in place. It was acknowledged that research repositories could potentially also serve as repositories of teaching materials, fostering parity of esteem between teaching and research. However, a range of important challenges were present, and alternative solutions emerged, which are discussed in the context of the present and future of online OER repositories.

Keywords: OER, repository, open education, higher education, Ireland

Introduction

The Drive Towards OER Management

For more than a decade the open education movement has continued to gather momentum in higher education, prompted by increasing demands for more flexible education options, developments in technology and infrastructure, and advocacy at the policy level. As part of this movement, open educational resources (OER), defined as "educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes" (UNESCO, 2002, p. 24), has seen exponential growth in this period. The crucial quality of OER is that they are meant to be freely used, reused, adapted. and shared, thus serving as a catalyst for collaboration and shared digital literacy skills across subject disciplines and borders (McAvinia & Maguire, 2011). There is a clear rationale for promoting engagement with OER for the enhancement of teaching and learning; the Horizon Report (New Media Consortium, 2018) on the technology outlook for higher education, identifies the proliferation of OER as a key trend for the acceleration of technology adoption in higher education. With the current emphasis on modernising and transforming higher education, embracing openness and promoting engagement with OER can help to (re)professionalise teaching and learning by enabling open educational practices (OEPs) through effective open pedagogies, and increasing digital capacity through developing the educational technology and digital literacy skills required to create, reuse, and remix OER. However, despite the continued growth of OER, their potential to transform educational practice has not been fully realised (European Union, 2013). Some of the barriers to the effective repurposing and reuse of OER can be traced to the choices around how these are deposited and managed in the first place, as individual OER are often difficult to find. Thus, by carefully planning the way in which resources will be stored and accessed, those producing and releasing OER can work more effectively (Thomas, Campbell, Barker, & Hawksey, 2012). Good practice in the management of OER is crucial for their sustainability as "just 'sticking it online' might work for one person but individual approaches rarely scale up to work for teams or organisations" (Thomas et al., 2012, p. 668). Defining a model for the storage and release of OER is dependent on the specific context, motivation, and intended outcomes of OER projects. Factors such as the requirements of stakeholders, sustainability, existing institutional policies and practices, practical issues around technical infrastructure, staff skills and understanding (i.e., librarians, learning technologists, web officers, or academics), workflows for quality assurance, and copyright licensing impact on choosing and adopting a particular approach. As such, there need to be policies in place at the institutional and national level to promote the curation and dissemination of OER beyond the individual responsibility of academics (Cronin, 2017). The section below goes on to describe the particular policy and practice context where this study took place, which informs the research undertaken.

Policy and Practice Context of the Management of OER in Irish Higher Education

The management of OER has been at the centre of developments in Irish higher education for over a decade. Early efforts were strongly focused on the creation of a repository consolidated at a national level, mirroring the centralised strategy adopted internationally (for example in the UK through JORUM, and in North America with MERLOT). Ireland's National Digital Learning Resources (NDLR) service was established as a pilot project in 2004 by the Irish Higher Education Authority to allow educators in publicly-funded higher education institutions (HEIs) in Ireland to develop, share, and distribute digital teaching and learning resources openly. This project saw the integration of the repository infrastructure with a community portal, bulk upload and asset harvesting tools, copyright

licensing workflows, developmental activities and training to support practices around OER, institutional and national collaborative projects, and events to showcase OER and build an evidence base around their use. The key highlight of the project was the investment in subject networks or communities of practice to support and accelerate the development and sharing of OER across the sector (McAvinia & Maguire, 2011). This centralised ecosystem provided a platform for creating OER, produced from funded digital projects available nationally and internationally, while harvesting and disseminating OER from other national repositories. By 2012, the project had hugely grown in scale, scope, and engagement. However, the centralised model also faced substantial financial and funding challenges: the network of coordinators was resource-intensive; the project remained reliant on recurrent strategic funding, which came under threat following the unprecedented global economic downturn; and it required significant recurring technical investment. Direct financial support for the NDLR was discontinued in 2012 in the middle of severe financial cutbacks across the HEI sector.

In contrast with the centralised approach taken to the curation and dissemination of teaching and learning resources, the development of open access in the research context in Ireland followed a devolved model from the outset. Institutional repositories were established in Irish universities from 2007 following a national movement that ensured their interoperability using common metadata standards. Quality assurance protocols are applied by each institution to comply with distribution and copyright requirements of original publishers. These repositories aggregate all the institution's open access publications in one place, disseminate and communicate research outputs globally, preserve intellectual output, and operate as a de facto university open press/publisher for a worldwide audience. This distributed service in turn becomes a virtual database composed of a user-defined set of cooperating databases on a network. This way, the institutional repositories permit disseminating research output through a non-commercial channel that has a professional look and feel and provides researchers with a showcase for their research on a global level. In addition, a national harvesting service named RIAN (www.rian.ie) was formed, aiming to harvest in one portal the contents of the institutional repositories of the university libraries, in order to make Irish research material more freely accessible, and to increase the research profiles of individual researchers and their institutions. To date, the portal showcases almost 80,000 research outputs that include a wide range of material defined by each institution as recognised research outputs, ranging from journal papers to music videos.

As part of its enhancement and transformation agenda, the National Digital Roadmap recommends developing and implementing open education principles and practices for Irish education that align with emerging international practice (National Forum, 2015). To enact this recommendation, the National Forum proposed a system-led action around a devolved approach to OER management that relied on hosting teaching and learning OER in existing research institutional repositories. This proposed use of existing institutional repositories of research for the curation and dissemination of OER represented a departure from the previous centralised approach. The initiative implied the expectation that library managers and educational developers at the institutional level would liaise with academics to promote sharing of digital teaching and learning resources to their own local repository, which in turn would be connected at the national level and disseminated under the principles of open education. As a follow up from this recommendation, this investigation aimed to explore how the digitised teaching and learning resources could be ingested, managed, and discovered using local repositories. As the National Forum currently works to rearticulate a national vision for digital teaching and learning, which is collaborative, responsive, and adaptable to institutional contexts, the findings presented here come to inform its future decisions around a mechanism for compiling and sharing open resources related to

teaching and learning. Although the international trend towards management of repositories at the institutional level, and the popularity of the hybrid repository model that combines teaching and research outputs has been reported (Santos-Hermosa, Ferran-Ferrer, & Abadal, 2017), the international literature has not fully explored the perceptions of the stakeholders involved in such enterprises. Importantly, while the global open education movement strives toward openness as a feature of academic policy and practice, given the disappointingly low level of awareness in institutions, it is crucial to explore the voices often unheard, those of the teachers and professional service staff with whom we are engaging (Rolfe, 2017). This investigation is relevant to an international audience as this approach to OER management represents a departure from the OER-exclusive, central repository model which has been reflected by developments elsewhere (e.g., since the retirement of JORUM), and because it gives a voice to all those involved.

Methods

In investigating the research question, it was recognised that the methodological approach should integrate the views and suggestions of all stakeholders, namely, higher education academics, librarians and library managers (especially institutional repository managers), educational developers, and educational technologists, and should integrate historical developments around OER management in Ireland. This was envisaged to provide a wealth of perceptions from the specialist insight knowledge to the more generic, community-based views informed by academic culture and practices. Therefore, a mixed methods approach was taken in order to collect quantitative and qualitative data that could be triangulated to provide rich and contextualised insights and understandings. The methodological approach included a survey of higher education staff through an online questionnaire; three focus groups with a mix of academic staff, library staff, educational developers, and educational technologists in three different geographic locations; and a specialist focus group with key informants who had responsibility for the management of their institutional repositories. The research project was ethically approved, and the collaborating institutions acknowledged this approval. In order to allay any possible concerns about participation, an information and consent form was included at the beginning of the questionnaire, and also at the beginning of each focus group. The forms described the project, the intended use and storage of project data, and assured confidentiality and anonymity. Each of the elements of the investigation are described in detail next according to the stakeholder group.

Multi-Stakeholder Survey and Focus Groups

A mix of survey open and closed questions was developed, informed by the project remit and the ongoing literature review, in order to investigate the potential role of repositories in general, and institutional repositories in particular, in the management and sharing of OER, including motivations and barriers to use. The survey aimed to canvass the perspectives of academics and other higher education stakeholders such as educational developers and technologists. The survey was distributed online (with a link thereto from the project website) through a designated list of contacts in HEIs, who shared the call for participation with staff within their institutions. Attention was also drawn to the survey through network lists, institutional newsletters, and social media. Of the total of 192 complete responses to the questionnaire, the majority were lecturers in full-time lecturing posts, with a normal distribution in terms of age, but female respondents outnumbered males 3 to 2.

With the research question in mind, a set of questions/discussion topics were also developed for a total of three focus groups which were organised by team members in different regional locations. Those with an interest in and knowledge of OER and institutional repositories were targeted for participation with mixed representation of academics, librarians, educational technologists, and technical ICT services staff. These discussions were anticipated to exploit the diversity of the groups, highlighting coincidences and divergences around expectations, and raising ideas for how OER might work at institutional level. Eleven staff from institutions in the Limerick region participated in Focus group 1. Focus group 2 had 16 participants from six institutions in the Dublin region, both public and private. Focus group 3 had eight participants, all from the same institution in the western region.

Analysis of open-ended responses in the survey and the transcribed recordings of the focus groups was through thematic analysis (Braun & Clarke, 2006). Data were reviewed following Braun and Clarke's (2006) six stages (familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining/naming the themes, and writing the analysis). The findings of the qualitative analysis of focus groups are presented and discussed below.

Specialist focus group. All institutional repository managers were invited to attend a focus group which reflected representation from the University sector, the Institute of Technology (IOT) sector, and the private colleges in Ireland sector. Seven of them attended, and in addition, two experts in open access and repositories, who had past experience with the NDLR, also participated. One university institutional repository manager declined to attend, but wished to register opposition to the recommendation of using institutional repositories for curating OER for the record. The discussion occurred in this focus group was recorded, transcribed, and thematically analysed for discussion here.

Results

Multi-Stakeholder Perceptions

Survey results. The questionnaire data revealed mixed levels of awareness and usage of repositories to start with. Just under half of respondents (49%) used their institutional repositories to share their research outputs, or access research outputs deposited by their colleagues. Those 98 (51%) respondents who did not use their local repositories were asked to specify why. Following thematic analysis, almost 60% (59) of respondents declared not to have an institutional repository (as is the case in many private colleges), was unaware of whether or not their institutions had repositories, or were not sure what a repository was. Of the remaining respondents, 13 said that the local repository was not of value/relevance for their subject, 11 respondents cited a lack of time as the reason for not using their local repositories, seven people indicated that they were not researchers or did not have time for research (hence they had no need to use repositories), three people stated that their part-time status was a barrier to usage, and finally, three people gave reasons relating specifically to the quality of the material deposited in repositories and their organisation.

When asked whether or not they thought their institutional repositories were appropriate for sharing OER, results were split down the middle with 51% viewing their institutional repositories as appropriate and 49% as not appropriate. When probed further for reasons as to why, a large percentage stated that this question was not applicable or that they did not know enough about repositories to answer. When these were excluded from analysis, together with answers that were not relevant, there were just 10

answers remaining on the "Yes" side and 26 on the "No" side. The 10 reasons (from 5% of respondents) given to support the premise that institutional repositories were suitable for educational resources included ease of access, sharing and collaboration, and raising their own profile. For example, one of the respondents stated that: "It is a means to marketing and attracting growth, cross fertilisation and collaboration, thereby ensuring a broader perspective on educational relevance and application of material."

The 26 reasons (from 14% of respondents) given for the view that repositories were inappropriate for the sharing of educational resources included: other more flexible platforms available (7); lack of visibility and critical mass (7); the need for research and teaching outputs to remain separate (3); and other concerns such as lack of culture of sharing and the need for quality control.

Just over half (102; 53%) of all respondents provided reasons as to what would motivate them to share their educational resources in their institutional repository. Thematic analysis of these answers revealed a wide range of themes, including altruistic motivations (19), recognition/credit/profile raising (11), collegiality and opportunities for collaboration and networking (9), and reciprocity (8), followed by other motivational factors. Likewise, when asked to state what might deter them from sharing resources in their institutional repositories, if that repository was made available for OER, 58% (112) provided responses in all. Thematic analysis revealed the main concerns to be loss of control/ownership/intellectual property (42); repository functionality (20); time (17); lack of confidence in resources/fear of being 'judged' (15); lack of quality control (9), and lack of participation/reciprocity (5).

Focus groups results. The thematic analysis of the discussions that took place during the focus group largely aligned with the results of the open survey, while delving deeper into these mixed understandings of OER repositories in general, and local institutional repositories and their suitability for hosting OER, in particular. However, those who were more experienced in OER use and production were also able to provide more historically contextualised views that were informed by their own and their colleagues' practice. In some cases, they had taken a more flexible approach that had moved away from repositories towards the use of broader reaching social media tools, or their own professional networks: "Over time I've used repositories less and relied on my learning networks...with Creative Commons licenses"; "The concept of a repository is gone. It's more about branding something within the open web environment e.g., a YouTube Channel"; and "I just put a skeleton of my course on [the Virtual Learning Environment] and share content through my WordPress blog."

There was however one respondent, who had been involved in the NDLR project, that made a case for the use of repositories: "It takes an awful lot of time and energy to create any kind of learning object and for me the credibility and safety of the repository that I'm going to upload it to is really an overriding factor."

In relation to the proposed use of local institutional repositories and their suitability for hosting OER generated, again, some ambiguity in that not all people knew about them or knew whether they used one or not. One participant stated that a positive aspect of purposing these repositories in such a way would be that: "It would ensure that material has proper licensing/copyright etc., because they don't accept stuff unless it's done properly."

Some participants saw it as a way for those new to sharing to start sharing teaching practice, as a precursor to sharing in the open, with some protections not offered in Web 2.0 platforms: "They could say that you can't have stuff in your teaching portfolio unless you put it in the repository" and "Some people may not be fans of the YouTube environment ... may prefer to share in a different space."

Interestingly, one of the academics seasoned in using OER saw potential in the suggested proposal as a possibility to curate at the institutional level resources already shared openly, with the repository acting as a corridor to the web: "They might already exist as OER and just the links can be in there. Because I'm just thinking... anything that I produce is out anyway with a Creative Commons licence so it wouldn't actually reside in there."

Finally, one other participant further highlighted this potential for the institutional repository to serve more as a profiling tool than a learning warehouse by paralleling OER curation to that of research outputs: "It's the same situation with research papers that are published: they are out there in the journals' websites. So it's sort of like a way of validating or proving it for the university."

Specialist Focus Group

Given their specific expertise and experience, the focus group organised with institutional repository managers provided the most in-depth and informed data around the research question. In general, the group felt that technically, learning resources could be accommodated in so far as they could be taken into repositories—the storage capacity existed. This does not mean that technical difficulties were not expected. For example, multi-object OER present specific challenges for storage, editing, and re-purposing; however, most of the participants were at least potentially open to the proposed innovation. As one participant expressed: "It could be quite exciting if you were given the tools to do it....you could do something really new, experimental, and amazing. But it can't be done easily."

The participants in this group were aware of the challenges to OER reuse when educational design is invisible, which has been widely acknowledged in the literature (Wiley, Bliss, & McEwen, 2014). Drawing on the NDLR experience, it was recognised that teachers can benefit from peer observation and the contextual pedagogical information around OER, especially when these are accompanied by metadata on the original context in which it was produced, the circumstances for which it was created, how it worked, what learning outcomes it serves, etc.

A second area that was discussed by participants as having potential for exploration was that of research-led teaching. Members of the focus group acknowledged a growing divide between teaching and research and felt that OER could well be a way to bridge that gap. Research-led teaching is an aspect of strategic planning in every HEI in which it is very difficult to track to key performance indicators that demonstrate progress. Participants hypothesised that if OER were linked to research resources, then a structure could be established for them. This could be a potential way forward and help libraries to accommodate OER materials. As data sets are being brought into repositories, so OER could be a type of "associated material" to evidence the impact of research in teaching practice. It is potentially possible for institutional research repositories to support broader changes in the culture of institutions around how scholarly work is communicated, and perhaps how such repositories could include all scholarly output and communication.

Overall, it was discovered that participants supported the possibility, in principle, for different reasons, but also had serious concerns and considerations which we will expose next.

Questions of quality. Much of the discussion revolved around the differences between research resource and learning resource management environments. Libraries have been dealing with research outputs in a research environment for a very long time. There is a huge amount of flux in the research sphere, but it is one where libraries know what they are dealing with—there is a culture within libraries of managing these resources. There are clearly defined definitions for peer review, copyright, and quality control. On the contrary, participants felt they do not have such concrete guidelines around OER or when a resource has reached a quality that is acceptable for sharing. One participant stated that we are "one hundred years behind" with OER, and that a shared definition is needed, as well as an agreement on where they fit, so that libraries can begin to archive OER in a systematic way.

Participants expressed serious concerns about quality and branding issues, though one participant said he "would not be as concerned about quality as copyright." While people uploading OER to a repository might well have invested time and effort in their creation, this might not always be the case. If an institutional repository was intended to showcase the outputs of an institution, then quality assurance was important, not just for academics, but for the institution itself: "The only way I could ever see OER in my repository would be if they...have been through a rigorous peer review process and are the best of the best."

Repository managers have been seen as neutral facilitators of the curation of research outputs, deferring to academic colleagues to decide what is acceptable, while there is no equivalent peer review system for OER. Moreover, participants feared that opening to OER curation could further recall the myth that institutional repositories contained a lot of non-peer reviewed materials. Therefore, participants called for a credible quality review system for OER intended for research repositories, perhaps even a system overseen independently of institutions.

Resourcing. Analysis of the rich discussion in this focus group signalled the significant resourcing issues that would arise if a devolved model of OER storage using institutional research repositories were to be pursued. The use of the repositories could not be automatic; planning, development, research, and training would all be required with their attendant expenses. Institutional repository managers reported that they were already working with drastically reduced budgets and very small teams of staff. The fundamental differences of dealing with dynamic OER, instead of archiving research, would have very practical implications for their workloads. It was noted that NDLR's reliance on recurrent annual funding had been a vulnerability, and all stakeholders would need to have some guarantees that a similar service was going to be sustained. Advocacy of the repository for OER would also be necessary and the project would require leadership. At the national level, funding would be needed to develop appropriate metadata to facilitate access to OER across the institutional repositories (as is the case currently with research and the RIAN umbrella service).

About the recognition of teaching outputs. Participants felt that it remained "a full-time job" to persuade academics to upload their research outputs into the local repositories. Recognition within an evaluation system, both inside and outside the university, provides a rationale for supporting and accommodating research outputs. To encourage OER to be successfully curated through institutional repositories, a system of recognition should be built into institutional strategies, commitments, and reporting structures. This links to a wider issue around the recognition of teaching and learning outputs in higher education, and the need to achieve parity of esteem with research. It was pointed out that historically, there has been a long tradition in Ireland of professionalising research, and by implication, teaching resources would have to be produced in a professional way. The

participants reminded a major lesson from the NDLR experience that training and support was key to enable staff to feel comfortable about sharing their resources in the first place.

In summary. Given that the members of this focus group were people working for over a decade in the development of institutional research repositories, their understanding of the issues involved was detailed and clear. They stressed that their progress so far with the institutional open research repositories has required a positive and proactive stance. Their views were expressed from this perspective, but nonetheless showed the complexity and challenge of deploying research repositories to meet different objectives. Research repository managers were not averse to the idea of accommodating OER in principle, provided that the process was properly resourced and planned. There needed to be an element of experimentation to design the best model, and the same model may not necessarily suit every institution. The perceived quality problem, with insightful comments from institutional focus group participants, would be a major stumbling block for institutional repository managers. Other concerns included the ambiguity around the definition of OER, sustainability issues, and the fit between institutional research repositories and the needs of potential OER repository users. Therefore, in summary, participants felt that the culture of an institutional research repository is very different to that of a teaching and learning resource repository. The former was set up for a very specific purpose, which is to preserve and disseminate the research output of the institution. Different sets of processes and support skills are required for the latter, and "there would be an element of square peg/round hole retrofitting." A considerable amount of work and investment would be required to produce a common metadata standard so that learning objects could be discoverable across repositories, and clearly such a project would need to be properly scoped and resourced. In summary, all participants agreed that "just because the infrastructure exists does not necessarily mean that it is the best place for OER to reside." The participants also highlighted that academics were already using resource sharing Web 2.0 tools independently, and that NDLR was perhaps an early indication of a move away from repositories for teaching resources in general, and towards the open web. Overall, the rationale for supporting the accommodation of OER in institutional research repositories, which have a long-established history and a very different culture to that of learning resource repositories, was seriously questioned.

Conclusion

The most recent Horizon Report (New Media Consortium, 2018) on the technology outlook for higher education, affirms that initial advances in the authoring platforms or curation method of OER are now overshadowed by campus-wide OER initiatives. However, the complexity of these campus-level initiatives has not been covered in the literature. This exploratory research has contributed to this gap with a snapshot of issues around the scoping, development, evaluation, and sharing of OER in the Irish context around a proposed model for OER management at the campus level. A few study limitations need to be highlighted as caveats for interpreting findings and recommendations. The first relates to the specific focus of this research project: the OER field of study is a fledgling but vast one with many calls for more research and deeper investigation. In this study, the focus was on providing an overview of key issues and an exploratory empirical investigation. A second limitation refers to the wide scope of institutions considered in the study. It is acknowledged that each institution has its own unique learning mission and goals regarding the type of education each is attempting to provide and the type of learning design that best meets these goals. It is acknowledged, therefore, that not all aspects of this study will be relevant for all institutions. Also, findings must be considered in the context of the methodological

limitations inherent to self-selected survey responses and focus group participation. The project study sample is not necessarily representative and does not support generalisations. There are many other groups whose views on OER could have been collected in this study to gain a more balanced and comprehensive understanding of issues around OER in higher education (e.g., students, teaching team and subject coordinators, and management staff). Though participants were self-selected, it likely that early adopters and champions are over-represented. This exploratory study therefore provides a first snapshot of the complex reality and dynamics involved in the proposed use of existing institutional infrastructure for a novel application around OER that can be investigated and discussed further.

Move Away From Repositories?

A move from formal use of repositories to less formal online communities and networks emerged in the focus groups in this research. Indeed, the argument for letting sharing and reuse happen via the web in a more organic way has gained great momentum given the proliferation of Web 2.0 tools. Many free, open, flexible, and widely adopted platforms are now available online, and sharing of resources (whether OER or not) widely occurs across these platforms and on personal Web spaces. For example, it is interesting to note that in a special issue in this journal specifically devoted to the implementation of OER, repositories were not mentioned (Hilton, 2017). Moreover, Allen, Browne, Green, and Tarkowski (2015) argue that current platforms that enable the management, discovery, use, and reuse of open content are inadequate and not very well-known, and repositories are varied and generally do not include common search terms or metadata. Also, although currently most repositories of OER provide some kind of facility to accommodate community engagement (Santos-Hermosa et al., 2017), it is unlikely that this engagement transcends the OEP community. However, moving away from repositories raises a question in relation to the management of OER. Putting a resource online might work for an individual academic but such individual approaches rarely scale up to work for teams or organisations. As well as scaling issues there are sustainability issues to be considered. The use of *referatories*, reference systems or special platforms that enable users to rate, tag, and describe resources is proposed as an appropriate alternative (Heinen, Kerres, Scharnberg, Blees, & Rittberger, 2016). These types of services allow users to find references to OER in many repositories, and even can include references that were not explicitly published as learning materials but can be used as such.

Potential of a Blended Approach to Repository Use

The findings of our study point to alternative management approaches that could be investigated. There is certainly scope to consider a blended approach to repository use, which could include the use of reading-list like management software, the capturing of links to resources stored elsewhere online, and the linking of learning resources to research resources. Cohen, Reisman, and Bied Sperling (2015) advocate providing spaces in repositories for enabling personal expression as a facilitator for adoption of OER, so there is obvious potential to harness the energy and enthusiasm of staff currently engaged in OER use in order to showcase samples of their best ones. The capturing of “excellent” OER from all staff could be self-managed via individuals’ teaching portfolios, e-portfolios or online presences, and fostered through relevant national or initiatives, such as teaching fellowships or excellence awards.

OER Within Educational Context

Our research has indicated that OER use, re-use, sharing, and creation are not ends in themselves. They are only useful if they result in teaching practices and learning experiences that are more effective than those without them. In this line, Wiley and Hilton (2018) even propose a new term, "OER-enabled pedagogy," defined as the set of teaching and learning practices that are only possible or practical in the

context of the permissions that are characteristic of OER. In Ireland, such approaches could be embedded with the introduction of the National Professional Development Framework for staff teaching in higher education (National Forum, 2016).

The Larger Issue of OEP

In an indirect way, the survey and focus groups conducted in the process of this investigation contributed to increasing awareness of OER as evidenced in comments, and at the same time identified several OEP champions. However, there is little evidence to suggest that OER are understood, let alone valued, in the wider higher education community yet. Ultimately, in the context of the enhancement of teaching and learning, any OER initiative should have an OEP component, which includes practices that support the reuse and production of OER through institutional policies, promote innovative pedagogical models, and respect and empower learners as co-producers on their lifelong learning paths (Ehlers, 2011). Policy change and strategic buy-in is crucial in the institutional journey as it can be an indicator of OEP maturity and provides clear evidence of a commitment to changing practice, which ultimately supports sustainability (Abeywardena, Karunanayaka, Nkwenti, & Tladi, 2018; Cronin, 2017). Given the low levels of awareness and understanding of openness in higher education in general, national and institutional policies need to place greater emphasis on OEP, and open education more generally. Such policies need to be integrated with teaching and learning strategies and policies. Widespread adoption of Creative Commons licensing and the sense of public ownership of resources and content developed with public monies is helping to foster openness, but ultimately any proposed OER-related policy intervention is mediated by an institution's existing policy structure, its prevailing social culture, and academics' own agency (Cox & Trotter, 2016). Thus, it is important that lecturers get support to engage in open education beyond technical support and training, as evidence has shown that support mechanism related to time allocation for the development of open education, and its recognition for career development are uncommon (Castaño, Punie, Inamorato, Mitic, & Morais, 2016).

Some Final Comments

The next number of years will probably see greater importance attached to OER sets and to the educational context where these are used, moving away from OER as individual ‘nuggets’ which are often difficult to find (New Media Consortium, 2018). Ultimately, we have learned that issues around OER management are much broader than the question of infrastructural digital capacity, and concur with Rolfe (2017) that adopting critical approaches to gain a deeper understanding of the philosophical and pedagogic stances within institutions is crucial. More exploration is needed in order to find the best model for each institution (Cox & Trotter, 2016). There is also a strong rationale for a more in-depth understanding of issues that includes policy makers involved in implementing institutional OER strategy, academics who use OER, academics who have not yet used OER, and students. Importantly, more qualitative (and quality) work is needed with academics “at the chalkface” that poses special emphasis on discipline pedagogies.

Acknowledgements

This work was supported by the National Forum for the Enhancement of Teaching and Learning (www.teachingandlearning.ie) under the Focused Research projects in 2015. We would like to thank all our colleagues in the five institutions participating in this study which contributed to the research project.

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Athabasca University

International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Open and Shut: Open Access in Hybrid Educational Technology Journals 2010 – 2017

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Abstract

Little is known about open access publishing in educational technology journals that employ a hybrid model which charges authors only if they wish to publish via gold open access. In this study we sought to address this gap in the scholarly understanding of open access publishing in hybrid journals that publish research into the intersection of education and technology. We analysed three categories of article access types: gold, green, and limited access, and collected data on their prevalence in the seven-year period from 2010-2017 across 29 journals. Data was gathered from Scopus, Unpaywall, Sherpa RoMEO, and via manual searches of the journal websites, resulting in a dataset comprising the metadata of 8,479 articles. Our findings highlight that most research remains locked behind paywalls, that open access publishing through legal means is a minority activity for the scholars involved, and that the complexity and costs of legal open access publishing in these journals may be inhibiting the accessibility of research to readers.

Keywords: open access, open scholarship, open education, educational technology research, gold open access, publishing

Introduction

This paper aims to shine a light on publishing patterns of scholars in the area of educational technology research. More specifically it aims to take stock of the practices of open access publishing by scholars in this area. There are some well-known, and well-regarded open access journals in the area (Perkins & Lowenthal, 2016; Zawacki-Richter, Anderson, & Tuncay, 2010), including of course The International Review of Research in Open and Distributed Learning (IRRODL). However, educational technology open access journals are few in number (Costello, Huijser, & Marshall, 2019) relative to the overall journal landscape. There are other forms of open access publishing, outside of fully open access journals. Authors can share early iterations (often known as preprints) of their manuscript in various places as allowed by the publisher. Alternatively, authors can pay to have their work published in journals that are comprised of both open and closed articles.

Open access is a not an uncontested concept, with Chen and Olijhoek (2016) suggesting that it is more appropriate to regard open access as a spectrum that incorporates differential copyright, reuse, and author posting rights. The question arises as to how scholars can grapple with this often complex scholarly publishing landscape. This study sought to explore this topic in the area of educational technology research by examining journals that dominate the area, that are not fully open access, but that in theory provide a range of publishing options to authors. We sought to interrogate how scholars are publishing articles in these journals according to different open access options available to them. Finally, we assess the impact these publishing practices may have for scholars and readers of this literature.

Literature Review

Open access refers to a model of academic publishing where readers have access to published works without cost. While a commitment to the sharing of scholarship predates modern communication technology, the advent of the Internet heralded an era of vast new possibilities (Suber, 2012). There arose the potential for a momentous revolution in scientific and scholarly publishing (Allahar, 2017; Harnard, 1991; Suber, 2012). Researchers now have the ability to promote and share their work in a way that previous generations could have scarcely imagined.

What may have started as a philosophical commitment to openness by individual researchers has increasingly become articulated and translated in institutional and national policy. For example, The European Commission's recommendation on access and the preservation of publicly funded scientific data represents an important milestone in the EU's commitment to ensuring that those who pay for publicly funded scientific research should get to see those outputs without restriction. In May 2016 the 27 members of the European Union committed to making all scientific publications from publicly funded research freely available by 2020; a commitment that was formally articulated in 2018 as "Plan S" (European Commission, 2019). This commitment subsequently formed the basis of "cOAlition S," a coalition of national research funders and charitable organisations across Europe that have agreed to implement the 10 principles enshrined in Plan S (cOAlition S, 2019). In America, the Bill and Melinda Gates Foundation (2015) adopted an open access policy requiring all future research supported by the foundation to adopt open practices with

respect to all. This growth in open access commitment is well illustrated by The Registry of Open Access Repository Mandates and Policies (ROARMAP) tracking of the open access mandates and policies adopted by different funders (including private foundations, research organisations, and universities) which has seen the number of policies and mandates of all types grow from 122 in Quarter 1 of 2015 to 959 in Quarter 4 of 2018 (ROARMAP, n.d.). These are just two examples of a worldwide trend that is attempting to promote open access for research.

An important (and frequently cited) reference point for open access is the Budapest Open Access Initiative (BOAI):

> By "open access" to this literature, we mean its free availability on the public Internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself (Chan et al., 2002).

The BOAI, in conjunction with the Bethesda Statement on Open Access Publishing (Brown et. al., 2003) plotted two strategies to this open access. First, it promoted archival by scholars of their published works to their own institutional or subject archives. Second, it called for fully open access journals that would enable open access at the point of publishing in the journal itself with no fees or subscription costs to readers.

While there are other definitions of open access, (see Bailey, 2007), the BOAI concepts of gold and green options have continued to persist – but with evolving practices and subtypes that have the potential to confuse (Smith, 2017). Gold open access refers to articles that become open to readers immediately at publication (are born free), on the journal website itself. As the gold model evolved, two scenarios of gold access developed. The first scenario is an open access journal which provides all articles free of charge to the reader, but the authors pay a fee, known as an Article (or Author) Processing Charge (APC). APCs were a response to the loss of revenue incurred by journals for no longer charging subscriptions. They enabled, for instance, a new form of journal known as the mega-journal pioneered by the Public Library of Science One (PLOS One) and were quickly co-opted by the major traditional publishers (Björk, 2018). In some fields, journals supported by APCs are well established (Berger & Cirasella, 2015). However, the issue has also been somewhat clouded by fears of “predatory” journals, largely understood as journals that accept articles regardless of merit for money and hence “prey” on authors (Berger & Cirasella, 2015; Smith, 2016). Predatory journals may be something of a red herring, in terms of actual harm that they cause (Eve & Priego, 2017). Commentators have argued that the real predators may be the dominant big academic publishers (Olijhoek & Tennant, 2018).

The second scenario is journals that take a hybrid form, publishing closed articles alongside open ones paid by APC (Eve, de Vries, & Rooryck, 2017). A third scenario comprises journals which provide gold open access with no APCs, that are financed through other revenue such as membership subscriptions of a scholarly professional association. The terms “platinum” or “diamond” have been proposed for open access journals with no APCs (Fuchs & Sandavol, 2013). These journals have a model of publishing that neither charges the author to publish nor the reader to read.

Another major category is green open access (Guédon, 2004) which dates to at least to 1991 when physicists practiced the self-archival of versions of their articles to the Arvix archive before their official publication (Harnad et al., 2004). Green access allows scholars to archive a version of their article somewhere other than the publishing journal website. This version may be at the pre-peer review stage, or at some other stage of the publishing lifecycle, such as before typesetting, and up to and including the final version.

A recent study by Piwowar et al (2018) highlighted what they term "bronze" access (Ridgway, 2014) to refer to two types of article. The first appear in journals that share many characteristics of gold open access journals insofar as all articles are freely available. However, they may lack a clear license, such as Creative Commons, and hence legal usage of the articles remain unclear. The second type of bronze article are those that appear in hybrid journals. These articles have been referred to as having "peek-a-boo," (Harnad, 2006) "fourrée," (Costello, 2019) and "fauxpen" (Freshwater, 2014) access, to highlight that these articles may not always be available. We use the term "temporary access" for this access type in an attempt to give a concise but technical definition of this very limited and hence problematic form of access. We will return to this issue in the discussion section.

The importance for open access to scholarship is clear. Open access journal articles have been posited as a form of "open educational resource" (OER) particularly for graduate students (Anderson, 2013). It has been shown that some scholars in the area place particular value on open access journals (Perkins & Lowenthal, 2016). However, a study that contrasted open and closed models found editors ascribed no quality judgement based on journal type (Zawacki-Richter et al., 2010). Interestingly, open access publishing helped contribute to the idea of the digital scholar (Weller, 2011) and from this, a dawn of open scholarship was heralded (Veletsianos & Kimmons, 2013). The open access movement found ready friends in the open education movement with its roots in traditional open and distance learning (Costello et al., 2019). Open education, as a movement, has spread and expanded in definition and now encompasses a wide "kaleidoscope" of practices (Conole & Brown, 2018). Nonetheless, the "battle" for open continues (Weller, 2015) as, despite the success of a number of open access journals in the field of educational technology research, the major academic publishers still predominate (Larivière, Haustein, & Mongeon, 2015). The majority of these journals are not fully open access but instead operate a subscription-based hybrid model of publishing, in which open articles are published in the journals alongside closed ones (Prosser, 2018).

As Piwowar et al. (2018) highlight, very little is known about temporary access or bronze articles. To our knowledge, nothing has been published on this topic in the area of blended, online, or educational technology research. Furthermore, very little appears to be known about gold and green publishing patterns in the major journals in the area. Hence, this study aims to address this gap regarding what is known about publishing in hybrid access journals in the area of online, blended, and educational technology research.

This study is guided by the following overarching research question: What is the pattern of open access publishing in prestigious hybrid educational technology research journals? This is further broken down into three sub-questions:

- What is the prevalence of the different access types for articles published in prominent educational technology journals with a hybrid publishing model?

- What article processing charges (APCs) are authors paying to educational technology journals in order to publish gold access?

- How can the rates of open access publishing in hybrid journals be determined?

Methodology

Several data sources were used in this study. The Scimago database was used to determine prominent journals in the field. Scimago Journal and Country Rank rates journals according to the Scimago Journal Rank (SJR) indicator (Colledge et al., 2010). It is used in conjunction with Scopus in many ranking systems of academic scholarship such as the Time Higher Education University Rankings and the 2018 QS World University Rankings (Hanafi & Boucherie, 2018). We selected the top 50 journals by SJR score in the category of "e-learning." We then removed completely closed journals (i.e., those with no option to publish gold open access as of 2018). We also excluded conference proceedings and fully gold open access journals, of which it should be noted there are 13, including, of course, The International Review of Research in Open and Distributed Learning (IRRODL). It also noteworthy that none of these 13 gold open access journals charge APCs to authors. This left us with a list of 29 prestigious hybrid journals which are detailed in Table 3. It should be noted that we use the term prestige in the technical scientometric sense, which relates to a journal's attraction of citations from other highly ranked journals. We are not ascribing any value beyond this to these journals nor their publications per se. Indeed, some research argues that prestigious journals may actually publish more dubious research (Brembs, Button, & Munafò, 2013).

Initial searches of the Scopus database indicated that no articles were published in the journals as open access prior to 2010. We next performed a search using the Scopus database for all research articles published in these journals between 2010 and 2017 inclusively. This resulted in a dataset comprising the metadata of 8,479 articles. One of these metadata fields showed whether an article is available as gold open access.

To validate this data, one researcher manually verified the access type of each individual article via a systematic hand-search (Armstrong, Jackson, Doyle, Waters, & Howes, 2005). Temporary access articles were also recorded during this search and the results of these manual searches were cross-checked with the Scopus data. Researchers then performed searches of the journal websites to determine APC costs in US dollars. Next a search was made for each journal title in the Sherpa RoMEO database to determine its stated level of archival policy. Sherpa RoMEO (n.d.) is a database that records the self-archiving policies of journals for their authors. It uses the following colour codes to describe the archiving policy allowed by each journal:

- Green: author can archive pre-print and post-print or publisher's version/PDF;

- Blue: author can archive post-print (i.e., final draft post-refereeing) or publisher's version/PDF;

- Yellow: author can archive pre-print (i.e., pre-refereeing); and

- White: archiving not formally supported.

Finally, we conducted a search of the Unpaywall database. Unpaywall is an open database of over 23 million open access scholarly articles and contains the access data on over 90 million articles. Unpaywall uses indexes such as Crossref and the Directory of Open Access Journals (DOAJ); additionally, it draws upon over 50,000 other online sources including gold open access journals, hybrid journals, institutional repositories, and disciplinary repositories (Piwowar et al., 2018). We used the Digital Object Identifier (DOI) of each article in our dataset to query the Unpaywall dataset programmatically. This returned 8,425 results which equates to over 99% coverage. These results provided green access data to supplement the temporary access data of our dataset. We then merged these results into one master dataset and performed descriptive and inferential statistics using Excel and the statistical software R.

Results

Temporary Access

We found 38 temporary access articles through manual search. Unpaywall identified 111 temporary access articles. Unpaywall refers to these articles as "open (via free pdf)." Of the 38 temporary access articles we found manually, 15 were also found by Unpaywall. By combining these two data sources together, we calculated a total of 134 articles in this category. A check of several of the Unpaywall articles revealed that while some were still available to access, others had reverted behind a paywall and were no longer available to access. Hence, we use the term "temporary access," to describe these articles, as access is unreliable over time. All we can say is that articles in this category were available to access freely at some point in time.

In order to best categorise the corpus as a whole, we chose to use *the best possible type of access of all forms available*. There were only a small number of papers that could be placed in multiple access categories. For example, there were three temporary access articles for which there was a green version (better) also available. Similarly, there were five green articles which had a gold access version (better again) available. The most complicated category however, is temporary access, as separating them from the fully paywalled category could give a misleading impression that they are more accessible than they actually are. In our judgement these are very close to paywalled articles. The results hence show the best available access version, at the point in time during which the data for this study was collected. We report our results in the subsequent charts with colours that equate to the relative level of openness: black for least access; grey for limited access; green for non-final versions, that are not available on the journal website itself; and gold for fully open access versions that are available on the journal website. This may serve to help the reader differentiate access types (with the caveat that the relative merits of access types is contested).

During the period 2010 to 2017, we report 140 gold open access articles, 785 green open access articles, 124 temporary access articles, and 7,429 closed/paywalled articles. Grouping green and gold together, we have 925 articles or 9.26% of the corpus that are available in some open format. Combining temporary access and paywalled articles, that have no green access version, we report 7,553 articles or just over 89% of the corpus. Figure 1 shows the proportion of each best access type in the corpus.

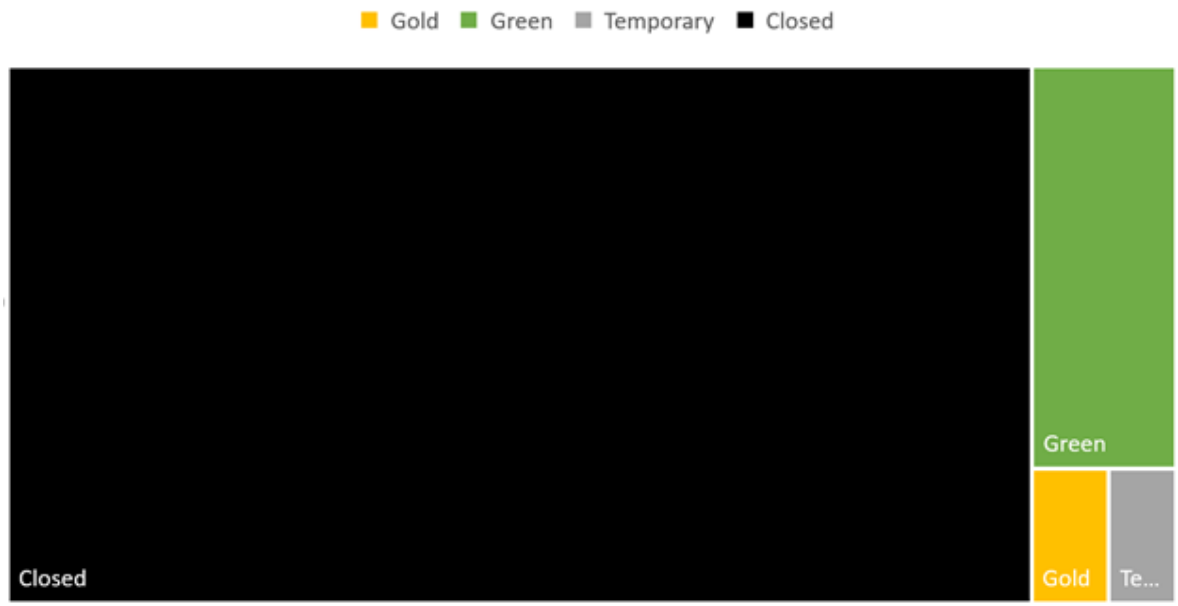

Figure 1. Best access type for 8,478 articles in hybrid e-learning journals 2010 – 2017.

When the data on these four access types is looked at over time, it appears that green access remained at a relatively stable rate with an average of 98 articles per year over the period. Gold open access averaged only five articles a year between 2010 and 2014 but this rose to 27 in 2015 and then to 44 and 49 in 2016 and 2017 respectively. Temporary access articles also increased from 2013 onwards and averaged 27 articles annually for the subsequent four years. Figure 2 below illustrates these trends.

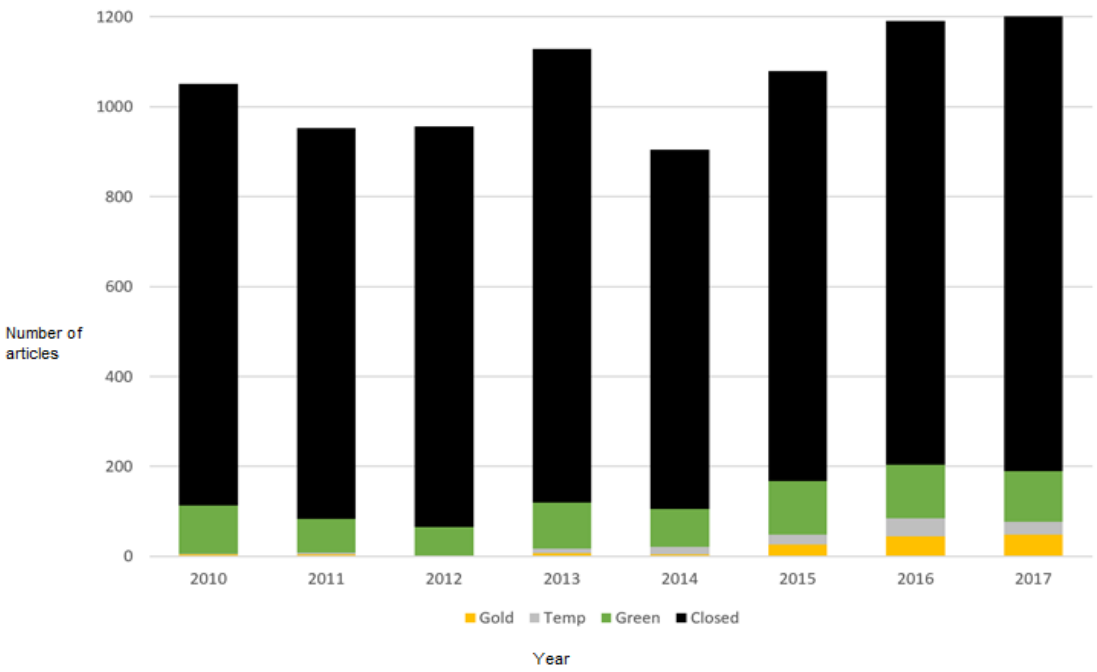

Figure 2. Number of best access type of all articles in hybrid e-learning journals per year.

Funding information, such as acknowledgements to funding agencies, was available for 1,435 articles. Thirty of the 140 gold articles acknowledged funding, and 138 of the 785 green. A chi square test was conducted to determine if there was any correlation between funding information and open access gold or green publishing but none was found ($\chi 2$ [1, N = 8,478] = 2.37, p = .30).

Green Archival

The archival to a repository or website, of various versions of an article manuscript such as the pre-print or post-print version, are allowed for by all but one of the 29 journals, according to the Sherpa RoMEO database. Furthermore, RoMEO catalogues these according to four colours, where green is the most permissive followed by blue, yellow, and white. The archival policies can be further classified according to publisher, of which there are 10. We found that each publisher has one archival policy, as shown in Table 1, which applies to all of its journals in our dataset.

Table 1

Archival Policies per Publisher as per Sherpa RoMEO

Publisher	RoMEO archival
IGI Global	Blue
Elsevier Ltd	Green
Emerald Group Publishing Ltd	Green
Informa/Taylor & Francis	Green
Kluwer Academic Publishers	Green
Inderscience Enterprises	Yellow
Wiley-Blackwell	Yellow
Springer Nature	Green
IEEE Education Society	Green
Ovid Technologies (Wolters Kluwer Health)	Not found

When the RoMEO policies of the publisher are examined for the green access articles there is a correlation between the most permissive policy (green) and slightly higher rates of green access. This is shown in Table 2. There is a negative correlation between green access and the blue archival policy and similarly low rates of green access where archival is not formally supported by the journal (though notably there are 16 articles appearing in a category where archival is not formally supported by publisher policy). This relationship is significant ($\chi 2$ [1, N = 8478] = 17.60, p = .00053).

Table 2

Proportion of Green Access Versions of Articles and Corresponding Sherpa RoMEO Archival Policies of Their Publishing Journals

	Green	Yellow	Blue	No policy	Total
Green access	601	146	22	16	785
Not green	5735	1256	416	286	7693
Total	6336	1402	438	302	8478

Gold Access Costs

Table 3 shows the APC charge per article which authors can pay to make their article available immediately from the publisher website via gold open access. There is a narrow range of APC costs with the lowest being $1,100 and the highest $3,200.

Table 3

APC per Journal as of 2018

Journal	Publisher	APC
Journal of Computer Assisted Learning	Wiley-Blackwell	$3,200
Government Information Quarterly	Elsevier	$1,100
Internet and Higher Education	Elsevier	$1,800
Computers and Education	Elsevier	$1,950
Reference Services Review	Emerald Group Publishing	$2,650
Transforming Government: People, Process, and Policy	Emerald Group Publishing	$2,650
IEEE Transactions on Learning Technologies	IEEE Education Society	$1,950
International Journal of Distance Education Technologies	IGI Global	$1,500
International Journal of Electronic Government Research	IGI Global	$1,500

International Journal of Mobile and Blended Learning	IGI Global	$1,500
Electronic Government	Inderscience Enterprises	$2,550
International Journal of Mobile Learning and Organisation	Inderscience Enterprises	$2,550
Learning Environments Research	Kluwer Academic Publishers	$3,000
The Journal of Continuing Education in the Health Professions	Kluwer Academic Publishers	$2,650
Open Learning	Informa/Taylor & Francis	$2,590
American Journal of Distance Education	Informa/Taylor & Francis	$2,950
College and Undergraduate Libraries	Informa/Taylor & Francis	$2,950
Distance Education	Informa/ Taylor & Francis	$2,950
Information Technology for Development	Informa/Taylor & Francis	$2,950
Interactive Learning Environments	Informa/Taylor & Francis	$2,950
International Journal of Lifelong Education	Informa/Taylor & Francis	$2,950
Internet Reference Services Quarterly	Informa/Taylor & Francis	$2,950
Journal of Library and Information Services in Distance Learning	Informa/Taylor & Francis	$2,950
New Review of Academic Librarianship	Informa/Taylor & Francis	$2,950
International Review of Education	Springer Nature	$3,000
Education and Information Technologies	Springer Nature	$3,000
International Journal of Artificial Intelligence in Education	Springer Nature	$3,000
Journal of Continuing Education in the Health Professions	Wiley-Blackwell	$2,100
British Journal of Educational Technology	Wiley-Blackwell	$3,000

Most publishers also had one APC charge across all journals, but some had different charges per journal, therefore we used an average of these per publisher to get an overall picture at publisher level as summarized in Table 4 below.

Table 4

APC per Publisher as of 2018

Publisher	Average APC
IGI Global	$1,500
Elsevier	$1,617
Emerald Group Publishing	$2,650
Informa/Taylor & Francis	$2,950
Kluwer Academic Publishers	$3,000
Inderscience Enterprises	$2,550
Wiley-Blackwell	$3,100
Springer Nature	$3,000
IEEE Education Society	$1,950
Ovid Technologies (Wolters Kluwer Health)	$2,650

Using the above data, we can estimate the approximate total fees paid by authors to publishers to make their articles gold access. Table 5 below shows the estimated APCs paid to journals which totals $364,850.

Table 5

Estimated Total APCs per Journal

Journal	Gold OA articles	Estimated APCs paid
Education and Information Technologies	27	$81,000
Learning Environments Research	13	$39,000
International Review of Education	8	$24,000

International Journal of Artificial Intelligence in Education	4	$12,000
Information Technology for Development	12	$35,400
Open Learning	7	$20,650
Interactive Learning Environments	6	$17,700
Distance Education	3	$8,850
International Journal of Lifelong Education	3	$8,850
New Review of Academic Librarianship	2	$5,900
College and Undergraduate Libraries	1	$2,950
Internet Reference Services Quarterly	1	$2,950
Computers and Education	28	$54,600
Government Information Quarterly	11	$12,100
Internet and Higher Education	3	$5,850
British Journal of Educational Technology	8	$24,000
Journal of Computer Assisted Learning	2	$6,400
Transforming Government: People, Process and Policy	1	$2,650
Total	140	$364,850

If we group journal by publisher, we can see how these estimated APC costs were paid to each of five publishers. This is shown in Figure 3 below.

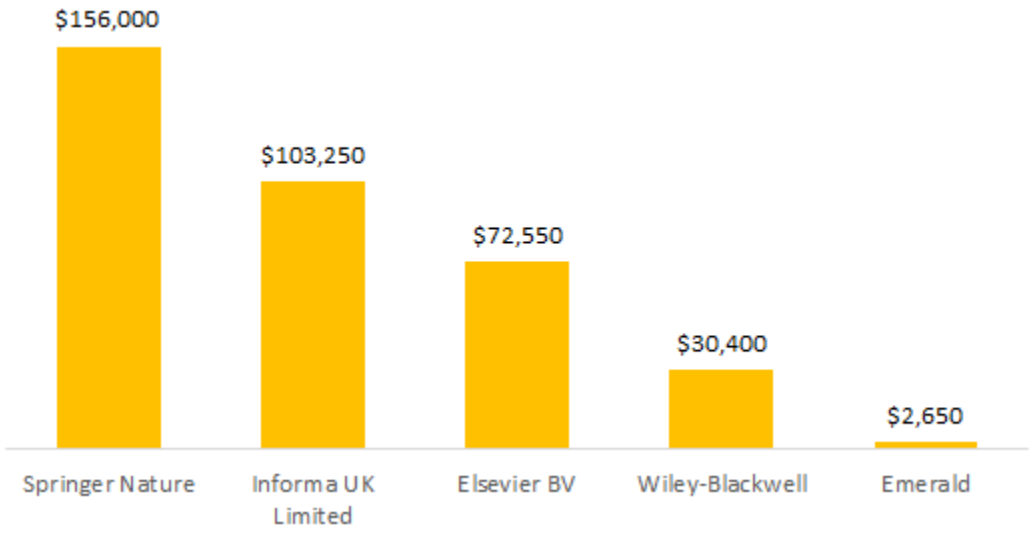

Figure 3. Estimated total APCs paid per publisher 2010 – 2017.

Finally, we multiplied the APC cost that each journal advertises to authors by all of the articles published in that journal in the dataset. This gives us a hypothetical potential total cost if all of the authors had availed of the option to make their articles gold access by paying an APC. There are a number of issues with this calculation as we discuss later, but it has some indicative value. This calculation produces a figure of $21,099,750. Figure 4 below shows this hypothetical estimated cost by publisher.

Figure 4. Hypothetical potential total APC cost.

Search Evaluation

There was a disparity in outputs between the searches we employed. Although Scopus provides copious and well-structured article metadata it did not find all of the open access articles which we found via manual and Unpaywall searches. The manual and Unpaywall searches indicated 64 more open access articles than Scopus. The journals with the greatest differentials were: Information Technology for Development (-12); Learning Environments Research (-9); Open Learning (-7) and British Journal of Educational Technology (-6).

Discussion

Our manual and Unpaywall searches highlight that gold open access levels are underreported by Scopus. This is worth noting, as some previous reports that have relied solely on Scopus, will likely have understated the true level of open access.

We have used the term temporary access in order to provide a clear technical impression of the nature of articles that appear with the word “free” on journal websites. We noted that several of the temporary access articles we discovered during the manual search, had soon after disappeared back behind paywalls. This was starkly confirmed when we compared those articles classified as temporary access we had found, with those reported by Unpaywall, as our manual search only found 15 of the 111 from Unpaywall. In other words, we surmise that 96 articles were no longer freely available to read and had reverted behind paywalls.

Snapshots from Unpaywall may give a misleading impression as to the true accessibility of these articles. There are few certainties when attempting to quantify the prevalence of this article type. Technically, it is only true to say that such articles have been freely accessible *at some point in time*. Essentially, they are only accessible for as long as the publisher wishes. They may very well be used to opportunistically drive traffic to a journal website. Ultimately, they can be used to gain readers and citations for a journal, but the journal can cut access at any time. The journal publisher hence continues to charge subscriptions to institutions, and users, who need reliable access to all of the journal articles. To return to Anderson's (2013) example of using articles as OER in educational scenarios, it is clear we cannot use these articles as they are not true open access articles. We cannot download and share them, and nor can they even be reliably linked to. They fail to meet most of the 5 Rs of open access (Hilton, Wiley, Stein, & Johnson, 2010; Wiley, 2014) in particular the 5th R which is the right to "retain" a given work. Given the potential issue with the bronze metaphor, we suggest the mineral pyrite, and the term "pyrite access" instead of bronze for this article access type. Pyrite is also known as fool's gold, a base metal that gleams like gold and may beguile casual observers with its false promise. We are currently tracking these articles to see how their availability changes over time as a topic of future research.

APCs can change over time, so our estimates have some potential for error. However, we did find that the APCs are clustered within a tight range of prices. Hence our hypothetical cost to authors are indicative. We report prices in US dollars but many publishers have variable pricing and indeed some have various types of waiver for scholars from developing countries or who cannot pay full prices. Hence, we are reporting the maximum possible cost. Further, there is some limited but growing fight back from academic institutions against so called "double dipping" from publishers, whereby institutions are charged a subscription to a journal but authors are then charged a fee to publish open access in the journal (Earney, 2017; Pinfield, Salter, & Bath, 2017). Hence, waivers have been negotiated in some cases for authors or a reduction, known as offsetting, in the subscription fee for institutions (Earney, 2017; Pinfield et al., 2017). However, this is not widespread and if anything serves to highlight how complex this topic is, and the subsequent difficulty academics and institutions face in attempting to negotiate with what have been termed "oligopolistic publishers" (Larivière et al., 2015).

It is known that green access levels are underreported. The developers of the Unpaywall dataset acknowledge that they are always underreporting the true level of green access (Piwowar et al., 2018). They do not have access to every institutional repository (even though have an index of 50,000 resources and growing) and avoid considering academic social networking sites—understandably as have been deemed sites of "black open access," for the amount of content they contain that breaches copyright (Björk, 2017). Nonetheless, it is fair to assume that a vast swathe of articles in the journals we analyzed remain closed but could effectively be freed as green versions. We have highlighted that, according to the policies of all but one journal in the dataset, authors have the option of archiving a green version of their paper for free. Scholars need to be better educated about archiving green versions of their papers, to encourage them to make their articles available in this way. Fears that scholars may have about green access, such as whether their works will be indexed or cited, can be mitigated through better explaining, and indeed busting some of the myths surrounding open scholarly publishing (Tennant et al., 2019). Although the value of making work more openly and freely available may seem self-evident to many, to others there is the incentive of the hypothesised Open Access Citation Advantage (OACA). Piwower et al.'s (2018) study found evidence to

suggest that open access articles are cited more often than closed ones, and although there is much debate about this phenomenon, increasing evidence points in this direction (Lewis, 2018).

More work is needed to try to understand the open access scholarly publishing literacies of scholars in this area. Björk and Holmström (2006) proposed a framework of a "net value of submission" comprised of factors that scholars consider when making choices about where to submit their work. This model comprises 29 factors aggregated into four groups: infrastructure, readership, prestige, and performance. Level of performance is one of the most important of the 29 factors whilst article processing charge cost is one of the few negative factors. Openness of journal has been considered relatively unimportant to authors in where they chose to submit (Björk & Holmström, 2006). The perceived quality/prestige, and the fit for the manuscript are generally considered most important (Björk & Holmström, 2006). Additionally, some recent research indicates that peers may be influential in nudging scholars towards open access (Heaton, Burns, & Thoms, 2019). Most research in this area has concentrated on fully gold open access journals (Solomon & Björk, 2012) and less attention has been paid to hybrid journals which have been the focus of this research. Moreover, there is no research on the practices and beliefs of educational technology researchers regarding green and hybrid gold publishing, though one study examined scholars perceptions of fully open access journals where respondents reported that their perception of journal quality did not directly correlate with traditional rankings (Perkins & Lowenthal, 2016). Hence, further research is required to explore what factors are important for educational technology researchers who publish in hybrid journals and how they pay the associated charges. Finding out more about their beliefs and practices should help scholars in the field better understand open access publishing and increase awareness of the associated issues. This is the focus of a follow up study we are conducting.

Scholars may be under increasing pressure to publish in prestigious closed and hybrid journals. Better education of scholars in how they can publish pre and post prints of their work is important. We have highlighted the low levels of green versions of articles here. On the other hand, we found 16 articles that may have been distributed in contravention of publisher policies. A study of Researchgate and Academia.edu found high levels of scholars (wittingly or otherwise) breaching publisher policies by uploading versions of papers prohibited by the publisher agreements (Jamali, 2017). Authors suffer two problems: breaching publisher policies when attempting to archive their work, and not taking full advantage of what is allowed by publishers in terms of archiving and sharing their work; consequently, they either overshare or undershare their work (Jamali, 2017).

Green access open publishing is complex, being described by Smith (2017) as a "piecemeal approach to openness" (p. 6). So much so that we argue that we need to develop a literacy of open access scholarship. The potential Open Access Citation Advantage might spur scholars in this direction; however, there may be other motivators. We have highlighted the vast sea of educational technology research locked behind paywalls. Hence, we must also appeal to scholars' intrinsic motivations. Why are we depriving readers of this published research? How can we enable access to those without the privilege afforded by expensive institutional subscriptions to journals that many academics enjoy? The total cost of publishing all of this research via APC as we have highlighted may be prohibitive. Green access publishing is complex but free. Moreover, we have not even touched on the fully open access journals in the field available to scholars, which, although not as numerous as their hybrid counterparts, nonetheless are an uncomplicated gold open

access outlet, many of which do not charge APCs. Research indicates that scholars in this area as a whole publish in multiple journal types (Weller, Jordan, DeVries, & Rolfe, 2018) so a multifaceted strategic approach to addressing the problem may be needed.

The large potential total APC costs we have highlighted may serve to give scholars in the field pause for thought. Is this a sustainable model and how would such APC costs be borne? The main contribution we seek to make with this research is to cause scholars to critically reflect on the role of publishers and scholars, but ultimately readers. Open access benefits readers most, and there is a much larger constituency of readers than authors. Accordingly, we should strive as a community to make the most literature available to the greatest readership possible. There is an imperative for scholars, as a community, not to leave our work in an "intellectual periphery" (Canagarajah, 2002, p. 207) but rather to ensure its accessible place in the domain of human knowledge.

Conclusion

This study has sought to shine a light on the publishing patterns of scholars regarding open access in prestigious hybrid access journals in the area of educational technology research. In doing so it has addressed a gap in the scholarly understanding of author publication patterns in this area regarding gold, green, and limited access. Our research has found low levels of open access publishing. In providing this evidence, and suggesting possible reasons, we hope to stimulate critical debate amongst the scholarly community in this area around how they publish and disseminate their academic work. Ultimately, we hope that this debate will result in more research on the interplay between technology and education being made available to more readers who can thus benefit from it.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Designing a Community of Inquiry in Online Courses

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Abstract

This article describes a practical approach for implementing instructional strategies in order to build a Community of Inquiry (CoI) into an online course. Online community building has positive effects on the quality of student learning, increases student engagement, and encourages motivation of students in online courses. The CoI is a theoretical framework focusing on facilitating meaningful learning experiences through three presences: cognitive presence, social presence, and teaching presence. This article will introduce the CoI framework by way of literature review focusing on CoI instructional strategies. Using Sorensen and Baylen's (2009) seven principles of good practice, the author will structure CoI instructional activities into presence categories for practitioner use.

Keywords: community of inquiry, online learning, instructional strategies, sense of community, collaborative learning, distance education

Introduction

One of the most widely used frameworks for building communities online is the Community of Inquiry (CoI) theoretical framework developed by Garrison, Anderson, and Archer (2000). Applying the CoI framework as a lens, the purpose of this article is to provide a collection of CoI instructional strategies based in cognitive presence, social presence, and teaching presence (Garrison, Anderson, & Archer, 2000), for practitioners (instructors, online course developers, instructional designers) to use in online courses. This collection of CoI instructional strategies is built using Sorensen and Baylen's (2009) seven principles of good practice. Garrison and Arbaugh (2007) indicated the need for practical strategies and guidelines for how to facilitate presence from a real-world pedagogical perspective as a future area for CoI research. This article hopes to fill this void.

Community and CoI Framework

History of CoI

Grounded in John Dewey's (1938) view of practical inquiry, Garrison et al. first introduced the Community of Inquiry (CoI framework) in 2000 (as cited in Swan & Ice, 2010). With inquiry and community at the core of his philosophy, Dewey believed individual development was dependent upon community (Swan, Garrison, & Richardson, 2009). "Community," a word used copiously in educational research, is often used to refer to the cognitive or emotional connections established between physically separated learners. A broad construct of community has been defined by McMillan and Chavis (1986) as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (p. 9). Wang, Laffey, and Poole (2001) argue that community can result from shared knowledge among online learners, and this online community is especially important as Rovai (2000) stated, "strong feelings of community increase the flow of information, the availability of support, commitment to group goals, cooperation among members, and satisfaction with group efforts" (p. 286).

CoI in Online Learning Environments

The literature specifically advocates that within online environments, interaction between learners is of great importance to student success (Akyol & Garrison, 2008; Arbaugh, 2008; Richardson, Maeda, Lv, & Caskurlu, 2017). The CoI framework that highlights three core elements –cognitive presence, social presence, and teaching presence – is used to create a meaningful educational experience (Garrison et al., 2000). These presences are interdependent as depicted in Figure 1. The CoI framework assumes that effective online learning, particularly higher order learning, is dependent on the development of a community (Swan et al., 2009). Since its publication in 2000, researchers have suggested additions to the original framework in terms of presences, dimensions, and influences (Kozan & Caskurlu, 2018; Peacock & Cowan, 2016). This article will focus on three original presences as defined by Garrison et al. (2000). For additions to the CoI framework, refer to Kozan and Caskurlu (2018) and Peacock and Cowan (2016). The three presences of the CoI framerwork as discussed in this article are multidimensional, but in order to understand how they work collectively we must examine them individually.

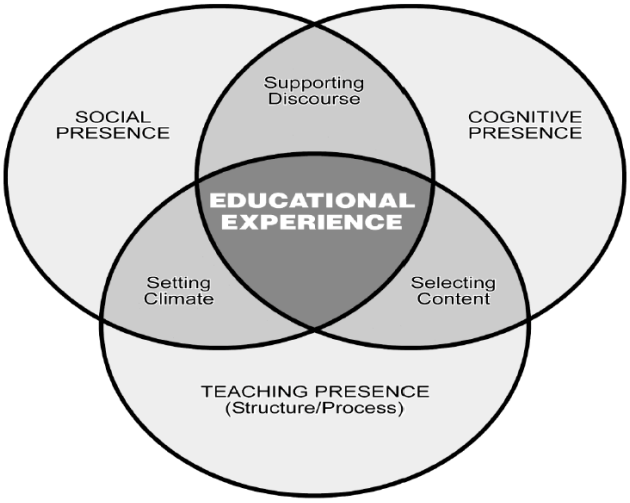

Figure 1. Community of inquiry framework. From "Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education," by D. R. Garrison, T. Anderson, and W. Archer, 2000, *The Internet and Higher Education, 2*, p. 88. Copyright 2000 by Elsevier Science Inc. Reprinted with permission.

Cognitive Presence

Cognitive presence, the ability to construct and confirm meaning through sustained reflection (Anderson, Rourke, Garrison, & Archer, 2001), is demonstrated in the Practical Inquiry Model (PIM) created by Garrison et al. (2000) and depicted in Figure 2. The PIM includes four phases: (1) a triggering event, where a problem is identified for further inquiry; (2) exploration, where an individual explores the issue; (3) integration, where learners concept meaning from ideas formed in the exploration phase; and (4) resolution, where students can apply the new skills and knowledge learned from the previous phases into real-world application(s) (Garrison et al., 2000). Reflection is a key aspect of the CoI framework and helps learners to increase their cognitive presence as Redmond (2014) states, "reflecting on learning content and outcomes relates to knowledge acquisition where learners identify their increased knowledge and skills in the subject area" (p. 50).

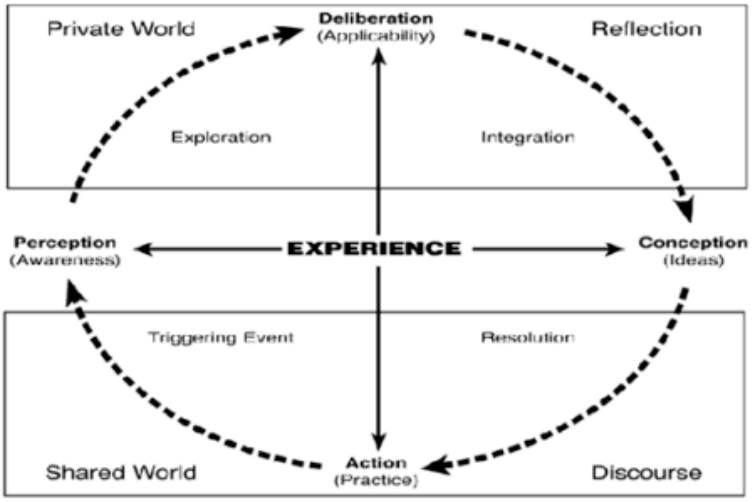

Figure 2. Practical inquiry model. From "Online Community of Inquiry Review: Social, Cognitive, and Teaching Presence Issues," by D. R. Garrison, 2007, *Journal of Asynchronous Learning Networks, 11*, p. 63. Copyright 2007 by ERIC. Reprinted with permission.

Social Presence

According to Lowenthal and Lowenthal (2010), "social presence is a theory that explains the ability of people to present themselves as 'real people' through a communication medium. Most studies on social presence focus on how students present themselves and/or are perceived as 'real' people online" (p. 1). Garrison et al. (2000) determined three categories of social presence indicators. These categories are: (1) emotional (affective) expression, where learners share personal expressions and values; (2) open communication, where learners develop aspects of mutual awareness and recognition; and (3) group cohesion, where learners build and sustain a sense of group commitment (Garrison et al., 2000). A study conducted by Richardson and Swan (2003) found that social presence positively affects student and instructor course satisfaction. During the study, a relationship between social presence and perceived learning was identified; students who perceived high social presence learned more than those who perceived low social presence (Richardson & Swan, 2003).

Teaching Presence

Garrison and colleagues describe teaching presence as the design, facilitation, and direction of cognitive and social processes to support learning (Garrison & Arbaugh, 2007; Garrison et al., 2000). Teaching presence has three components: (1) instructional design and organization (e.g., setting curriculum, designing methods, etc.); (2) facilitating discourse (e.g., setting course climate, acknowledging or reinforcing student contributions, etc.); and (3) direct instruction (e.g., summarizing the discussion, presenting content/questions, etc.; Anderson et al., 2001).

CoI Instructional Activities in Practice

While the presences are important, they are of no use to instructors or instructional designers without guidance on how to foster them in online environments. For the purpose of this article, an instructional strategy refers to a method or activity used to help learners achieve a learning objective (Wolfe, 2010). Instructional strategies for each presence will be discussed in the next section of this review.

Cognitive Presence and Course Design

Instructional cognitive presence strategies include having students self-select topics they are curious about within the topic being taught, facilitating critical analyzation discussions (role-playing discussions), creating course rules to allow for an open environment for different perspectives, and encouraging students to share with each other resources related to the course topic (Richardson, Ice, & Swan, 2009).

Improving cognitive presence in online courses can be done by focusing on the four phases of the PIM (triggering event, exploration, integration, and resolution; Garrison et al., 2000). However, what do these instructional activities look like? Triggering event items must provide learners with activities related to the inquiry process; exploration activities should focus on allowing students to brainstorm, discover, and openly discuss problems in an environment that supports such learning; and instructional activities developed around reflection and integration of ideas fall into the integration stage (Richardson et al., 2010). According to Garrison, Cleveland-Innes, and Fung (2010) moving through the four domains of PIM, learners are “in an environment of reflection and discourse; analysis and synthesis” (p. 32) and thus reflection and the practice of staying engaged throughout the process enables movement toward the resolution phase.

Social Presence and Course Design

In a study conducted by Tu and McIsaac (2002), a link between the development of online social presence with course design was presented via trust building, “hand-holding” technical support, and promoting informal relationships; and, the authors argued that the dimension of social presence should be taken into consideration during course development. Course design elements used to support social presence (emotional affective) expressions, open communication, and group cohesion include personal profiles and photos, welcome messages, student profiles, limiting class size, structured learning activities, and activities in which students can incorporate feelings and personal experiences (Richardson et al., 2017).

When designing specifically for emotional (affective) expressions, activities should encourage initial and introductory content that helps develop trust and interactions among peers (Richardson et al., 2010). Creating course rules (i.e., netiquette), encouraging or requiring participation in discussions, and allowing opportunities for both peer-to-peer and peer-to-instructor connections (e.g., journals, blogs, and discussion) will allow for open lines of communication (Richardson et al., 2010; Stephens & Roberts, 2017). For group cohesion, activities should include problem solving tasks, collaborative projects, and small group discussions that allow for the integration of community building (Richardson et al., 2010).

Teaching Presence and Course Design

It is the instructor's role to create a narrative story or path through the course design and course content when using CoI as a foundation for effective course design (e.g., "This week we will be discussing," "I am going to divide you into groups," "I think Stephanie said it best"; Anderson et al., 2001). While many research studies focus on the role of teaching presence in online discussion forums, we must not exclude how an instructor's presence can be established in other aspects of the course (i.e., course announcements, weekly overviews, feedback to students or student groups, or design of assignment and course activities).

The instructional design and organization components are those items developed prior to the start of the course. By creating mini lectures (audio/video), embedding personal insight in course material, and providing scaffolding on how the course structure helps the learners, an instructor can plan for establishing a teaching presence (Richardson et al., 2010). Facilitating discourse (active teaching) calls for instructors to review student comments, move discussions forward, and check for accurate student understanding (Richardson et al., 2010). Lastly, direct instruction activities include giving detailed feedback to the learner as the content expert (Richardson et al., 2010).

Designing for Community of Inquiry

The previous section discussed different methods to implement CoI strategies into course design. Current CoI strategies are summarized in Table 1 for practitioners who wish to create an effective and meaningful online community. While online discussion can be invaluable for building online community, it can be ineffective if designed poorly. The same can be said of all strategies complied in Table 1. The table presented in this paper is needed in the field because the CoI framework does not provide specific instructional guidelines for implementation as a descriptive model. For ease of use, the author decided to align CoI instructional strategies with Sorensen and Baylen's (2009) online guidelines.

Sorensen and Baylen's Format

Sorensen and Baylen (2009) adapted Chickering and Gamson's (1987) widely cited "Seven Principles of Good Practice for Undergraduate Education," applying the guidelines to improve online student experiences. Newlin and Wang (2002) conducted a study implementing Chickering and Gamson's (1987) seven principles in online instruction; the study showed community collaboration was essential to the effective implementation of the principles. Ehrmann (2002), who has collaborated with Sorensen and Baylen, noted that Chickering and Gamson's (1987) seven principles, "seem equally important for all kinds of learners (and faculty) in all kinds of situations" (para. 1). However, in 2009, Sorensen and Baylen decided Chickering and Gamson's (1987) original seven principles were not enough to meet the needs of faculty who were new to teaching in online environments. Therefore, with help from faculty members across the country, the seven principles were adapted with adult learning theory in mind (Sorensen & Baylen, 2009). Sorensen and Baylen's (2009) final principles, which parallel Chickering and Gamson's principles, include:

1. Student-teacher contact, a principle focusing on the interaction between a student and instructor in an online environment;

2. Cooperation among students, a principle for effective teaching focusing on cooperation among students;

3. Active learning, a principle emphasizing the importance of students to engage in meaningful learning activities and reflection on the process;

4. Prompt feedback, a principle focusing on giving guidance and feedback to ensure students are on the right track in terms of meeting course learning objectives;

5. Time on task, a principle concentrating on giving students assistance and guidance for managing their time in an online environment;

6. Communicate high expectations, a principle based on the theory that when instructors communicate to their students about high expectations for the course, students will aim to meet these expectations; and

7. Respect diverse ways of learning, a principle ensuring instructors are developing and implementing a wide variety of instructional strategies to meet the diverse population of students (p. 71).

Summary of Instructional Activities for CoI

Given these principles, the author of this paper combined the frameworks (seven principles and CoI) to create a working document of CoI instructional strategies for practitioners and online instructors (Table 1). Literature selected for this study met the following criteria: must be an empirical study published in a peer-reviewed journal, instructional strategy(ies) must confirm a positive impact or growth on student learning or student perception of online community, is less than 20 years old, and did not include a specific technology in the testing (e.g., PowToon, Skype, MySpace). Articles with duplicate findings or instructional strategies were omitted and excluded from the table.

Table 1

Summary of Instructional Activities for CoI

Seven principles of good practice for the online environment	CoI framework presences	Instructional activities
Student-teacher contact	Social presence	• Create a "Meet Your Classmates" section of your course where you and students introduce yourselves to one another (Richardson, Ice, & Swan, 2009). • Develop initial course activities (e.g., ice breakers) to encourage the development of swift trust (Peacock & Cowan, 2016; Richardson et al., 2009). • Model and encourage the use of verbal immediacy behaviors in interactions with students (Richardson et al., 2009). • Encourage students to share experiences and beliefs in online discussion (Richardson et al., 2009). • Encourage and support vicarious interaction (Richardson et al., 2009). • Use short videos of yourself to introduce the course and particular topics (Richardson et al., 2009; Seckman, 2018).

		• Consider including real time communications using applications such as chat, collaborative whiteboards, interactive video, text, or virtual messaging (Lowenthal & Dunlap, 2018; Richardson et al., 2009; Seckman, 2018). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Richardson et al., 2009; Stephens & Roberts, 2017). • Work within teams but change roles amongst students (Richardson et al., 2009). • Explicitly introduce students to the importance of student-to-student interaction (Stewart, 2017). • When possible, have course sizes with a smaller student-instructor ratio (Rovai, 2000). • Consider conducting one-on-few coaching and mentoring; online course orientations (Lowenthal & Dunlap, 2018; Rovai, 2000). • Have dedicated discussion for course introductions to help build a sense of community (Rovai, 2000). • Provide opportunities for student and teacher profiles within learning management system (Lowenthal & Parscal, 2008). • Incorporate audio and video within the course content (Lowenthal & Parscal, 2008; Seckman, 2018). • Share personal stories, professional experiences, and use emoticons (Lowenthal & Parscal, 2008). • Address students by name (Lowenthal & Parscal, 2008). • Make many human connections early in the course to ensure all students feel comfortable communicating with you and each other (Dunlap & Lowenthal, 2018).
	Cognitive presence	• Use content and process scaffolds to support discourse behaviors (Richardson et al., 2009). • Reflect on student-teacher interactions (Redmond, 2014).
	Teaching presence	• Provide frequent opportunities for both public and private interactions with students (Richardson et al., 2009). • Design diverse, graded activities to be completed every week (Richardson et al., 2009). • Explicitly introduce students to the importance of student-to-student interaction (Stewart, 2017). • Prepare for timely return of assignments and prompt response to students in email, chat, or discussion (Watson, Bishop, & Ferdinand-James, 2017). • Be active in discussion boards; however, be aware that posting instructor ideas too soon can stop student discussion (Watson et al., 2017). • When possible, have course sizes with a smaller student-instructor ratio (Rovai, 2000). • Limit class size (Lowenthal & Parscal, 2008). • Promptly answer email (Lowenthal & Parscal, 2008). • Show your character; personality is a good thing (Dunlap & Lowenthal, 2018). • Have a sense of humor and share it if and when appropriate (Dunlap & Lowenthal, 2018).
Cooperation among students	Social presence	• Develop initial course activities (e.g., ice breakers) to encourage the development of swift trust (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Model and encourage the use of verbal immediacy behaviors in interactions with students (Richardson et al., 2009). • Encourage students to share experiences and beliefs in online discussion; show multiple perspectives (Richardson et al., 2009; Stephens & Roberts, 2017).

		• Make participation in discussion a significant part of course grades (Richardson et al., 2009). • Require discussion participants to respond to their classmates' postings and/or to respond to all responses to their own postings (Richardson et al., 2009). • Have students serve as experts (e.g., lead a discussion; Richardson et al., 2009). • Encourage and support vicarious interaction (Richardson et al., 2009). • Use tracking mechanisms to reward reading as well as responding to messages (Richardson et al., 2009). • Design community building activities; allow students to rename generic groups for personalization (Richardson et al., 2009; Stephens & Roberts, 2017). • Design collaborative activities – problem solving tasks, projects, small group discussions (Richardson et al., 2009). • Consider including real time communications using applications such as chat, collaborative whiteboards, interactive video, text or virtual messaging (Lowenthal & Dunlap, 2018; Richardson et al., 2009; Seckman, 2018). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Work within teams but change roles amongst students (Richardson et al., 2009). • Explicitly explain to students to the importance of student-to-student interaction so that they can view classmates' perspectives as valuable (Stewart, 2017). • Create areas where students can communicate with each other (class email, student discussion tab, virtual social café, etc.; Peacock & Cowan, 2016; Stewart, 2017). • Use group discussion, group brainstorming sessions, and journaling/blogging to encourage reflective observation (Dunlap, Verma, & Johnson, 2016). • Establish an appropriate social climate for in-group and cross-group communication that contributes to cultivating learning experiences (Stephens & Roberts, 2017; Szeto, 2015).
	Cognitive presence	• Encourage experimentation, divergent thinking, and multiple perspectives in online discussion through provocative, open-ended questions (Richardson et al., 2009). • Model, support, and encourage diverse points of view in online discussion (Richardson et al., 2009; Stephens & Roberts, 2017). • Use content and process scaffolds to support discourse behaviors (Richardson et al., 2009). • Use peer review of discussion postings to shape responses (Richardson et al., 2009; Stephens & Roberts, 2017). • Allow areas (discussions, blogs, wikis, virtual café, and journals) where students can hear other students' intellectual property (their own ideas; Peacock & Cowan, 2016; Stewart, 2017). • Provide student's views and comments in conversations (matching students with similar ideas; Stewart, 2017). • Use group discussion, group brainstorming sessions, and journaling/blogging to encourage reflective observation (Dunlap et al., 2016). • Construct a formative assessment scheme for peer-supported learning that enhances both the student learning and instructor teaching experiences (Szeto, 2015). • Provide opportunities for higher order learning and experiential learning to engage students (Dunlap & Lowenthal, 2018). • Reflect on group work or peer-supported learning experiences (Redmond, 2014).
	Teaching presence	• Restrain from being overly "present" in online discussions, rather facilitate student interaction (Richardson et al., 2009).

		• Apply collaborative learning principles to support small group discussion and collaborative projects (Richardson et al., 2009). • Be active in discussion boards; however, be aware that posting instructor ideas too soon can stop student discussion (Watson et al., 2017). • Establish an appropriate social climate for in-group and cross-group communication that contributes to cultivating learning experiences (Stephens & Roberts, 2017; Szeto, 2015). • Structure collaborative learning activities (Lowenthal & Parscal, 2008). • Use group work strategies (Lowenthal & Parscal, 2008). • Contribute to discussion forum throughout the week (Lowenthal & Parscal, 2008). • Use collaborative group projects to have students work on topics of their own choosing that still meet learning objectives of the course (Dunlap & Lowenthal, 2018).
Active learning	Social presence	• Make participation in discussion a significant part of course grades (Richardson et al., 2009). • Require discussion participants to respond to their classmates' postings and/or to respond to all responses to their own postings (Richardson et al., 2009). • Make students responsible for sustaining discussion threads (Richardson et al., 2009). • Make students summarize discussion threads (Richardson et al., 2009). • Have students serve as experts (e.g., lead a discussion; Richardson et al., 2009). • Require students to incorporate materials from the discussions in their assignments (Richardson et al., 2009). • Use tracking mechanisms to reward reading as well as responding to messages (Richardson et al., 2009). • Journal or otherwise interact with your students on an individual and personal basis (Richardson et al., 2009). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Incorporate audio and video within the course content (Lowenthal & Parscal, 2008; Seckman, 2018). • Let students post video responses, use apps like screencasting (Dunlap & Lowenthal, 2018; Seckman, 2018).
	Cognitive presence	• Identify big ideas you want students to take away from your course and develop major course activities around their assessment (Richardson et al., 2009). • Identify important knowledge, skills, and attitudes students should learn and develop additional course activities around their assessment (Richardson et al., 2009). • Provide multiple representations of the knowledge you want students to learn and multiple activities for practicing desired skills (Richardson et al., 2009). • Encourage experimentation, divergent thinking, and multiple perspectives in online discussion through provocative, open-ended questions (Richardson et al., 2009; Stephens & Roberts, 2017). • Require discussion summaries that identify steps in the knowledge creation process (Richardson et al., 2009). • Use peer review of discussion postings to shape responses (Richardson et al., 2009; Stephens & Roberts, 2017). • Use online discussion and writing activities to support conceptual learning and divergent thinking (Richardson et al., 2009). • Use self-testing, practice assignments, simulations, and other interactive activities to support skill development and convergent thinking (Richardson et al., 2009).

		• Develop grading rubrics for discussion and course activities that reward desired cognitive behaviors (Richardson et al., 2009). • Develop general learning modules with opportunities for active learning, assessment, and feedback that can be shared among courses and/or accessed by students for remediation or enrichment (Richardson et al., 2009). • Developing discussions about students' intellectual property (their own ideas; Stewart, 2017). • Allow areas (discussions, blogs, wikis, virtual café, and journals) where students can hear other students' intellectual property (their own ideas; Peacock & Cowan, 2016; Stewart, 2017). • Involve students with video, case studies, labs, stories, simulations, and games (Dunlap et al., 2016). • Provide video/audio lectures, have students complete readings, write position papers, and model building (Dunlap et al., 2016; Seckman, 2018). • Provide students opportunities where they can complete projects and simulations, engage in service learning and fieldwork (Dunlap et al., 2016). • Develop student- or teacher-led discussion groups, debates, projects, and collaborative learning groups (Rovai, 2000). • Model higher-order thinking by frequently asking questions that probe students' knowledge (Rovai, 2000). • Develop open-ended critical thinking discussion questions (Lowenthal & Parscal, 2008). • Incorporate reflective activities (Lowenthal & Parscal, 2008). • Let students create and post materials, search out and post resources (Dunlap & Lowenthal, 2018).
	Teaching presence	• Explicitly introduce students to the unique nature and learning potential of online discussion (Richardson et al., 2009). • Restrain from being overly "present" in online discussions, rather facilitate student interaction (Richardson et al., 2009). • Apply collaborative learning principles to support small group discussion and collaborative projects (Richardson et al., 2009). • Clearly state course goals and instructional expectations (Richardson et al., 2009). • Provide a detailed course schedule including due dates for all assignments (Richardson et al., 2009). • Provide clear grading guidelines including rubrics for complex assignments (Richardson et al., 2009). • Clearly explain to students that course participation is not only a requirement, but a graded component of the course (Rovai, 2000). • Use continuous and authentic assessment strategies (Lowenthal & Parscal, 2008). • Create opportunities for students to solve their problems (Dunlap & Lowenthal, 2018).
Prompt feedback	Social presence	• Use audio/video to embed feedback on assignments within them (Lowenthal & Dunlap, 2018; Richardson et al., 2009). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Personalized feedback; one-to-one emails (Lowenthal & Dunlap, 2018). • Walk-through or how-to screencasts/videos regarding specific feedback (Lowenthal & Dunlap, 2018). • Use of phone calls (Lowenthal & Dunlap, 2018). • Use peer review for relationship building (Lowenthal & Dunlap, 2018).

	Cognitive presence	• Use peer review of discussion postings to shape responses (Richardson et al., 2009; Stephens & Roberts, 2017). • Develop grading rubrics for discussion and course activities that reward desired cognitive behaviors (Richardson et al., 2009) . • Provide frequent opportunities for testing and feedback (Richardson et al., 2009). • Automate testing and feedback when possible (Richardson et al., 2009). • Develop general learning modules with opportunities for active learning, assessment, and feedback that can be shared among courses and/or accessed by students for remediation or enrichment (Richardson et al., 2009). • Use peer evaluations in the form of feedback (Rovai, 2000; Stephens & Roberts, 2017). • Construct a formative assessment scheme for peer-supported learning that enhances both the student learning and instructor teaching experiences (Stephens & Roberts, 2017; Szeto, 2015). • Provide relevant individual and group feedback in a timely manner; feedback is essential, and be specific in your feedback (Dunlap & Lowenthal, 2018).
	Teaching presence	• Provide frequent opportunities for both public and private interactions with students (Richardson et al., 2009). • Provide students with timely and supportive feedback, personalized feedback, one-to-one emails (Lowenthal & Dunlap, 2018; Richardson et al., 2009). • Design diverse, graded activities to be completed every week (Richardson et al., 2009). • Prepare for timely return of assignments and prompt response to students in email, chat, or discussion (Watson et al., 2017). • Provide constructive and timely feedback to students (Watson et al., 2017). • Provide feedback, even if feedback consists of a simple acknowledgement that the work was received (Rovai, 2000). • Provide immediate feedback; post timely questions; share finished learning artifacts between groups of students (Szeto, 2015). • Use continuous and authentic assessment strategies (Lowenthal & Parscal, 2008). • Send progress reports on participation and quality of postings (Lowenthal & Parscal, 2008). • Grade frequently; every week or more often (Dunlap & Lowenthal, 2018). • Make sure feedback is clear, explicit, and includes opportunities to ask questions for clarity (Dunlap & Lowenthal, 2018).
Time on task	Social presence	• Explicitly introduce students to the unique nature and learning potential of online discussion (Richardson et al., 2009). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Instead of a text-based announcement, use a video walk through (Dunlap & Lowenthal, 2018; Seckman, 2018). • Provide online orientation to the course, course video walk through (Lowenthal & Dunlap, 2018).
	Cognitive presence	• Identify important knowledge, skills, and attitudes students should learn and develop additional course activities around their assessment (Richardson et al., 2009). • Use self-testing, practice assignments, simulations, and other interactive activities to support skill development and convergent thinking (Richardson et al., 2009). • Avoid extraneous video and audio, do not add redundant on-screen text (Richardson et al., 2009).

		• Begin presentations with descriptions of components and organization (Richardson et al., 2009). • Allow learners to control the pace of presentations (Richardson et al., 2009).
	Teaching presence	• Design and review courses for clarity and consistency (Richardson et al., 2009). • Ensure courses are well organized and that the organization is clear to students and easy to navigate; online course orientation (Lowenthal & Dunlap, 2018; Richardson et al., 2009). • Provide suggested due dates for initial postings that promote mid-week engagement as opposed to weekend only postings (Lowenthal & Parscal, 2008). • Promptly answer email (Lowenthal & Parscal, 2008). • Send progress reports on participation and quality of postings (Lowenthal & Parscal, 2008). • Have effective assessment tools/rubrics so students know how they are being assessed (Dunlap & Lowenthal, 2018). • Map out all course requirements in advance so you and your students can plan out the workload at the start of the course (Dunlap & Lowenthal, 2018). • Make sure your students can't get lost – make sure they know your expectations, what they should be doing, when it needs to be done, and your expectations for the course (Dunlap & Lowenthal, 2018). • Structure online learning resources so materials are one click away (Dunlap & Lowenthal, 2018). • Address universal design for learning (UDL) principles in all created materials (Dunlap & Lowenthal, 2018).
Communicate high expectations	Social presence	• Explicitly introduce students to the unique nature and learning potential of online discussion (Richardson et al., 2009). • Explicitly explain to students to the importance of student-to-student interaction so that they can view classmates' perspectives as valuable (Stewart, 2017). • Create areas where students can communicate with each other (class email, student discussion tab, etc.; Stewart, 2017). • Post introductions and expectations document before students are given access to the course (Lowenthal & Parscal, 2008).
	Cognitive presence	• Identify big ideas you want students to take away from your course and develop major course activities around their assessment (Richardson et al., 2009). • Model, support, and encourage diverse points of view in online discussion (Richardson et al., 2009). • Use content and process scaffolds to support discourse behaviors (Richardson et al., 2009). • Develop general learning modules with opportunities for active learning, assessment, and feedback that can be shared among courses and/or accessed by students for remediation or enrichment (Richardson et al., 2009). • Allow areas (discussions, blogs, wikis, virtual café, and journals) where students can hear other students' intellectual property (their own ideas; Peacock & Cowan, 2016; Stewart, 2017). • Model and provide structured guidance; offer examples of papers and projects for samples (Watson et al., 2017). • Model higher-order thinking by frequently asking questions that probe students' knowledge (Rovai, 2000).
	Teaching presence	• Explicitly introduce students to the unique nature and learning potential of online discussion (Richardson et al., 2009). • Provide students with explicit and redundant instructions for all course activities (Richardson et al., 2009). • Make goals clear and use redundancy (Richardson et al., 2009).

		• Provide clear grading guidelines including rubrics for complex assignments (Richardson et al., 2009). • Provide students' views and comments in conversations (matching students with similar ideas; Stewart, 2017). • Provide instructor availability so students are aware of instructor response time (Watson et al., 2017). • Be concrete and explicit with instructions for all activities, assignments, and projects (Dunlap & Lowenthal, 2018). • Make everything explicit: say more than you think you need to say (Dunlap & Lowenthal, 2018).
Respect diverse ways of learning	Social presence	• Establish rules of Netiquette for your course (Richardson et al., 2009; Stephens & Roberts, 2017). • Encourage students to share experiences and beliefs in online discussion; allow for multiple perspectives (Richardson et al., 2009; Stephens & Roberts, 2017). • Have students serve as experts (e.g., lead a discussion; Richardson et al., 2009). • Consider incorporating Web 2.0 applications in course activities, especially social software such as blogs, wikis, etc. (Peacock & Cowan, 2016; Richardson et al., 2009; Stephens & Roberts, 2017). • Use group discussion, group brainstorming sessions, and journaling/blogging to encourage reflective observation (Dunlap et al., 2016).
	Cognitive presence	• Provide multiple representations of the knowledge you want students to learn and multiple activities for practicing desired skills (Richardson et al., 2009; Stephens & Roberts, 2017). • Encourage experimentation, divergent thinking, and multiple perspectives in online discussion through provocative, open-ended questions, authentic products (Richardson et al., 2009; Stephens & Roberts, 2017). • Model, support, and encourage diverse points of view in online discussion (Richardson et al., 2009; Stephens & Roberts, 2017). • Use self-testing, practice assignments, simulations, and other interactive activities to support skill development and convergent thinking (Richardson et al., 2009). • Develop general learning modules with opportunities for active learning, assessment, and feedback that can be shared among courses and/or accessed by students for remediation or enrichment (Richardson et al., 2009). • Present words in spoken form, use words and pictures simultaneously to explain concepts (Richardson et al., 2009). • Use group discussion, group brainstorming sessions, and journaling/blogging to encourage reflective observation (Dunlap et al., 2016). • Involve students with video, case studies, labs, stories, simulations, and games (Dunlap et al., 2016). • Provide video/audio lectures, have students complete readings, write position papers, and model building (Dunlap et al., 2016; Seckman, 2018). • Develop student- or teacher-led discussion groups, debates, projects, and collaborative learning groups (Rovai, 2000). • Consider collaborative work where students can share alternative viewpoints with each other (Rovai, 2000).
	Teaching presence	• Provide frequent opportunities for both public and private interactions with students (Richardson et al., 2009). • Design courses for learner choice, flexibility, and control (Richardson et al., 2009). • Design learning experiences that address all learning preferences/styles; authentic products (Dunlap & Lowenthal, 2018; Stephens & Roberts, 2017). • Account for cultural differences (Dunlap & Lowenthal, 2018).

Conclusion

Summary

Stemming from Dewey's emphasis on collaborative constructivism, Garrison et al. (2000) developed the CoI framework to build community in online environments. The CoI framework is the process of creating a meaningful learning experience through the development of three interdependent presences – social, cognitive, and teaching (Garrison et al., 2000). The CoI framework is currently becoming a concrete asset for creating online environments and thus meeting the issues online courses and programs are experiencing (e.g., the disconnect between students and their instructors, and students and their peers; Moskal, Dziuban, & Hartman, 2013; Slagter van Tyron & Bishop, 2009). The cognitive, social, and teaching presences work together in an overlapping, interdependent method to help students gain deep levels of community to support their individual learning (Szeto, 2015).

By reviewing the literature and studies on the CoI framework, there is a void of how to implement instructional strategies aligned with the CoI for practitioners. This paper presented an overview of online community and by orientating the CoI principles to Sorensen and Baylen's (2009) principles, a collection of instructional activities was presented to guide online practitioners in creating effective, engaging, and meaningful activities into course design and the facilitation process.

Implications

This review is significant to the field of instructional design and online education as it identifies evidence-based strategies and conceptualizes them into a working design document. This paper has implications for the field in terms of 1) informing online instructors and course developers about the importance of creating community in online environments; 2) providing an introduction and general review of the CoI framework; and 3) offering a design document to guide practitioners on instructional activities that best align with the CoI framework as well as the seven principles for best practices for the online environment.

Limitations and Future Research

For the summary of instructional activities (Table 1), the author provided an array of instructional strategies, as determined by the search criteria listed above, best suited for developing community. The list of instructional strategies is not all-inclusive; the author intentionally omitted duplicate instructional activities and excluded specific Web-tool activities as these constantly change (e.g., PowToon, Skype, MySpace). Additionally, a limitation of this review is that it focuses specifically on the original CoI framework and not on the literature addressing additional aspects (presences, influences), thereby potentially overlooking some potential strategies (e.g., tutor-facilitated CoI). Moreover, students may have individualized needs in terms of different presences; therefore, students may respond to instructional strategies differently (Lowenthal & Dunlap, 2018). However, it is not without acknowledgement that further research should be conducted on the effectiveness of these instructional strategies as they align within the CoI framework and the seven principles work by Sorensen and Baylen (2009).

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Getting Started with Open Badges and Open Microcredentials

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Abstract

This article is intended as a practical resource to help interested organizations design and implement an open badging system. Open badges are a type of open credential designed to recognize a variety of skills, knowledge, and experiences, both inside and outside of traditional educational settings. While growing in popularity, common questions asked by those interested in using open badges include: How do I get started? What technologies exist to produce open badges? And what do I need to know? This article seeks to address questions such as these. First, we introduce the reader to key terms in the badging world and explore open badge design precedents, responding to who, what, how, where, and why open badges have been used in the past. Drawing on this research as well as our own personal experience, we then present a possible framework for getting started with open badges and a step-by-step guide for implementing that framework within your organization.

Keywords: open badges, alternative credentials, open credentials, microcredentials, open education

Getting Started With Open Badges

It is undeniable that open education will play an important role in future education. The number of people seeking education is accelerating. This rush to education has increased due to the accessibility of the Internet, making it possible for potential learners in lower-income countries to access educational options. Open education is no longer simply a nice idea, but a necessity for providing affordable and accessible education to the world.

However, much of the focus in open education has been on open educational content and resources. Scholars study how to make reuse more common within content repositories (Santos-Hermosa, Ferran-Ferrer, & Abadal, 2017), and how to leverage the potential of MOOCs (Kopp, Gröblinger, & Zimmerman, 2017). Most of the scholarship and discussion focuses on open textbooks, and their potential cost-savings (Wiley, Hilton, Ellington, & Hall, 2012), their effect on pedagogy (Pitt, 2015), or their ability to increase access (Feldstein et al., 2012).

These positive impacts from open educational content are real and important. However, open educational content alone will not be sufficient to remedy to the world's educational challenges. Education is more than simply providing content, and includes effective assessment, formative and summative feedback, mentoring, authentic experiences for experiential and transformative learning, and creative/research opportunities. Wiley (2019) echoed this by arguing that open education requires open content, open competencies, open assessments, and open credentials.

As more students engage in learning from open content, providing the open credentials to recognize that learning will become increasingly crucial. However, the biggest question we get asked by educators interested in developing open credentials is how do I get started? This paper seeks to address this challenge by providing a review and synthesis of the work on open badges, a type of open microcredential.

The Rise of Alternative Credentials

In recent years, alternative credentialing has become an increasingly important method of recognizing learning and achievement that takes place in a wide variety of environments. Alternative credentials have been defined as "competencies, skills, and learning outcomes [that are] derived from assessment-based, non-degree activities and align to specific, timely needs in the workforce" (Fong, Janzow, & Peck, 2016, p. 1). This rise in the popularity of alternative credentials is due, at least in part, to changes in the cost, availability, and perceived value of both formal (e.g., universities, colleges) and informal (e.g., MOOCs, YouTube, Khan Academy) learning opportunities; economic changes (e.g., rising tuition, dropping enrollment in institutions of higher education); and demographic shifts across the world (Fong et al., 2016).

One form of alternative credentialing that is rapidly gaining traction are open badges. Many corporations, government agencies, institutions of higher education, certification issuing organizations, and others are beginning to adopt open badges as a viable means to recognize learning, accomplishment, and other types of achievement (Devedžić & Jovanović, 2015). An open badge is a digital microcredential that adheres to the open badge infrastructure (OBI) developed by the Mozilla Foundation and currently administered by IMS Global. OBI calls for badges to be formatted as images enriched with metadata (e.g., issuing organization, badge description, badge requirements, submitted evidence, standards, endorsements) that

allow people to (a) digitally verify that the badge was earned by a particular recipient and (b) gain deep insight into the actual skills the badge earner possesses. Open badges are envisioned as (a) remixable (i.e., they can be mixed, matched, and republished to different audiences for distinct purposes); (b) controlled by the badge earner, rather than by an institution, in terms of how it is shared, collected, and displayed; (c) portable across media and thus widely shareable to anyone selected by the earner; and (d) issuable by any party, to any party, within any learning context (Mozilla Open Badges, 2014a). They also tend to be competency-based and to require evidence of completion in order to be earned (Jovanović & Devedžić, 2014). While open badges are primarily a method for recognizing learning, they have been used for a wide variety of other purposes as well, including as (a) a mechanism for increasing learner motivation, (b) a means of charting learning routes or pathways, and (c) a strategy for supporting self-reflection, planning, and learner agency (Jovanović & Devedžić, 2014).

A variety of tools have made it possible for organizations to begin issuing open badges with minimal effort required; however, many of those seeking to do so quickly find that implementing a successful badging program involves more than simply issuing badges. This article is intended as a practical resource to help interested organizations design and implement an open badging system. First, we introduce the reader to key terms in the badging world and explore open badge design precedents, responding to who, what, how, where, and why open badges have been used in the past. Drawing on this research as well as our own personal experience, we then present a possible framework (see Figure 1) for getting started with open badges and a step-by-step guide for implementing that framework within your organization.

Key Badging Terms

One of the disorienting issues for new organizations developing a badging system is the specific nomenclature used to describe persons and objects associated with badging. In brief summary, the process for open badges is to first create the badge image and its data (e.g., criteria, endorsements, and standards), and then upload this to a *badge issuing platform*. You can then issue badges to earners by entering their email. They can see, share, and store their badges in a digital *backpack*.

The following terms may be useful in understanding the remainder of this article as well as other literature surrounding open badges. These terms are frequently used by developers and the early adopters of open badges, and are often referenced in the open source code for open badging technologies.

- **Assertion.** Developer terminology for an earned badge. Assertions contain data unique to the recipient such as who earned the badge, who gave the badge, and what the badge represents (Mozilla Open Badges, 2014b).

- **Backpack.** An earner-controlled digital repository that facilitates the collection, categorization, and sharing of open badges.

- **Badge Class.** A description of what the badge represents, or what it means to receive one. This can include various pieces of data including who gives the badge, what the criteria is to earn one,

when the badge might expire, what standards it is aligned to, and tags for organizing the badge classes (Mozilla Open Badges, 2014b).

- **Competency-Based Education.** According to the U.S. Department of Education (2019), competency-based education is learning that "allows students to progress as they demonstrate mastery of academic content, regardless of time, place, or pace of learning" (para. 1). Nodine (2016) described the history of competency-based learning as following centuries of traditional instruction that focused on mastery learning, such as through apprenticeships, craft guilds, and technical training programs. An early focus on learning outcomes also provided support for an emerging conceptualization of CBE as focused on what students learn, not how or where they learned it. This perspective contrasts with time-based perspectives on learning rooted in the Carnegie Unit, or credit hour, which since its introduction in 1906 has developed into a common standard for measuring time spent on learning and student readiness for higher education (Silva, White, & Toch, 2015). However, many in higher education believe the Carnegie Unit is less useful in an information economy (Levine, 2015).

- **Consumers/Interpreters.** The ultimate audience of a badge—the individuals, employers, peers, and institutions, who use a badge to evaluate an individual's qualifications.

- **Digital Badge.** Badges that do not conform to the OBI standard. Often used in video games or to motivate student behavior but not portable between platforms.

- **Earner.** An individual who satisfactorily meets badge completion criteria and is awarded the badge by the issuer. "Badge earners can combine multiple OBs from different issuers, display them on the Web, and share them for employment, and/or further education" (Jovanović & Devedžić, 2014, p. 116).

- **Endorsements.** A recent addition to the OBI that enables third parties to endorse an issuer's badge or an individual's earned badges. Endorsements are designed to bring greater value to badges as the recognition and value they receive from others is recorded in a badge's metadata.

- **Evidence.** Information embedded within the badge or linked out to separate web pages demonstrating what the recipient did to earn the achievement (IMS Global Learning Consortium, 2018).

- **Issuer.** The organization that designs and publishes a badge, reviews badge submissions, issues the badge to an earner, and provides digital verification of the badge's authenticity. "OBI defines the badge issuer as a learning provider or an employer awarding an OB for completing a certain task (tasks) and/or attaining a certain goal (goals). The issuer creates the criteria that the badge earner needs to fulfill in order to win the badge" (Jovanović & Devedžić, 2014, p. 116).

- **Issuing Platform.** A platform enables individuals and institutions to issue badges to their learners. In other words, if you want to give badges to your students, you create and upload your badges to an issuing platform, along with the criteria for earning the badge and a description of the

badge. You can then usually send badges to students by email. Examples of badge issuing platforms include Badgr (https://badgr.io), Accredible (https://www.accredible.com); OpenBadges.me (https://www.openbadges.me/openbadges); MyMantle (https://mymantl.com/); Open Badge Factory (https://openbadgefactory.com/), My Open Badge (https://myopenbadge.com), Badgewell (https://www.badgewell.com), and Credly (https://info.credly.com/). A complete list of certified (OBI 2.0 issuing platforms is available at https://www.imsglobal.org/cc/statuschart/openbadges.

- **Learning Pathways.** Open badges can be organized into pathways by requiring badges as criteria for earning another badge, creating a guided path through the thousands of available badges for learners interested in a particular topic or trajectory. Emerging tools such as Badgr Pathways (https://pathways.badgr.io) make it possible to create pathways utilizing open badges from various issuers.

- **Metadata.** Information embedded within a badge. Under the OBI standard, required metadata for a given badge includes a unique id, recipient information, issuer information, badge name, description, criteria, image and date issued. Optional metadata includes evidence, a narrative explaining evidence, expiration date, educational standards the badge aligns to, tags describing the achievement, and whether or not the badge has been revoked (IMS Global Learning Consortium, 2018).

- **Microcredential.** A credential recognizing a distinct skill or accomplishment. Microcredentials come in a variety of formats including certificates, nanodegrees, digital badges, and open badges.

- **Open Badge Infrastructure (OBI).** Open Badge Infrastructure—the technical standard for open badges developed by the Mozilla Foundation and maintained by IMS Global. The OBI facilitates the portability and interoperability of the badging system; "OBI comes with a set of open application programming interfaces (APIs) that allow developers to integrate OB services with existing applications, Websites, and social networks." (Jovanović & Devedžić, 2014, p. 116).

- **Verification.** A process by which the validity of a badge can be confirmed. Most OB issuing tools provide instructions for verifying badges issued by their system.

Badging Precedents

Open Badges have been issued in a variety of settings: universities, massive open online courses (MOOCs), K-12 schools, and informal learning groups (Abramovich, Schunn & Higashi, 2013; Ahn, Pellicone, & Butler, 2014; Cross & Galley, 2012; McDaniel, Lindgren & Friskics, 2012). Open Badges have been used in these settings for several purposes including as a tool to motivate learners and incentivize learners (Aberdour, 2016; Gibson, Ostashewski, Flintoff, Grant, & Knight, 2015; Jovanović & Devedžić, 2014; Santos et al., 2013). They have also been used to guide learning, increase engagement, and promote specific brands (Jovanović & Devedžić, 2015; Leaser, 2018). Also, of course, they have been used to certify or recognize

skills and learning (Aberdour, 2016; Jovanović & Devedžić, 2014; Gibson et al., 2015; Young, West, & Nylin, 2019), especially recognition for skills learned outside formal schooling.

What can open badges be used for? Almost anything, it seems, related to informal or formal learning, activity, and skill. As this can be a little overwhelming for anyone getting started with open badges, we provide the following examples so others can learn from the experience of these initiatives.

Who Is Issuing Open Badges and To Whom?

There have been over 1,400 institutions who had issued open badges as of 2013 (Mozilla Open Badges, 2018). As the list below indicates, open badges are currently being issued by a wide variety of organizations to an even wider variety of target audiences. Higher education institutions are issuing badges to their students (Gibson, Coleman, & Irving, 2016; Randall, Harrison, & West, 2013), K-12 schools and districts are issuing badges to teachers for professional development (Davis, 2017; Gamrat, Zimmerman, Dudek, & Peck, 2014; Lynch, 2018; Otter, 2018), teachers, tutors, and coaches are issuing badges to their individual students (e.g., Aurora Public Schools, 2017; Corona-Norco Unified School District, 2018; Davis, 2017; Lynch, 2018; Otter, 2018), and sometimes, badges can be for extracurricular learning, such as with afterschool programming (Davis & Singh, 2015).

The beauty of flexible and open credentials such as open badges is that they can also be issued by nontraditional learning institutions or experience providers. For example, corporations (e.g., IBM; see https://www.youracclaim.com/organizations/ibm/badges) are issuing badges to employees and members of the community, including customers (Young et al., 2019). Libraries and museums are issuing badges to their patrons, in particular to youth as part of their summer learning programs (Chicago City of Learning, 2017). Professional development organizations and credentialing bodies are issuing badges to trainees.

This flexibility provides the opportunity for open badges, and other open credentials, to address the challenge of access in education, by enabling other providers/supporters of learning outside of traditional universities to provide their own recognition of the skills and knowledge earners achieve. As an example, nonprofits issue badges to assist employability of patrons (e.g., Badges for Vets, focused on translating military-learned skills to civilians). Examples include Newport City Homes (Ifenthaler, Bellin-Mularski, & Mah, 2016), which provides trainees hands on construction skills, and National Health Service (Alexander & Neill, 2018) in the UK, which uses badges to promote children's education of health and wellness.

Institutions seeking to set up their own badging system may benefit from reviewing the cited resources for organizations similar to their own. These articles cited are examples only, as there are too many cases to list for each one.

What Badges are They Issuing?

Badges can be issued for learning or achievement within any subject domain. They can also follow any classification or leveling system that meets the needs of the issuer and earners. Some general ideas for badges within a system include color coding the badges; using levels (e.g., bronze/silver/gold or Level 1/2/3); attaching categories or tags; and using meaningful icons (Santos et al., 2013). In considering how

to establish their own badging systems, organizations may find it useful to consult some of the following precedents.

Skill badges. IBM issues badges focusing on professional technical *skills*. Their badges are organized into categories such as analytics, cloud, mobile, and security. Similarly, Brigham Young University (BYU), Purdue, and The University of Memphis issue badges focused on various technology skills for educators. There is little hierarchy among the badges, but each badge is tagged with specific categories, such as *media production* or *assessment tools*. Another example is that of Colorado Community College System responding to address a perceived skills gap between graduates and employers by using badges to better communicate the skills of potential employees.

Knowledge badges. Many, if not most, badging organizations offer some badges for acquiring knowledge, sometimes in preparation for applying that knowledge in skills-based badges. One example is the extensive badging program offered by Wichita State University, which includes badges for skills and completing projects, but many for acquiring knowledge in disciplines such as health care, library sciences, business, and engineering (see http://badges.wichita.edu/badgecatalog).

Social or life skills. Many organizations are exploring using badges to recognize learners' efforts to develop social and life skills that are not typically taught in classes, but are important for a successful life. The University of Central Oklahoma has created a Student Transformative Learning Record that encourages and recognizes, through open badges, students gaining abilities in global and cultural competencies, health and wellness, leadership, service learning and civic engagement, disciplinary knowledge, and research and creative activities (see http://sites.uco.edu/central/tl/stlr/). Similarly, the Education Design Lab has created badges for 21st century learning (see https://eddesignlab.org/badgingchallenge/) that includes skills in cultural fluency, creativity, empathy, and resilience.

Participation badges. Siemens (a multinational industrial manufacturing company) issues a variety of badges, including a voluntary participation badge for those who volunteer to contribute to a Siemens project for one day (see https://www.openbadgeacademy.com/badge/1273). Cambridge University Press offered badges for participating in Cambridge Day events and workshops (https://www.cambridgeenglish.org/it/events/openbadges/).

Identity badges. Earning a badge can represent a person's entry into and development as a member of a community. In this way, badges can help one develop an identity as a professional in a certain discipline or community, which can be particularly valuable for students who may otherwise feel disenfranchised. When an organization certifies that someone belongs, or has successfully started on a path to becoming a full member of the community, such badges contribute to sense of belonging and identity development. The University of New Mexico's Chemical and Biological Engineering program has experimented with such badges as part of furthering students' sense of identity as engineering professionals. They found that in first year courses, the students most interested in earning professional engineering identity badges were non-traditionally-aged students (Svihla, personal communication, September 26, 2019).

Earning a badge can represent development of a person's expertise and their evolution into becoming key members of a community. In this way they can help one develop an identity as a professional in a certain discipline or community, which can be particularly valuable for traditionally disenfranchised or minority persons. The University of New Mexico's chemical engineering program offers badges to students to provide flexible and responsive learning opportunities as part of furthering students' sense of identity as engineering professionals.

Certification badges. Badges can be used as certificates that represent culminating achievements in a portable, data-rich way. Davies, Randall, and West (2015) outlined how badges could help certify professional evaluators. Microsoft, Apple, and National Instruments are some companies using open badges to issue certificates.

Where Are They Issuing Badges?

Open badges have been used in all educational settings, including corporate, K-12, higher education, informal and formal learning experiences. They are particularly useful in distributed learning environments, as the open badge can be issued and then shared via the Internet. With many encouraging movement towards an open recognition ecosystem, the potential is to make recognizing learning and skill something everyone can eventually give to others, not just seek for themselves (see https://www.openrecognition.org/).

Creating a Badging Program

The remainder of this article provides a framework for approaching the design of a badging program. We have divided this process into four phases: (1) Design the system, (2) Design the badges, (3) Publish, and (4) Emphasize change management. Figure 1 provides a visualization of these stages and subcomponents. Although we represent these stages linearly, the context of a given program may lead to dependencies between stages and their subcomponents. Flexibility should be allowed in the design process by anyone seeking to follow these guidelines.

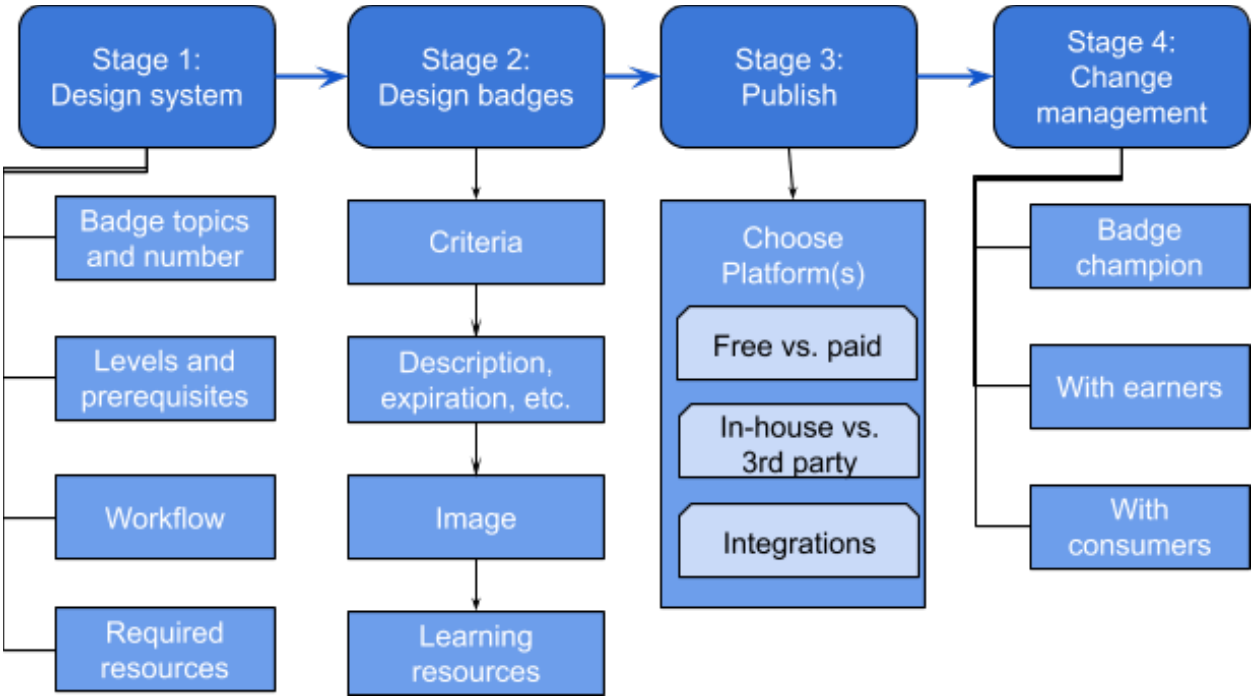

Figure 1. Suggested design process for designing open badging systems.

Stage 1: Design the System

The complexity of a badging program grows as the number of badges and earners increases. For this reason, planning the broader system in which individual badges and earners will take part in is essential. This includes, considering the number of topics a program will include, the amount of badges aligned with each topic, and the resources available to implement the design.

Program scope. One challenge every badging initiative faces is determining what competencies will be represented. A common pitfall many badging initiatives fall into is the temptation to badge everything. Our recommendation, despite planning the broader system for eventual growth, is that badging programs start small by focusing on a few core skills.

Workflow. The process by which participants in the program find and earn badges will have implications for how badges will be formatted and which badging platform should be used. Does the evaluation process need to be integrated into an existing workflow? How will earners know what badges are available? What will the interaction between earners and evaluators be like? Answering questions such as these can help guide the decision-making process later on. It may be helpful to consider broadly what type of system metaphor you are seeking. Do you want a system where learners browse badges and apply for them, one where issuers award badges based on evidence acquired outside of the system (perhaps as part of a course management system), one where badges can be earned as part of gamification, or something else?

Identify participants. Badging initiatives often begin with a specific population of earners in mind. Those designing the program should consider how this population may change over time and how those changes may impact the structure of the program. For example, it may be useful to design the badges

to allow for future levels, as badge earners may want to continue their professional learning. Equally important is considering how those playing an administrative role in the badging program may change over time, and how the administration of the badging system can be continued during this transition.

Resources. Beyond personnel, what resources are available to implement the badging program? One example may be funds required for updating the badges if they get outdated or paying for someone to review and award the badges. Will these resources be available on an ongoing basis? Will those evaluating badge criteria require training of any kind? How will badge evidence be hosted online? Each of these decisions will have implications for the amount of resources required to sustain the badging program. For example, requiring expert human grading of evidence can provide higher rigor, but also a higher cost. Perhaps it is useful to explore peer evaluation and other methods of crowdsourcing the "expense" of badge reviewing.

Stage 2: Design the Badges

Since the image representing an open badge is its most visible component, designing an open badge involves much more than creating a simple graphic. Designers will need to determine the scope of what the badge represents, specify metadata values, and plan for how learners will complete the badge's requirements.

Badge scope. Open badges can represent any number of skills or experiences; however, most badges are designed to represent distinct individual skills or accomplishments. In such settings, tiered systems with multiple badges (i.e., beginner, intermediate, expert) can be used to represent complicated skills.

Figure 2. Tiered badging system. IBM uses stars to indicate the level of skill a particular badge represents.

Metadata. Every open badge is embedded with metadata including the badge name, description, criteria, issuer information, evidence, date issued, and other fields. Most badge issuing tools guide the issuer through the badge creation process and will indicate which fields of data need to be completed. Adding as much metadata as possible helps to increase the perceived rigor of each badge and its value to badge earners and consumers.

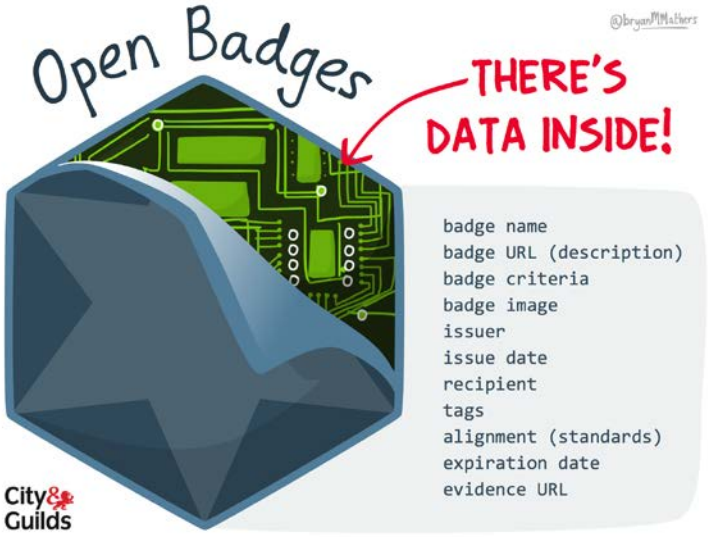

Figure 3. A visual representation of the kinds of data that can be included in an open badge. Adapted from **"**Open badges (P.S. there's data inside...)," by Mathers, 2019 (https://bryanmmathers.com/open-badges-data-inside/). Image is licensed CC-BY-ND.

Badge images. Although metadata often explains the significance of a given badge, the badge image is what gives the first impression. One study found the credibility of an entire program can be lowered by less aesthetically pleasing badge images (Dyjur & Lindstrom, 2017).

The images themselves can be created using any tool and then uploaded to the issuing platform. Some platforms even allow the user to generate potential images while creating the badge. Alternatively, tools such as Makebadges (http://www.makebadg.es/badge#) allow users to create badge images and download them.

Learning resources. Open badges are often connected to broader competency-based learning programs (Hickey, Willis, & Quick, 2015). Badges are usually designed to include in the metadata an explanation of the criteria or competencies earners are required to complete, but they do not include instructions on how to achieve that competency (i.e., they display the task you need to do, but lack the training on how to do it). For this reason, we recommend that a badging program provide guides or references outside the badge metadata to guide potential earners in obtaining the necessary skills. This can be a website or a learning management system that accompanies and supports the badges.

Managing a team. Many badging systems rely on a team to create and manage the badges. Scaffolding team members with clear templates can help keep all badges uniform. In one study, Randall, West, & Farmer, in press) found that by emphasizing effective training of undergraduate badge designers enabled these newer designers to create badge rubrics and designs that were as high quality as those created by more experienced professionals. The key, it seems, is in the training, templates, documentation, and opportunities for peer review (see Figures 4-5 for examples of some scaffolding documents we used in developing our educational technology badges).

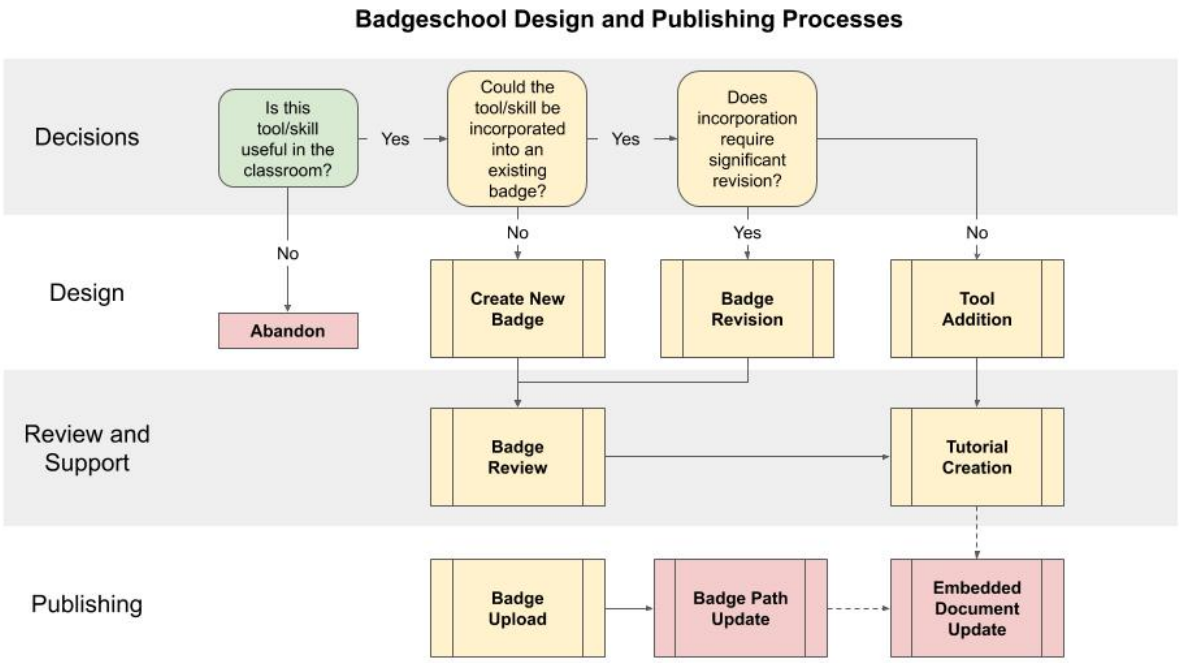

Figure 4. One of many internal Google documents used to scaffold new badge designers. Badge designers were typically teaching assistants in the courses, who had strong content area experience but limited badge design experience, and who were rotated frequently (see Randall,Farmer, & West, 2019).

Figure 5. An example of one of the Google Sheets rubrics used to scaffold new badge designers. This scaffolding was done through the process of drafting and revising a new educational technology badge, and making certain all new badges were reviewed and approved. We found it to be much more efficient to do the bulk of the badge design work in Google Docs and Sheets before transitioning to the badging platform.

Stage 3: Publish

The third stage of creating a badge program includes publishing the badges with your selected badge issuing tool and making them available to earners. A variety of platforms exist for this purpose; the complete list of

issuing platforms that are fully compliant with the OBI 2.0 specification is available here: https://www.imsglobal.org/cc/statuschart/openbadges.

Choosing a platform. Every open badge issuing platform is unique. We recommend reviewing multiple platforms before decided which one will be used to implement your program. Where possible, creating one or two badges within each platform can give you a sense of how your program would work using that tool. Consider the following issues as you make your selection.

Workflow. If possible, create a badge using the platform you are considering. Walk through the process of earning the badge to make sure the platform supports the types of interactions you envision for the program. Also consider whether or not the platform you are considering can integrate with tools already being used by your organization, such as learning management systems.

Permissions. Several badging platforms offer varying levels of permissions that enable members of the badging organization to fulfill different roles. For example, one account may be allowed to edit and add badges while another can only issue them.

Cost. Specific features may only be available for on a subscription basis. Other platforms provide their features for free up to a certain number of badges or users. Consider what the potential of your program is to grow and whether or not the potential of added costs may limit that growth.

Stage 4: Emphasize Change Management

Every organization will likely require a cultural shift of some kind when implementing a badging program. The following recommendations may assist in ensuring a smooth transition to badging.

Find a Badge champion. As outlined here, implementing a successful badging program requires several steps. For this reason, we recommend designating someone within the organization to lead out on designing and implementing the program. This allows for the creation of badges, selection of an issuing tool, and other essential decisions to be coordinated and helps ensure none of these steps are forgotten.

Focus on earners. A warm reception to the badging program by those who are expected to participate in earning badges greatly enhances the transition. We have found including earners in the badge design process, starting small and iterating based on earner feedback, and where applicable allowing earners to apply for badges based on their prior work and experience, can improve reception of a program. In addition, clear training ahead of time about what badges are, and why they can be valuable, can quickly answer many of the common questions and encourage greater badge earning participation.

Focus on consumers. Most badging programs hope to increase the acceptance of badges among badge consumers (those who will see the badges and value them). Several forms of microcredentials have begun to emerge, however employers have been slow to adopt these alternatives (Fong et al., p. 15). The best thing a program can do to ensure a positive reception by badge consumers is work with badge consumers to design the program in the first place. While this may not be feasible for a widespread audience, incorporating a consumer's input early on will help them value the completed program. For

example, in designing our preservice educational technology badges, we responded to feedback from the local school districts and national educational technology associations about how to improve the badges.

An open badge's metadata provides another opportunity to improve consumer reception. When designing a badge, consider how well the description and criteria will be understood by an external audience. Providing a brief description of the review process and anticipated amount of work required to earn the badge can go a long way towards helping someone else understand what the badge represents.

Conclusion

The goal of this paper was to answer the question many have asked about open badging, "how do I get started?" Because open badging was originally a technological innovation, technical jargon surrounding the technology has sometimes been a hurdle to teachers or institutions wanting to become badge issuers. In addition, a microcertificate, skill-based paradigm, is very different from many educational systems, and adopting open badging can require significant systemic change, leading to additional concerns and questions. This article, we hope, addresses some of the most common of these questions and can help open up the world of microcredentialing to more teachers.

While we have seen many benefits from open badges, open badging and alternative credentials are not a panacea for solving educational problems (are any educational technologies?). Many misunderstand this, and can be frustrated when open badges do not solve problems such as how to ascertain if someone has developed a soft skill (e.g., leadership, motivation, collaboration) or questions such as how to know if someone really has earned a badge and developed the skill. These are assessment problems already existing in education, no matter the credential received at the end. In addition, some have concerns about how to know what skills are worth receiving a badge for—in other words, what learning and development is most important? This, again, is not really a badging problem as much as a learning objectives problem.

In this and other situations, we have seen that engaging in open badging has caused us to reflect more deeply about what our goals are for a particular learning situation, what we feel matters, what we want people to know and be able to do, and how we think we will know when they have done it. These are important questions, which can lead to significant pedagogical reform, which has been our experience. Because of this, one of the greatest benefits of alternative credentials, such as open badges, is they are the catalyst to force us to think about alternative educational practices and processes.

In addition, the emphasis that open badging gives to micro certification, rather than larger scale certificates such as degrees and diplomas, can open up possibilities for a re-organizing of learning systems, where learning can happen from one institution or many, at one time or over time, and in this way perhaps break free from the tyranny of the one semester, "X" credit hour system that artificially constrains many learning experiences. In this way, open badges and microcredentials may be the key to unlocking the potential of MOOCs, online modules, and open courseware by providing a credentialing option for these open resources. In addition, open badges could provide the opportunity to break down barriers between informal and formal learning, and professional education and academic education.

It is unknown what the future of open badging may be, or whether it may be supplanted by future technologies. However, these pedagogical and philosophical questions about what we feel the nature of education is and should be will remain. Whatever the future of education, we feel confident it will involve increased opportunities for some kind of skill-based, micro learning in addition to other educational practices. As open education evolves, we believe the field will need to build off of the success it has had in creating open content, and address how to provide learning that is more skills-based, distributed, flexible, and linked to 21st century career needs. Open badges will not give us all the answers, but we do feel that open credentials can provide at least the technological opportunity to explore possibilities.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Constructing a Design Framework and Pedagogical Approach for Adaptive Learning in Higher Education: A Practitioner's Perspective

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Abstract

While adaptive learning is emerging as a promising technology to promote access and quality at a large scale in higher education (Becker et al., 2018), the implementation of adaptive learning in teaching and learning is still sporadic, and it is unclear how to best design and teach an adaptive learning course in a higher education context. As early adopters, a team of instructors, instructional designers, and administrators at the University of Central Florida (UCF) identified five key design features as an adaptive learning design framework to guide the unique course design process. These five features involve deliberate design and development efforts that could bring significant benefits to student learning. The purpose of this field note is to present a design framework and best practices for teaching from both a systems and a pedagogical approach in the context of implementation at UCF. We also share the rationale and classification framework UCF has adopted to ensure the term "adaptive learning" is universally understood across campus. This paper offers insights into the design, delivery, and implications of utilizing adaptive learning systems in higher education courses at a public research university and attempts to capture the intimacy of lessons learned and best practices gathered since the project's inception in 2014.

Keywords: adaptive courseware, adaptive learning, course design, higher education, instructional design, learning analytics, mastery learning, personalized learning

Introduction

Any cursory review of the digital learning marketplace or stroll through an EdTech conference exhibit hall will reveal the ubiquity of the term "adaptive learning." Whether the term refers to a specific platform, a publisher, or a pedagogical practice, it is clear that the last 5-10 years have seen a significant increase in its usage. But what does the term "adaptive learning" mean? As the usage of adaptive learning in higher education has advanced over the past few years, the research and practitioner communities seem to have coalesced around a few unifying concepts. For example, in 2013, the Bill and Melinda Gates Foundation launched the Adaptive Learning Market Acceleration Program (ALMAP) with nine platforms that "use learning model algorithms to track learner progress and recommend next steps in a learning path" (Yarnall, Means, & Wetzel, 2016, p.5). Similarly, another initiative funded by the Bill and Melinda Gates Foundation, the Association of Public and Land-Grant Universities' (APLU's) Personalizing Learning with Adaptive Courseware explains that "(a)daptive courseware collects student data through assessment, analyzes that data and uses it to offer personalized learning paths to each student or reports and recommendations to instructors to help personalize the learning experience" (Association of Public & Land-Grant Universities [APLU], 2017a, para.1).

However, with the increased attention and usage of the term "adaptive learning" there is also an increase in the inconsistency with which it is used. Due to its popularity and promotion by high-profile organizations such as the Bill and Melinda Gates Foundation, the term has also become something of a marketing buzzword. There are various adaptive learning systems available in today's educational technology market. For example, the Association of Public and Land-Grant Universities (APLU; 2017b) approved 21 adaptive courseware providers and products, with more and more companies in the marketplace using the term to promote their products. Unfortunately, their products do not all function in the same way and may not offer the same feature sets. They adapt learning in many different forms, yet are being labeled under the same umbrella term of "adaptive learning."

Adaptive learning remains elusive to define and continues to develop over time (Edsurge, 2016; Pugliese, 2016), and there are no specific guidelines or taxonomies for how the adaptive capabilities are described. Some adaptive systems providers classify their adaptive systems according to the instructional activities where adaptivity occurs: the content, the assessment, or the sequence as an integrated approach (Edsurge, 2016). Others classify the systems based on the underlying adaptive algorithm (Khosravi, Sadiq, & Gasevic, 2020; Thompson, 2013). Pugliese (2016) categorized adaptive systems into four types: machine-learning systems, advanced algorithm systems, rule-based systems, and decision-tree systems (also see: Edwards et al., 2017). Yet, one specific adaptive algorithm is rarely identified with one system. As a matter of fact, many of the major adaptive learning players use a combination of the above adaptive algorithms in their systems. At the same time, these algorithms are often protected as proprietary commercial secrets. In such cases, even experienced users do not have the capabilities to decode the "black box" and understand the specific rules of the adaptive learning systems.

The matter of how institutions of higher education design and deliver adaptive learning courses (using a variety of adaptive platforms) to ensure program objectives are being met becomes a paramount issue and has been so at the University of Central Florida (UCF) as well. As UCF expanded its adaptive learning initiative, it became increasingly difficult to manage the many platforms that were either being considered

for adoption or were already being used by faculty across campus. The companies behind these platforms (in many cases publishers) labeled their systems as "adaptive," yet the systems did not all function the same way. The underlying adaptive schemas differed, the feature sets varied, and the emphases between homework/practice/assessment and primary instructional content were not consistent.

Therefore, as its adaptive learning initiative grew from a few pilot courses to a more institutional scale, it became necessary to ensure that the courses labeled as "adaptive" all referred to the same basic functionalities. This was important for two primary reasons: (1) to make sure that students understood what they were registering for when they selected a course with an adaptive learning indicator in the schedule, and (2) to ensure that institutional evaluation efforts "compared apples to apples" when assessing the efficacy of adaptive learning regarding student success.

In order for UCF to credential a course as "adaptive" in its course catalogue, regardless of platform, the course must provide a minimum of three adaptive design features, with two other features listed as preferred (the UCF Adaptive Learning Design Framework). These features are, in the order of a design sequence:

1. The course consists of objective-based learning bits/lessons.

2. It presents personalized content and assessments with timely feedback.

3. It offers an adaptive learning pathway that includes prerequisite learning materials, an acceleration or remediation capability that adapts to students' knowledge, provides learning analytics, and recommends personalized interventions.

4. It presents alternative adaptive content presentation (video, text, etc.) based on learning performance and learning characteristics (optional but preferred criterion).

5. It procedurally generates questions and content using variables and conditions (optional but preferred criterion).

To answer the question of how to design and teach adaptive courses, this paper will expand upon each of the above five design features to provide institutional context and rationale and discuss the implementation of the design framework and pedagogical practices that maximize the benefits of adaptive technologies.

The Digital Learning Context at UCF

UCF has a long history of successfully delivering online and blended learning, which was initiated in the mid-1990s. In the 2018-2019 academic year, UCF generated more than 47% of its annual student credit hours in online and blended modalities. Digital learning at UCF serves both on- and off-campus students and includes an exclusively online virtual campus called UCF Online. The university's adaptive learning initiative, consequently, grew out of this foundation of digital learning success.

UCF currently recognizes six official course delivery modalities (Center for Distributed Learning, 2019):

- **World Wide Web** - "W" courses are conducted via Web-based instruction and collaboration. Some courses may require minimal campus attendance or in-person/proctored examinations.

- **Mixed Mode/Reduced Seat Time** - "M" courses are blended and include both required classroom attendance and online instruction. Classes have substantial activity conducted online, which substitutes for some classroom meetings.

- **Video Streaming** - "V" courses are delivered over the web via streaming digital video, which may be supplemented by additional online activity, projects, or exams.

- **Video Streaming/Reduced Seat Time** - In these "RV" courses, classroom-based content is available over the web via streaming video and classroom attendance is not required. Other required activities that substitute for video instruction may include any of the following elements: web activity, in-person or proctored examinations, and labs.

- **Active Learning/Reduced Seat Time** - "RA" courses utilize Web-based learning technologies as the primary instructional medium within a blended course combining required face-to-face and online elements. Classes have substantial activity conducted online, and classroom activities are limited to no more than 20% of the instructional time over the course of the semester.

- **Face-To-Face Instruction** - "P" courses have required classroom attendance and meet on a regularly scheduled basis. Students may encounter online, video, or adaptive elements as part of the instruction, thus requiring a computer.

These modalities are coded into the university's student information system, allowing students to search for specific types of classes and the institution to track and evaluate by course type. Adaptive learning design and technology may then be applied to any of these modalities as illustrated by Figure 1. The Personalized Adaptive Learning (PAL) indicator is a course attribute that can be individually searched for by students looking through the course catalog.

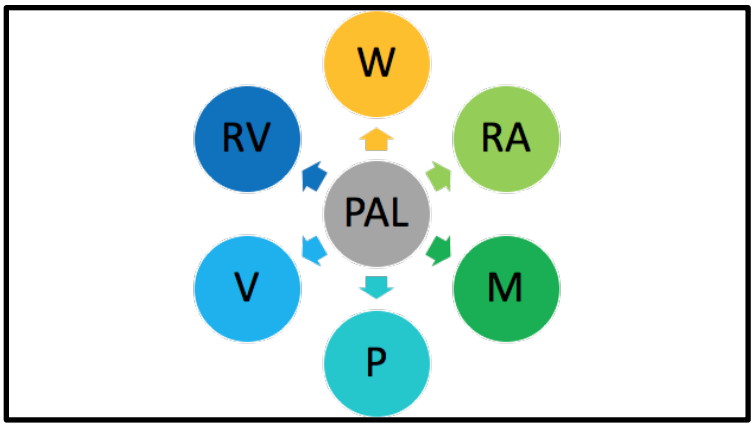


Figure 1. PAL course attribute supporting all six course delivery modalities.

In a PAL course, a portion of the overall instruction is delivered via an online adaptive learning system that customizes objective-driven content and assessments to create a personalized learning path for each

student according to their knowledge, skills, and learning needs. PAL courses utilize one of several adaptive platforms that provides the previously defined adaptive design features. Some of the systems in active use on campus include Realizeit, ALEKS, Knewton Alta, and LearnSmart.

To support the development, delivery, and evaluation of its adaptive learning initiative, UCF established the PAL team. Consisting primarily of credentialed instructional designers, with assistance from technical and content experts, the PAL team is responsible for working with faculty to design and construct adaptive courses in all modalities, as well as support the course delivery and evaluation of its efficacy. In addition to direct faculty support through consultations, the PAL team may also assist faculty with course authoring within an adaptive platform, and this focus on faculty development and preparation has been key to the success of the university's adaptive learning initiative.

To further enhance the onboarding experience of faculty interested in designing and teaching an adaptive course, the PAL team has developed a training course called PAL6000. This self-paced course involves meeting with an assigned instructional designer at least six times, during the process of completing online course readings and a *Build Your Course Project*. The PAL6000 Certificate of Completion grants PAL credentials to design and teach using the Realizeit adaptive learning system. While a large percentage of certified PAL6000 faculty design their adaptive course(s) from scratch or some form of existing content, some alternatively adopt adaptive courseware from publishers. In these cases, the PAL team also partners with adaptive vendors to conduct workshops and ad hoc training for faculty to maximize the benefits of personalization and adaptivity for students.

Now that a contextual base has been established, the remainder of this field note focuses on the design, delivery, and implications of utilizing PAL systems at UCF, capturing the lessons learned and best practices gathered since the first adaptive pilot in 2014.

An Adaptive Learning Design Framework

At UCF, many instructors choose to design their adaptive courses with self-authored content, open educational resources (OER), or publisher content. This is primarily due to the lack of existing adaptive courseware in most disciplines. When designing these new adaptive learning courses with individual faculty, the PAL instructional designers follow a systems approach using the five key adaptive design features—the Adaptive Learning Design Framework—as displayed in Figure 2. The first three design features are required components of any PAL designated course, while the last two (although not required) add important value to any PAL course experience. The designers work with instructors to incorporate these five features into course design. (These five design features will be discussed in further detail in the following sections).

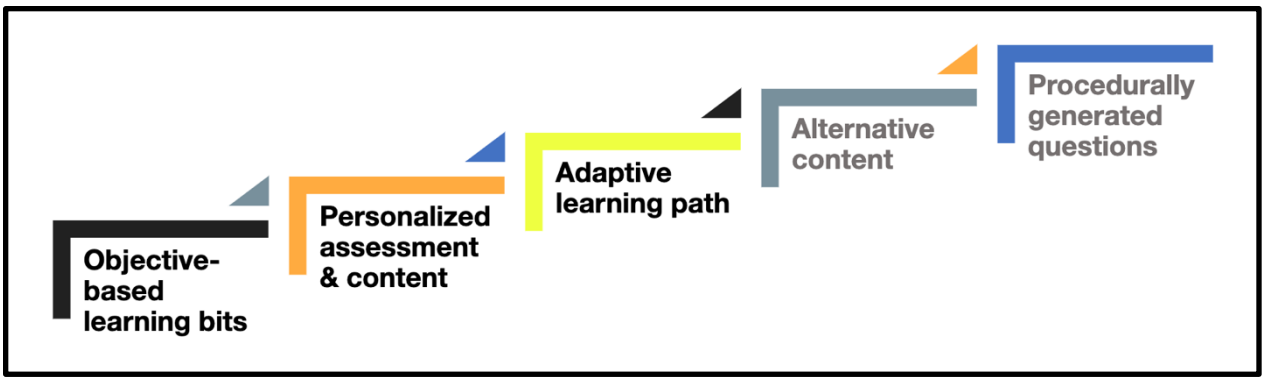


Figure 2. UCF's adaptive learning design framework with five key features.

Objective-Based Learning Bits

Defining specific learning objectives as a "first-step" in adaptive course-design establishes the parameters by which a variety of content-trajectories can converge, diverge, and/or repeat (Willcox & Huang, 2017). In the process of authoring adaptive content, as a best practice, UCF course instructors, as the subject matter experts (SMEs), are guided to identify small knowledge units, called *learning bits* (i.e., lessons) that typically take students an average of 30 minutes to complete. This content structuring process typically takes on the form of breaking one learning objective into five or more concepts. For instance, instead of delivering 14 fully intact chapters of content, UCF's PAL courses might contain up to two hundred mini lessons derived from those 14 chapters where students are evaluated frequently (e.g., at the end of each lesson) to measure the level of mastery they have achieved related to one or more learning objectives.

Suppose one course objective reads as follows: "Students will be able to use simple linear regression as indications and trends of business and economic data" (Buhagiar, 2018). To support this objective, 10 lessons (Figure 3) on concepts or component skills are identified and mapped back to that objective in the form of evidence-bearing assignments and/or assessments, which are then measured individually and collectively by the PAL system to determine which content and/or assessment item(s) to deliver next to increase the students' likelihood of achieving mastery on that objective.

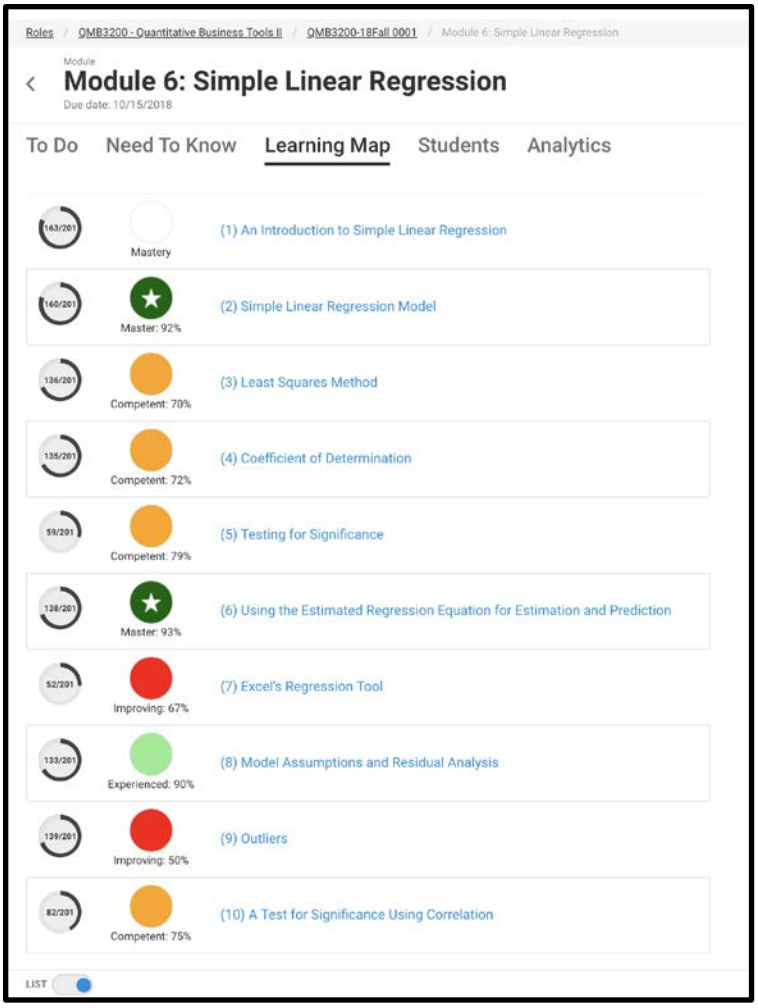


Figure 3. Ten lessons associated with the objective on the topic of Simple Linear Regression. Adapted from *QMB3200: Quantitative Business Tools II,* by T. Buhagiar, 2018, Orlando, FL: University of Central Florida. Copyright 2018 by the University of Central Florida.

Personalized Assessment and Content

After specifying learning bits or lessons at the concept or component skill level, the courseware authoring process involves drafting content materials, assessment items, and detailed feedback. The majority of adaptive systems are assessment-driven (Essa, 2016) as the platform delivers personalized instruction based on the results of pretests/posttests and practice and/or graded assessment(s). Compared to traditional online courses, an instructor spends considerably more time developing assessment items and feedback than writing content. During the process of designing an adaptive course, after the learning objectives are granularized, an instructor would likely identify learning bits that lack assessment items from the existing question pool, as it is recommended that each adaptive lesson includes at least five or more questions. The more questions a lesson includes, the more robust the learning experience. In some of UCF's completed adaptive courses, for example, instructors expanded their question pool from a couple of hundred (maybe 20 per chapter) to over 1,000 for the entire curriculum.

Writing detailed feedback is another key element in adaptive course design. Students improve their performance through continuous practice, feedback, correction, and enrichment in the formative assessments of each lesson. Students need to practice with timely feedback in order to identify specific areas they may need to improve. Therefore, instructors are highly recommended to write detailed feedback at the question level to scaffold student learning. This feedback could include the correct answer, why a particular response/option is correct (or incorrect), or recommendations of topics for the student to review (Chen, Bastedo, Kirkley, Stull, & Tojo, 2017). Figure 4 illustrates an example question (Chen, 2019) from an adaptive course with detailed feedback for both correct and incorrect responses.

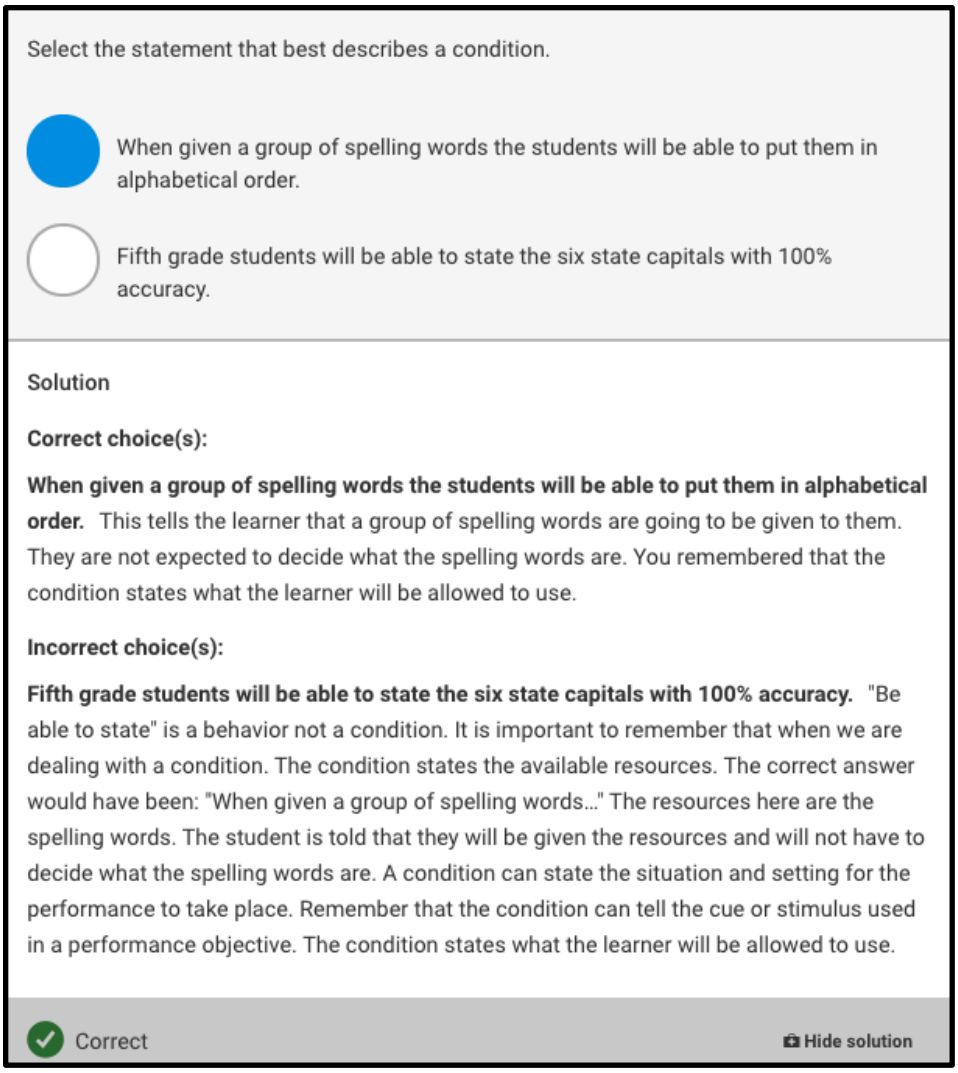


Figure 4. Detailed feedback for each assessment item. Adapted from *EME6613: Instructional Systems Design*, by B. Chen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 from the University of Central Florida.

To meet each student's unique learning needs, a large number of learning activities must be developed and tagged, which creates significant workload for faculty SME and instructional designers (Khosravi, Sadig, & Gasevic, 2020). While the design and development work are time-consuming, this phenomenon is rarely

reported in the literature (Baker, 2016; Essa, 2016). However, when reported, such as in the case of Pavlik Jr., Brawner, Olney, & Mitrovic (2013), an estimate of 200 hours of development time was estimated to be spent for every one hour of instructional content design. In another study (Aleven, Mclaren, Sewal, & Koedinger, 2009), with the use of smart tools, it took the SME alone 25 hours to author one hour of content. At UCF, each PAL instructional designer actively works with two to five faculty members who focus on completing one or two adaptive modules (objectives) each semester; therefore, due to resource limitations, one adaptive course might take six or more academic semesters to complete.

Adaptive Learning Path

The assessment-driven learning bits that were authored during the content development phase are then mapped into a hierarchical structure to ensure students master prerequisite skills before proceeding to more advanced topic areas in the hierarchy. The adaptivity starts with knowledge determination (in the form of a pre-determined set of questions) to allow the system to gather information about the students prior to having them engaging in the core material. As a caveat in regard to "pretesting," the degree to which an adaptive system can be configured varies across platforms. Pretesting determines preliminary questions a student sees, and based on students' performance, an adaptive system determines students' acceleration or remediation through the objective-based learning pathway. It is a very valuable system functionality for an adaptive system to determine students' knowledge prior to moving forward to their core learning task(s), particularly if it is developed thoughtfully.

To a varying extent (depending on the system), a learning path with feedback/remediation can be constructed, but the adaptivity only exists in theory until an agent (in this case a student) enters the system and interacts with it. At that point, the system begins to gather data about the learner—primarily structured around content preferences (possibly identity) and proficiency level. These bits of information then power the type and/or difficulty-level of material(s) a student encounters, and as the learner-profile begins to form related to the aforementioned items, the instructor can analyze those learner-centered data trends and intervene as appropriate to encourage content review and revision—reinforcing student mastery. Figures 5a and 5b illustrate two learning paths based on different adaptive course designs at UCF.

Figure 5a illustrates several initial modules (objectives) of a business statistics course built in Realizeit. This portion of the learning path consists of 25 learning bits (lessons) on six color coded topics. Students start the learning path from left to right, and subsequent lessons can only be unlocked if prerequisite lessons have been completed. This type of mapping allows space for students to choose their pathway (e.g., down the p-bar or x-bar route), while applying enough foresight (design-wise) to limit students to the materials they are prepared to engage with during particular points along the learning pathway(s).

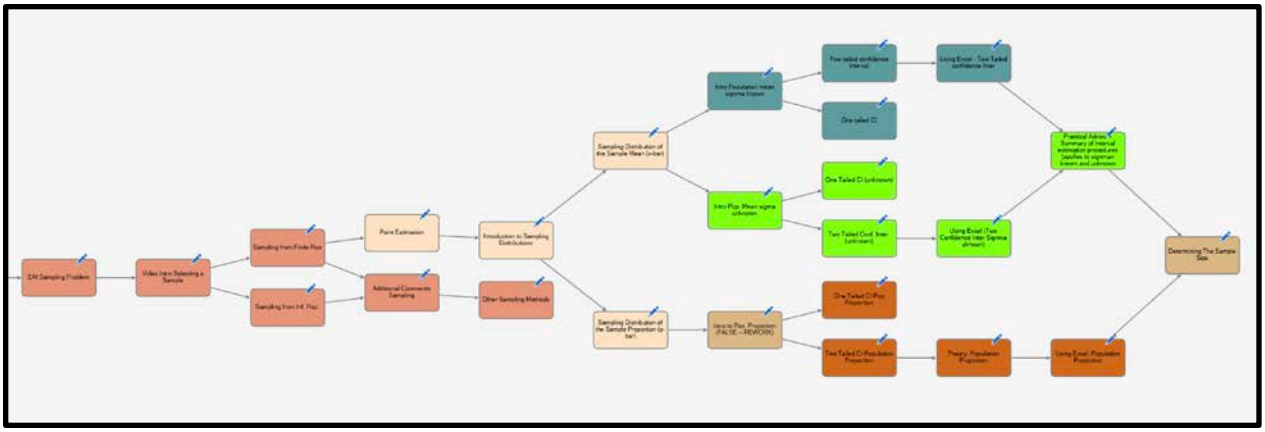


Figure 5a. A portion of a Realizeit learning path in QMB3200 (modules 2 and 3). Adapted from *QMB3200: Quantitative Business Tools II*, by T. Buhagiar, 2018, Orlando, FL: University of Central Florida. Copyright 2019 from the University of Central Florida.

Figure 5b represents an example learning pie in ALEKS. The slices are color coded and represent the chapters in the domain or course curriculum. The number of instructor-selected topics in each slice is shown below its title. In this example course, those chapters are divided into 14 weekly custom objectives and each objective contains 20 topics. Custom objectives are used for weekly pacing throughout the curriculum. ALEKS organizes those topics in a "Ready to Learn" category based on previous learned and mastered topics. In Figure 5b, the student is at objective 4 called "Obj. 4 2.1-2.3" and has 12 more topics left to learn. The next topic to learn on the learning path is "Variable expressions as inputs of functions: Problem type 1."

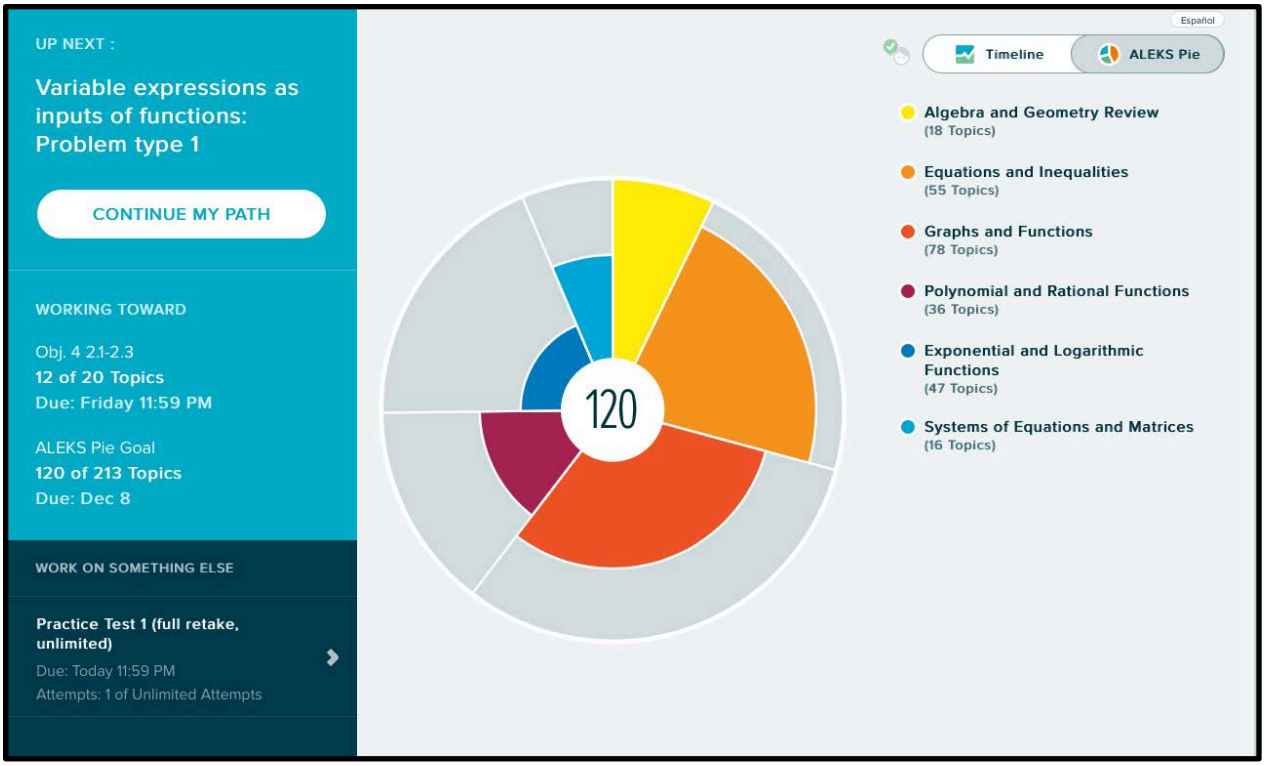


Figure 5b. A sample of the ALEKS learning pie. Adapted from *MAC1105C: College Algebra*, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 from the University of Central Florida.

Learning analytics is another key component of the adaptive learning path. It is not a design feature but a key teaching feature once the instructor starts to teach with an adaptive system. In a number of courses at UCF, adaptive courseware delivers a robust web of content with personalized feedback that results in granularized data points for each student, which can then be acted upon by the instructor(s) in real-time. How long has a student spent in a given learning space, and how much effort has been expended during that time? Has this student flagged any questions for review or made continuous attempts at certain questions to no avail? This can be viewed at the aggregate (class) level and domain level as well, and what is particularly helpful in each scenario is if an instructor actually possesses the flexibility to engage differently (based on that feedback) in the next face-to-face session, online component, office hours, or even email and/or a class announcement. This type of student-centered learning analytics can be used to create peer/mentoring groups and provide any other type of intervention before this academic concern becomes either irreparable or very challenging to resolve. Detailed examples of learning analytics are presented in the Pedagogy section of this paper.

The success of this adaptive pathway depends on the instructor and a few main system functionalities: prerequisite mapping, assessment variability (textual and numeric components), content preconditions, and alternative learning modalities (textual, interactive, multimedia). The latter of which will be expounded upon in the next section.

Alternative Content and Choices

In the process of organizing content into learning bits (lessons), UCF PAL instructors and instructional designers found that relative to traditional courses, adaptive courses need additional or alternative content (Chen et al., 2017). This feature is not discussed widely in adaptive learning literature (as far as the authors have observed), but anecdotal feedback indicates this enhancement augments the adaptive personalization of adaptive courses. For example, in adaptive courses with alternative content (Figure 6), the system will ask students if they would like an alternative version of an example or instruction during a lesson path.

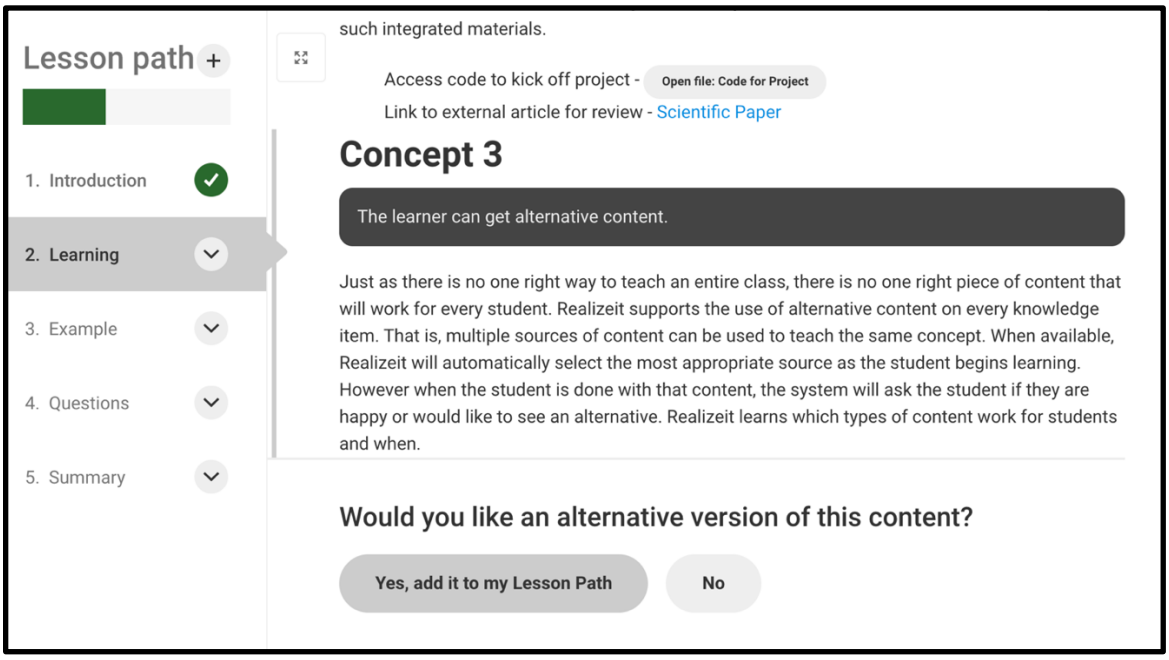


Figure 6. An example of a Realizeit lesson with alternative content.

The alternative content could be a video related to the content students have just read or another practice example with different variables. Due to time and personnel limitations, alternative content or choices are developed in only a select number of UCF adaptive courses, but as more instructors have now completed their initial design, this is a prioritized feature in their course revision agenda.

Prior to pursuing adaptive course design and development, instructional content in the Learning Management System (LMS) at UCF often consisted of PDF documents, PowerPoint slides, and some basic Web-based content pages. To evolve from the traditional course building model to an adaptive one, instructional designers, along with multimedia specialists and course instructors, have enhanced the content with additional text, detailed examples, embedded videos, animations, and other resources (Chen et al., 2017). By doing so, the institution found a novel way to accommodate diverse student learning preferences and incorporate learning principles for universal design (CAST, 2018). For instance, having a variety of question sets, examples, and multimedia increase the level of content variation for students who revisit lessons to engage with the learning materials.

Procedurally Generated Questions

While content and assessment development can be arduous and time-consuming, their payoff is in the potentiality of constructing a personalized (contextually relevant) and adaptive (evolving) learning experience. This adaptive experience can be further enhanced through leveraging content variables, groupings, and conditions.

Regarding content variables, groupings, and conditions, there are a few noteworthy examples from within the UCF PAL ecosystem. One that stands out is a set of mathematical (word) problems that have strings of variables for male and/or female names and a completely different scenario depending on a student's major (e.g., business, education, etc.) so each student will access content that is relevant to learner's background and characteristic (Muhs, 2018). This same design feature is applied to quantitative aspects of the course as well, where numbers are randomly generated (within predefined thresholds) for practice problems and other numeric assessments (including advanced data analysis using Microsoft Excel). Grouping and conditions are closely related and can be looked at simultaneously and, depending on the flexibility of the adaptive learning system, groupings of questions can also be set up to manifest upon certain conditions. These conditions might relate to the variables of a given problem or case study and even to specific values appended to learning content so the content only appears under specific numerically defined circumstances (e.g., less than or equal to a score of 70% on the last assessment will offer learning item 1, whereas a score greater than 70% will offer learning item 2). Figure 7 presents a case study with embedded variables from a nursing undergraduate course. Each student is presented with a unique case study with varying correct answers and feedback. Students are motivated to practice the case study multiple times because a different case study is presented for each attempt.

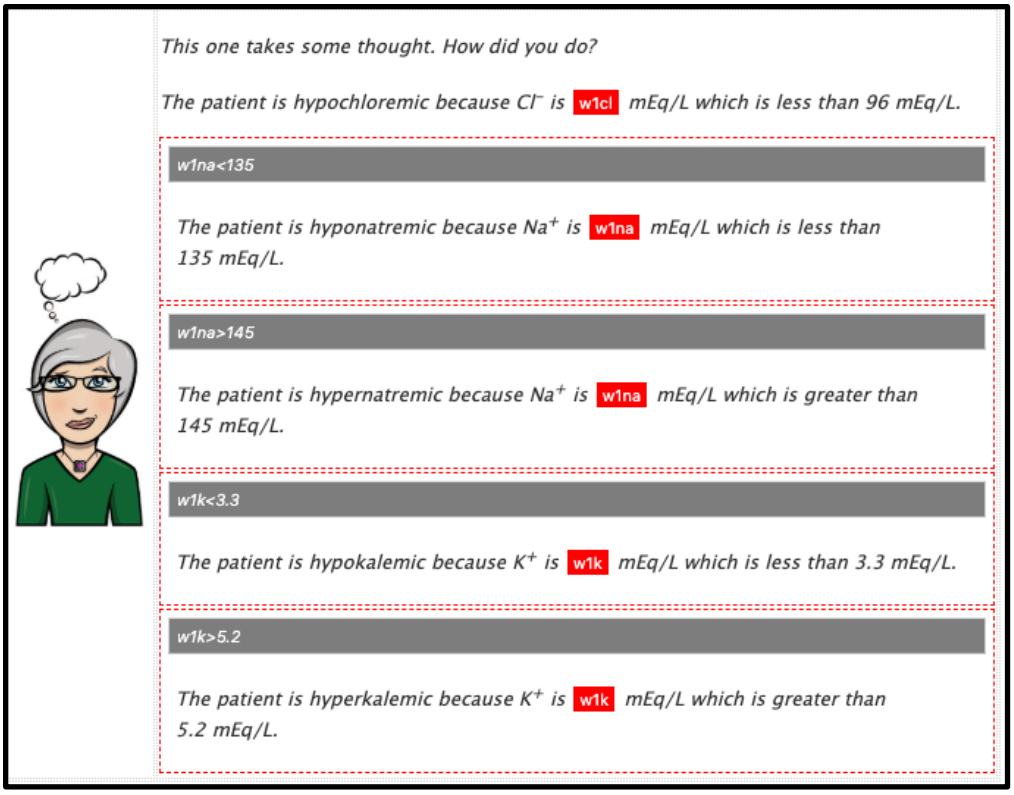


Figure 7. An example of an adaptive case study with varying feedback that embeds numerical variables. Adapted from *NUR3125: Pathophysiology for Nursing Practice*, by J. Hinkle, 2017, Orlando, FL: University of Central Florida. Copyright 2017 from the University of Central Florida.

The five adaptive design features listed above can be arranged in a myriad of complex ways, but the content area itself (and the amount of content available), along with the subject matter expert/instructor and design team, may afford or restrict the adaptive system capacities due to a lack of systems expertise or simple time constraints. That being said, adaptive systems are continuously evolving, so the more involved a design team is with the build process—communicating directly with the software company, offering feedback, and proposing feature requests— the more willing these educational technology companies are to stretch and expand to create new and innovative ways to provide meaningful adaptive learning solutions.

A Pedagogical Approach

Regardless of the instructors' choice to create their own adaptive content or adopt existing courseware, teaching with an adaptive platform involves deliberate planning and management, and the importance of an instructor in the use of an adaptive platform cannot be stressed enough. Therefore, adaptive pedagogy is highlighted in our faculty training process to make sure instructors use the system, not only as a homework system, but also as an integrated instructional tool to improve student learning. The following sections discuss the best practices for teaching with adaptive technologies.

Change of Perspectives: From Lecturing to Personalization

As the literature (Chen et al., 2017; Dziuban, Moskal, Johnson, & Evans, 2017; Dziuban et al., 2018; Essa, 2016) suggests, adaptive learning is often linked with terms such as *personalized learning*, *mastery-based learning*, and *student-centered learning*. Unlike traditional lecturing, adaptive instruction is dynamic and personalized to meet the unique needs of individual learners. Since students come with different knowledge sets, the intention of adaptivity is to help each of them reach a desired level of mastery at their own pace by allowing them to be active and independent learners instead of passive listeners in traditional lectures. Adaptivity is achieved by determining individual's prior knowledge and providing personalized learning recommendations. In adaptive courses, instructors release control of certain aspects of instruction, leaving some of the responsibility in the hands of students.

One of the *misconceptions* that comes with the adaptive system is that the technology will replace instructors in schools. Although adaptive technology facilitates the students' learning process, the successful implementation of adaptive learning still requires human planning, interactions, monitoring, and interventions. The role of an instructor remains crucial (Baker, 2016; Brusco, 2018; Essa, 2016; Essa & Laster, 2017) in adaptive learning because only the instructor can select learning objectives that fit with the overall course learning outcomes and targeted student population, align both online and face-to-face activities and assessment with selected learning objectives, orchestrate learning activities both online and in person, and provide individualized feedback and support for all learners (Essa & Laster, 2017). The instructor organizes various additional class activities around the adaptive practices, sets up course expectations and grading schemes, monitors students' progresses, and answers questions. It is the instructor's responsibilities to assist students in understanding the functionalities and the value of the adaptive system, and to help students transition from passive learners to active collaborators so they can begin to understand the rationale why frequent assessments provide guidance instead of hindrance to their progress. This level of awareness is critical, as Deslauriers, McCarty, Miller, Callaghan, & Kestin (2019) so aptly convey: A lack of timely instructor communication will result in student resistance and learner disengagement.

Understanding the Adaptive System: Getting Ready to Teach

For instructors who adopt existing adaptive courseware, the first step is to understand what an adaptive system is and evaluate existing adaptive courseware to select the one that most supports the course learning outcomes. Some of the questions that the instructor can ask during the evaluation process include: Is it simple to navigate? Does it integrate with the institutional LMS? Is it compliant with the Americans with Disabilities Act (ADA)? How does it make learning recommendations to students? Does it provide good explanations and ample resources? Can the instructor customize, add, or edit content and questions? What kind of instructor and student support will the company provide? A complete list of technology evaluation criteria can be found on the Courseware in Context website. If none of the existing adaptive courseware suffices, the instructor still has the option to create their own adaptive courseware using an adaptive platform that permits original or 3rd-party content to be integrated.

After selecting the courseware, it is essential for the instructor to take some time to learn how the adaptive system supports student learning, enlisting the support of publisher representatives and instructional designers as necessary. Only with a thorough understanding of the system will the instructor be able to

select relevant content, take advantage of the system adaptivity, and remedy any existing system limitations with instructor-made supplementary resources and class activities. After the instructor understands how the system works and what content and questions the system offers, he/she can then help the students build trust in the system's recommendations, select objectives and learning activities that meet students' needs, and prepare additional learning materials that might be missing from the adaptive courseware.

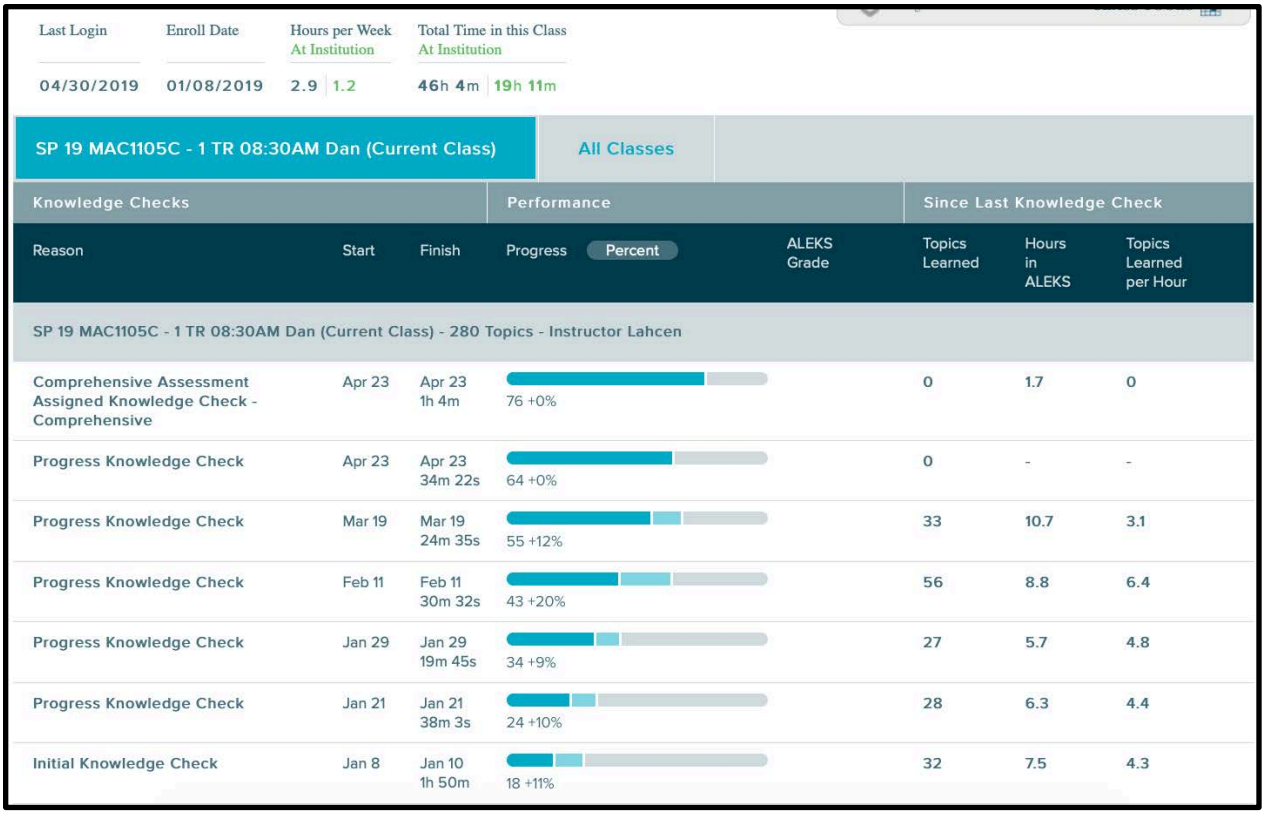
In an adaptive course, instructors should provide students with an overarching picture of how the course works to help them understand and manage the workload. Most likely, adaptive assignments have a non-traditional grading scheme where scores are calculated based on a combination of factors, such as learning performance, time spent, effort, speed, and other data points. Again, it is the instructor's responsibility to help students translate the scores and guide them in the right direction to maximize their learning efforts. Confusion about grading schemes could easily result in low student motivation, which will lead to poor learning performance.

Teaching With Adaptive Learning: Class Management Strategies

At the beginning of the semester, in adaptive courses, instructors should present clear syllabus documentation with explicit assignments, grading policies, and criteria for advancing if students are allowed to complete the course early to advance into the next class. In addition to a clear syllabus, we highly recommend that instructors prepare a syllabus quiz for students to complete so they read the syllabus carefully and do not miss important information.

As most of the adaptive assignments are self-paced individual learning activities, instructors should make recommendations to guide self-paced learning so learning is effective. As the learning path for each student is personalized, some students might have more objectives to learn or master than others. Thus, it is important to allocate adequate time for those students to learn and reflect before important milestones. In the situation where students pace their own learning, some might procrastinate and fall behind due to various reasons. Therefore, it is essential for instructors to intervene with reminders and online or in-person mentoring opportunities and to allow for extra time on milestone tests and reasonable opportunities for students to catch up.

It is critical for instructors to become knowledgeable about learning analytics presented in the adaptive system, as indicated in Figure 8a and 8b. Student-centered learning analytics, including learning rates/speed, login frequency and time, student progress, and learning performance, can offer insights to help instructors understand their students. An early progress feedback alert system can greatly help students focus on their tasks. For instance, instructors can set up automated reminders based on inactivity or abnormal learning rates. It is a good practice to check in with students with abnormally slow or fast learning rates to avoid procrastination or potential cheating/gaming practices.



Last Login	Enroll Date	Hours per Week At Institution	Total Time in this Class At Institution
04/30/2019	01/08/2019	2.9 | 1.2	46h 4m | 19h 11m

SP 19 MAC1105C - 1 TR 08:30AM Dan (Current Class) | All Classes

Knowledge Checks			Performance		Since Last Knowledge Check		
Reason	Start	Finish	Progress Percent	ALEKS Grade	Topics Learned	Hours in ALEKS	Topics Learned per Hour
SP 19 MAC1105C - 1 TR 08:30AM Dan (Current Class) - 280 Topics - Instructor Lahcen							
Comprehensive Assessment Assigned Knowledge Check - Comprehensive	Apr 23	Apr 23 1h 4m	76 +0%		0	1.7	0
Progress Knowledge Check	Apr 23	Apr 23 34m 22s	64 +0%		0	-	-
Progress Knowledge Check	Mar 19	Mar 19 24m 35s	55 +12%		33	10.7	3.1
Progress Knowledge Check	Feb 11	Feb 11 30m 32s	43 +20%		56	8.8	6.4
Progress Knowledge Check	Jan 29	Jan 29 19m 45s	34 +9%		27	5.7	4.8
Progress Knowledge Check	Jan 21	Jan 21 38m 3s	24 +10%		28	6.3	4.4
Initial Knowledge Check	Jan 8	Jan 10 1h 50m	18 +11%		32	7.5	4.3

Figure 8a. Progress report (ALEKS) shows student progress knowledge checks, topics learned, hours in the system, and learning rate. Adapted from *MAC1105C: College Algebra*, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 by the University of Central Florida.

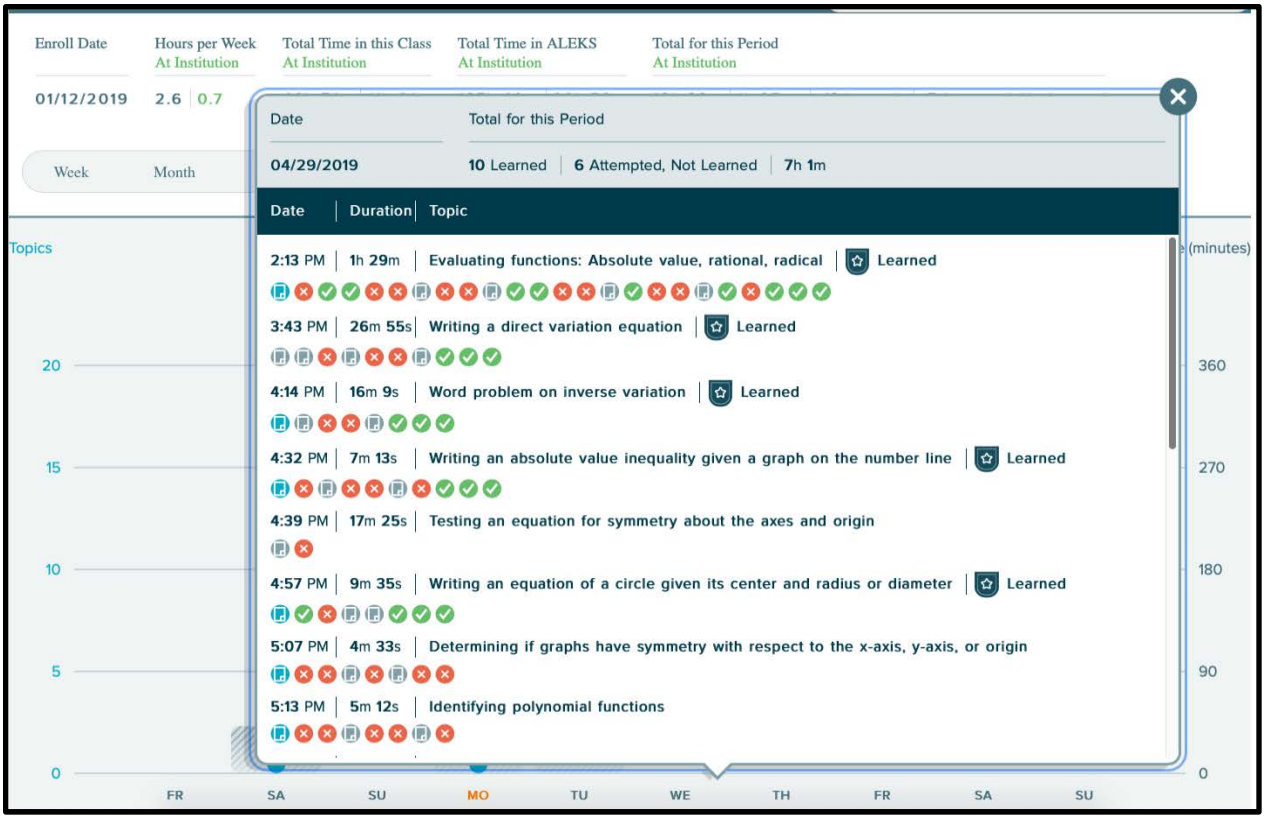


Figure 8b. Time and Topic (ALEKS) show the actions of the student in the learning path. This snapshot shows that on April 29 the student failed to learn three topics (attempted, but didn't learn). The instructor can see that the student accessed the explanation page before the last attempt. The student's answers are recorded and can be referred to when the instructor meets with the student for one-on-one tutoring. Adapted from *MAC1105C: College Algebra*, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 from the University of Central Florida.

Domain-centered analytics (Figure 9a and 9b), on the other hand, can help instructors identify problem areas and improve their teaching practices. Effective instructors should take a concept-based flexible teaching method. Traditional lecturing to a whole class while students are on different learning paths contradicts the purpose of adaptive learning. Instead, based on system analytics that show students' weaknesses, instructors can prepare small chunks of supplementary materials and activities to target problem areas.

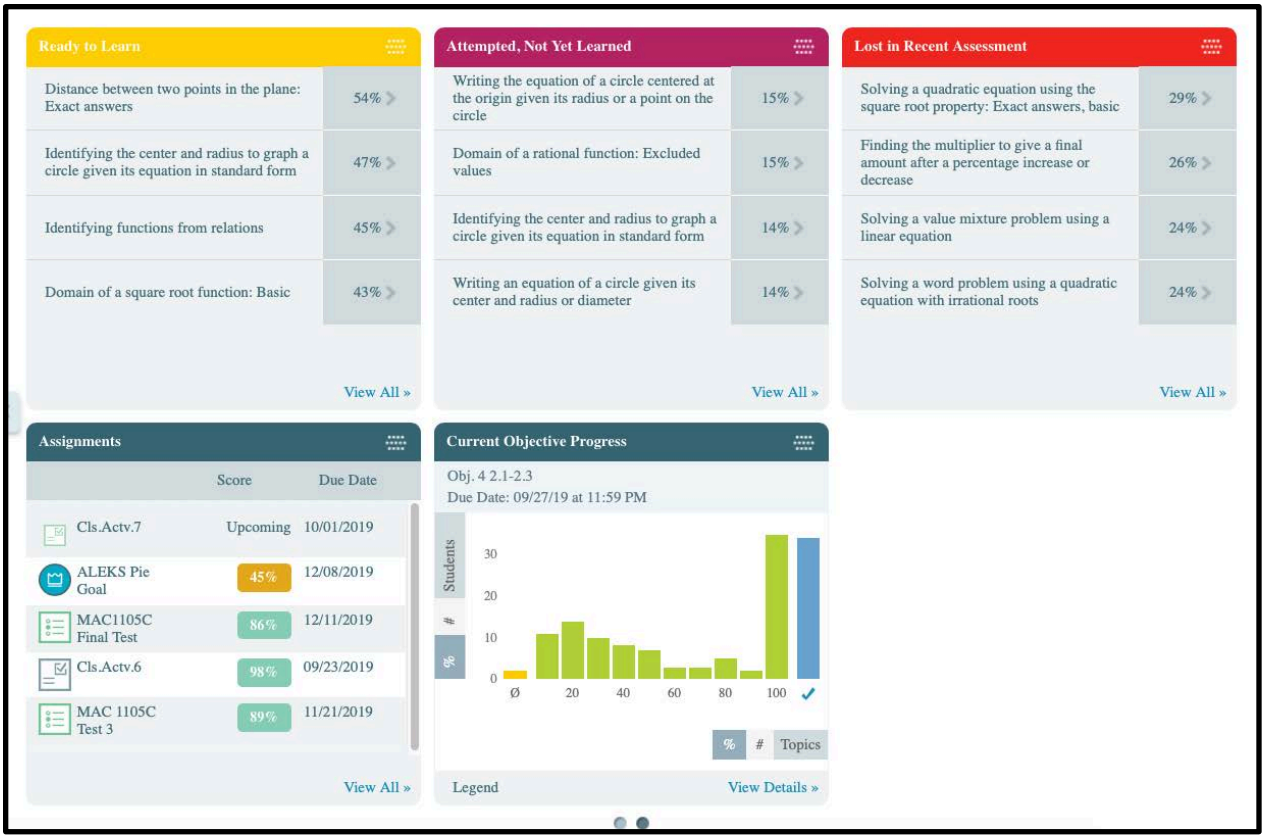


Figure 9a. Tiles on dashboard (ALEKS) offer analytics at the course section level. Each one can be expanded for details on the group of students that lost topics on a most recent assessment, attempted a topic but didn't learn, or weren't ready to learn certain topics. Adapted from *MAC1105C: College Algebra*, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 by the University of Central Florida.

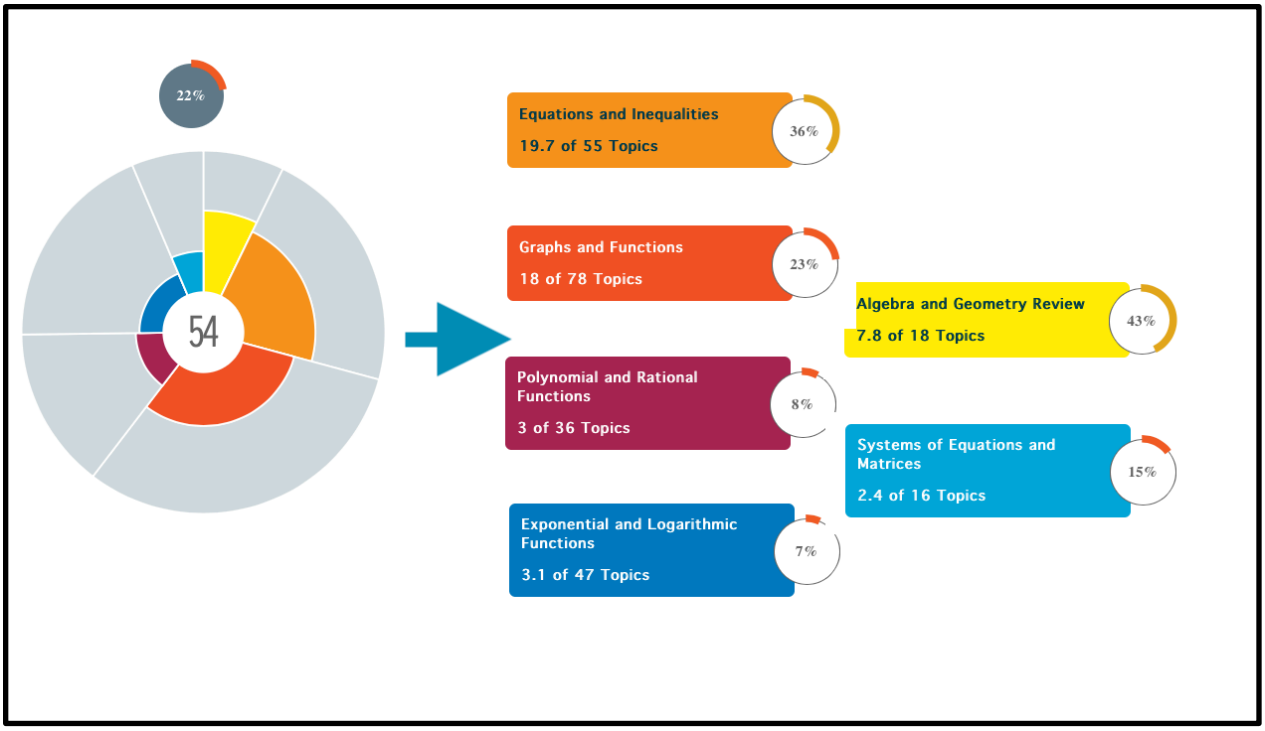
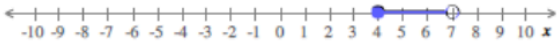


Figure 9b. The Pie report (ALEKS) illustrates students' mastering information after the initial knowledge check. The instructor can build on this baseline in follow-up class meetings or online communications. Adapted from MAC1105C: College Algebra, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 by the University of Central Florida.

As instructors review the students' performance and interact with them, it is easy to identify learning gaps, misconceptions, and challenging concepts among students. Depending on the results from these dashboards, instructors can prepare in-class mini-lectures, small-group discussions, or workshops to provide additional support for groups of students with common difficulties. Figure 10 documents an example of a mini-lecture and how it is delivered for students with low mastery of compound inequalities in the College Algebra course. For specific groups or students, instructors can also offer individualized cumulative reviews to help them set up connections between prior knowledge and new concepts. Providing automated and instructor-led feedback adds tremendous values to the adaptive learning process.

Mini-Lecture example 1: Since data analytics show that students come with low mastery of compound inequalities (#3 and #4) we indetified the problem to be more of the the solution interpretation than the algebraic manipulation. Hence, the mini lecture starts with a backward idea of giving a solution as graph or interval and ask the student to find the compound inequality of that graph. Once the instructor or teaching assistant discussed different scenarios with the students he or she asks them to solve question 3 and 4 and use question 1 to decide on the interval notation. Question 2 is considered a review and only used to idetify students who may need additional review.

1. Write a compound inequality for the graph shown below.
Use x for your variable.



2. Solve the inequality for v.

$$v+\frac{1}{5}\geq-\frac{2}{3}$$

Simplify your answer as much as possible.

3. Solve the compound inequality.

$$2v-3>-11 \quad \text{and} \quad 4v+5\geq 29$$

Write the solution in interval notation.
If there is no solution, enter Ø.

4. Solve the compound inequality.

$$3y-5\leq-23 \quad \text{or} \quad 2y-2\leq-4$$

Write the solution in interval notation.
If there is no solution, enter Ø.

Figure 10. Sample in-class mini-lesson for students with low mastery of compound inequalities in the College Algebra course. Adapted from *MAC1105C: College Algebra*, by R. Ait Maalem Lahcen, 2019, Orlando, FL: University of Central Florida. Copyright 2019 by the University of Central Florida.

Conclusion

As instructors, instructional designers, and administrators, we attempt to facilitate the adaptive learning process so that the benefits of adaptive technologies can be maximized in the design and delivery of adaptive courses. Following a systems approach to course design, we define adaptive courses as those which have a portion of the overall online learning content delivered via an adaptive learning system. It customizes objective-driven content and assessments to create a personalized learning path for each student according to their knowledge, skills, and learning needs. In the design process, the instructor should expect to spend a good amount of time 1) chunking the materials into learning bits based on granular objectives, 2) authoring assessment items and detailed feedback, 3) selecting and mapping objectives and lessons that are aligned with the course goals and student needs, and 4) enhancing the course with variables and alternative content.

As for teaching with adaptive courses, the following list highlights some pedagogical best practices. An instructor should

1. understand how adaptive systems work, especially with how grades are calculated;

2. review key domain-based learning analytics to get an overall understanding of student performances;

3. adopt a concept-based flexible teaching method that targets challenging concepts, not all concepts; and

4. provide personalized teaching interventions based on student-based learning analytics.

The use of adaptive learning in higher education is an emergent area for study. While the pedagogical approach is grounded in student-centered mastery learning theories, there is still limited evidence on how adaptive systems improve student performance and/or reduce learning gaps (Anderson, 2019; Dziuban et al., 2017, 2018; Essa & Laster, 2017; Weber, 2019). Our goal is to document best practices for adaptive implementation from our design and teaching experiences, and we encourage further experimentations to be conducted on the effectiveness of these best practices. We hope that the adaptive learning design framework and best teaching practices proposed in this field note could be implemented in other higher education institutions with any assortment of adaptive platforms. We also welcome responses and invitations from other institutions for future collaboration and research opportunities.

Acknowledgements

The lessons learned and best practices shared in this field note are drawn from the works of the course instructors and Personalized Adaptive Learning instructional designers at the University of Central Florida. In particular, the authors would like to express gratitude to the piloting faculty members, Dr. Tammy Muhs, Dr. Julie Hinkle, and Mr. Tarek Buhagiar, and the instructional designers, Ms. Kathleen Bastedo, Ms. Corrinne Stull, Ms. Debbie Kirkley, Ms. Jessica Tojo, and Mr. Joseph Lloyd.

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International **R**eview of **R**esearch in **O**pen and **D**istributed **L**earning
Volume 21, Number 1

January – 2020

Book Review: High-Impact Practices in Online Education

Editors: Kathryn E. Linder and Chrysanthemum M. Hayes (Sterling, VA: Stylus Publishing, 2018, 221 pages) ISBN: 978-1-62036-847-3 (paperback)

Reviewed by: Emily K. Faulconer, *Embry-Riddle Aeronautical University – Worldwide Campus, Daytona Beach, FL*

High-Impact Practices in Online Education, edited by Kathryn E. Linder and Chrysanthemum M. Hayes, presents a comprehensive discussion of how to translate impactful educational experiences to the asynchronous and synchronous online classroom. The first work of its kind, this volume is useful to educators across the disciplines, administrators, educational researchers, and instructional designers. The collection is rich with examples of high impact practices (HIPs) in online learning environments, with each well-researched chapter prepared by credible authors focusing on a specific HIP. The editors expertly ensured a coherent voice across the chapters.

The introduction presents a strong premise for the work (pp. 2 -3):

- The demand for high-quality college degrees is increasing;
- The demographic profile of the degree-seeking student is becoming more diverse;
- Over the last 13 years, the number of students taking distance courses has steadily increased; and
- Online students are expecting more.

Instead of viewing HIPs as individual practices, the editors present a constellation of HIPs that, when approached as milestones along a students' academic career, has a cumulative effect, particularly as the key transferable skills employers desire the most in graduates. This vision is presented in Figure I.1, which charts the 11 HIPs by increasing student independence and critical thinking skills.

Aligned with the constellation of HIPs, this book starts with the foundational HIPs, those with lower student independence, complexity, and critical thinking. Chapter 1 explores first-year seminars by first laying out the key criteria for a successful experience based on traditional first year experiences. The chapter ends with a call for research in this area to establish reach and outcomes of online first-year seminars.

The authors then point to a gap in the literature on other first-year experiences delivered online beyond seminars. In Chapter 2, the authors present the use of "big questions" from the Narrative, Engagement, Transformation (NET) framework in general education courses to achieve a common intellectual experience online. Following this, online learning communities are discussed in Chapter 3 where the authors present a key concept: "There is a critical semantic distinction between fostering a community of learners through educational strategies supported by technologies and the design of a learning community (LC) – the intentional linking of college courses and assignments as a means of fostering curricular coherence and deep, integrated learning" (pg. 41). The strategy presented – using "big questions" as a

linkage in an interdisciplinary course or a block of courses appeared to be very similar to the NET framework from Chapter 2, only with more emphasis on the learners and less on the content.

HIPs that require moderate student independence and critical thinking include writing intensive courses, collaborative projects, and undergraduate research. Because online classes are already very text-heavy, quality of writing prevails over quantity. Chapter 4 highlights what makes writing activities in online courses high-impact, including clearly communicated high performance expectations, authentic tasks, frequent constructive feedback, and structured reflection. Suggested approaches for the online classroom include peer review and screencast technology for feedback delivery. Chapter 5 explores the challenges to collaborative learning in the asynchronous environment, including communication gaps, technical difficulties, and the authenticity of the collaboration (all of which are also valid concerns in traditional courses). The chapter authors present strategies to support clear online communication within the group and how to make grading criteria explicit. Chapters 6 and 7 explore undergraduate research in online humanities and science courses. While Chapter 6 discusses a single example, Chapter 7 provides multiple suggestions for obtaining data for research at a distance. A key concept underlined by the authors is scaffolding research skills throughout the curriculum.

Towards the end of a student's academic career, they have gained increased independence and critical thinking. These skills support higher level HIPs, including diversity and global learning, service-learning, internships, capstone courses, and e-portfolios. Chapter 8 tackles the somewhat nebulous idea of diversity and global learning, which could take many forms. The authors boil it down to active learning, with a focus on multiple strategies for supporting interaction among students. The authors note the challenges in online learning, including the heavy dependence on written communication that restricts non-verbal communication. While the suggested strategies of a community scavenger hunt and jigsaw groups seem viable, the international partner class seems less attractive due to logistics. Chapter 9 presents the limited body of research on eService Learning hybrids while acknowledging the barriers. Tables 9.2 and 9.3 offer strategic suggestions for how to translate the traditional service-learning experience online. As an educator who used service-learning in my traditional teaching and who has struggled to reimagine it for the asynchronous online environment, this chapter offered solid suggestions like starting small, considering how the service is executed (integrated, component, or stand-alone), and selecting a community partner. I would have liked to see more discussion about how to identify a community partner and project that is suited for online execution. Chapter 10 establishes that online internships, while under-researched, appear to have the same best practices as traditional internships, including faculty and professional supervisors, defined goals, feedback, and self-reflection. Table 10.1 is a critical resource to anyone considering supervising or administering an online internship. Interestingly, and breaking from the previously discussed HIPs, online capstones (discussed in Chapter 11) show improved student outcomes compared to traditional capstone courses. The authors present the best practices from the nationally recognized program at Portland State University. In Chapter 12, the authors explore the benefits of e-portfolios to address two significant problems in online education: connectedness and communication. The authors deftly identify e-portfolios as a remedy to programmatic evaluation required for accreditation. Students benefit from a platform that supports metacognition, reflection, and synthesis by connecting learning across courses and extra-curricular learning.

I approached *High-Impact Practices in Online Education* as an online educator and active SoTL researcher with a particular interest in undergraduate research, collaborative learning, and eService learning. Overall, this work was objective and thorough while striking a balance between the discussion of high-impact practices and their context in online spaces. The key takeaways at the end of each section are a nice touch, making the work even more useful. However, there was some redundancy in the background of each chapter and the book would have been equally effective with less emphasis on establishing the validity of the HIPS in traditional learning environments in the beginning of each chapter. Additionally, if you are looking for more practical advice for day-to-day teaching of an online course, you may not find it as prescriptive as some others such as, Aaron Johnson's (2013) the *Excellent Online Teaching: Effective Strategies for A Successful Semester Online*.

Still, I strongly believe in that the *High-Impact Practices in Online Education* achieved its goal of making online HIPs tangible by presenting the current research and emerging practices. I recommend this book to all online educators and administrators – and to anyone who says, "but you can't do that online."

Reference

Johnson, A. (2013). *Excellent online teaching: Effective strategies for a successful semester online.* Retrieved from https://www.amazon.com/Excellent-Online-Teaching-Strategies-Successful/dp/0989711609