

3-1-2017

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Higher education institutions have been playing a pivotal role in the emergence and elaboration of the Open Educational Resources (OER) movement. Initially, pioneering institutions such as the Massachusetts Institute of Technology (MIT) have led the conceptualization of OER, providing models of sustainable initiatives. Following the forerunners, many other institutions started their own OER initiatives to help achieve affordable and equal education. Unfortunately, however, several OER initiatives have experienced failed efforts, making minimal impact. This article studies previous OER efforts and articulates the process, principles, and anticipated outcomes based on critical lessons learned from these higher education institutions. Informed by a review of the literature related to organizational innovation, change management, and OER implementations, the

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authors provide a systematic set of guidelines for developing an implementation model for institutional OER initiatives.

Introduction

Strategic implementation of Open Educational Resources (OER) in higher education institutions' research and practice is currently gaining momentum (Hylén, 2006). Seaman (2015) states that an increasing number of higher education institutions have implemented some sort of OER in their environment, and that many more are seriously considering implementing OER in the near future to (1) share knowledge, (2) reuse publicly available knowledge, (3) reduce cost of knowledge creation, and (4) conduct good public relations (Hylén, 2006). This momentum has been largely driven by both significant financial support from corporations and empirical research findings that support OER efficacy, perceived value, and, importantly, cost reduction (Fischer, Hilton, Robinson, & Wiley, 2015; Hilton, Gaudet, Clark, Robinson, & Wiley, 2013; Hilton, Robinson, Wiley, & Ackerman, 2014; Robinson, Fischer, Wiley, & Hilton, 2014). Research on OER has focused largely on student benefits, while organizational benefits and cost when implementing OER remain largely undiscovered. For example, successful OER implementation requires a substantial amount of financial and human resources, along with purposeful planning and facilitation; otherwise, innovations are not likely to be sustained (Baer & Frese, 2003; Damanpour, 1991; Poole & Van de Ven, 2004).

Higher education institutions should realize that participation in the OER movement requires a significant investment and a strategic plan when initiating a university and program-level effort (Schaffert, 2010). For example, ample time is required to locate and put in place appropriate OER materials. Procurement and maintenance of a technological infrastructure are reliable indicators of successful initiatives. For the OER movement to become sustainable, a solid business model and secure funding are highly recommended (Schaffert, 2010).

Research on OER has mainly focused on a few specific topics including user's perceptions, cost, and efficacy, while research related to OER implementation strategy remains scarce. Recognizing the attention and momentum of the OER movement in higher education, the potential impact of uncovering effective OER implementation strategies is promising. Thus, the purpose of this review of the literature is to provide an overarching OER implementation model for effective implementation of OER initiatives in higher education institutions. This includes related literature pertaining to organizational change, change management, OER innovations, instructional design, and professional development when implementing innovations in higher education.

The Five Phases of Implementation

Although literature pertaining to OER implementation is scarce, a large volume of literature is available from neighboring fields, such as higher education, innovation, instructional design, and change management. From the literature review on educational change models conducted by Ellsworth (2000), it appears that the traditions of educational change were initially rooted in the *diffusion of innovation* (Rogers, 2010) in the 1940s, followed by *general systems theory* (Von Bertalanffy, 1968) in the 1950s. Later, a fusion of these two lines of research emerged as *systemic change in education* (Jenlink, Reigeluth, Carr, & Nelson, 1996; Jenlink, Reigeluth, Carr, & Nelson, 1998; Reigeluth, 1992; Reigeluth, 1994). Synthesizing the principles of educational change models and change theories, this research proposes an implementation model for Open Educational Resources (OER) in the context of higher education. The proposed OER implementation model is divided into five phases and the components associated with each phase. The five phases are (1) Analysis, (2) Adoption, (3) Optimization, (4) Evaluation, and (5) Stabilization. It is important to note that these phases are not always sequential, and some are iterative and reciprocal.

Analysis Phase

The analysis phase is crucial as it sets the stage for the entire initiative and is similar to a needs assessment (Borich, 1980; Dick, Carey, & Carey, 2006; Goldstein, 1986; Morrison, 1976; Wang & Burris, 1997). Morrison (1976) describes needs as "existing any time an actual condition differs from a desired condition in the human, or 'people,' aspect of organizational performance or, more specifically, when a change in present human knowledge, skills, or attitudes can bring about the desired performance" (p. 9). In the same sense, change theorists and scholars have proposed models of change, among which the first step listed is about awareness of problems and the need to come up with plans and solutions (see also Kaplan, 2005; Kotter, 1995; Kotter & Cohen, 2012; Lewin, 1943, 1946; Lueddeke, 1999; Weick & Quinn, 1999). The initial goal-setting process is very important, as it sets the directions of the entire implementation; other components outlined below must align with the goals and vision established from the beginning. The analysis phase is composed of the following steps:

- a. Establish an OER initiative task force.
- b. Define overarching problems OER can address.
- c. Set OER initiative goals and vision.
- d. Establish OER initiative objectives.
- e. Analyze resources needed for the OER initiative.
- f. Analyze the technological infrastructure needed for the OER initiative.

- g. Align OER initiative with institutional mission and values.
- h. Develop a feasible and manageable timeline for OER initiative.
- i. Decide on either creation or adoption of an OER platform.
- j. Establish relationships with external partners to support the implementation of the OER initiative.

In the context of OER, higher quality OER materials have been made available with easier access, leading many higher education institutions to adopt OER resources at various levels, such as the course-specific, program/department, university-wide levels (Glennie, Harley, Butcher, & van Wyk, 2012). However, higher education institutions should realize that an effective OER initiative is an organization-level innovation, requiring a thoughtful implementation process involving a wide variety of stakeholders (OpenStax, personal communication, February 2016). Hall and Hord (2001) state in their book, *Implementing Change*, for successful implementation universities should regard the change process as a team effort supported by strong leadership. Therefore, higher education institutions should begin with (a) establishing a taskforce team devoted to OER implementation. Core stakeholders, such as university leadership, the information technology director, library representatives, and online education professionals are included in this process, which later scales up to distribute the innovation (Rogers, 2010). At this point, it is critical to designate a leader(s) to oversee and lead the whole implementation process. Scholars have long advocated the importance of leadership in practically any innovation process (Hall & Hord, 2001; Rogers, 2010).

The first taskforce meeting should center on (b) identifying problems or areas for improvement in order to advance the discussion of initiative goals (Gibbons, Boling, & Smith, 2014). The leaders and team members then (c) contemplate the goals of their initiative in consideration of a long-term vision (Hall & Hord, 2001), followed by (d) identifying objectives associated with the overall goals and vision of the initiative (Kouzes & Posner, 2009). For optimal implementation results, organizations should analyze whether or not they possess sufficient (e) human and financial resources (Havelock & Zlotolow, 1995), (f) a solid supporting technology infrastructure (Schaffert, 2010), and ensure compatible technical standards (Bissell & Boyle, 2007) given that the vast majority of OER content is available on the Web and electronic devices. Furthermore, higher education institutions should consider if (g) the underlying goals of OER initiatives align with the university's mission and values (Olcott, 2012). In addition, a (h) timeline analysis needs to be conducted in this phase in order to ensure that feasible and manageable deadlines are set for each milestone and objective (Havelock &

Zlotolow, 1995). In doing so this can help organizational members solidify the vision and goals of the initiative and establish outcome benchmarks (Moore & Dutton, 1978). Lastly, universities must (i) choose to either adopt an existing OER platform, such as OpenStax or OpenCourseWare (OCW), or create a new OER platform of their own (OpenStax, personal communication February, 2016). Here, it is noteworthy to point out the difference between the development and implementation of an innovation, which initially sounds like two sides of the same coin. However, development of an innovation entails all activities associated with creating an innovation, whereas implementation involves the use of an innovation. Interestingly, the amount of time required for innovation development and implementation is often similar. Choosing either path requires different strategies, including styles of change facilitators (Hall & Hord, 2001). With a variety of OER platforms currently available, selecting the most appropriate platform investigations should be done by (j) establishing a strategic partnership with an external vendor to help support the implementation of the OER initiative (Hall & Hord, 2001).

Adoption Phase

After the components of the analysis phase have been addressed, ideally organizations would move into the adoption phase. This phase involves the development of macro-level implementation strategies, pilot-testing, and formative evaluation of the initiative so that leaders of the university can make an informed decision for potential university-wide implementation. The list of adoption components below is followed by the details for each step:

- a. Develop an OER implementation strategy.
- b. Establish stakeholders' roles and responsibilities during OER implementation.
- c. Adopt or prototype OER materials.
- d. Conduct an OER pilot.
- e. Conduct action research for the OER pilot.
- f. Integrate OER within the LMS using Learning Tools Interoperability (LTI).
- g. Conceptualize an OER content management system.
- h. Develop a production plan and budget.

The very first task in the adoption phase is to (a) come up with a thorough implementation strategy aligned with the initiative goals and objectives articulated in the first phase. Developing implementation strategies should begin in the adoption phase after the initiative goals and objectives have presumably already been established in the analysis phase. Developing implementation strategies mainly involves setting the strategies and tactics for effective implementation and should address both the macro- and micro-levels, as well as considering the short-term, mid-term, and long-term

effects of the initiative. Lane (2008) states that this stage involves articulating crucial steps and strategies that will ensure a successful implementation. Ideally, the strategies identified build on the lessons learned and descriptions from implementations at other higher education institutions, such as case studies.

With the implementation strategies outlined, it is important to (b) establish stakeholders' roles and responsibilities, at least briefly, in order to estimate who does what during implementation (Von Krogh, Ichijo, & Nonaka, 2000). Then the organization goes on to execute with care and calls for small-scale experiments to predict the impact of the innovation. Therefore, we suggest (c) adopting or prototyping OER materials (Gibbons *et al.*, 2014), and then (d) conducting a pilot test (Keengwe, 2007), and incorporating (e) action research for summative and formative evaluations of the pilot (Gall, Borg, & Gall, 1996). At both the pilot and large-scale adoption phases, university stakeholders should periodically revisit the articulated roles and responsibilities to determine if they are well aligned or need to be modified according to emerging needs of the OER implementation. Since OER is likely to be housed within a Learning Management System (LMS), it is imperative to ensure that the (f) plug-in (LTI) process is compatible with the current LMS environment (Ertmer, 1999). During this process, IT professionals (g) conceptualize the development of an OER Content Management System (e.g., a learning repository) with a detailed blueprint for developing a CMS (Govindasamy, 2001). To facilitate this, organizations should consider utilizing strategic partnerships with OER leaders, such as OpenStax of Rice University. Synthesizing these steps, organizations will be able to (h) plan out a production and budget for OER implementation (Gibbons *et al.*, 2014).

Optimization Phase

After the adoption phase, organizations can optimize the OER effort by localizing and contextualizing the innovation. This includes initiating strategies for the diffusion of the innovation, proper marketing, enculturation, and adjusting the general implementation framework relative to the local environment. The following list shows the specific components of the optimization phase:

- a. Localize/customize the OER initiative to the institutional setting.
- b. Initiate OER diffusion/promotion strategies.
- c. Enculturate the OER initiative within the institution.
- d. Adjust the OER implementation framework (technologies, competencies, business model, incentive system, organization).

Localization (a) entails customizing the innovation to the institutional and environmental setting (Pine, 1993).

Higher education institutions pursue unique values and missions, leading to the emergence of different objectives and priorities. OER can save or reduce student costs, but it can also be an effective marketing tool for the university. Either way, it is important to position OER within the context of a university's situation, which in turn provides a credible justification for OER implementation as well. In addition, (b) *diffusion of the innovation* is critical and associated with the stakeholder buy-in, which plays a pivotal role in the entire OER implementation (Rogers, 2010). Institutions first need to focus on increasing awareness of OER and its benefits. Articulating the benefits of OER is particularly important for faculty members due to the considerable amount of time and commitment required to utilize OER in their courses. Diffusion of an innovation involves a collaborative learning process. Therefore, it is advisable to establish a learning community in which higher education professionals engage in intellectual dialogues to receive feedback about their adoption strategies. Peer-learning, learning-by-teaching, and community of inquiry principles can be utilized to facilitate the formation of such a community (Schaffert, 2010). Institutional enculturation (c) involves understanding the concept of OER and accepting and engraining the practice of OER as a norm throughout departments, programs, and/or the university (Gibbons et al., 2014). During this process, institutions will be able to establish (d) or adjust their general framework with emphases on five components: Technology, Competencies, Business Model, Incentive System, and Organization (Malhorta, 2000).

Evaluation Phase

Similar to many instructional design models and change theories, the evaluation phase follows the implementation phase. Evaluation of an OER implementation entails assessing the following components:

- a. Ensure OER quality.
- b. Measure degree of OER awareness.
- c. Evaluate initiative outcomes.
- d. Assess faculty and student perceptions of OER.
- e. Measure the efficacy and efficiency of the OER initiative.
- f. Examine accessibility of OER materials.
- g. Measure student learning outcomes.

Quality assurance (a) has been a central issue among OER researchers and practitioners (Alley & Jansak, 2001). OER users have been largely concerned about the quality of OER materials and have considered them seriously. Higher education institutions adopting or implementing OER should contemplate effective and efficient ways to assure quality. For example, a large-scale OER leader, OpenStax, hired a group of publishing professionals—editors, reviewers, and proofreaders—for quality assurance purposes when developing OER materials. Similarly, those developing or adopting

small-scale OER initiatives should also find ways to address quality. A collaborative effort to establish a quality assurance team is highly recommended. Building awareness (b) is also an important consideration for OER initiatives. Researchers have strived to enhance the awareness of OER, and as a measurement construct, the degree of awareness can be used to evaluate the success of the initiative (Rolfe, 2012). Outcomes resulting from the initiative (c) should align with the articulated objectives the OER task force initially developed. Measuring the results of such outcomes can testify to the success of the OER initiative (Patton, 1990). Assessing faculty and student perceptions of the OER initiative (d) can be addressed through many sub-constructs, as several measurement tools are available in the OER literature (Bliss, Robinson, Hilton, & Wiley, 2013). Evaluating the efficacy of the initiative (e) in OER literature is related to teacher efficacy and prior ability of OER (Bowen, Chingos, Lack, & Nygren, 2014). It is important to also measure the efficiency of OER throughout the process, as it contributes to efficacy as well. Higher education strives to serve everyone in the community. Therefore, accessibility (f), especially when technology is involved, should be carefully examined (Teixeira et al., 2013). One method to examine the accessibility of OER is with the Web Content Accessibility Guidelines 2.0 (WCAG 2.0), a vendor-neutral set of guidelines to create accessible Web content. Lastly, the measurement of student achievement of learning outcomes (g) must be conducted. If the achievement of student learning outcomes significantly decreases when integrating OER materials into courses, cost saving becomes meaningless (Hilton, 2016). Equal or higher achievement levels of student learning outcomes are highly desirable.

Stabilization Phase

Once adopted and implemented, universities should stabilize the innovation for sustainability (Koochang & Harman, 2007). The final phase is to routinize the OER practice as an important part of the university's everyday life. This phase is largely about maintenance and improvement of the OER adoption, along with consistent evaluation of the initiative. The following steps are essential to sustain the OER initiative in higher education institutions:

- a. Develop sustainable OER strategies.
- b. Secure sufficient OER staffing and funding.
- c. Provide ongoing professional development/workshops.
- d. Establish a feedback system.
- e. Conduct ongoing OER research and development.
- f. Develop a sustainable business model and financial support for the OER initiative.

Stakeholders involved in the OER initiative should first (a) develop an action plan of strategies for sustainability

(e.g., Conole, 2012; D'Antoni, 2009; Downes, 2007; Helsdingen, Janssen, & Schuwer, 2010; Johansen & Wiley, 2011; Koochang & Harman, 2007; Olcott, 2012; Sclater, 2010; Wolfenden, 2008). This should involve (b) allocating staff to support the OER initiative, ideally by assigning roles and responsibilities to OER professionals (Browne, Holding, Howell, & Rodway-Dyer, 2010). For example, the University of Georgia has a professional who specializes in the OER field and is in charge of OER-related duties (OpenStax, personal communication, February, 2016). Librarians, university technology officers, instructional designers, and/or leadership professionals can also serve in support of OER efforts. In addition, (c) providing a consistent provision of workshops and professional development seminars can help users and providers keep up-to-date with the contemporary OER knowledge and practice (OpenStax, personal communication, February, 2016). Establishing a feedback system and communication lines (d) are also important to manage and respond to faculty, student, and administrator feedback about the OER initiative in order to continuously detect and correct errors for iterative improvement (Fleck, 1993). Leveraging useful stakeholder feedback, (e) university researchers can conduct a series of research studies and experiments for general initiative improvement (BurgeSmani, *et al.*, 2009), as well as identifying key indicators of a healthy and sustainable OER implementation (Smith & Wang, 2007). Systematic research on user behavior patterns and the effects of OER on learning outcomes and the teaching and learning process can also contribute to the development of the field (Smith & Wang, 2007). Finally, organizations should (f) develop a feasible business model and secure sustainable funding to maintain the OER initiative. Without sufficient funding, initiatives rarely survive (Wiley, 2007).

Implications

Based on the five phases discussed above, we suggest university stakeholders focus OER efforts on outcome-oriented, rather than action-oriented, initiatives. Setting the goals and vision of the OER initiative at the beginning are most critical, serving as the backbone of the entire implementation process. Also, it is important to remember that institutions have different levels of capacities, willingness, motivation, and human resources. Therefore, continuous dialogues are highly encouraged in an effort to flexibly cope with contingencies and unexpected challenges during the implementation process.

We also believe that faculty participation is the cornerstone for an OER initiative to thrive. For example, it is advisable that key university stakeholders promote and advertise incentives for participating in the pilot phase, which is essential to creating an initial core of success and to establish a supportive environment.

Effective and satisfied faculty participation will attract more university stakeholders and generate subsequent participation in OER efforts. Furthermore, learning from precedent cases is a key to success. Investigating other successful and failed OER initiatives will help higher education professionals identify which strategies to utilize and which to avoid.

Conclusion

Many misinterpret the OER movement as a "free textbook" initiative. It is indeed an organization-level innovation process in which every stakeholder should to some degree participate in the process. Universities are particularly important in leading the OER movement because of their underlying roles as public knowledge institutions. Generally speaking, universities have as part of their mission altruistic motives of sharing knowledge, gaining positive public relations, and distributing knowledge (Schaffert, 2010), which ultimately align with the results of OER initiatives.

OER may serve as a key leverage point for policy development in the hopes that affordable and equal life-long learning will come true. Using an OER implementation framework, such as the one introduced here, is one approach to realizing the OER movement across higher education institutions. When planning a strategic integration of OER, universities should also take into consideration current organizational culture and structure. OER implementation is not only intended to save educational cost, but also to encourage open pedagogy and innovation. Through the implementation of an OER initiative, universities can promote technology-enhanced teaching and learning, increase collaboration between university instructors and administration, as well as potentially produce a more student-centered educational system. To achieve these results, however, it is imperative to start by planning for an effective implementation of an OER initiative. As higher education professionals design the implementation process, the five-phase model presented in this article can serve as a starting point and reference guide. □

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Q & A with Ed Tech Leaders

Interview with Ingrid Guerra-López

Susan M. Fulgham
Michael F. Shaughnessy
Contributing Editors

Jason Carrizales

1. *What is your background in Human Performance Technology?*

My doctorate is from Florida State University's Instructional Systems Design program, where I was fortunate enough to work with Roger Kaufman as my advisor and mentor. I worked as a graduate research assistant in the Office for Needs Assessment and Planning, where I got the chance to work on large projects with the U.S. Navy and other organizations. These experiences provided me with great insight about performance systems, and in particular the front-end piece. I always enjoyed the measurement aspect of needs assessment, finding that many of the clients with whom we worked found it quite challenging to figure out what to measure and how, and making the link between the data generated and practical application. These were areas that I found particularly interesting and gratifying to me personally. That led to my career-long focus on performance measurement. Over the years, my focus evolved from measurement as an "event" (for example, needs assessment or impact evaluation) to a continuous process that is central to ongoing feedback, decision-making, management, and improvement.

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