FACTORS INFLUENCING FACULTY INNOVATION AND ADOPTION OF OPEN EDUCATIONAL RESOURCES IN HIGHER EDUCATION

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Abstract

The goal of this mixed-method research study was to examine the adoption process and use of Open Educational Resources (OER) in higher education. The study used Rogers’ (2003) Diffusions of Innovations theoretical framework to guide the description of the innovation and adoption process of OER. The significance of this research for scholar-practitioners was to investigate faculty adoption of OER to facilitate valuable and sustainable adoption of OER. In order to identify the connection between the creation and continued adoption of OER, certain aspects such as the characteristics of OER, the innovation-decision process, and the kind of supports institutions should provide have been investigated. Data has been collected for this study from targeted organizations that have participated in a Next Generation Learning Challenges grant funded project. This study used a mixed methods explanatory sequential descriptive design with a quantitative method which informed a subsequent qualitative method that produced detailed findings. Five themes emerged from the three research questions that guide this study. First off, the attributes that faculty believe constitute a valuable and sustainable faculty created OER include OER that are cost effective and focus on improving student learning and success. Secondly, the ability to customize, remix, and share OER considerably contributes to faculty adoption of OER as reported by faculty. Finally, resources from home institutions, as well as projects and grants with funding for faculty time and effort are the supports that faculty identify as meaningful to the innovation and adoption of OER. These five themes explain and reinforce the process of innovation and adoption of OER by higher education faculty.

Keywords: faculty, open educational resources, diffusions of innovation, adoption, higher education.
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Chapter I: Introduction

Statement of the Problem

Undergraduate students have amassed 57 million dollars in federal student loans, in comparison to 23 million ten years ago in 2004 (College Board, 2014). According to the Federal Reserve the amount including private loans exceeds 1.3 trillion dollars (Smialek, 2014). Undergraduate college students are graduating or dropping out with a sizable financial aid burden. The Open Educational Resources (OER) movement is an activist movement that works to achieve equality and access for underserved populations, specifically those populations who rely on federal student loans (United Nations Educational, Scientific and Cultural Organization, n.d.). In 2002, United Nations Educational, Scientific and Cultural Organization (UNESCO) defined OER as the “open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for noncommercial purposes” (2002, p. 24). OER are educational materials that exist in the public domain or license that allow them to be used at no cost and re-purposed by others (William and Flora Hewlett Foundation, n.d.). OER seek to not only minimize and decrease costs for college students, but also provide them with high quality education materials. The goal of OER is to “use information technology to help equalize the distribution of high quality knowledge and educational opportunities for individuals, faculty, and institutions within the United States and throughout the world” (William and Flora Hewlett Foundation, n.d.).

Although educators regularly reuse content and materials as regular practice, participating in OER practices formally is a more complex matter (DeVries, 2013). One of the major ways higher education institutions have historically and currently achieved successful adaptive practices in OER is through the innovation, scholarship, creativity, and pedagogy of its faculty (Camblin & Steger, 2000). Faculty that use OER and have support from administration
extend the institution’s outreach, augment collaborations among colleagues, and benefit the global community (Perkins, 2010). However, the extent of those benefits depends on the very donations of intellectual energy and time faculty and administration are willing to contribute (Perkins, 2010). These types of opportunities facilitate changes that occur in higher education institutions. This study’s purpose is to gain a better comprehension of the essential processes that enable the adoption of OER teaching and learning innovations by faculty.

**Significance of the Research Problem**

The significance of this research for scholar-practitioners is to investigate faculty adoption of OER in order to facilitate valuable and sustainable adoption of OER. By identifying the connection between the creation and continued adoption of OER, certain aspects such as the reasons behind the usage of the innovation and what kind of supports the institutions should provide will be investigated. New innovations designed to improve student learning, be efficient, and save money are prevalent in higher education. Now is the time to find out why some faculty support and adopt OER.

The study also seeks to inform the larger field of diffusion studies by offering additional contexts by exploring the creation and adoption of OER. As funding for programs, learning materials, and faculty development get more difficult to obtain, proposing an innovation with a proven adoption framework as a guideline would only assist in providing validity and credibility to the development and adoption of OER across higher education institutions.

In relation to this study, the OER are educational activities that are used by higher education faculty and provided at no or low cost to students. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Scott, 2003). According to the Diffusion of Innovations framework, individuals
and social systems adopt innovations at different rates and play different roles in the adoption process. The instructional supports are framed as a solution to successful adoption rather than the overall goal of the innovation or adoption.

Research studies on OER and faculty adoption have been implemented in certain global regions. For example, The Teacher Education in Sub Saharan Africa (TESSA) program developed OER to promote innovative and sustainable pedagogical change aimed to improve education in higher education institutions (Murphy & Wolfenden, 2013). Hodgkinson-Williams and Gray (2009) studied a program at the University of Cape Town with respect to key attributes of OER, to find out how to make the transition processes from traditional materials to OER more effortless for the educators. In Canada, faculty and instructional designers reviewed a large number of OER and identified challenges for potential reuse in a variety of higher education disciplines (DeVries, 2013). There is a lack of research being performed in the United States on this global issue. Having new studies performed in the United States would put the innovation and adoption of OER into a new context.

Research Central Questions

The following three research questions will guide this study:

1. What attributes do faculty believe constitute a valuable and sustainable OER?
2. What contributes to faculty adoption or non-adoption of OER as reported by faculty?
3. What supports do faculty identify as meaningful to the innovation and adoption of OER?

Positionality Statement

Five years ago I was invited to participate in a Bill & Melinda Gates/ Hewlett Foundation grant. The purpose was to service at-risk college students and collaborate with colleagues to
provide the students with low cost/high quality open educational materials, specifically in reading and mathematics. We developed our plans and materials through a learning community format. Bettez (2011) relays the assumption that faculty learning communities and groups are popular but don’t necessarily address issues of social justice. In contrast, what we have done via the grant funded Kaleidoscope Open Course Initiative (KOCI) through a lens of Social Justice is create instructionally designed curriculum OER modules so they could be incorporated in to a living classroom and faculty could adopt them in different ways relevant to their courses. The modules are not intended to stand-alone and are done independently, they are meant to compliment the individual instructor’s existing curriculum.

Choosing to pursue this topic as the research focus was a turning point. I believe that providing college students with a “no textbook or educational material cost” curriculum is important, but unless faculty members use the materials, the initiative can’t work. I hate to see my colleagues love a new idea and believe in it, but be afraid to adopt it or become discouraged because of technological issues. I want to find out what factors influence whether or not they adopt OER, and what can be done to support them to do so in a sustainable way.

Theoretical Framework

Based on existing literature, three general assumptions regarding the problem of practice exist:

1. Higher education is facing unprecedented challenges due to technology and changing student populations;

2. Faculty are believed to be a means to promote and manage the changes and innovations needed in higher education;
3. Best practices and strategies for the adoption of innovations have been articulated; however, little has been done to validate these practices or to explore the underlying psychological processes that are affected by these practices (Watson, 2007, p. 2).

Overall, the conclusion is that psychological processes are what make new innovations successful or unsuccessful. The technological and pedagogical processes of the innovation and adoption of OER is central to the study.

When considering the influence of faculty development, Rogers’ (2003) model on the diffusion of innovations can be applied. For over 50 years, Rogers has been working on diffusion theories along with models and concepts developed by researchers such as Havelock (1971), Hall, Wallace, and Dossett (1973), Ely (1990), Fullan (2001), and Watson (2007). In a nutshell, change simply involves something being made or becoming different, while innovation suggests progress (Scott, 2003). Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (2003). Success of an innovation depends on whether or not the participants partake in the innovation. Understanding that decisions are not collective or authoritative, each member of a social system, in this case the faculty in higher education, face innovation-decisions that follow a 5-step process: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation (Rogers, 2003).
During this process, a number of variables impact the rate of adoption such as “the role adopters play in the decision process, dynamics and pressures within the social system, effectiveness of communication channels, and the strength of the need for adoption” (Watson, 2007, p. 28). A great deal of attention has also been given to predicting rate of adoption based upon the perceived attributes of innovations: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003).

According to this framework, individuals and organizations adopt innovations at different rates and play different roles in the adoption process. Using statistical methods Rogers identified five adopter categories- 1) innovators, 2) early adopters, 3) early majority, 4) early minority, and 5) laggards (2003). Based on Rogers’ scheme, innovators and early adopters are quick to accept and experiment with novel resources such as emerging technological tools. The remaining
majority are individuals who accept an innovation much later in the process or who may actually resist adopting new tools (Baldwin, 1998).

Figure 2. Rogers’ five adopters categories

The early adopters tend to have strong technology focus, are visionary, like to take risks and experiment, favor revolutionary change, and are largely self-sufficient with regard to technology. In contrast, mainstream instructors are problem and process, not technology, focused; they are pragmatic or conservative and favor evolutionary change. Typically, they need significant technical support and want proven applications that will enhance their work performance, not untested tools that require risk-taking and experimentation (Baldwin, 1998).

It is estimated that 15% of faculty are early adopters who enjoy trying out new technologies either for the fun of it or because they believe that new tools will enable breakthrough improvements in teaching and technology. The remaining instructors need to be convinced by compelling evidence that technology will support their professional lives in meaningful ways (Baldwin, 1998).

Laggards, the last instructors to adopt the innovations, are either very traditional or isolates. If they are traditional, they are suspicious of innovations and often only interact with others who share their values. If they are isolates, their lack of social interaction decreases their awareness of an innovation’s demonstrated benefits (Rogers, 2003). Laggards take much longer
than average for to adopt innovations, if they ever do. Although it is beneficial to draw general conclusions about the growing role technology plays in higher education institutions, we must also remember that every instructor has unique experiences and feelings about technological innovations (Baldwin, 1998).

All of these categories of innovators influence how change occurs. Rogers (2003) describes a list of overarching generalizations regarding innovator change strategies. According to Rogers, innovators should do the following to ensure successful change:

- Have as much contact as possible with clients;
- Ensure the innovation in question serves to meet client needs;
- Orient themselves to meet those needs;
- Be empathetic and homophilous to the target population;
- Foster credibility and work with and through opinion leaders as much as possible;
- Gather feedback from clients regarding the innovation (Watson, 2007, p. 34).

In order for innovators to infuse change and adoption, the actual innovation must have certain attributes. These attributes include:

- their relative advantage (the degree to which they are perceived as being better than the idea they are replacing);
- compatibility with existing values (past experiences and the needs of potential adopters);
- complexity (how difficult the innovation is to understand and use);
- trialability (the degree to which the innovation can be ‘tried out’ before fully adopted);
observability (or how easily others can see the benefits of adopting the innovation) (Rogers, 2003; Elliot, Foster & Stinson, 2003).

Innovations are most expected to be adopted if they are compatible with existing values, not very complex, highly advantageous, and easy to experiment with (Rogers, 2003). These qualities align with the OER “remixability” attribute.

Contemporary researchers such as Groves and Zemel (2000) have applied Rogers’ Diffusion of Innovation theoretical work in case studies regarding instructional technology adoption in higher education. Samarawickrema and Stacey (2007) also used the theory in a case study about adopting web-based learning and teaching in higher education. Most recently, Antonenko (2015) published a paper describing the instrumental value of conceptual frameworks such as Rogers’ theories in educational technology research.

In the context of higher education institutions, various factors regarding technologies and innovations come into play. First off, the entire community needs to buy-in to the importance of the technologies and innovations so that they can be successful (Tabata & Johnsrud, 2008). What is necessary within higher education institutions is that the community understands the focus of the innovations and adoptions is to enhance student-learning success. Nevertheless, failure or abandonment of the innovation can occur with a lack of support of such adoptions (Zemsky & Massy, 2004).

**Justification for the theory.** Theories provide explanations to advance knowledge in fields yet they vary in their breadth of coverage at different levels - micro-level, meso-level, and macro-level (Creswell, 2014). Micro-level theories identify explanations to limited segments of time, space, or numbers of people, while Macro-level theories identify themes in larger populations such as society, cultures, or long time periods (2014). Diffusion studies seem to fall
into the meso-level theory arena. Meso-level theories act as the link between the micro and macro levels, as seen in organizations, communities, or social movements. Change and innovation within higher education institutions based on faculty creation and adoption of OER is a meso-level theory. What this study seeks to find out is whether or not faculty continued to adopt new OER innovations. Their individual beliefs and skills directly relate to the organization’s status and ability to process change, a meso-level theoretical stance.

By choosing Rogers’ Diffusion of Innovations, the framework will best inform the study’s mixed method design and analysis. As with any kind of technological or pedagogical change, time and adoption are vital to a successful implementation. This study will use the Rogers’ five step innovation process and adopter categories to organize the research questions. The theory also lends itself well a quantitative survey with a follow-up interview method because it can be used to scale questions to easily identify significance in questions and responses, while using the interview to gather rich details and nuances as with qualitative ethnographic research. Also by using quantitative data analysis, the study could identify multiple significant findings across the different areas of the faculty OER innovation process. One drawback to using this framework is that the language and categories are limiting. There isn’t any flexibility in describing the process because of the categories. For example, if a faculty member can only be described as one category such as late majority, even if they are an early adopter in one OER innovation and a laggard in another. They must be one of them or the averaged late majority, but not both.

Another theory, which was considered for this study, is Maslow’s Motivational Theory. Maslow’s (1943) theory organizes human needs and motivational forces that cause actions to either occur or not. He claims that individuals need to have basic needs such as food and shelter
met in order to seek out higher needs such as self-esteem and self-actualization (1943).

Furthermore, he discusses what kinds of factors, whether intrinsic or extrinsic, influence or motivate individuals to seek out the higher levels (1943). Although this theory could assist this study in identifying what factors influence adoption, it only focuses on motivation of the faculty member and not the process or outcomes of the OER innovation adoption.
Chapter II: Literature Review

Study Topic

The focus of this review is to examine the problem of practice in regards to the adoption and continued use of OER in higher education. These initiatives include changes in 21st Century teaching and learning through improving undergraduate education by developing and providing OER to undergraduate college students. Undergraduate faculty are at the center of this process and have the ability to make the change. This literature review explores how higher education has evolved into incorporating OER into coursework to improve student critical thinking, reading, and analytical skills.

In order to dissect the body of literature appropriate for this review, certain questions were chosen to guide the literature selection and research direction. For example:

- What is the history of OER internationally and in the United States?
- What communities participate in OER?
- What types of OER exist?
- What research in OER adoption has occurred?
- What is the current status of OER adoption in higher education?
- What does the research say about faculty adoption of new innovations?
- What does diffusion of new innovations look like in higher education?

This review begins with the history of OER through the sections listed above and ends with what diffusion of new innovation looks like in higher education.


**Context**

“If you give people tools, [and they use] their natural ability and their curiosity, they will develop things in ways that will surprise you very much beyond what you might have expected.” (Bill Gates, 2000).

**History of openness.** Before there were OER, there was still the concept of Openness. For example, D’Antoni and Savage (2009) share how “Openness is the breath of life for education and research. Resources created by educators and researchers should be open for anyone to use and reuse” (p. 138). They linked this idea to the United Nation’s Universal Declaration of Human Rights (1948), which states “Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages” (Art. 26, para. 1).

Distance learning has a long history of increasing access to education, dating back to examples in Sweden in 1833 (Simonson, Smaldino, Albright, & Zvacek, 2011). In the 19th Century distance education model, students received texts and reading resources via postal service and submitted assignments in return (Simonson et al., 2011). Correspondence schools and radio instruction contributed to reducing education barriers in the 20th Century (Siemens, 2013). Late 20th & 21st century technologies have switched the focus of curriculum deliver to a virtual or online method.

Building from the traditions of distance learning and correspondence schools, Open universities were initially established with the goal to reduce entry requirements for higher education and increase access (Siemens, 2013). A major milestone was occurred in 1971 when the Open University of the United Kingdom was founded. The Open University of the United Kingdom is a degree-granting university that offers full degree programs, sophisticated courses, and the innovative use of media in an entirely online environment (Simonson et al., 2011). The
Open University also offers free access to course materials and modules for millions of students and visitors; all they need is Internet access (The Open University, 2015). The Open University has produced respect and prestige to open education and prompted the formation of similar institutions in countries such as Canada (Athabascau University), West Germany, Japan, Sri Lanka and Pakistan (Simonson et al., 2011). OER gained higher global visibility in 2002 when UNESCO organized the Forum on the Impact of Open Courseware for Higher Education in Developing Countries, which was inspired by the 1997 launch of MERLOT (Multimedia Educational Resource for Learning and Online Teaching) & MIT’s OpenCourseWare Initiative in the early 2000s (Tuomi, 2013).

**History of OER in the United States.** As we know, there are many barriers that students pursuing post-secondary or higher education have to rise above in order to complete degree programs. As with Pestalozzi’s philosophy which pressed for quality education for all, not only the wealthy elite, Open Educational Resources (OER) are being developed and implemented as a “strategic international development initiative to expand people’s substantive freedoms through the removal of ‘unfreedoms’: poverty, limited economic opportunity, inadequate education and access to knowledge, deficient health care, and oppression.” (William and Flora Hewlett Foundation, n.d.). These barriers are especially prevalent among immigrant, lower economic income, and minority students. For example, only 42% of students who enroll in college complete a bachelor’s degree… out of the low-income students the completion rate is only 26% (Next Generation Learning Challenges, n.d.). The goal of OER is to “use information technology to help equalize the distribution of high quality knowledge and educational opportunities for individuals, faculty, and institutions within the United States and throughout the
world” (William and Flora Hewlett Foundation, n.d.). In order to successfully achieve this goal, all of the stakeholders need to participate.

What are Open Educational Resources? According to the William and Flora Hewlett Foundation, OER are:

- teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (William and Flora Hewlett Foundation, n.d.).

According to Fischer, Hilton, Robinson, and Wiley (2015), OER are educational materials that allow faculty and students to do what is called the 5Rs: retain, reuse, revise, remix, redistribute. OER can be full course shells, modules embedded into courses, singular assignments, or readings. The purpose of OER is to reduce costs for students and close the achievement gaps that exist for students.

In the beginning of the 21st Century, Wiley (2003) put forth a “modest manifesto” that called for education professionals to step away from traditional textbooks and make “free, high quality educational materials available to everyone.” (p. 72). Since that period and with the help of various resources, people from all over the globe have joined together through new and existing networks and partnerships to answer the call for action. In the United States, Hewlett Packard & the Gates Foundation have been two major supporters of various initiatives. However, the advantage of OER is that large funding partners are not required to create innovative OER. Any educational professional can retain, reuse, revise, remix, redistribute OER at whatever level they can in order to serve the students.
Similarly to Pestalozzi’s work in the eighteenth century, the current belief is that students that come from disadvantaged backgrounds may be able to benefit from using OER that are relevant to their own experiences. Merriam states how action and change that is deliberate and will change the social situation of the population (1991). The purpose of creating the high-quality low-cost educational materials is to be inclusive of the disadvantaged students. Every student should have the opportunity to feel valued and included in his or her course curriculum while improving academic skills and becoming empowered by them.

Considering the school and the student through the lens of constructivist theory and applications of student-centered activities, the goal of including of students is that the students have the greatest benefit (Carlson & Wiedl, 2013; Vonderwell & Boboc, 2013). Instructional designers, faculty, and researchers often use these theories as justification for implementing curriculum changes (Smith & Ragan, 2005). Allowing a student to be an active participant in the learning process through OER can only increase the benefits of a general education curriculum in the 21st Century.

**OER communities of practices and sustainability.** A community of practice is defined as a group of practitioners participating in a common activity while performing different roles in which the purpose is to venture into a joint enterprise with mutual engagement while producing a shared repertoire of communal resources (Koohang & Harman, 2007; Wenger, 1998). By nature, communities of practice are vital to the health and sustainability of OER since members have a common goal yet are involved in different aspects of OER with a focus remaining on sustainability. In an OER community of practice, members have different skills and experiences, which can be blended together in a decentralized way to create scalable OER (Koohang & Harman, 2007).
Wiley (2005) recognizes that decentralization improves scalability. Koohang and Harman (2007) further the claim by arguing that the scalability of OER is improved by the format of communities of practice because they are characteristically decentralized. Instructional design & presentation, cost of production and maintenance, support of OER, and OER communities of practice all influence the scalability and sustainability of OER (Koohang & Harman, 2007). Sustainability of OER is when it functions properly in an on-going basis for groups over an extended period of time.

The educational value of an OER contributes to its sustainability. The value is influenced by its presentation and instructional design that are linked to learning theories (Koohang & Harman, 2007). Research has long documented that knowledge construction and design resulting from the constructivism theory is valuable to the creation and sustainability of OER (Bannan-Ritland, Dabbagh, & Murphy, 2000; Koohang & Harman, 2007). Consequently, the sustainability of OER is not due to available resources alone, but related to the creation and design of an OER.

**Types of OER.** OER materials meet the needs of instructors and students, are available online, are licensed for reuse and revision, and are exemplified as:

- Learning resources (courseware, course books, content modules, videos, learning objects, learner-support and assessment tools, online learning communities);
- Resources to support teachers (tools for teachers and support materials to enable them to create, adapt, and use OER, as well as training materials for teachers and other teaching tools);
- Resources to assure the quality of education and educational practices (journal articles, research studies) (Johnstone, 2006; Bissell, 2009; Hewlett, 2013).
**OER delivery and platforms.** Online delivery of OER is seen as the natural way to implement the approach (Tuomi, 2014). In 1999, Rice University developed Connexions, one of the first open source software development model and platforms. The purpose of Connexions was to create and distribute peer-produced the now more than 17,000 learning resources for stored, refined, and remixed modular learning objects (Tuomi, 2013). In the 21st Century, internet infrastructures and technology diffusions have developed enough to where immense numbers of Global OER users can be sustained at manageable costs (2013). Educational institutions and funding entities have been taking advantage of this innovation and revolutionary change. Platforms such as Coursera, Open-CourseWare, Khan Academy, OLAT, China Open Resources for Education (CORE), and Moodle provide platforms for millions of individuals and thousands of universities to roll-out their OER courses (Tuomi, 2013; Hilton, Robinson, Wiley, & Ackerman, 2014). Since the OER phenomenon is often viewed as a social justice movement, as part of the OLnet project Carnegie Mellon and the UK Open University teamed up and created the Evidence Hub for Open Education in order to get educators and researchers collaborating on OER shared knowledge while documenting the rapid changes (Johnstone, 2006; Tuomi, 2013).

**Research initiatives in OER.** Through the process of researching with qualitative and quantitative methods and sharing the findings in publications and conferences, the OER movement is continuing to work and meet its goals of access and achievement by helping future teachers, researchers, entrepreneurs, and foundations focus their efforts and resources on effective models and programs (Picasso & Phelan, 2014). The OER movement and subsequent research publications serve to empower the audience, such as high school curriculum leaders, college professors, graduate students, and scholar-practitioners, so that they may improve 21st
century learning (Stagg, 2014). OER education may become the boundless open experience that students and educators have dreamed of since eighteenth century Europe.

In 2011, Bacsich, Phillips, and Bristow conveyed concern that the views and needs of students are not adequately built into the design of OER learning (2011). Recently, Agosto, Copeland, & Zach (2013) asked in their qualitative study whether or not a blended and collaborative educational experience can be created for students by integrating social technology (OER blogging) into an online course. More research is needed on what kind of OER students benefit from the most and how faculty can best influence said benefit.

**Next Generation Learning Challenges.** Next Generation Learning Challenges (NGLC) is an EDUCAUSE initiative founded in 2010 and is primarily funded by the Bill & Melinda Gates Foundation (Next Generation Learning Challenges, 2016). The leadership team from EDUCAUSE manages the macro and micro functions of NGLC. The purposes of NGLC providing over 150 investment capital grants are to improve college readiness and completion in the US by educational technological innovation (2016). The long-term goal is to “expand the use of proven and emerging learning technologies, collecting and sharing evidence of what works, and fostering a community of innovators and adopters will result in a robust pool of solutions and greater institutional adoption which, in turn, will dramatically improve the quality of learning experiences in the United States” (2016). At the heart of NGLC is the concept of sustainable innovation and adoption of educational technology materials for all students.

**Kaleidoscope Open Course Initiative.** Kaleidoscope Open Course Initiative (KOCI) is a NGLC-funded project with three goals. KOCI was intended to “(1) eliminate textbook costs as a barrier to student success, (2) improve the quality of course designs in order to increase student success, and (3) create a collaborative community to share learning and investment in the
project” (Hilton, Robinson, Wiley, & Ackerman, 2014, p. 69). Faculty from eight selected colleges collaborated to identify, adapt, and when necessary create OER materials (new course designs and textbook replacements) for commonly taught courses (Hilton et al., 2014). As part of the initiative each course was taught both by the colleges that participated in their development and also by some other KOCI colleges who had not participated in the creation of that specific course. The colleges also offered other sections using traditional textbooks (Lumen Learning, 2015).

At the time of inception, KOCI included over 20 community and four year colleges. The sites included the following colleges: Cerritos College (Norwalk, CA, 22,000 students); Chadron State College (Chadron, Nebraska, 3,000 students); Mercy College (Dobbs Ferry, New York, 10,000 students across four campuses); College of the Redwoods (Eureka, California, 10,000 students); Santa Ana College (Santa Ana, California, 18,000 students); Santiago Canyon College (Orange, California, 10,000 students); and Tompkins Cortland Community College (Dryden, New York, 3,500 students). The faculty involved in KOCI ranged from tenured faculty to adjuncts. KOCI impacted over 4,000 students and around 150 teachers (Lumen Learning, 2015).

The project exceeded the original three goals by eliminating the cost of required textbooks in participating courses and replacing the costly textbooks with free OER, and by improving average student success rates by five to ten percent when compared to average student performance in the same courses offered by the same instructors in previous years (Lumen Learning, 2015). After the second round of funding, the KOCI grant administrators sought additional funding from NGLC in order to continue and expand the project. Instead of relying solely on grant funding, the Gates Foundation urged the grant administrators to form a
sustainable organization that could support OER adoption and modeling long-term (Lumen Learning, 2015). Lumen Learning was the result of the initiative.

**Lumen Learning.** As a result of the success of KOCI, Open Education visionary Dr. David Wiley and education technology strategist Kim Thanos, co-founded Lumen Learning in order to facilitate broad, successful adoption of OER (Lumen Learning, 2015). The major goals at Lumen Learning are to work with higher education institutions and K-12 schools to eliminate textbook costs, increase access to education, strengthen student-learning, train and support faculty, and sustain success with OER (Lumen Learning, 2015).

**KOCI research.** Many of the existing research regarding OER and from KOCI focuses solely on the costs of materials. However, one of the first KOCI research published articles focused on the perceived quality of the OER materials in comparison to the traditional materials. Students and instructors involved in KOCI reported on their perceptions of the cost, outcomes, uses, and quality of the new OER (Bliss, Robinson, Hilton, & Wiley, 2013). All respondents not only reported significant financial savings, but also positive learning and pedagogical impressions due to the adoption of the KOCI OER materials and even reported the KOCI OER to be equal in quality to traditional textbooks (Bliss et al., 2013).

A case study presented by Hilton, Gaudet, Clark, Robinson, & Wiley (2013) focused on Scottsdale Community College math classes that began to use KOCI OER materials in Fall 2012, which allowed the researchers to compare how students performed on the exit exams before and after the KOCI OER was introduced. The students performed at the same level on the exit exams using the KOCI OER as students in fall 2011 and fall 2010 that used traditional materials (Hilton et al., 2013). Pawlyshyn, Braddlee, Casper, and Miller (2013) found that when KOCI OER material was integrated into the math courses at Mercy College, the pass rates of the
courses increased to 68.9% (Fall 2012) from 63.6% (Fall 2011—when traditional learning materials were employed). Correspondingly, Freshmen students enrolled in KOCI OER versions of a reading course performed better than peers using traditional materials in other sections (Pawlyshyn et al., 2013).

Hilton, Robinson, Wiley, and Ackerman (2014) sought to focus on the amount of money students in KOCI courses saved as a result of their course materials being OER and the amount of money students in non-KOCI courses spent on their materials. They found that textbook costs varied among the KOCI schools, departments, and instructors. This variance in textbook costs, such as $174.19 to $67.36 for the same type of introductory textbook, is still a significant cost saving to students when OER is introduced (Hilton et al., 2014).

**Current standing of 21st century higher education faculty and OER innovations.** OER are an extremely complex issue that have social, economic, cognitive and technical dimensions (Tuomi, 2013). OER also requires that the higher education institutions reconsider their mandates and roles with faculty and students (Tuomi, 2013). The first part of this section centers on faculty collaboration focused on creating the student-centered educational activities. Before any work can be done, faculty need to back the initiative, collaborate effectively with each other, and be an active part of the process. The second part, faculty innovations describes studies performed on how higher education faculty approach and adopt innovations. The third section gives an overview of research on innovations in higher education.

**Faculty collaborations.** Faculty should to be supported in order to understand, create, utilize, and share the educational activities. One way to ensure success is by faculty participation in learning communities. Back in 1999, Shapiro & Levine published “Creating learning communities: a practical guide to winning support, organizing for change, and implementing
programs.” The idea of learning communities is not new, but what has changed over the past decade is the way professionals organize and collaborate. In 2005, Stevenson et al. outlined in “Fostering Faculty Collaboration in Learning Communities: A Developmental Approach” (Innovative Higher Education) how given proper support and structure on campus, faculty from across disciplines could successfully collaborate in learning communities to improve first-year programs. Over the past few years, video conferencing and Google docs have revolutionized the ways that we lead, collaborate, work, and relate to one another, specifically when the goal is improving student-learning outcomes.

Between OER and improvements in information technology, faculty collaborations are not limited to a specific structure. But what do faculty collaborations that focus on OER need to succeed? The culture behind the OER initiative is one of “a culture of sharing, not only within individuals, but also within major institutions of higher education. It has helped shift faculty perspectives from this courseware is mine to this courseware is for (open) mining. The next phase is to nurture a culture of learning in which both intellectual capital (content) and human capital (talent) spiral upward, together” (William and Flora Hewlett Foundation, n.d).

Sagor recognizes that “negative consequences are experienced disproportionately by low-income and minority students and those with disabilities, we who created the groupings cannot escape culpability” (1999, p. 75). We have the opportunity to change the academic experiences of all students and achieve social justice while producing the American ideals into realities (1999). OER can create the opportunities for inclusion and equality that speak to these American ideals. If we change the educational environments, the mental structures and perceptions of position and status will change for students (Bourdieu, 1989).
By focusing on the human and structural elements of change, many factors such as student learning, program level assessments, and faculty learning community culture can be positively improved. Also, by allowing the community to determine not just what curriculum is delivered, but how to develop it, the faculty can work at the deepest level of collaboration. Faculty collaboration sessions may also be helpful in bridging the transition between classroom and online teaching activities (Ryan, Hodson-Carlton, & Ali, 2005).

Finally, Holloway (1996) argues that in relation to their belief systems, faculty are unaware of market concepts since they believe learning should be the primary focus and they believe financial profit is an inappropriate metaphor for an educational context; yet their adoption practices strongly resemble market research. The faculty member’s belief system (not an economic or empirical reward) is what determines the success of educational innovations (1996). Data collection and research in this field, such as this study, could only serve to promote further initiatives and research in OER.

**Faculty adoption of new innovations.** Edwards, Kirwin, Gonyeau, Matthews, Lancaster, and DiVall (2014) reported on a trial at Northeastern University that required faculty to incorporate an innovative teaching method in a class, course, or experiential activities. The wide array of new methods were linked to evidence-based principles for effective teaching and 75% included the use of technology (2014). All faculty members had brief training on the methods and afterwards reported to either continue using their new strategy as is or continue with additional modifications for future implementations (2014). The study is an example of how multiple targets of faculty development, innovative curriculum, and student-centered instruction can be realized (2014).
On the opposite spectrum, instructors who have participated in new innovations often become frustrated with the amount of time and effort needed adapting a new instructional tool to then also encounter glitch after glitch in the rollout phase (Hagler, 2016; Arinto, 2016). Instructors not only need to devote time to organizationally sponsored training, but they need to explore, experiment, and learn from practice (Arinto, 2016). Instructors that focus their instructional working time on curriculum and developing student learning might have difficulty incorporating a new innovative practice (Hagler, 2016).

**Innovations in higher education.** Powell, Olivier, and Yuan (2015) use Bower and Christensen’s (1995) theory of disruptive innovation to illustrate how higher education institutions can recognize and best respond to diffusion and sustaining of a new innovation. The innovations address an unserved or over served organization or group of people a product or service with new features and/or lower cost to a group of people have existing offerings (2015). Powell et al. (2015) examined two case studies that each implemented the same innovative OER model yet the “work-focused learning” (training) was done differently. The OER model generated high interest internationally and the appropriate structural and governance arrangements is what enabled the model to sustain or not (2015).

Venkatesh, Morris, Davis, and Davis (2003) developed the model of Unified Theory of Acceptance and Use of Technology (UTAUT) to explain how innovation and technologies are adopted and accepted. The model can be seen in Figure 3. Although the model is found to be robust and rich, it does not include an explanation of successful adoption within a higher education context.
Hariri and Roberts (2015) took the UTAUT into the context of higher education and added important factors that influence innovation adoption within universities. New constructs such as students’ requirements, expectations and learning were measured along with the UTAUT constructs in higher education settings and were found to be as valid and reliable to innovation adoption as the existing constructs (2015).

Summary

In the past when educators would talk about innovations in curriculum, change would occur slowly and time would be given to revise new curriculum and materials. However, now in the 21st Century the introduction of new innovations and the expectations that go along with them are occurring faster than instructors can keep up with, especially considering the resources and time allotted. One major innovation that has been introduced in higher education is OER. Not only are OER new and innovative, but they are fast paced and “remixable” by nature. As a
result, some instructors and educational materials can be left behind because they are not given the opportunity to adapt to the changes. It isn’t that they don’t want to take part in the adventure; it is that they don’t know how to help students improve their learning and skills with the new innovations. However, with the proper training and resources innovations can be adopted and sustained into existing higher educational institutions and serve instructors and students better than the traditional materials.
Chapter III: Methodology

This chapter presents the research questions, research design, and methodology for this mixed methods study. The sampling strategies, data collection, data analysis, threats to validity and reliability, and measures to protect human subjects are also outlined in the chapter.

Research Questions

The following three research questions guided this study:

1. What attributes do faculty believe constitute a valuable and sustainable OER?
2. What contributes to faculty adoption or non-adoption of OER as reported by faculty?
3. What supports do faculty identify as meaningful to the innovation and adoption of OER?

Research Design

The purpose of the research study is to examine the adoption process and use of OER in higher education. The study’s non-experimental descriptive design sought to describe the innovation and adoption process of OER, which includes the attributes faculty believe constitute a valuable and sustainable OER and what instructional supports are meaningful to the use of OER.

Research tradition. The objective of a descriptive design is to summarize and describe how participants think or feel or how they behave in a particular situation, program, or activity (Fraenkel, Wallen, & Hyun, 2012). The non-experimental descriptive design aligned with all three research questions because they pursued to define, describe, and identify attributes and traits of the OER and themselves. The three descriptive research questions informed the emerging research areas regarding innovations in OER and were best investigated in a mixed methods approach.
Methodology. This study used a mixed methods explanatory sequential descriptive design with a primarily quantitative method that informed a subsequent supplemental qualitative method that produced detailed findings. A mixed methods design allowed the researcher to use the benefits of both quantitative and qualitative research and examine a research problem more completely than by using either method only (Creswell, 2012). The explanatory sequential research design is illustrated in Figure 4.

![Explanatory Sequential Design](image.png)

Figure 4: Explanatory Sequential Design (Creswell, 2012, p. 541).

The explanatory sequential design combines the benefits of quantitative generalizability with the nuanced details that open-ended interview responses can provide, which can lead the researcher to a rich picture of the phenomena (Creswell, 2012). The strengths of the quantitative and qualitative methods can be viewed as compensating for each of the method’s limitations when combined to become mixed methods (Fraenkel, Wallen, & Hyun, 2012). The qualitative interview section of the data collection employs an ethnographic focus. An ethnography research group is small and shares with the observant researcher the values, beliefs, behaviors, and language (Creswell, 2013).

Mixed method research in OER innovation and adoption is non-existent. The majority of research is single-method quantitative only. In contrast to a single-method study, mixed method studies typically involve significant time, resources, and expertise (Creswell, 2012).
**Limitations.** Limitations do exist within this research design. One problem with descriptive research questions is that data from them do not help researchers understand why participants feel, think, or behave a certain way or why programs should possess certain characteristics or strategies (Fraenkel, Wallen, & Hyun, 2012). Researchers can learn what happened, or how something happened, but not why it happened, which makes descriptive designs limiting (2012). In relation to this particular study, since there is so little existing research on innovations in OER, a descriptive design does not give all of the answers, which is why the inclusion of open-ended questions was so valuable. The open-ended questions provided insight into how the participants feel and think about the OER and innovation adoption process.

**Quantitative data collection and analysis.** This study used a cross-sectional survey tool that seeks to identify the variables that influence the adoption of OERs. Sections of the survey consisted of demographic, innovation-decision adoption, attitudes towards OER, and OER use. The theoretical framework of Rogers’ Diffusions of Innovations informed the study’s quantitative design and analysis. The theory also lent itself well to a quantitative survey method because it can be used to scale questions to easily identify significance in questions and responses in direct relationship to the theory. Rogers’ innovation-decision process and the perceived characteristics of OER offered the structure of a quantitative and descriptive method. These categories were used in the survey scales in this study, as discussed below and presented in Appendix B.

**Qualitative open-ended survey questions.** In addition to the scaled closed-ended questioned sections of the survey tool, a section with open-ended questions was included (Appendix B). Open-ended questions allow participants to provide their perspectives and experiences outside the constraints of the researcher’s perspectives or past findings (Creswell,
Open-ended responses provide researchers with insights as to why participants are providing the closed-ended responses that they do and the discovery of details participants find important to include about the question topics (Creswell, 2012). Not only do participants have to reply with qualitative statements, but also open-ended questions must rely on logical analysis of responses by the researchers (Frankel, Wallen, & Hyun, 2012). In order to analyze open-ended responses, researchers must find themes in the responses and relay the prevalence of those themes across participant responses (Creswell, 2012).

**Interviews.** The second phase of qualitative data collection consisted of several semi-structured interviews with five participants who agree to be interviewed. Interviews were conducted using a web-based virtual conferencing program allowing for the participation of faculty independent of their location. The interviews allowed the researcher to use the qualitative data to refine the results from the quantitative data and analysis of open-ended responses related to significant findings or outlier responses (Creswell, 2012). The interview protocol is provided and discussed below and sample questions are provided in Appendix C.

**Population and Sampling**

This study was conducted in the context of open education initiatives through Lumen Learning. KOCI is a Next Generation Learning Challenges-funded project with three goals. KOCI was designed to (a) eliminate textbook costs as a barrier to student success, (b) improve the quality of course designs in order to increase student success, and (c) create a collaborative community to share learning and investment in the project (Lumen Learning, 2015). Eight community colleges and state colleges agreed to work together to develop new course designs and textbook replacements that exclusively use OER. Faculty from selected colleges collaborated to identify, adapt, and when necessary create OER materials for common courses.
that were taught at each of their schools. As part of the initiative each course was taught both by the colleges that participated in their development and also by some other KOCI colleges who had not participated in the creation of that specific course. The colleges also offered other sections using traditional textbooks.

At the time of this study, KOCI includes over 20 community and four year colleges. The faculty involved in KOCI range from tenured faculty to adjuncts. KOCI has impacted over 4,000 students across around 150 teachers. Since the population size is limited, the researcher reached out to all faculty instead of sampling selected faculty. The KOCI grant administrators provided contact information and support to the researcher. The grant administrators have had high participation rates from faculty on previous endeavors.

Instruments

The cross-sectional survey instrument consisted of four parts (Appendix B). The data was collected in nominal (demographics), ordinal (demographic and Likert), and open ended ways. Collection at the interval level was desirable because the data can use the more powerful statistical procedures available for Means and Standard Deviations tests of differences (t test, ANOVA). To extend this advantage, many of the ordinal data was treated as though they were interval when used in Likert scales.

Part one: Demographic information. The survey instrument began with a series of demographic questions designed by the researcher. The questions focused on collecting demographic information including gender, age, years of teaching experience, professional rank, teaching delivery methods, highest degree held, school (discipline), self-assessment of computer skills, and the number and type of OER experiences designed to improve the teaching-learning process in which the respondent has participated.
Part two: Innovation-decision process indicator. Lichty (2000) developed the Innovation-Decision Process Indicator (IDPI) as an instrument to place faculty in one of Rogers’ (2003) five innovation-decision stages regarding the adoption of instructional technologies. The instrument required that faculty check all of the statements regarding adoption that correspond to Rogers’ stages. The scale contained 15 total statements in which three statements correspond to each of the five innovation-decision stages, and the participants are placed into the stages based on the total number (Lichty, 2000). The ranges for the stages are knowledge (0-3 items), persuasion (4-6 items), decision (7-9 items), implementation (10-12 items), and confirmation (13-15 items) (Lichty, 2000). The fifteen items are listed in Appendix B and terminology has been modified from computer-based instruction to OER usage in order to make the items relevant to the participants and study.
Table 3.1

Modified OER Innovation-Decision Process Indicator (IDPI)

<table>
<thead>
<tr>
<th>Innovation-decision stages</th>
<th>Survey items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>I read brochures from companies marketing OER learning programs.</td>
</tr>
<tr>
<td></td>
<td>I read journal articles about OER applications in my area of specialization.</td>
</tr>
<tr>
<td></td>
<td>I think about ways to implement OER in my courses.</td>
</tr>
<tr>
<td>Persuasion</td>
<td>I am considering the advantages and disadvantages of OER instruction.</td>
</tr>
<tr>
<td></td>
<td>I am creating or previewing OER for future incorporation into my courses.</td>
</tr>
<tr>
<td></td>
<td>I have observed demonstrations of technologies and OER for instructional use within my discipline.</td>
</tr>
<tr>
<td>Decision</td>
<td>I have decided not to use OER applications or strategies for instruction in my next class.</td>
</tr>
<tr>
<td></td>
<td>I am currently using OER in my instruction.</td>
</tr>
<tr>
<td></td>
<td>I will use OER on a trial basis during the coming year.</td>
</tr>
<tr>
<td>Implementation</td>
<td>I will use OER instructional programs or strategies during the upcoming academic year.</td>
</tr>
<tr>
<td></td>
<td>I have secured the technical assistance I need to effectively implement OER materials.</td>
</tr>
<tr>
<td></td>
<td>I have integrated OER into my normal curriculum-planning activities.</td>
</tr>
<tr>
<td>Confirmation</td>
<td>I evaluate student learning using OER tools.</td>
</tr>
<tr>
<td></td>
<td>I will continue to evaluate my efforts to provide quality OER.</td>
</tr>
<tr>
<td></td>
<td>I have secured funding to support my efforts with OER.</td>
</tr>
</tbody>
</table>

Part three: OER attributes. This section was written by the researcher and included closed-ended questions regarding OER attributes in regards innovation and adoption that align with the Perceived Characteristics from the Diffusions of Innovations Theoretical Framework (Rogers, 2003; Elliot, Foster & Stinson, 2003). The closed ended questions asked questions regarding the faculty member’s beliefs about the attributes of OER as an innovation. The
Compatibility characteristic was used in two items. One focused on participant values and the other on the needs of students. Five-point Likert scale items ranging from strongly disagree to strongly agree included:

- I believe OER are better than traditional learning material (relative advantage);
- OER represent my values in teaching and learning (compatibility with existing values);
- My students benefit from using OER (compatibility with past experiences and the needs of potential adopters);
- OER are easy to use and “remix” for future use (complexity);
- OER allow me to try new materials and hone them to meet student needs (trialability);
- My students and colleagues have begun to use more OER since I began to (observability) (2003).

**Part four: OER adoption and support.** This section was written by the researcher and include closed and open-ended questions regarding OER attributes and instructional support of OER innovation and adoption. The open-ended questions asked participants to reflect and respond on what attributes a valuable OER has and what instructional support resources were essential for the innovation and adoption of the Kaleidoscope OER. The responses were thematically coded and categorized. The questions aligned with the study Research Questions, as well as the Perceived Characteristics from the Diffusions of Innovations Theoretical Framework. Questions included:
Table 3.2

Open-Ended Survey Questions Alignment with Research Questions and Framework

<table>
<thead>
<tr>
<th>Open-Ended Survey Questions</th>
<th>Alignment to Research Questions and Theoretical Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you now using KOCI or faculty developed OER? If not…why not? If so…please describe them and why are you using them?</td>
<td>RQ1, relative advantage, compatibility, &amp; complexity</td>
</tr>
<tr>
<td>If so, what makes the OER valuable to you and your students?</td>
<td>RQ1, relative advantage, complexity &amp; observability</td>
</tr>
<tr>
<td>What kinds of instructional supports have been available to you during the adoption process of the OER (workshops, trainings, instructional design staff, etc.)?</td>
<td>RQ3, compatibility, complexity, trialability &amp; observability</td>
</tr>
<tr>
<td>Has your college been supportive of you access/using the OER? If so, how? If not, what could they have done differently?</td>
<td>RQ3 compatibility, complexity, trialability &amp; observability</td>
</tr>
<tr>
<td>In many cases there are a number of faculty who gladly use OER or don’t want to. Speaking for yourself, why do you use or not use OER (For example, quality/cost/convenience)?</td>
<td>RQ2, compatibility, complexity, observability and trialability.</td>
</tr>
</tbody>
</table>

**Interview questions.** Interview questions were written by the researcher and focused on the theoretical framework, innovation-decision process, and OER usage. Sample questions are available in Appendix C.

**Data Collection.**

The survey data collection took place over a two-week period using a web-based survey tool, Qualtrics. The data set was prepared into an Excel file and screened for any incomplete data sets. If a participant did not complete all the survey items, their data was excluded from the study. The data file was cleaned up at that point, all variables were labeled, and the completed surveys were left with their identification number. The Excel file was then imported into IBM’s Statistical Package for Social Science software (SPSS).
The Interviews consisted of several semi-structured interviews with 5 participants who agree to be interviewed. Interviews were conducted either in person or using a web-based virtual conferencing program allowing for the participation of faculty independent of their location. Transcripts were created and imported into MaxQDA, a software for qualitative data analysis. The responses were coded and evaluated for themes and patterns within MaxQDA files following Creswell’s (2013) the template for coding for ethnography.

![Diagram](image)

*Figure 5: Template for coding an ethnography (Creswell, 2013, p. 208).*

**Validity and reliability.** Survey instruments must be measured for validity before being activated. Three different measurements (content validity, criterion validity, and construct validity) are used to assess the validity of a survey instrument (Muijs, 2011). Reliability is the extent to which test scores are free of measurement error. Researchers are expected to prove that survey instruments are free from error and have internal consistency through the Cronbach’s alpha statistical test (Muijs, 2011). Reliability across the entire survey instrument will be done to ensure that the questions address each individual construct. A section will be pulled from an existing survey: Lichty’s (2000) Innovation-Decision Process Indicator (IDPI) which has a
reliability co-efficient of .84. In order to meet the free from error and internally consistent expectation, the Cronbach’s alpha test for all items will need to have a combined value over 0.7 (Muijs, 2011).

In order to address bias and validity in the qualitative data, the researcher performed certain steps to ensure trustworthiness in the data collection. First, collecting data from multiple sites and participants offered a depth of data and different perspectives to establish credibility and triangulation (Creswell, 2013; Fraenkel, Wallen, & Hyun, 2012). Secondly, rather than talk about validation of the researcher, the credibility of the researcher was clarified by using the three types of data 1) the closed ended questions, 2) open ended questions, and 3) interview questions to compile the evidence to formulate a “compelling whole” (Creswell, 2013, p. 246). The weight of the evidence demonstrates the researcher’s credibility. Lastly, video and audio recording of the interviews assured reliability with the collection and analysis of data (Fraenkel, Wallen, & Hyun, 2012). By executing these components, the researcher secured reliability in the qualitative data collection and addresses researcher bias.

**Data Storage Methods**

Interviews were recorded using sound recording software. The recordings, MaxQDA files, Excel files, and SPSS files have been downloaded onto two password protected and encrypted external hard drives, which are kept in a locked fire resistant cabinet in the researcher’s private residence. Creswell (2013) advised researchers to store all data in multiple backups in at least one secure location. The researcher is the only person with access to the hard drives and cabinet. The original recordings have been destroyed after the transcriptions were confirmed.
The protection of the participants’ privacy and respect for their participation was vital. The data collection and storage methods follow to the guidelines defined by Northeastern University’s IRB and human protection agencies. Every effort has been taken to protect the identity, confidentiality, demographics, responses, and location of participants.

**Quantitative Data Analysis**

First off, the descriptive statistical analyses were conducted in SPSS in order to screen the data set. This set of analyses checked the "normality" and for "outliers" of data. Demographic & Research question two data set univariate analyses of the descriptive study was conducted.

**Part one: Demographic information.** The descriptive analyses of the demographic information included:

1. Frequency Distribution of demographic information that looked at the averages, spreads, and SDs of age, faculty position, and years teaching of the faculty sampled.
2. Difference of Means tests that compare the degree of variation/dispersion between different groups of faculty and the IDPI composite variables, as well as the OER attribute items.

**Part two: Innovation-decision process indicator.** Regarding the second research question concerning the instructional technology-based innovation-decision stage as it relates to the adoption of OER, ANOVA was employed. ANOVA investigates “for the presence of some overall significance that could exist somewhere among the various levels of the independent variables” (Goodwin, 2005, p. 234). The purpose of using an ANOVA is to determine if OER adoption is significantly different across demographic distributions and instructional technology-
based innovation-decision stages. Where significant differences were discovered, Tukey’s post hoc test was used to determine between which stages differences reside.

**Part three: OER attributes.** This section included Likert-type questions regarding OER attributes in regards to innovation and adoption. An ANOVA was employed to determine if there are significant differences across faculty member’s beliefs about the attributes of OER as an innovation. If some overall significance are found for one or more of the independent variables, Tukey’s post hoc test was used to determine the exact location of the significant difference.

**Part four: OER instructional supports.** Regarding the final section, it addressed all three research questions within the open ended questions. After being organized with the completed survey data, the open-ended questions from this section were exported into MaxQDA. The software program allowed the researcher to code the answers. Coding the data required the researcher to decide how to label themes, find such themes and concepts in the responses, and determine whether or not any relationships between the codes/themes can be identified (Rubin & Rubin, 2005). Rogers’ (2003) theory of the Diffusion of Innovations provided the lens for analyzing the open-ended questions. Ultimately, all data was triangulated through analyzing the identified codes and themes from the various data sections and relating them to the three research questions.

**Validity, Reliability and Generalizability**

**Validity.** The main threat the internal validity in this study was the lack of random sampling because a convenience sample was used. Although the population did not self-select into the grant (they had to be recruited by grant administrators), their participation in the grant makes the group as a whole very similar. Therefore, their demographics (age, rank, gender,
socioeconomic status) might all be very similar. The specific population also effected the “Interaction of setting and treatment”, which is a threat to external validity that comes from the inability to generalize from the setting to another setting (Creswell, 2012). Another issue with validity is that the OER adoption took place over a five-year period. Therefore, mortality could be a factor. Either self-reported data is erroneous or a lack of interest in providing data by participants is an issue (Creswell, 2012).

Reliability. Aside from the instrument, the sample itself has to be reliable. The sample was selected based on the researcher’s access and the immediate problem of practice. Although random sampling is always more desirable, convenience sampling is an acceptable alternative in educational research (Muijs, 2011). The main risks to the sample reliability are in regards to the attitude and willingness of subjects, as well as the implementation method of the survey.

Generalizability. According to Creswell (2012), Quantitative research attempts find out what the trends, opinions, and attitudes of a population are by generalizing the results of a sample of that population. The larger the sample, the stronger the generalization will be. The main limitation with generalizability with this study is the limited sample size. The sample consisted of 96 faculty members. Furthermore, the use of a convenience sample limits the generalizability of study findings to other populations (Creswell, 2012). Regardless, since the OER and diffusion fields themselves are so limited the researcher believes that the data will be useful, especially if the instrument and/or research design can be replicated.

Protection of Human Subjects

The welfare and rights of all human subjects who will participate in the research study complied with all applicable state and federal laws. Moreover, the researcher has received a Certification of Completion of the Web-based training course “Protecting Human Research
Participants” from the National Institutes of Health (NIH) Office of Extramural Research in November 2014 (certificate number 1616877). The researcher is competent in the three principles essential to research including: respect for persons, beneficence, and justice (National Institutes of Health, 2016).

All research was completed in accordance with the Northeastern University Human Subject Research Protection (HRSP) manual and research did not begin prior to formal Internal Review Board (IRB) approval. All research participants were given an electronic informed consent form intended to comply with Northeastern University and human subject protections including HHS regulation 45 CRF 46.111. All forms approved by the IRB indicate the specific IRB approval numbers for the research study.

The participants were informed that the study was being conducted by the researcher for the purpose of completing doctoral thesis research at Northeastern University’s College of Professional Studies Doctor of Education Program. Refusal to participate did not involve penalty and participants were free to withdraw at any time (Creswell, 2012). Participants were notified that they were being asked to participate in this study because they were a participant in an OER initiative; because they were able to communicate their experiences; and because their personal experiences are helpful to others in similar roles. Because of these attributes, the faculty participants constituted a purposive sample in alignment with quantitative and qualitative inquiry practice (Appendix A).

Ethical considerations. The risks involved in participating in this study were minimal. The study researcher was trained in the principles of human research and is certified by CITI, and was trained in the need to maintain strict confidentiality. The Institutional Review Board Application (IRB) from Northeastern University approved the study for use of human
participants in research. No one at the research institution had access to any identifying data except for the student researcher. No individual names are listed in the thesis. Any information that has the potential to identify participants personally is not included. As the larger sample population exceeds 90 faculty members, the particular identities of the individual participants in this study are not easily determined. Participant names do not appear in the materials collected for data analysis. Hard copy and computerized research data have research code numbers and redacted indicators where information has been removed. The results of the study are presented in the thesis manuscript in a manner that confidentiality of the participants is maintained.

**Summary**

This Methodology chapter specified the research questions, research design, sampling strategies, data collection, data analysis, threats to validity and reliability, and measures to protect human subjects for this mixed methods study. The mixed method design best presented itself to examine the adoption process and use of OER in higher education. Through the lens of Rogers’ (2003) theory of the Diffusion of Innovations, the study’s quantitative and qualitative approaches pursued to describe the innovation and adoption process of OER which includes the attributes faculty believe constitute a valuable and sustainable OER and what instructional supports are meaningful to the usage of OER.
Chapter IV: Data Analysis

This chapter presents the data analysis for this mixed methods study. The data collection, quantitative data analysis, and qualitative data analysis are outlined in the chapter. A summary of the findings concludes the chapter.

Overview of Data Collection

The online survey instrument was sent to 96 possible respondents and available for data collection for 15 days. Due to the timing of the announcement over the summer months, eight “out of office” replies were received upon delivery of the survey invitation and one invitation was undeliverable. Two reminder announcements were sent out before the close of the survey. Of the 96 possible respondents, 19 opened the survey link and 16 completed the survey instrument resulting in a response rate of 16.7 percent. All 16 submissions contained complete data. Of the 16 submissions, nine participants agreed to be interviewed and a random sample of six were contacted for interviews. Five interviews took place; four were conducted via telephone conversation and one was conducted in person. In order to reduce technology glitches, all interviews were recorded by the “Sound Recorder” software application onto two separate password protected electronic devices.

Demographic Frequencies

Gender and age. Responses to the gender selection revealed that females accounted for 56.25 percent of the responses. Males comprised 43.75 percent of the responses. None of the participants wrote in a response in the “Self Selected” option. In regards to age, there were six options in which the participants could select from. The range of 60-69 had the highest response rate of 37.5 percent followed by 40-49 at 31.3 percent. The smaller ranges were 50-59 with 18.8...
percent and 30-39 with 12.5 percent. None of the participants selected the 20-29 or 70 and above ranges. Table 4.1 displays the distribution of responses.

Table 4.1

*Distribution of Age Respondents*

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>40-49</td>
<td>5</td>
<td>31.3</td>
</tr>
<tr>
<td>50-59</td>
<td>3</td>
<td>18.8</td>
</tr>
<tr>
<td>60-69</td>
<td>6</td>
<td>37.5</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Degree and rank.** Responses for highest degree held show that 56.3 percent of participants have a Master’s degree as the highest degree, while 43.8 percent of respondents have Doctorate degrees. None of the participants completed the “Other” text option. The highest response for Professional Rank is for Professor at 37.5 percent. Closely following is Associate Professor at 25 percent, Assistant Professor at 18.8 percent, and Instructional Faculty at 12.5 percent. Adjunct Instructional Faculty rounded out the selections at 6.3 percent with one selection. Table 4.3 shows the distributions for Professional Rank.
Table 4.2

*Professional Rank*

<table>
<thead>
<tr>
<th>Rank</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjunct Instructional Faculty</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>Instructional Faculty</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>Assistant Professor</td>
<td>3</td>
<td>18.8</td>
</tr>
<tr>
<td>Associate Professor</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>Professor</td>
<td>6</td>
<td>37.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>

_Years of college teaching._ Participants were asked to select the range of years that they have taught in higher education. All of the options were selected with the majority of responses being evenly distributed between 6-10, 11-15, 15-20, and 21-24 years. 6-10 and 11-15 years have 18.8 percent each, while 15-20 and 21-24 have 25 percent each. The outliers of 3-5 years and more than 25 years had 6.3 percent respectively. Table 4.3 lists the responses for the question.

Table 4.3

*Years Teaching in Higher Education*

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5 years</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>6-10 years</td>
<td>3</td>
<td>18.8</td>
</tr>
<tr>
<td>11-15 years</td>
<td>3</td>
<td>18.8</td>
</tr>
<tr>
<td>15-20 years</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>21-24 years</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>More than 25 years</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>
**Teaching discipline.** Respondents were asked to select or write in which discipline they most often teach in. One of the original four selections, Liberal Arts came in the highest at 43.8 percent. The remaining three original selections came next with Natural Science having 18.8 percent, Social Science having 12.5 percent, and Business having 6.3 percent. The two write in answers were Education with 12.5 percent and Communication with 6.3 percent. The distribution of responses is found on Table 4.4.

Table 4.4

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Science</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>Natural Science</td>
<td>3</td>
<td>18.8</td>
</tr>
<tr>
<td>Liberal Arts</td>
<td>7</td>
<td>43.8</td>
</tr>
<tr>
<td>Business</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>Communication Studies</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>Education</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Computer skills.** The majority of respondents at 75 percent identified themselves as having Above Average computer skills. 12.5 percent of respondents identified as either Average or Expert. No respondents selected Beginner or Below Average.

**Methods to deliver instruction.** For methods to deliver instruction, participants were able to select multiple options and write in additional responses. The option of “In Person, Online” had the most selections at 31.3 percent. Both “In Person” and “In Person, Hybrid, Online” had 25 percent each with “Online” having 12.5 percent. One text response (6.3 percent) of “In Person, Hybrid, Online, Blended” was recorded. Therefore, 87.5 percent teach In Person,
75.1 percent teach Online, and 31.3 percent teach Hybrid courses. Table 4.5 shows the methods of deliver, frequency, and percentages.

Table 4.5

Methods to Deliver Instruction

<table>
<thead>
<tr>
<th>Methods</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Person</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>Online</td>
<td>2</td>
<td>12.5</td>
</tr>
<tr>
<td>In Person, Online</td>
<td>5</td>
<td>31.3</td>
</tr>
<tr>
<td>In Person, Hybrid, Online</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>In Person, Hybrid, Online, Blended</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100.0</td>
</tr>
</tbody>
</table>

OER workshops. Participants were asked two questions about their level of attendance in OER workshops hosted by the KOCI grant. Both questions had the same responses. 87.5 percent of participants attended between 0-5 workshops and 12.5 percent attended 6-10 workshops.

Analysis of the Innovation-decision process indicator.

Lichty’s (2000) Innovation-Decision Process Indicator (IDPI) places faculty in Rogers’ (2003) five innovation-decision stages regarding the adoption of instructional technologies (Appendix B). The vocabulary of the instrument items was modified from computer-based instruction to OER usage in order to make them relevant to the study, yet the stages remain the same. The ranges for the stages are knowledge (items 0-3), persuasion (items 4-6), decision (items 7-9), implementation (items 10-12), and confirmation (items 13-15) (Lichty, 2000). The knowledge stage is when a person is exposed to the existence of an innovation and finds out its purpose. The persuasion stage is when a person forms an initial attitude toward the innovation. The decision stage is when a person chooses to adopt or reject the innovation. The
implementation stage is when the person is creating new habits with the innovation and the confirmation stage is when the person either uses the innovation to its fullest potential or completely rejects it.

Participants selected which of the 15 statements regarding adoption correspond to their beliefs and values. The ranges for the stages are knowledge (0-3 items), persuasion (4-6 items), decision (7-9 items), implementation (10-12 items), and confirmation (13-15 items) (Lichty, 2000). Participants can present identification in more than one stage, but the stage with the most items selected is the stage they currently reside in. The range of responses was 2-14, with 16 valid instruments. The mean response for the number of behavioral statements engaged in was 7.69, assigning the average participant in the decision stage of the innovation-decision process. 62.5 percent (10 of the 16 respondents) fell into the decision stage. The standard deviation was 2.4, which allowed for the possibility for the score to vary two items in either direction but mostly to the persuasion stage. Since the first three stages (knowledge, persuasion, decision) can be cyclical and iterative, a participant “could be in the decision stage and decide not to use computers for instruction, and go back to stage one for more information or stage two for additional evidence to support a decision to move forward to stage four, implementation” (Litchy, 2000, p. 75). 6.3 percent of respondents are in the knowledge stage and 12.5 percent of respondents fell into persuasion stage. 18.8 percent of respondents were in the implementation stage and no respondents were in the confirmation stage. Based on these results, the majority of respondents have clearly made the decision to use OER. These frequencies are found in Figure 6.
Figure 6: Participants innovation-decision stages

As for each individual item, Table 4.6 lists the percent, frequency, and stages for each item in order from highest to lowest percentage. The most selected item with 93.75 percent is “I am currently using OER in my instruction”. The one participant who did not select this item is currently retired and not teaching. The least selected item with 0 percent is “I will use OER on a trial basis during the coming year”, which based on all other answers is because the participants have an ongoing relationship with OER and have moved on from pilot or trial efforts. All three items in the implementation stage are in the top five frequency of responses. The decision stage has the top response and two lowest responses, which may be due to the language of the items or the current activity of the respondent.
Table 4.6

**OER Innovation-decision Process Indicator Items, Percents, Frequencies, and Stages.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Percent</th>
<th>Frequency</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. I am currently using OER in my instruction.</td>
<td>93.75%</td>
<td>15</td>
<td>Decision</td>
</tr>
<tr>
<td>9. I have integrated OER into my normal curriculum-planning activities.</td>
<td>87.50%</td>
<td>14</td>
<td>Implementation</td>
</tr>
<tr>
<td>15. I will continue to evaluate my efforts to provide quality OER.</td>
<td>87.50%</td>
<td>14</td>
<td>Confirmation</td>
</tr>
<tr>
<td>2. I will use OER instructional programs or strategies during the upcoming academic year.</td>
<td>75.00%</td>
<td>12</td>
<td>Implementation</td>
</tr>
<tr>
<td>5. I have secured the technical assistance I need to effectively implement instructional technologies.</td>
<td>68.75%</td>
<td>11</td>
<td>Implementation</td>
</tr>
<tr>
<td>8. I think about ways to implement OER in my courses.</td>
<td>68.75%</td>
<td>11</td>
<td>Knowledge</td>
</tr>
<tr>
<td>12. I have observed demonstrations of technologies and OER for instructional use within my discipline.</td>
<td>56.25%</td>
<td>9</td>
<td>Persuasion</td>
</tr>
<tr>
<td>3. I evaluate student learning using OER tools.</td>
<td>50.00%</td>
<td>8</td>
<td>Confirmation</td>
</tr>
<tr>
<td>11. I am creating or previewing OER for future incorporation into my courses.</td>
<td>50.00%</td>
<td>8</td>
<td>Persuasion</td>
</tr>
<tr>
<td>1. I am considering the advantages and disadvantages of OER instruction.</td>
<td>43.75%</td>
<td>7</td>
<td>Persuasion</td>
</tr>
<tr>
<td>7. I read journal articles about OER applications in my area of specialization.</td>
<td>43.75%</td>
<td>7</td>
<td>Knowledge</td>
</tr>
<tr>
<td>10. I have secured funding to support my efforts with OER.</td>
<td>25.00%</td>
<td>4</td>
<td>Confirmation</td>
</tr>
<tr>
<td>4. I read brochures from companies marketing OER learning programs.</td>
<td>12.50%</td>
<td>2</td>
<td>Knowledge</td>
</tr>
<tr>
<td>6. I have decided not to use computer-based applications or strategies for instruction in my next class.</td>
<td>6.25%</td>
<td>1</td>
<td>Decision</td>
</tr>
<tr>
<td>13. I will use OER on a trial basis during the coming year.</td>
<td>0.00%</td>
<td>0</td>
<td>Decision</td>
</tr>
</tbody>
</table>

Composite variables were created for each of the stages. *Figure 7* expresses the composite variable percentages in a line chart. Each stage has an average score and percentage as well. The knowledge stage has 44.44 percent, persuasion has 55.56 percent, decision has 35.56 percent, implementation has 80 percent and confirmation has 57.78 percent. Based on the
composite variables and the findings regarding the participants reported stages, the participants most frequently partake in activities found in the implementation and confirmation stages, but still cycle back to the previous three stages. Also, by looking at the individual items, one can see that items four and thirteen may not be appropriate for adopters to select because they are aware of the innovation and are past the trial stages. Furthermore, item six should have been worded differently to differentiate between open materials and publisher materials, rather than computer-based. The findings may have been different with these changes.

**Figure 7:** Percentages of scores of the innovation-decision process indicator.

**Analysis of OER attributes**

This section includes Likert-type statements that refer to innovation and adoption attitudes about using OER for instructional purposes. The five-point items ranging from strongly disagree to strongly agree correspond to the perceived characteristics of innovation which are relative advantage, compatibility (compatibility with existing values, and past experiences and
the needs of potential adopters), complexity, trialability, and observability (Rogers, 2003; Elliot, Foster & Stinson, 2003). Table 4.7 lists the items and percentages for the six items and Figure 8 shows the items and percentages in chart form. Overall, 75 percent of respondents Agree or Strongly Agree with the items, while only 1 percent Strongly Disagree.

As seen in Figure 8, 93.75 percent (Agree and Strongly Agree) of participants believe that OER are compatible with their teaching and learning beliefs in item two, and no participants disagreed with the statement. Similarly, 87.5 percent (Agree and Strongly Agree) of participants believe that their students benefit from using OER for item three. No participants disagreed with that statement. For item five, 81.25 percent (Agree and Strongly Agree) of participants believe that OER are flexible and meet the needs of students, and no participants disagreed with the statement. Item one had the most spread out distribution and the only Strongly Disagree response in the entire survey. 37.5 percent of respondents were Neutral and 37.5 percent agreed that OER materials are better than traditional materials, which corresponds to the relative advantage of OER. Item four has to do with how complex or difficult the innovation is to understand and use and 68.75 percent (Agree and Strongly Agree) of participants believe that OER are easy to use and “remix” for future use. In item six, 75 percent (Agree and Strongly Agree) of participants believe that others can see the benefits of adopting and using OER. Overall, 75 percent of the total responses were either Agree or Strongly Agree. These results make it clear that the participants hold positive characteristics and beliefs towards OER. The participants believe that both they and their students benefit from using customizable OER that align to their teaching and learning values.
Table 4.7

OER Attributes

<table>
<thead>
<tr>
<th>Items</th>
<th>Strongly Disagree</th>
<th>Slightly Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I believe OER are better than traditional learning material</td>
<td>6.25%</td>
<td>18.75%</td>
<td>37.50%</td>
<td>31.25%</td>
<td>6.25%</td>
</tr>
<tr>
<td>2. OER represent my values in teaching and learning</td>
<td>0.00%</td>
<td>0.00%</td>
<td>6.25%</td>
<td>56.25%</td>
<td>37.50%</td>
</tr>
<tr>
<td>3. My students benefit from using OER</td>
<td>0.00%</td>
<td>0.00%</td>
<td>12.50%</td>
<td>31.25%</td>
<td>56.25%</td>
</tr>
<tr>
<td>4. OER are easy to use and &quot;remix&quot; for future use</td>
<td>0.00%</td>
<td>18.75%</td>
<td>12.50%</td>
<td>43.75%</td>
<td>25.00%</td>
</tr>
<tr>
<td>5. OER allow me to try new materials and hone them to meet student needs</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18.75%</td>
<td>62.50%</td>
<td>18.75%</td>
</tr>
<tr>
<td>6. My students and colleagues have begun to use more OER since I began to</td>
<td>0.00%</td>
<td>12.50%</td>
<td>6.25%</td>
<td>37.50%</td>
<td>43.75%</td>
</tr>
<tr>
<td>Averages</td>
<td>1.04%</td>
<td>8.33%</td>
<td>15.63%</td>
<td>43.75%</td>
<td>31.25%</td>
</tr>
</tbody>
</table>

Figure 8: Percentages of scores of the OER attributes.
Tests of Differences

Statistical tests to determine differences in means were conducted for the demographics and survey items. A series of $t$ tests and ANOVA were conducted on the survey items for bivariate demographic variables of gender and degree. The demographics items of age and years teaching were transformed into bivariate variables for difference of means analysis. Overall, the $t$-tests conducted on demographic categories showed few significant differences between the subgroups in each category. The significant differences that occurred are related to differences in gender and observability, persuasion, and implementation, as well as years of teaching and observability.

$T$ Tests. Independent sample $t$ tests were conducted in order to identify significant differences between the mean responses for gender (male and female), degree (masters and doctorate), age (30-49 and 50-69), and years teaching (3-15, 16+) against the survey items. The $t$ test for independent sample results for the variables of age and degree showed no significant differences across the OER Attitudes and Innovation-decision process items. The $t$ test for independent samples for the gender variable showed a significant difference in the response means between males ($M = 3.71, SD = .1.380$) and females ($M = 4.44, SD = .527$) was found in the OER Attitude item of observability where $t = -1.467, df = 14, p < .001$. A significant difference was found between mean responses for male ($M = 1.8571, SD = .899$) and females ($M = 1.33, SD = 1.41$) on the persuasion composite item ($t = .852, df = 14, p < .036$). A significant difference was also found between mean responses for males ($M = 2.71, SD = .488$) and females ($M = 1.88, SD = .1.167$) on the implementation composite item ($t = 1.746, df = 14, p < .006$).

These significant differences between male and female responses indicate that males and females

have diverse experiences in the innovation-decision process stages of persuasion and implementation, as well as experiences with how colleagues use OER.

Table 4.8

Summary of Results of T-tests for Gender Variable and Observability, Persuasion, and Implementation

<table>
<thead>
<tr>
<th>Item</th>
<th>Male (n=7)</th>
<th>Female (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>6, Observability</td>
<td>3.71</td>
<td>1.38</td>
</tr>
<tr>
<td>Persuasion</td>
<td>1.857</td>
<td>0.899</td>
</tr>
<tr>
<td>Implementation</td>
<td>2.714</td>
<td>0.488</td>
</tr>
</tbody>
</table>

**OER Attributes ANOVA.** Analysis of Variance (ANOVA) have been employed to determine if there are significant differences across faculty member’s beliefs about the attributes of OER as an innovation. While ANOVA identifies whether there are significant differences between the groups analyzed, it does not identify specifically where the significance lies. A major limitation in these findings is that the sample size was considerably small at 16 respondents. There were no significant differences for gender, age, degree, years teaching, rank, and school. The demographic category of computer skill did show significance in one item.

**Computer skill and OER attitudes ANOVA.** An ANOVA was conducted to measure statistical significance between Computer Skill and all of the OER Attitude characteristics of innovation. The ANOVA data in Table 4.9 suggests there is no significant difference between groups for computer skill and characteristics of advantages (Item 1) $F = 1.13, p < .353$, compatibility (Item 2) $F = .341, p < .717$, experience and needs (Item 3) $F = .699, p < .515$, complexity (Item 4) $F = .553 p < .588$, and observability (Item 6) $F = .141, p < .870$. However, there is a statistically significant relationship between Computer Skill and trialability (Item five)
$F = 4.136, p < .041$. A Tukey’s post hoc test was run to determine the exact location of the significant difference. The locations of the difference occur in both the Above Average and Expert options ($p < .033$) and are in Table 4.10.

Table 4.9

**ANOVA for Computer Skill and OER Attitudes**

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, I believe OER are better than traditional learning material, Advantage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.333</td>
<td>2</td>
<td>1.167</td>
<td>1.130</td>
<td>.353</td>
</tr>
<tr>
<td>Within Groups</td>
<td>13.417</td>
<td>13</td>
<td>1.032</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15.750</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, OER represent my values in teaching and learning, compatibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>0.271</td>
<td>2</td>
<td>0.135</td>
<td>0.341</td>
<td>.717</td>
</tr>
<tr>
<td>Within Groups</td>
<td>5.167</td>
<td>13</td>
<td>0.397</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5.437</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3, My students benefit from using OER, experience &amp; needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>0.771</td>
<td>2</td>
<td>0.385</td>
<td>0.699</td>
<td>.515</td>
</tr>
<tr>
<td>Within Groups</td>
<td>7.167</td>
<td>13</td>
<td>0.551</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7.938</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4, OER are easy to use and &quot;remix&quot; for future use, complexity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>1.333</td>
<td>2</td>
<td>0.667</td>
<td>0.553</td>
<td>.588</td>
</tr>
<tr>
<td>Within Groups</td>
<td>15.667</td>
<td>13</td>
<td>1.205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17.000</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5, OER allow me to try new materials and hone them to meet student needs, trialability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>2.333</td>
<td>2</td>
<td>1.167</td>
<td>4.136</td>
<td>.041</td>
</tr>
<tr>
<td>Within Groups</td>
<td>3.667</td>
<td>13</td>
<td>0.282</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6.000</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6, My students and colleagues have begun to use more OER since I began to, observability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>0.333</td>
<td>2</td>
<td>0.167</td>
<td>0.141</td>
<td>.870</td>
</tr>
<tr>
<td>Within Groups</td>
<td>15.417</td>
<td>13</td>
<td>1.186</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15.750</td>
<td>15</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Table 4.10

Tukey Post Hoc for Computer Skill and Item Five

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(I) Comp Skill QID7 Q7</th>
<th>(J) Comp Skill QID7 Q7</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>5, OER allow me to try new materials and hone them to meet student needs, trialability</td>
<td>3 Average</td>
<td>4 Above Average</td>
<td>-.167</td>
<td>.406</td>
<td>.912</td>
<td>-9.0 1.24</td>
</tr>
<tr>
<td></td>
<td>5 Expert</td>
<td></td>
<td>-1.000</td>
<td>.531</td>
<td>.183</td>
<td>-2.40 .40</td>
</tr>
<tr>
<td></td>
<td>4 Above Average</td>
<td>3 Average</td>
<td>-.167</td>
<td>.406</td>
<td>.912</td>
<td>-1.24 .90</td>
</tr>
<tr>
<td></td>
<td>5 Expert</td>
<td></td>
<td>-1.167*</td>
<td>.406</td>
<td>.033</td>
<td>-2.24 -.10</td>
</tr>
<tr>
<td></td>
<td>5 Expert</td>
<td>3 Average</td>
<td>1.000</td>
<td>.531</td>
<td>.183</td>
<td>-.40 2.40</td>
</tr>
<tr>
<td></td>
<td>4 Above Average</td>
<td></td>
<td>1.167*</td>
<td>.406</td>
<td>.033</td>
<td>.10 2.24</td>
</tr>
</tbody>
</table>

Qualitative Analysis

The online survey consisted of five open ended questions. The 16 participants completed all the questions that align with the research questions, innovation-decision process, and perceived characteristics from the theoretical framework. The questions and alignment can be seen in Table 3.2 (Open-ended survey questions alignment with research questions and framework).

Following the survey questions participants were given the opportunity to provide contact information in order to partake in the follow up interviews. 9 out of the 16 participants provided contact information. 5 participants were randomly chosen and via email were invited to participate in the follow up interview. All 5 participants scheduled interviews either by telephone or in person. 4 interviews were conducted via telephone and one was in person. All interviews were simultaneously recorded onto two different electronic devices in order to
minimize user or technological errors. In the beginning of each interview as a review, Participants were told the purpose of the study and the ten open-ended questions. The three main research questions guided the interview stage of this study:

1. What attributes do faculty believe constitute a valuable and sustainable OER?
2. What contributes to faculty adoption or non-adoption of OER as reported by faculty?
3. What supports do faculty identify as meaningful to the innovation and adoption of OER?

After the interviews were transcribed, the open ended questions from the survey and the text of the interviews were organized and input into MaxQDA, a Mixed-Method Data Analysis software. The five documents were then coded based on the frameworks of the innovation-decision process stages and the OER attitudes. The qualitative information captured in the responses to the five open-ended survey questions and ten open-ended interview questions were analyzed by employing a multi phased general inductive approach familiar to the explanatory sequential design and ethnographic focuses. The explanatory sequential design & multi phased general inductive approach tease out nuanced details in open-ended interview responses that lead the researcher to a rich picture of the phenomena (Creswell, 2012).

In this approach, responses will be coded into 5-7 broad themes that emerge and then be organized into reliable and valid results (Creswell, 2012). In this study, the themes were viewed though the lenses of the innovation process stages and the perceived characteristics of OER attitudes in order to answer the study’s three research questions on faculty adoption of OER. Within MaxQDA, the documents containing the responses were read and re-read in order to identify consistent emerging themes (Thomas, 2006). Responses were highlighted and selected key words and phrases were placed into coding segments within software. In the beginning
readings, responses were coded into various sub codes within the frameworks. Creswell (2012) recommends that when using general inductive analysis, the initial reviews could have between 25 and 30 codes. On subsequent reviews, redundancy is eliminated and sub codes regarding the responses are gradually reduced based on the emerging themes. The review and organizing process was repeated multiple times until a manageable number of coded themes remained (Creswell, 2012).

Once the final coding and organizing was complete, the themes were ultimately identified and available in a Code matrix (Figure 9). The Code matrix illustrates the frequency of the themes in the coding framework. The larger the square, the more it was recorded as a response in the surveys and interviews. More prevalent themes can be identified in this matrix. For example, cost, student learning and success, and comparable/better material have the largest squares and therefore have the most mentions in the survey responses. Student learning and success also had the most mentions by interview participants. What is also important to note is the lack of responses in certain areas, specifically how Interviewee One did not have as many responses in any category as the other interviewees.
Figure 9: Code matrix.

Emerging concepts and themes analysis. Each code and sub code is summarized in the sections below. The narrative description of the relationships of the frameworks and themes can be found in the Chapter Five of this doctoral thesis. Upon completing the phases of the quantitative and qualitative data analysis, the themes emerging from each phase provide insight towards answering the three research questions. This broader overview of mixed method data collection gives insight into deeper themes across the interactive dynamic link between the innovation decision process, faculty attitudes towards OER, and future possibilities.

Research question one: Perceived characteristics from the diffusions of innovations. The first research question seeks to find out what attributes do faculty believe constitute a valuable and sustainable OER. The emerging codes were based on the five perceived characteristics from the diffusions of innovations theoretical framework. Within the five perceived characteristics, certain sub codes were created based on the emerging themes within
them. *Figure 10* exemplifies the percentages of responses for each of the five main codes. Compatibility had an overwhelming amount of responses with 43 percent, more than one third of all responses. Relative advantage has 24 percent of responses, while complexity and observability with closely group between 12 and 11.5 percent. Trialability had the least amount of responses with 9.5 percent. This may be due to the fact that participants are past the trial stage of adoption.

Most prevalently, faculty believe that OER are compatible with their values and needs of students. This corresponds to the highest rated OER attitude survey item which was the compatibility item where 93.75 percent Agreed and Strongly Agreed. The second highest responses were for relative advantage, which also corresponds to the second highest survey item where 87.5 percent (Agree and Strongly Agree) of participants believe that their students benefit from using OER. Overall the quantity of responses for the OER attitudes in the qualitative section mirror the responses in the OER attitudes survey section, which shows a soundness to the data collection and findings.

*Figure 10*: Perceived characteristics from the Diffusions of Innovations theoretical framework code percentages.

Within each characteristic, codes and sub codes had certain counts. Relative advantage had two sub codes emerge: comparable/better material with 28 responses and access with 20
responses. Compatibility had two sub codes: cost with 29 responses and student learning and success with 57 responses. Complexity had 24 responses and trialability had 19 responses. Finally, observability had two sub codes: sharing with 12 responses and support with 11 responses. Figure 11 lists the counts for each code and sub code.

<table>
<thead>
<tr>
<th>OER Attitudes Codes and Sub Codes</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative advantage</strong></td>
<td></td>
</tr>
<tr>
<td>Comparable/Better Material</td>
<td>28</td>
</tr>
<tr>
<td>Access</td>
<td>20</td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>29</td>
</tr>
<tr>
<td>Student Learning &amp; Success</td>
<td>57</td>
</tr>
<tr>
<td><strong>Complexity (Remixable &amp; Flexible)</strong></td>
<td>24</td>
</tr>
<tr>
<td><strong>Trialability</strong></td>
<td>19</td>
</tr>
<tr>
<td><strong>Observability</strong></td>
<td></td>
</tr>
<tr>
<td>Sharing</td>
<td>12</td>
</tr>
<tr>
<td>Support</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>200</td>
</tr>
</tbody>
</table>

Figure 11: Counts of OER attitudes (Perceived characteristics from the Diffusions of Innovations).

_How Good Is It?_  The characteristic of relative advantage is when an innovation is perceived as being better than the idea it replaces. In this study, the questions asked focused on whether or not faculty perceive OER to be better than traditional learning materials and what their perceptions are about the newer innovation. This characteristic was found to have two prevalent findings. The first is comparable/better materials and the second was access. Respondents claim that OER are advantageous for financial, quality, accessibility, and user-friendly reasons. Survey responses for the comparable/better materials related how “the quality
of the material is same as the high cost material” and “OER is more flexible and current than publisher-created materials”. Other sample responses are listed in Table 4.11.

Table 4.11

**Comparable/better Material Sample Responses**

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>I can mix, match and move around content at the chapter or module level. A print textbook won't do this well. And online course textbooks may not play well with the learning management system. It is convenient. I can seamlessly add and subtract reading materials. Students don't get a feeling that the textbook is not being used or chapters are being skipped.</td>
</tr>
<tr>
<td>Interview</td>
<td>It is amazingly similar in that the chapter breakdowns are about the same, the vocabulary is about the same, the reading level is about the same. It's extremely well done and it is comparable to any public speaking textbook on the college market and it's competitive.</td>
</tr>
<tr>
<td>Interview</td>
<td>It met the needs better of our students than the books that students had to pay 150 dollars for. Someone might say, well, then it was less rigorous than the books that were used prior, and maybe that’s the case. If you have a car that will go 200 miles an hour and you can only drive 55, then how effective is that? How cost effective is that? I think they met our needs better than the textbooks we were using prior to that.</td>
</tr>
</tbody>
</table>

The responses in the access sub code included the advantages the materials have being available to students immediately, removing barriers that exist with financial aid, and the availability for faculty to easily find the growing of OER sources. Survey response included “reduced cost to students, available to students from the first day of class, available online” and: the textbook is immediately available to students online. There is no wait for the book to arrive to Web students. There is no shortage in the book store. There is no problem waiting for student aid funds to arrive. Everyone immediately has the textbook and my courses can get moving as soon as class meets.
Interviews had similar responses, yet also focused on the increase of access for faculty. For instance, one participant recalled how a few years ago there was little OER available but “now, it's everywhere. There's so many people that are producing OER materials that the job of finding it is the most difficult part, but it's out there”.

Compatibility with existing values. The degree in which OER represent values in teaching and learning, as well as how students benefit from using OER based on their past experiences and needs is the next perceived characteristic. This perceived characteristic code of compatibility with existing values has two sub codes: student learning and success, and cost. Participants assert that OER are cost effective and have a positive association to student learning and success. In relation to student learning and success, one survey participant stated that “OER changes how entry level math courses can be taught to students who lack both confidence and skills”. Frequently, the success of online or distance education students was mention. One survey participant relayed how “I use it in order to provide current materials to my students and to target the information they need. In an online environment, this is vital. It allows for the kind of interaction that is normally available in a face-to-face classroom situation. Online students need considerable guidance”. In an interview, one participant gave this detailed and data-driven account:

From a results standpoint, we first began using OER, that goes back to 2008. In 2008 we did a pilot and in 2009 we started getting involved in OER. Back then, I did the test, the pilot test for that. Our retention, student retention ran 67% in the semester prior to when I did the pilot, and when we added OER to the mix, our retention went up 7.58%, about 1% for traditional classes, base classes, and 17.1 or 17.2% in our distance ed classes. The rationale or our understanding of why that probably happened was that in a face-to-face
class, students can sit there, takes notes, watch PowerPoints, borrow their fellow students textbooks, go to the library because they textbooks at the library, go to the library, read the textbook there, etc.

There's a lot more ways the student gains information if they're taking the class face-to-face. If they're doing it online, they don't have all of those things available to them. If they don't have a textbook, they're headed to trouble. The reason we originally became interested in OER was we got tired of standing up in front of classes with only half the students that have books because they're the only ones that could afford it. You would see a dramatic increase in grades of those students that had books and a dramatic decrease in the students that didn't have textbooks. OER just seemed like the way to go, and we've been very aggressive in adopting OER.

Therefore, the students, particularly online students, benefitted greatly from the inclusion of OER in relation to their learning and academic success. Additional responses range from students having ownership and interest in the assignments to students having a seamless experience with the course learning. This is how the curriculum of OER meets the needs and values of the students. Table 4.12 shows sample responses that pertain to student learning and success.
Table 4.12

*Student Learning and Success Sample Responses*

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>It's about half and half. Some students are just like, &quot;Oh, whatever. I just want to do the assignment&quot;, but then others, they really become engaged. They get excited about it and they're proud of their work. Going back to values, I think that kind of exemplifies my teaching philosophy and trying to engage students and this is a good tool OER, open pedagogy is a good tool to practice by that.</td>
</tr>
<tr>
<td>Interview</td>
<td>We're rarely starting to create courses from scratch. We have courses on the books. These courses have been vetted by the curriculum committees and have gotten approved. In order to totally throw them out and replace them with something else is very difficult. What you want to do is take an existing course, an existing syllabus, and you know what your topics are. Then you start searching for material that feeds into the topics that you want to teach.</td>
</tr>
<tr>
<td>Survey</td>
<td>It is convenient. I can seamlessly add and subtract reading materials. Students don't get a feeling that the textbook is not being used or chapters are being skipped.</td>
</tr>
<tr>
<td>Interview</td>
<td>We like to be on the cutting edge. We want to be on the cutting edge. We take pride in the fact that we're out there on the edge. It's a good thing. I think our students are certainly well-served by that. I know it makes our jobs a lot more interesting.</td>
</tr>
</tbody>
</table>

The second part of the compatibility characteristic has to do with cost savings for students. Saving students the cost of textbooks and learning materials is a major case in the OER movement. One survey response asserted “we save our students approximately a million dollars each year in textbook expenses. Retention, student success and completions have improved considerably since we began using OER”. An interview participant said that students find “not having to buy a textbook was fantastic. They start off happy. They find that it's flexible. In some classes, they feel that if there are chapters that aren't covered that they have wasted their money”. Table 4.13 lists more sample responses on the cost saving aspects of OER on student needs.
Table 4.13

Cost Sample Responses

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>Yes. I am using math courses available on myopenmath.com. They are of good quality, and the fact that they are free/low-cost is beneficial to my students.</td>
</tr>
<tr>
<td>Survey</td>
<td>The very low cost to my students. Across the college, we are saving our students significant amounts of money. Furthermore, the textbook is immediately available to students online. There is no wait for the book to arrive to Web students. There is no problem waiting for student aid funds to arrive. Everyone immediately has the textbook and my courses can get moving as soon as class meets.</td>
</tr>
<tr>
<td>Interview</td>
<td>100% it's because I want to reduce costs for students, and our Concepts of Biology book, all the instructors in my department use that book, nobody complains about it. I think they've forgotten about the transition period and there ever was a time when they were opposed to this. It's very much a part of our team.</td>
</tr>
<tr>
<td>Interview</td>
<td>Well, I have been fighting to keep textbook prices low for years and I was constantly filing exception forms to use cheaper textbook and I was usually, usually, able to get my textbook costs down to about a third of what it cost other instructors to use. When I found that I could get it for free, that did exactly what I wanted it to do. I really believe that textbooks are over-priced and I have fought with instructors that have under-used textbooks, on required textbooks but never really used them in the classroom.</td>
</tr>
<tr>
<td>Interview</td>
<td>Well, first off, my colleagues discovered right away that my classes were filling and theirs weren't, because I had a free text book. They told me today ... Today was our first day of Tuesday, Thursday classes and</td>
</tr>
</tbody>
</table>

**Complexity.** Complexity is the amount in which an OER is perceived as reasonably difficult to use and understand. This study looks at how easy OER are to use and “remix” for future use. The theme for this characteristic is customizable and flexible. Participants report that OER are easy to modify in order to meet student and course needs. Responses in this category range from the ability to “develop materials myself, share them with others, borrow and remix materials others have developed” to “I modify a lot…The content may or may not change, but
it's what I do with the content that changes. I may emphasize...depending on what the topic is or what's the current politics, current news”. isn’t only about changing activities in a course around, it is about modifying the content to enhance the teaching and learning experience.

Sample responses from this characteristic are in Table 4.14.

Table 4.14

Complexity Responses

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>I know that Lumen Learning has done... They're working on classes that are really modular so that they can grab the simple amount and put them together and it's like Legos. That, I think, is probably easier. When I think of remixing, I really do think of getting into the words and I want to reformat and I want to change words.</td>
</tr>
<tr>
<td>Interview</td>
<td>It is at one extreme you have a syllabus and a textbook that you spent a lot of time working on at one point, and then 20 years later you're still using the same syllabus and the same textbook. Not a good idea. The thing about using open source materials, you revisit your course every single semester. It's not that somebody's forcing you to, but the nature of the materials and the course is such that you really need to, if nothing else, make sure those links are still active, that the videos still work, that there might be something better or different out there that you'd like to use or add to or change for something else. It invites the ongoing effort to improve your teaching every single semester in a way that a more fixed course does not.</td>
</tr>
<tr>
<td>Interview</td>
<td>Well, I certainly find that it's adaptable to a variety of situations. I also teach an oral communication course and I'm able to take chapters from the public speaking project and use it, but I'm also able to get material from other sources and a creative commons licensed and incorporate those in to create a different class. The ability to adapt those materials to different situations helps me immensely...I can also insert it exactly where it needs to be, into the learning management system. The adaptability, the modification... I can go at it any order I want to. I can cover chapter 18 first if I want to, for instance. When you have a hard copy textbook, skipping chapters causes problems for some students.</td>
</tr>
</tbody>
</table>
**Trialability.** The degree in which an innovation can be experimented with on a limited basis is trialability. This study seeks whether or not participants try new OER materials and hone them to meet student needs. This is similar to remixing, but only involves the first step of trying. It does not include the subsequent usage after remixing. For the most part responses in this characteristic focus on creating and trying new OER content for the first time. Since most participants are already using and remixing content, there were less responses in this code. Samples of the responses are in Table 4.15.

Table 4.15

**Triable Responses**

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>The process that I followed, which was fairly primitive because we were just starting out with this whole thing, was to take existing content and to review all those readings and build content modules around it, skill work and activities around it.</td>
</tr>
<tr>
<td>Interview</td>
<td>For one, I'm not locked into a textbook. I'm constantly from the last quarter, what worked, what didn't? For example, last quarter I worked on an instructional innovation grant where I incorporated a reading apprenticeship into the course. It was, for the most part, all open source. There were a few copyrighted articles, my favorite chapters of the book that I really wanted them to read were included, but the whole course was designed around eliminating the lecture and to more of a discussion inquiry-based class.</td>
</tr>
</tbody>
</table>

**Observability.** Observability is how visible an innovation is to others. This study seeks to find out if students and colleagues have begun to use more OER since the participants began to. The two sub codes of this characteristic are sharing and support. Participants related how having support from their institution is important, as well as the sharing of existing OER. These are the ways that the faculty and others observe existing OER usage and find out about future projects. Sharing responses focused on the ability to “develop materials myself, share them with others” and “sharing of materials is common at my institution, as is the use of a Creative
Commons license”. The need for repositories and sharing spaces was mentioned, including this excerpt:

We are now right in the middle of working with our IT department to have a place where we could deposit those materials so that they are free and available to everyone at the college and outside of the college as well, if we can pull that off. That way, we're at least exchanging materials and sharing materials as freely as we can get away with.

Sharing OERs, especially in repositories, is a visible way of showing what OERs are being used and by whom.

The final sub code relates to the support participants receive that allow for their use of OER to be visible to their communities. For example, one survey respondent stated “We have a dedicated OER person at our institution. Likewise, we have administrative support and encouragement to use OER”. An Interview participant relayed thoughts on the inclusion of a faculty learning community and the role it will play in improving observability of OER on campus. The participant stated:

I do a lot of presentations for faculty at (site redacted) on the use of OER. There's always a lot of interest in it conceptually, but rolling up their sleeves and doing the work is a little different. The progress has been slow. We are starting a faculty learning community this semester where we're inviting a group of people to meet at least 5 times. We're going to start with 5 times. We're going to work collectively.

The faculty learning community has the ability to increase sharing, which in turn brings more attention and interest to OER. All of these components add to the observability of the OER.
Research question two: The Innovation-decision process. The second research question seeks to find out what contributes to faculty adoption or non-adoption of OER as reported by faculty. The innovation-decision process describes the steps an individual goes through when deciding whether to adopt an innovation. This study focuses on the decision process faculty members have with OER. Therefore, the coding of this section was done within the framework of the innovation-decision process stages. Within the coded stages, sub codes were created based on the emerging themes within them. Figure 12 exemplifies the percentages of responses for each of the five stages. The most frequently coded stage is implementation with 30.8 percent, followed closely by confirmation with 23.9 percent. decision with 18.8 percent, persuasion with 16.2 percent, and knowledge with 10.3 percent round out the totals. The rankings of the stages in order of highest to lowest percentage match the order of percentages of the IDPI section of the survey. Once again, respondents claim to most often participate in the implementation and confirmation stages of the innovation-decision process of adoption, yet they also continue to participate in the first three stages.

![Figure 12: Innovation-decision process stages code percentages.](image-url)

Within each stage, the codes and sub codes had certain counts based on the frequency of responses. The knowledge stage had 13 responses. Persuasion had two sub codes, funding with
10 responses and institution support with 9 responses. Decision had 22 responses and implementation had two sub codes: internal and external instructional support with 25 responses and repository with 10 responses. The final stage of confirmation had 22 responses. Figure 13 lists the stage codes, sub codes, and counts for each.

<table>
<thead>
<tr>
<th>Innovation-decision Stages Codes and Sub Codes</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge (Awareness &amp; Change)</td>
<td>13</td>
</tr>
<tr>
<td>Persuasion</td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>10</td>
</tr>
<tr>
<td>Institution Support</td>
<td>9</td>
</tr>
<tr>
<td>Decision (External Influences: Grants, Programs, Software)</td>
<td>22</td>
</tr>
<tr>
<td>Implementation</td>
<td></td>
</tr>
<tr>
<td>Internal &amp; External Instructional Support</td>
<td>25</td>
</tr>
<tr>
<td>Repository</td>
<td>10</td>
</tr>
<tr>
<td>Confirmation (Individual Commitment)</td>
<td>22</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>111</strong></td>
</tr>
</tbody>
</table>

*Figure 13:* Innovation-decision process stage codes, sub codes, and counts.

**Knowledge.** The knowledge stage is the first in the innovation-decision process. An individual first needs to become aware of the innovation in order to choose whether or not to proceed through to the next steps. There are various ways people become introduced to the innovation and seek out information and materials. The themes that emerged in the knowledge stage of this study are awareness and change. Within this theme there are two aspects, potential users who are introduced but resist change and users who follow up with finding out more. Since the participants of this study have proceeded through subsequent stages, they all became aware and followed up. However, some respondents imparted how their colleagues are introduced and are aware of the innovation, but are resistant to change. For example, one interviewee relayed how in his department “my colleagues are rather conservative people. If
something looks different, they tend to be really critical of something that doesn't look like the
textbook”. Another interviewee stated that “people don't like change, even change for the better,
people are resistant to change”, but:

it's work and change. People don't like change, even change for the better, people are
resistant to change. If you've got somebody that's been teaching 10, 15, 20 years, they've
already got things dialed in and they kind of want to keep it that way. For some reason,
our department, we don't operate that way. We like to be on the cutting edge.

Other interviewees claim that the awareness and change was a welcome introduction that aligned
with their teaching and learning beliefs. One participant stated:

My first quarter here, I priced the textbooks. For what we got, I was amazed. At this
time, we had a designated OER person come on board, so I started collaborating with her
and she said, "Hey, we got a conference in (location redacted). Would you like to go and
participate?" "Sure, why not?" So that's how I got involved.

Another participant said the introduction to OER came about “almost by luck”. Therefore, the
study can assume that all participants have knowledge of the OER, but what has been discovered
is that the participants most often were approached by colleagues who had knowledge of OER
and introduced them to the innovation.

**Persuasion.** When individuals move past awareness, they have progressed into the
persuasion stage. The individual has incentive to move into the adoption process. The themes in
persuasion are funding and institution support. Funding includes the need for funding faculty
development and OER creation and institution support includes the backing of the home
institution on OER initiatives, which are both incentives to persuade participation. What one
participant found useful would be “financial support to create any and teach faculty how to use it, how to create it, what it's for and explain to them that there's a learning curve”.

One survey participant mentions both aspects in saying “the distance Ed at my institution have been very supportive of OER material. Of course I think that the college can definitely help by allocating more funding to help faculty transition into OER”. An interviewee does the same and recounts that:

We've got a couple other irons in the fire, about every grant we go for has an OER component in it. We've got a full-time grant manager now that we didn't have before.

We're kind of in. I would change the question, not if we or when we, because it's a foregone conclusion at this point. What would I like to see from a support standpoint? I'm pretty happy with the way it's going. I think that the Gates grant, because there is so little there for stipends for faculty, that I think I could get a lot more faculty involved if there was stipends involved because seriously, should change the name to chump change instead of stipend. Really if you look at the time that instructors put into this, it's very demanding. We should at least give them something to say thank you for doing it. Not a couple hundred dollars a year.

Another participant reported that if his institution “were to work on another OER grant...It would fund a group of faculty from a program working on a course or a set of courses together with some commitment of time for which they would be paid. I would like to have an instructional designer as part of that team”, again combining funding with institution support.

As far as a singular comment on institutional support, one interviewee stated that “the college has been supportive me and my department using OER. They have been less supportive of other areas and disciplines adopting. There appears to be a roadblock at the Dean-level. The
college currently has a committee and a consultant attempting to determine how to adopt OER”.

There seem to be growing pains on how to best approach support at various levels.

Decision. Once past the persuasion stage, the decision stage is where the previous stages influence and drive the actual decision to pursue adoption or reject it. The process involves the weighing of advantages and disadvantages based on current circumstances. This study focuses on how both the external and internal cultures influence the decisions to either adopt or not adopt. The emerging theme in the decision is external influences (grants, programs, & software). External influences are the support and resources that precipitates or hinders the innovation & adoption decision. External influences mentioned by participants include Lumen Learning, KOCI (Kaleidoscope), Waymaker, OpenStax, and State run programs. Sample responses can be seen in Table 4.16. These external supports have influenced the decision making process of the participants.

Table 4.16

External Influences Sample Responses

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>My experiences with the Kaleidoscope program were extremely positive. As soon as I had the college's support, implementation was easy -- although never glitch-free, that is the down side to all technology and not a negative reflection of OER or the K program.</td>
</tr>
<tr>
<td>Interview</td>
<td>California is doing this giant OER push, and they were offering money to institutions that adopted an OER clause into their senate documents and our college was very close to trying to make that happen. That's another ... I feel like we're thinking this way, we're sort of solidifying that we're thinking this way to reduce costs and maintain quality, and it's slow.</td>
</tr>
<tr>
<td>Interview</td>
<td>The couple of features that Waymaker have are incredible and really I think can have a big impact on student success. One is that they have a pretest at each module, and after they take the pretest, the students know what they did well and they know what they didn't do well and it identifies the areas that they need to focus on and study the material. If you give somebody a chapter and say, okay, here's 30 pages, read it from end to end, the retention on that would be poor. It just is. I used to have</td>
</tr>
</tbody>
</table>
a class, my first class, my orientation and I would say, “Okay, I'm going to teach you how to study from a book as opposed to read a book.”

...Waymaker does it for them, it identifies what knowledge they already have that they're bringing to the material, and tells them what areas they need to study....The second thing is feedback. One of the most difficult things that we as instructors have is giving students feedback that is from a timely standpoint and relevant. Two weeks later you send a student feedback on a paper they wrote two weeks ago, they have to reread the paper to remember anything about it because it's not timely. Whereas with Waymaker, it used to be called the project nurture or something, I really liked that but then they changed it. Anyway, with that feature that Waymaker has, students get feedback based on how much feedback I want to give them and based on what feedback I want to give them. I set the perimeters in Waymaker and I say, okay, if students get 90% or above, then I want this message to be sent to students. If it's 60% or below, I want this message to be sent. It's not sent every time they take an exam. I set those perimeters, as well. It's twice a week or once every two weeks or however I want to set it. That's the biggest feature. When you talk about OER materials, yes, there are OER materials but they're packaged in a course management system that makes them very effective and that's why we're really making a major commitment moving to the Waymaker platform.

Interview 1

Two of my colleagues actually tried modifying the majors level biology text from OpenStax. They tried to modify that and use it for zoology and cell biology. The cell biology instructor was fine with it, not thrilled but fine with it. The zoology instructor was very unhappy. It's the same kind of thing. You're trying to modify a text with one approach to meet the needs of a class with a different approach. The fact that the even were willing to try it says a lot. I think that our department is definitely moving towards embracing ... Keeping that as a filter that we evaluate our resources through.

**Implementation.** Integrating the innovation into routine use is called the implementation stage. This process of developing new habits can be slow. During this time, revision and modification of previously used OER happens. The two themes that emerged from the implementation code are internal and external instructional support, and repository. The internal and external instructional support responses focus on what institutional and external services are in place that support OER instruction. For example, administration, faculty learning
communities, instructional designers, software, and grants help to scaffold OER adoption at different levels. Table 4.17 lists the different types of instructional supports for OER.

Table 4.17

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>We have an instructional designer and one of our full-time professors is well-versed in OER and able to help us with revisions, uploading, etc.</td>
</tr>
<tr>
<td>Survey</td>
<td>To move beyond my own abilities, I would need serious release time to immerse myself in OER. Even better would be a faculty learning community or other dedicated group of faculty members who would immerse themselves in OER, with the aid, perhaps, of an instructional designer.</td>
</tr>
<tr>
<td>Survey</td>
<td>My experiences with the Kaleidoscope program were extremely positive. As soon as I had the college's support, implementation was easy -- although never glitch-free, that is the down side to all technology and not a negative reflection of OER or the K program.</td>
</tr>
<tr>
<td>Interview</td>
<td>We do everything here to try and be as environmental sustainable as possible and it is believed that OER is an environmental sustainability initiative. …Almost of all us are OER. The people that sit with us in this large area of cubicles across the aisle here are sociology and psychology instructors. One of our sociology instructors left last year for a position in South Carolina, and she left with the OER training that she had gotten from me and my colleagues and the materials. Now she's getting it adopted at her community college now. We're in weekly contact, helping them do that.</td>
</tr>
<tr>
<td>Interview</td>
<td>My Dean and my Vice-President for Academic Affairs, they are very supportive of this. It's got to start with the top and it needs to be leadership-toned from the top, which we have here.</td>
</tr>
</tbody>
</table>

The Repository has to do with having access to a clearinghouse or central sharing space supported by either the institution or external influences. In regards to the repository, sample responses are outlined in Table 4.18. Although there are places where OER are shared, it seems that there is either not enough awareness about them or they are not meeting the needs of OER users.
**Table 4.18**

*Repository Sample Responses*

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>This has been something that I've been saying for a billion years, that remix ability is hard. Finding it is hard. The ideal world would be one amazing powerful clearing house with ratings and reviews and sharing and everything that was in there had a certain format so everybody could reuse it and remix it and ... Because I think the sharing and the remixing is harder. You put in all this time and you develop stuff or you are using stuff, but it's really hard to share it.</td>
</tr>
<tr>
<td>Interview</td>
<td>We are now right in the middle of working with our IT department to have a place where we could deposit those materials so that they are free and available to everyone at the college and outside of the college as well, if we can pull that off. That way, we're at least exchanging materials and sharing materials as freely.</td>
</tr>
<tr>
<td>Interview</td>
<td>I don't think this college or most colleges can manage to establish an adequate repository for that kind of material that would be accessible from outside, but there are repositories that if we could figure out how to work with them and how their system works so that we could feed our material to them. I do think OER needs to be worked at locally, but then it needs to be sent out into the world. Otherwise, it's pointless.</td>
</tr>
</tbody>
</table>

**Confirmation.** The final stage, confirmation, is when the process of integration and re-invention is completed. This stage is when an individual is either committed to using the OER innovation and use it to its fullest potential, or reverse the implementation and reject it. The theme in code of confirmation is individual commitment. This theme has to do with the individual’s self-direction and ability. Regardless of what external supports are around, individuals have to want to pursue the adoption of OER. One survey respondent recounts that “to me, there was never a down side, from the minute I was introduced to OER, it made total sense and was very positively received by my students”. Participants were unsure of what they were becoming involved with, but they embraced the innovation, adopted the OER, and continue to create and use it, as can be seen in Table 4.19.
Table 4.19

Individual Sample Responses

<table>
<thead>
<tr>
<th>Response type</th>
<th>Sample responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview</td>
<td>Absolutely. I record video lectures for my flipped classes, and my brother looks at my videos and says, &quot;Dude, you've got to monetize these things, you've got to charge people for using your stuff,&quot; and he has learned that that is not a conversation that's going anywhere, because I feel so strongly that education should be available to everyone. High quality materials should be available to everyone for a very low cost. It shouldn't break the bank to go to school or to be learning something new. Philosophically, the OER approach is completely aligned with the way that I look at teaching and learning.</td>
</tr>
<tr>
<td>Interview</td>
<td>Me and another political scientist here just completed an American Government OER course. I'm going to use it this fall when I teach sections of American Government.</td>
</tr>
<tr>
<td>Interview</td>
<td>The process that I followed, which was fairly primitive because we were just starting out with this whole thing, was to take existing content and to review all those readings and build content modules around it, skill work and activities around it</td>
</tr>
</tbody>
</table>

Research question three: Meaningful supports to the innovation and adoption of OER. The final research question seeks to find out what supports faculty identify as meaningful to the innovation and adoption of OER. Within the survey and interview responses, four thematic areas emerged. They are institutional support, professional development, as well as projects, grants, and funding. These themes also present themselves in the previous two research questions, but are the main focus of the third question. The themes and counts can be found in Table 4.20.
Table 4.20

*Meaningful OER Supports for Faculty Adoption*

<table>
<thead>
<tr>
<th>Meaningful Supports</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutional Support</td>
<td>14</td>
</tr>
<tr>
<td>Professional Development</td>
<td>13</td>
</tr>
<tr>
<td>Project, Grants, &amp; Funding</td>
<td>12</td>
</tr>
</tbody>
</table>

Institutional Supports are campus-wide and appear at various levels. This theme of institutional support also emerged in the observability, persuasion, and decision codes for the first two research questions. Participants recount that “at the dean and academic vice presidential levels, the administration has encouraged and supported the use of OER”. Most respondents relayed that administration, academic-affairs, and deans support the use of OER, but so do “distance ed” and “online support staff”. Some institutions offer instructional designers to help with the creating, “revisions, uploading, etc.” of OER. However, some respondents relay that there are issues with how to implement OER campus-wide and have “a committee and a consultant attempting to determine how to adopt OER” because OER “is poorly understood at higher levels of administration”. Although there are issues with campus-wide implementation, there is a commitment to do so at institutional levels. At this point, faculty are being supported to use OER at their home institutions.

The theme of professional development has to do with OER workshops, trainings, and conferences that faculty attend. Institutions have “sent faculty to conferences and trainings and invited experts to campus to present and train”. Most frequently, the participants attended the OpenEd Conference and KOCI trainings, yet two participants relayed that at other national conferences they seek out OER sessions. The workshops, training, and conferences provide the faculty with support and professional development to advance the implementation of OER.
Project, grants, & funding are grouped together because the participants initially interacted with OER through external projects and grants, received initial OER funding via the KOCI grant, and continue to seek OER funding through external grants. Participants interact with OER projects such as OpenStax, Candela, Waymaker, and the Public Speaking Project. These existing OER projects assist faculty in adopting high quality OER without having to produce original OER. For example, OpenStax has “quite a bit of instructor resources as well, which rivals what a publisher will give”.

Although the initial KOCI grant is over, participants did report that Lumen Learning, who ran the grant, is still “always available” to help with OER. Grant and external or internal funding of faculty involvement would “help faculty transition into OER”. These scaffolded systems support faculty in the innovation-decision process and implementation of OER in a meaningful way.

Summary

This final subsection contains an overall summary of the data analysis findings from the quantitative and qualitative data collections across the three research questions. The findings of this study were collected via online survey and interviews. The mixed-method data collection and analyses offers a rich view into the world of innovation and adoption of OER by faculty.

Mainly, certain innovation stages and characteristics of OER were more meaningful to the faculty than others. Most prevalently, the faculty were predominantly engaged in the implementation and confirmation stages of the innovation-decision process, and outcomes can be seen in both the survey and interview data. In regards to the perceived characteristics of OER, the compatibility to existing values such as alignment to student learning and success and cost effectiveness, as well as being advantageous to use, was principally important to faculty in both
data sets. Both major findings in the innovation-decision process stages and perceived characteristics can be seen overlapping in the third research question’s findings regarding support systems. Faculty are able to implement and confirm their use of high quality OER with administrative support, proper training, funding, and external OER projects.

In conclusion, the quantitative and qualitative data analyses support the focus of the research questions regarding faculty innovation and adoption of OER. The emerging themes are discussed in greater detail in Chapter Five. Furthermore, Chapter Five provides a broader vision about the research area of innovation and adoption of OER by faculty in higher education in terms of future research, theory implications, and implications for practice.
Chapter V: Discussion of the Research Findings

The goal of this mixed-method research study was to examine the adoption process and use of OER in higher education. The significance of this research for practitioners and researchers was to investigate faculty adoption or non-adoption of OER in order to facilitate valuable and sustainable adoption of OER. The study used Rogers’ (2003) Diffusions of Innovations theoretical framework to guide the description of the innovation and adoption process of OER, which includes the attributes faculty believe constitute a valuable and sustainable OER and what instructional supports are meaningful to the use of OER. In order to identify the connection between the creation and continued adoption of OER, certain aspects such as the characteristics of OER, the innovation-decision process, and the kind of supports institutions should provide have been investigated. Data collected for this study came from targeted faculty at organization that have participated in a Next Generation Learning Challenges grant funded project through Lumen Learning. This study used a mixed methods explanatory sequential descriptive design with a quantitative method that informed a subsequent qualitative method that produced detailed findings.

Major Findings

Chapter Four presented five themes that emerged from the three research questions that guide this study. These five themes represent the major findings of this study. They include the attributes that faculty believe constitute a valuable and sustainable OER include OER which (1) focus on improving student learning and success, and (2) are cost effective. The second involves factors that considerably contributes to faculty adoption or non-adoption of OER as reported by faculty which are (3) the ability to customize, remix, and share OER. Finally, the supports that faculty identify as meaningful to the innovation and adoption of OER are the (4) value of
resources from home institutions, including (5) projects and grants with funding for faculty time and effort.

In reviewing the findings across the data, the five themes were identified to explain and reinforce the process of innovation and adoption of OER by higher education faculty. The first theme is how OER focus on improving student learning and success. Participants stated how “in addition to quality/cost/convenience; retention, student success, and completions” are improved because of OER. OER allow faculty to use “material from other sources and get Creative Commons licenses” which allow them to incorporate OERs to improve courses, “adapt those materials to different situations”, and “go at it any order I want to”. In regards to OER being cost effective, the participants find it “difficult to justify the expense of buying a textbook”, “many of the OER books are just as good as the publisher books that cost well over $120”, and “cost is the most important factor. I will admit there are times when the convenience of a textbook would be greatly appreciated. However, I have been creating OER source material for several years now, and I have quite a bit of material with a wide variety”. The third theme reflects the idea of variety of flexible materials. Faculty believe that the factors that contribute to OER adoption are focused on the ability to customize, remix, and share the OER. The customizable nature “of the materials and the ease of use make it desirable”. Faculty use OER in “order to provide current materials to my students and to target the information they need” and “I can mix, match and move around content at the chapter or module level. A print textbook won't do this well”. Most importantly, OER are not hoarded by faculty, and the faculty “can develop materials myself, share them with others, borrow and remix materials others have developed”.

The third research question which has the fourth and fifth themes are focused on the meaningful supports that faculty report on innovation and adoption of OER. One participant
related how “from a collegiality standpoint, to get people together working together, learning together” is “a very important part”, but that it is very difficult to get faculty “all together so that we can train them and so that we can say, okay, this is the direction we're going” with OER. Other participants related how they have “dedicated OER person”, “administrative support”, “an instructional designer” for OER, and administration have “sent faculty to conferences and trainings and invited experts to campus to present and train. There is a campus-wide initiative for OER”. The campus supports come in various shapes and sizes, but are necessary nonetheless. The fifth theme has to do with external projects and grants that include funding. The majority of participants have attended external conferences, workshops, and trainings on OER. They have also seen “compensation for developing/adopting OER”. A handful of participants had support from state initiatives that provide funding and resources. A summary of the five themes from the three research questions are presented in Table 5.1 and discussed below.
Table 5.1

Five Themes

Research Question 1: Attributes that faculty believe constitute a valuable and sustainable OER

Theme 1 OER focus on improving student learning and success
Theme 2 OER are cost effective

Research Question 2: Factors that contribute to faculty adoption of OER

Theme 3 OER offer the ability to customize, remix, and share materials

Research Question 3: Meaningful supports for the innovation and adoption of OER

Theme 4 Resources from home institutions
Theme 5 Projects and grants with funding for faculty time and effort

These five themes are consistent with findings from the Babson Group’s (2016) survey of 3000 higher education faculty members and a previous survey of KOCI faculty. The Babson Group’s reports major findings relate that the most common factors reported by faculty regarding adoption of OER had to do with the cost of the materials to students, the comprehensiveness of the materials, and how easy the materials are to find (Allen & Seaman, 2016). The report also cites that faculty believe the materials are too difficult to find and a comprehensive catalog of resources does not exist, yet they are of high quality and have proved efficacy (Allen & Seaman, 2016; Bliss et al., 2013). These results also mirror findings from a KOCI faculty and student survey from 2012. The faculty reported that the OER materials were low or no cost and easily accessible online (Bliss, Hilton, Wiley, & Thanos, 2013). The 2012 KOCI study mentions how faculty did relate negative comments about the online formatting of the materials, which is not mentioned by faculty in the current study (Bliss et al., 2013). One possible reason for this is due
to the flexible and remixable nature of OER. It is possible that between 2012 and 2016, the materials were remixed and revised to improve the formatting of the online OER materials or that the faculty sought out new OER materials to replace the initial ones. The findings of the current study reflect consistency with the adoption process by faculty in relation to existing studies.

**Attributes findings.** The first research question seeks to find out what attributes faculty believe constitute a valuable and sustainable OER. The two main themes that emerge from this question include OER that focus on improving student learning and success, and are cost effective.

**Student learning and success.** Student Learning and Success was the broadest and most common theme among survey and interview responses. Faculty believe that OER are material that focus on student learning and success that align to learning outcomes. OER give faculty the “ability to customize materials, reduced cost to students, [are] available to students from the first day of class, [and are] available online”. Noted differences in student “retention, student success and completions have improved considerably” since faculty began using OER. OER are notably different from traditional published materials because they are “very personal and humane” and meet “the needs and interests of the students”. These characteristics of OER closely align with the beliefs and values of the faculty.

**Cost effectiveness.** Freeing students the cost of textbooks and learning materials is a major argument in the OER movement. The respondents recounted how having no or low cost materials remove the “problem waiting for student aid funds to arrive. Everyone immediately has the textbook and my courses can get moving as soon as class meets”. OER removes the financial barriers that high cost traditional publisher materials have, and the faculty recognize
this issue as important to their students’ success. This attribute may not directly affect the faculty member because they do not have a financial stake, but they recognize that it is vital to their students.

**Innovation and adoption process findings.** The second research question asks what contributes to faculty adoption or non-adoption of OER as reported by faculty. The central theme that emerged is the ability to customize, remix, and share OER considerably. This theme directly aligns with the 5Rs of OER: retain, reuse, revise, remix, redistribute (Fischer, Hilton, Robinson, & Wiley, 2015). Most commonly, respondents valued the “customization of the materials” and how “the ease of use make it desirable”. The remixing and reusing of “existing materials to meet the specific needs of the group you're working with is very important”. As far as sharing, creative commons licenses are used “to promote sharing within and outside of the college” to “get instructors to not hoard their materials, but to put a license on it and make it freely available”. Within and between institutions, repositories, clearing houses, and other ways of sharing are highly valued and desired by the faculty.

**Meaningful supports findings.** The third research question looks to identify what supports faculty believe are meaningful to the innovation and adoption of OER. The principal themes are resources from home institutions, as well as projects and grants with funding for faculty time and effort.

**Resources from home institutions.** Instructional and logistical support from administration and faculty at home institutions was main theme with the innovation and adoption of OER by faculty. Respondents related how funding, technology support from IT departments, assistance from instructional designers, and backing from administration were important in successfully adopting OER, even if other faculty members were resistant to change. OER
innovation is successful at multiple levels, but support has “got to start with the top and it needs to be leadership-toned from the top”.

*Projects and grants with funding.* Since the participants of this study all partook in the grant funded KOCI OER project, it is not surprising that an emergent theme related to the importance of external projects and grants. The support of the KOCI grant, as well as the OER learning management systems such as Waymaker, were noted by several respondents. By having the financial and organizational support of external projects and grants, faculty found that the innovation and adoption of OER was more successful.

**Discussion of the Findings in Relation to the Theoretical Framework**

Roger’s (2003) Diffusions of Innovation theory was used as the theoretical framework used for this study. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (2003). Success of an innovation such as OER depends on whether or not members of a social system participate in the innovation. In this study, the members of the social system are the faculty in higher education. By recognizing that decisions are not collective or authoritative, each member of the social system face innovation-decisions that follows a 5-step process: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation (Rogers, 2003). Furthermore, these innovations have a predicting rate of adoption based upon the perceived attributes of innovations: relative advantage, compatibility, complexity, trialability, and observability, as well as the scheme of the five adopter categories: 1) innovators, 2) early adopters, 3) early majority, 4) early minority, and 5) laggards (2003). This study looked at how the innovation-decision process and perceived attributes of the innovation influenced the adoption of OER by faculty, not the five adopter categories.
The quantitative findings in this study found that participants placed themselves in the decision stage in the behavioral statements, yet self-selected more individual items in the implementation and confirmation stages. Based on these results, the majority of respondents have clearly made the decision to use OER and have moved into the subsequent stages. In some ways the decision to use the innovation was made for them by whoever persuaded them to participate in the KOCI grant. So, the knowledge, persuasion, and decisions stages were grouped closely together.

Reinvention, or remixing in OER terms, usually happens at the implementation stage. Reinvention is “the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003, p. 180). The implementation stage had the highest recorded responses with 80% of participants selecting the items in it. Also, the three implementation items in the IDPI scored in the top five overall responses with between 87.5 percent and 68.75 percent response rates. 87.5 percent of the participants claim that they have integrated OER into their normal curriculum-planning activities and continue to evaluate their efforts to provide quality OER. An interviewee recounted how “as soon as I had the college's support, implementation was easy --although never glitch-free, that is the down side to all technology and not a negative reflection of OER or the K program”. Implementation of a new innovation is not without growing pains and glitches, but the benefits of the innovation need to outweigh the disadvantages if the adopter is to move into the confirmation stage.

In the confirmation stage, the innovation-decision already has been made and the individual looks for support with his or her decision to adopt. The qualitative findings back the reporting in the survey, particularly with the emergent themes of implementation and support from institutions and external entities. Although none of the survey participants scored high
enough on the stages composite variable to place into the confirmation stage, 54.1 percent of the confirmation items were selected. 87.5 percent of respondents stated that they will continue to evaluate their efforts to provide quality OER, but only 25 percent have secured funding for OER efforts. Since financial resources are important to support the OER continued adoption, this roadblock in the innovation-decision process is considerable and reported in both the quantitative and qualitative responses.

In relation to the perceived attributes of the innovation, the participants commonly believed the OER as advantageous. The OER align with their needs and the needs of students, are easy to use, and observable within their social systems. Research showed that these factors from the theoretical framework influenced faculty members’ likelihood of adopting new innovations into their teaching (Sahin, 2006). The characteristics of OER that faculty mostly reported on were that they believe OER are compatible with their values and needs of students, that OER have advantages over traditional learning materials, and that their students benefit from using OER. Overall, the characteristics of OER emulate the characteristics of successful innovations in the theoretical framework. Although no innovation is perfect and without glitches, the inherent qualities of OER allow for the materials to be continuously implemented, improved upon, and adapted to technological and curricular changes.

**Discussion of Findings in Relation to the Literature Review**

In Chapter 2, the literature review for this research study principally presented the context of the history and current status of OER innovation and adoption in higher education. The review section additionally explored the types of communities that participate in OER, what types of OER exist, and what research in OER adoption has occurred. In relation to the research,
there was a focus on what the research says about faculty adoption of new innovations and what the diffusion of new innovations looks like in higher education.

**History of Openness and OER.** Within the review of the history of OER, the inherent concepts of Openness and educational rights and freedoms provided context for the evolution of OER into its current form. United Nation’s Universal Declaration of Human Rights (1948) affirmed that all people have the right to a free fundamental education. This concept is at the core of OER and this study. OER takes the concept further by reducing barriers to access higher education to benefit students (Siemens, 2013). The findings of this study show that participants value the accessibility and benefits for the students. For example, one participant captured the concept by stating how OER are “free for students...makes education accessible to more people”.

Both the survey and interview portion had questions regarding the value of OER to the faculty and students. The findings from the survey and interviews confirm that the low or no cost materials and accessibility for students were paramount in the continued adoption of OER by faculty, which directly correspond with the William and Flora Hewlett Foundation’s goal of using OER to equalize the distribution of educational materials and opportunities for individuals, faculty, and institutions within the United States and throughout the world (n.d.). Higher education can successfully capture this goal with the adoption of OER into regular practice.

OER are educational materials that allow faculty and students to do operate within the 5Rs: retain, reuse, revise, remix, redistribute (Fischer, Hilton, Robinson, & Wiley, 2015). The findings of this study highlight the importance of the OER innovation process of the 5Rs with the overall purpose of using the process to reduce costs for students and close the achievement gaps. The participants in this study stressed the importance of the 5R process, especially the
remixability of materials and redistribution to the larger OER communities which justifies Smith and Ragan’s theories for implementing instructional changes (2005).

**OER communities of practices and sustainability.** Scalable OER are developed by OER community members that come together in a decentralized way to create materials (Koohang & Harman, 2007). The participants in this study noted that individual remixability is important, but that the ability to adapt and sustain materials is necessary. As one participant stated “I can develop materials myself, share them with others, borrow and remix materials others have developed”. Participants have control over creation, yet scale the items by using a decentralized system to distribute and keep the materials fluid in the community. This decentralized format is what improves the materials and process (Koohang and Harman, 2007).

As with the final research question of supports, the participants identified resources such as instructional designers and other partners as important to the success of OER adoption, which has been previously postulated by Koohang and Harman (2007).

**Research initiatives in OER.** As stated in Chapter 2, the majority of studies on OER and KOCI emphasize quantitative methods. Bliss, Robinson, Hilton, and Wiley (2013) surveyed KOCI students and instructors involved on their perceptions of the cost, outcomes, uses, and quality of the new OER. The current study used a mixed-methods approach to gather findings on long term perceptions by faculty. This research study’s findings correlates to the findings from Bliss et al. in which participants reported positive learning and pedagogical impressions due to the adoption of the KOCI OER materials and even reported the KOCI OER to be equal in quality to traditional textbooks (2013). Therefore, years later faculty that have continued to innovate and adopt OER are reporting positive experiences with the process, material attributions, and learning outcomes.
Faculty adoption of new innovations. Edwards, Kirwin, Gonyeau, Matthews, Lancaster, and DiVall found that faculty members that had brief training with a new curricular innovation reported to either continue using their new strategy as is or continue with additional modifications for future implementations (2014). Participants of this study emphasized how institutions have “sent faculty to conferences and trainings and invited experts to campus to present and train”. Training on new innovation sponsored by institutions are vital, but faculty need to explore, experiment, and learn from practice (Arinto, 2016). The inherent nature of OER and the 5Rs allow faculty time to explore the innovation and adapt it for future use. As one participant said “OER allows me to tap into the most current resources and information. For instance, I teach a course that focuses on educational policies and current issues. These change frequently, and I either tap into or create new OER materials in order to keep my students engaged with the most current information and situations they are likely to encounter in their classrooms”. OER is like an boundless innovation and creates endless innovators in the faculty.

Limitations

Limitations exist with this study. First, sample size of 96 for this population was limiting because the participants participated in one specific grant project. Since all the participants partook in one specific grant, the population was more homogenous than if the sample was from a larger population. Also, the response rate of 16.8 percent (16 respondents) was very small. Although the participants came from various types of higher education institutions and diverse communities (locations, student populations, institutional goals), the small sample size made the quantitative findings not generalizable to other populations beyond the study participants. Having a larger number of participants would have potentially made the quantitative results more generalizable to larger faculty populations.
Another limitation had to do with the timing of the study. The initial email invitation to the survey was sent on July 18, 2016. Due to the academic calendars of many institutions, several faculty were away from their email for summer break. Multiple bounced back away messages were received by the researcher, indicating that potential participants were unavailable until the beginning of the Fall semester. Administering this study during the traditional academic semester may have yielded a larger response rate.

Within the quantitative phase, the instrument relied on participant self-reports of usage and attitudes towards OER, in contrast to direct measures of innovation adoption. This self-reporting creates an innate limitation in the study results. Although self-reporting is valuable, direct evidence and data collection is considered more rigorous.

In regards to the qualitative findings, only five percent of the sample population were interviewed even though it was one third of the total participants. Also, the interviewees self-selected to participate in the interview process. Their eagerness to participate and share their stories may mean that their responses may not reflect the full range of faculty experiences with innovation and adoption of OER within and outside the total study population.

**Implications**

The goal of this mixed-method research study was to examine the adoption process and use of OER in higher education. The significance of this research for scholar-practitioners was to investigate faculty adoption or non-adoption of OER in order to facilitate valuable and sustainable adoption of OER. In order to identify the connection between the creation and continued adoption of OER, certain factors such as the characteristics of OER, the innovation-decision process, and the kind of supports institutions should provide have been investigated.
This study was successful at identifying five themes that distinguish specific supports, resources, and characteristics are needed for successful adoption of OER.

Before this study, there was not a mixed method study in existence on the faculty adoption of OER. Opening up possible research designs to include qualitative methods can only make the volume of literature richer and more diverse, as well as inform future research studies. Since this was the first mixed method study on faculty adoption of OER, further research on the topic is suggested. These studies would assist in closing the gap in the literature identified in this study, as well as augment the generalizability of this study’s results by including a significantly larger sample size across a range of higher education institutions.

In relation to the needs of practitioners, through the five themes this study provides an outline specifying the key factors and practices that faculty believe make a successful adoption of OER. The study offers meaningful resources to improve the innovation-decision process for faculty, as well as what attributes and characteristics the OER should have for complete adoption. The themes and results of this study should be of interest to higher education administration, faculty, and external OER partners as a potential means of increasing the effectiveness and quality of OER material adoption.

Conclusion

This research study initially set out to examine the adoption process and use of faculty created OER in higher education. In order to identify the connection between the creation and continued adoption of OER, certain aspects such as the reasons behind the end result and what kind of supports the institutions should provide were investigated. This study took time to find out why some faculty support and adopt OER. Five themes emerged from the mixed methods design. First off, the attributes that faculty believe constitute a valuable and sustainable OER
include OER that focus on improving student learning and success, and are cost effective.

Secondly, the ability to customize, remix, and share OER considerably contributes to faculty adoption or non-adoption of OER as reported by faculty. Finally, resources from home institutions, as well as projects and grants with funding for faculty time and effort are the supports that faculty identify as meaningful to the innovation and adoption of OER. These five themes explain and reinforce the process of innovation and adoption of OER by higher education faculty. These themes can be used to assist practitioners in preparing and performing new OER initiatives, as well as inform OER researchers and future research proposals.
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Appendix A

Unsigned Consent Document For Online Survey

Northeastern University, College of Professional Studies

Investigator(s): Principal Investigator, Dr. Christopher Unger and Student Researcher, Virginia Coleman-Prisco

Title of Project: Factors Influencing Faculty Innovation and Adoption of Open Educational Resources in Higher Education

Request to Participate in Research:

We would like to invite you to participate in a web-based online survey. The survey is part of a doctoral research study, the purpose of which is to examine the innovation and adoption process of Open Educational Resources in higher education. This survey should take approximately 20 minutes to complete.

We are asking you to participate in this study because you are a participant in the Kaleidoscope Open Course Initiative (KOCI) through Lumen Learning. You must be 18 years old to take this survey.

The decision to participate in this research project is voluntary. You do not have to participate and you can refuse to answer any question. If you decide to participate but have second thoughts even after participation has begun, you may withdraw at your discretion.

There are no foreseeable risks associated with your taking part in this study, and your participation will not affect your standing in your organization.

There are no direct benefits to you from participating in this study however, your responses may help us learn more about what variables are important to consider in designing and adopting Open Educational Resources in higher education. You will not be paid for your participation in this study.

Your part in this study is confidential. There are some questions that will ask for identifying information such gender, highest degree earned and number of years experience in special education, however, given the number of expected participants in this study, it is very unlikely that any one participant can be directly identified. There is an option for participation in a follow up interview. You will be asked to provide your contact information if you choose to participate and this information will remain confidential. Given the nature of web-based surveys, it is possible that respondents could be identified by the IP address or other electronic record associated with the response. Neither the researcher nor anyone involved with this survey will be capturing those data. Any reports or publications based on this research will use only group
data and will not identify you or any individual or organization as being affiliated with this project.

If you have any questions regarding electronic privacy, please feel free to contact Mark Nardone, IT Security Analyst via phone at 617-373-7901, or via email at privacy@neu.edu.

If you have any questions regarding this study, please feel free to contact Virginia Coleman-Prisco by phone at 860-542-7070 or by email at coleman-prisco.v@husky.neu.edu. You may also contact Dr. Christopher Unger by phone at 857-272-8941 or by email at c.unger@neu.edu.

If you have any questions regarding your rights as a research participant, please contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University, Boston, MA 02115. Tel: 617.373.7570, Email: irb@neu.edu. You may call anonymously if you wish.

Please complete this survey by June 30, 2016.

By clicking on the survey link below you are indicating that you consent to participate in this study. Please print out a copy of this consent form for your records.

http://northeastern.qualtrics.com/SE/?SID=SV_ehV74n9HnTMBesZ
Appendix B

Survey

Faculty Innovation and Adoption of Open Educational Resources in Higher Education Survey

NOTE: In relation to this study, the Open Educational Resources are educational activities that are created by higher education faculty and provided at no or low cost to students. Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Scott, 2003).

Instructions: This survey consists of four parts and will ask you for demographic information as well as your perceptions and opinions regarding your usage of Open Education Resources (OER) associated with your involvement with OER stemming from the Kaleidoscope Initiative (KOCI). Each part of this survey has its own set of instructions.

Please read those instructions carefully before beginning each part.

Thank you for taking the time to provide answers to this survey.

Part One: Demographic Information

Please supply the following information regarding your experiences and background.

Gender:

( ) Male ( ) Female ( ) Self-Defined _____________________
Age:

( ) 20 to 29 ( ) 30 to 39 ( ) 40 to 49 ( ) 50 to 59 ( ) 60 to 69 ( ) 70 or above

Highest Degree Held:

( ) Masters ( ) Doctorate ( ) Other (Please specify): ________________________

Professional Rank:

( ) Professor ( ) Associate Professor ( ) Assistant Professor ( ) Instructional Faculty (Full-time, Non-Tenure Track) ( ) Adjunct Instructional Faculty (Part-time, Non-Tenure Track) ( ) Other (Please Specify): ____________

How many years have you taught on the college level?

( ) 3 to 5 years ( ) 6 to 10 years ( ) 11 to 15 years ( ) 16 to 20 years ( ) 21 to 25 years ( ) More than 25 years

In which discipline do you most often teach?

( ) Social Science ( ) Natural Science ( ) Liberal Arts ( ) Business ( ) Other (Please Specify):

Rate your computer skills:

( ) Expert ( ) Above Average ( ) Average ( ) Below Average ( ) Novice

What method(s) do you delivery instruction? (Check all that apply)

( ) In Person ( ) Online ( ) Hybrid ( ) Other (Please Specify): __________________
How many KOCI or KOCI-sponsored workshops, guest lectures, or retreats on OER innovation and adoption have you attended within the past five years (since Summer 2011)?

( ) 0-5 ( ) 6-10 ( ) 11-15 ( ) More than 16

How many home institution-sponsored workshops, guest lectures, or retreats on OER innovation and adoptions have you attended within the past five years (since Summer 2011)?

( ) 0-5 ( ) 6-10 ( ) 11-15 ( ) More than 16

**Part Two:**

Please check all of the statements regarding adoption of OER that you would place yourself into.

The fifteen items are as follows:

1. ( ) I am considering the advantages and disadvantages of OER instruction.
2. ( ) I will use OER instructional programs or strategies during the upcoming academic year.
3. ( ) I evaluate student learning using OER tools.
4. ( ) I read brochures from companies marketing OER learning programs.
5. ( ) I have secured the technical assistance I need to effectively implement OER materials.
6. ( ) I have decided not to use OER tools or strategies for instruction in my next class.
7. ( ) I read journal articles about OER applications in my area of specialization.
8. ( ) I think about ways to implement OER in my courses.
9. ( ) I have integrated OER into my normal curriculum-planning activities.
10. ( ) I have secured funding to support my efforts with OER.

11. ( ) I am creating or previewing OER for future incorporation into my courses.

12. ( ) I have observed demonstrations of technologies and OER for instructional use within my discipline.

13. ( ) I will use OER on a trial basis during the coming year.

14. ( ) I am currently using OER in my instruction.

15. ( ) I will continue to evaluate my efforts to provide quality OER.

Part Three:

The following statements refer to attitudes about using OER for instructional purposes. Indicate your level of agreement with each statement by choosing a number from 1 to 5.

Response Key:

1 – Strongly Disagree; 2 – Slightly Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly Agree

1. I believe OER are better than traditional learning material

1 2 3 4 5

2. OER represent my values in teaching and learning

1 2 3 4 5

3. My students benefit from using OER

1 2 3 4 5

4. OER are easy to use and “remix” for future use
5. OER allow me to try new materials and hone them to meet student needs

6. My students and colleagues have begun to use more OER since I began to

**Part Four:**

The following questions concern your overall experience with the Kaleidoscope OER. These are a series of open-ended questions for you to reflect on and respond to.

1. Are you now using faculty developed or KOCI OER? If not…why not? If so…please describe them and why are you using them?

2. What makes the OER valuable to you and your students? If there is more than one way please indicate how.

3. What kinds of instructional supports have been available to you during the adoption process of the OER (workshops, trainings, instructional design staff, etc.)?

4. In what ways has your college been supportive of you access/using the OER? If so, how? If not, what could they have done differently?

5. In many cases there are a number reasons why faculty gladly use OER or choose not to use them. Speaking for yourself, what are the reasons behind your usage or exclusion OER (For example, quality/cost/convenience)?
6. Please feel free to add commentary here with specific information that the questions above did not address. These comments will assist in understanding your experiences with and attitudes toward using the KOCI OER.

7. If you are willing to be contacted for a follow up interview, please provide your name and contact information. If not, please leave this section blank. This information will remain confidential and you will receive a separate informed consent for the follow up interview.

Thank you for taking the time to complete this survey.

[“Submit” button located here on the online survey instrument]
Appendix C

Follow Up Interview Questions

1. How did your participation in the KOCI grant & OER materials come about?

2. How do you believe OER compare to traditional learning material? What kinds do you recommend or believe are the easiest to “remix” for future use/ are most limiting?

3. How do faculty developed OER compare to other kinds of OER? Are there Pros and Cons to faculty innovating with OER?

4. How do OER represent the values in your teaching and learning beliefs?

5. How do you believe that your students benefit from using OER? Are there specific kinds of OER that they benefit from more than others? Can you give examples?

6. What are the reasons behind your continued usage or exclusion OER?

7. How have your students and colleagues used OER since you began to? Do you notice a difference within your institution and outside it?

8. What would you like to see happen when creating and adopting new OERs?

9. Based on your experience with KOCI, what do you think could have been done differently?

10. If you were to work on another OER grant, what would you want to see happen to support the OER adoption process for faculty and students?