1-1-2017

Course Quality and Hosting Platforms: Implications for Massively Open Online Course (MOOC) Design and Delivery

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by
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An Applied Dissertation Submitted to the
Abraham S. Fischler College of Education
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Education

Nova Southeastern University
2017

Approval Page

This applied dissertation was submitted by Rita Diane Schmallegger under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and approved in partial fulfilment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Statement of Original Work

I declare the following:

I have read the Code of Student Conduct and Academic Responsibility as described in the Student Handbook of Nova Southeastern University. This applied dissertation represents my original work, except where I have acknowledged the ideas, words, or material of other authors.

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R. Diane Schmallegger
Name

November 5, 2016
Date

Acknowledgments

As I reflect on the years of effort in putting this together and the struggle to persevere through to the end, I realize I was not alone in this journey. My mother, a life-long learner, was an inspiration and role model in showing me that education was important and, irrespective of hardships and responsibilities, was a worthy pursuit.

My Chair, Doctor Gord Doctorow, provided support and encouragement along the way. His direction, along with welcome input from his wife, Doctor Roz Doctorow, was invaluable when my research led me to dead ends with no apparent way to get back on track.

I am grateful for the love and encouragement of my son, Brian, throughout all of my educational journeys, and of my son Christopher who, in spirit, continued to motivate me to pursue my dream.

Lastly, my husband, my love, Leopold, through encouragement, praise, bribes and promises of even more exciting adventures, gave me the strength and confidence to make it through this seemingly endless challenge and across the finish line.

Abstract

Course Quality and Hosting Platforms: Implications for Massively Open Online Course (MOOC) Design and Delivery. R. Diane Schmallegger, 2017: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education. Keywords: MOOC, massive open online course, LMS, online, course quality, learning management system

Massive open online courses (MOOCs) began as an experiment in connectivist learning in 2008 (Downes, 2012). While the number of MOOCs offered has risen, as has the number of universities offering MOOCs (Brown, Costello, Donkon, & Giolla-Mhichill, 2015), perceptions of the quality of MOOCs have been mixed (Bali, 2014; Peterson, 2014). From a perspective of Merrill's first principles of instruction (2013), this qualitative study examined MOOC delivery platforms to determine what learning platforms and what specific characteristics may best promote and sustain MOOC quality. MOOCs selected for this study include those offered in English, open to anyone with Internet access, from accredited institutions of higher education.

Table of Contents

Chapter 1: Introduction

We create a coherent view of fragmented information through our interactions with others and through the feedback we receive as we engage with a particular subject. (Siemens, 2009)

Background

Massive, Open Online Courses (MOOCs) came about as experiments with connectivist learning in 2008 (Downes, 2012) and were later hyped with promises of significantly changing higher education. In 2012, MOOCs were just entering their most popular period, in regard to the number of mass media articles, to date. By 2013, they were starting to slip in media interest, and by 2014 were reported to be nearing obsolescence (Gartner, 2012; Lowendahl, 2013, 2014). According to Zemsky (2014), MOOCs "came; they conquered very little; and now they face substantially diminished prospects" (p. 237). However, more recent reports indicate MOOCs may be on the rebound, and furthermore, appear to be evolving to meet the needs of institutions delivering distance education and participants taking part in such instruction.

In 2015, a derivative of MOOCs appeared in Gartner's Education Hype Cycle, "MOOC-Enabling Technologies," as being a new innovation (Lowendahl, 2015). Also, a newspaper article published in India noted Indian residents were showing an increased interest in attending MOOC classes offered by institutions in the United States (Rebello, 2015). In addition, the Philippine Institute for Development Studies and Commission on Higher Education (2015) prepared a report to raise awareness about MOOCS and to provide decision-makers with the information needed in order to make informed decisions regarding the development and delivery of MOOCs. This effort was in support of their constitution's declaration to "Protect and promote the right of all citizens to

quality education at all levels, and shall take appropriate steps to make such education accessible to all" (Abstract section, para. 1).

Further interest in MOOCs is evidenced by the ever-increasing number of MOOCs. As noted in the Figure, the numbers have risen each year between 2011 and 2015, and in January 2016, more than double the number of MOOCs were offered than in January of 2015 (Online Course Report, 2016). As the numbers of MOOCs offered has risen, so has the number of universities offering MOOCs (Brown et al., 2015). Allen and Seaman (2015) reported the percentage of universities offering MOOCs in the United States in 2015 was around 8%, up from 5% in 2014 and 2.6% in 2013. "The fact that there were more enrolments in MOOCs in 2015 compared to the previous three years combined indicates that MOOCs are here to stay" (Commonwealth of Learning, 2016, p. v).

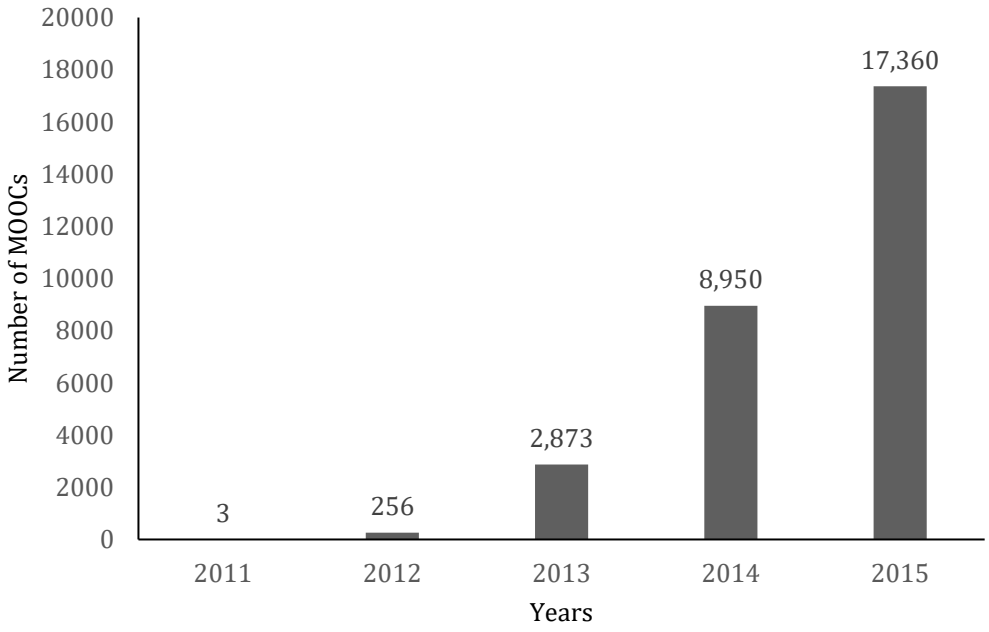

Figure. Total Number of MOOCs, by Year. Adapted from Online Course Report (2016).

Even as the number of MOOCs and institutions offering MOOCs has risen, there remain challenges in both the delivery and reception of these courses. Mackness, Mak, and Williams (2010) reported that students were overwhelmed by the number of posts and amount of content shared by other students, and various researchers indicated completion rates were low (Brown et al., 2015; Clemence, 2013; Jordan, 2015; Pappano, 2012; Stein, 2013). Faculty reported struggling to effectively communicate objectives to learners (Mackness et al., 2010), and indicated providing effective grading and feedback was a concern (Comer & White, 2016) as well as the high propensity of cheating (Brown et al., 2015; Pappano, 2012).

On the administrative side, lack of a sustainable business model was cited, along with concerns in regard to high development costs (Brown et al., 2015; Pappano, 2012). Representing another aspect of MOOC delivery, librarians identified challenges related to copyright, accessibility for disabled participants, and level of proficiency in the language in which the course was delivered (Kaushik & Kumar, 2016).

Description of the Problem

The number of MOOCs has increased from year to year, but compared to other topics covering educational delivery modes, according to V. Williams and Su (2015), little scholarly research has been focused on MOOC quality. In addition, Margaryan, Bianco, and Littlejohn (2015) suggested further research is necessary regarding the delivery platforms and their effect on course quality. While a study by Brown et al. (2015), compared characteristics of MOOC platforms, it did not evaluate them according to the quality of the courses delivered on those platforms. The problem addressed by the dissertation study is that a variety of learning management systems offer viable platforms

for delivering MOOCs, but no study has compared these platforms and the characteristics of these platforms to determine how they promote and sustain MOOC quality.

Audience. The information covered in this study is expected to be of benefit to higher education administrators and faculty in the selection of MOOC delivery platforms. This may also be of benefit for developers of MOOC delivery platforms as they determine which components and services to offer to clients, as well as to scholars determining subsequent important areas of focus in educational research.

About the Researcher

The researcher attended the University of Northern Colorado and graduated with a Master of Arts in Educational Technology in 2006. She was then employed by a private company to assist faculty at institutions of higher learning in preparing their courses for online delivery.

At this company, she facilitated the development of self-paced online training curriculum for higher education faculty on how to use their institution's learning management system and led a team in creating a curriculum covering best practices for teaching online. This curriculum included instructor-led courses that modeled effective online teaching and provided opportunities for faculty members to experience the online learning environment and discuss latest research regarding distance education.

To aid in measuring the quality of online instruction, the researcher led the development of a Course Delivery Rubric (The Learning House, 2012) to analyze the activities of online faculty. This rubric provided direction in rating online activities in six specific areas: social presence and availability, instructor feedback, student retention, forum participation, communication of university and/or course policies, and pacing.

The researcher next served as Director of Instructional Design Services for the Division of Distance Education department at a university in the western United States. At that institution, she co-led a team in developing quality standards for the development of online courses. In addition, she established a process for working with faculty in the planning, creation, development, maintenance, and assessment of online and blended courses.

At the time of this study, the researcher was employed as a curriculum designer by a major hospitality organization. In this role, she co-developed an instructional design process, based on the ADDIE model (M. Allen & Sites, 2012; Culatta, 2013; Dick, Carey, & Carey, 2006) in which five phases—analysis, design, development, implementation, and evaluation—were used to define a process for systematically designing instruction (M. Allen & Sites, 2012; Dick et al., 2006), and then customized this process to meet the unique needs of the business. In addition, the researcher worked as part of a team to centralize learning and development. As part of this reorganization, she developed standard evaluations to aid in determining Return on Investment (Kirkpatrick, 1998), as well as methods for implementation of said evaluations.

Purpose of the Study

The purpose of this study was to examine MOOC delivery platform efforts to promote quality, measure the quality of MOOCs on these platforms using a published instrument, and compare the platforms based on course quality.

Definitions of Major Concepts and Terms

For the purpose of this study, the major concepts and terms are defined as follows:

MOOC. First coined by Dave Cormier and Bryan Alexander (Siemens, 2010), a *MOOC* is a massive, open, online course. Cormier defined MOOC as:

> *Massive*, meaning big, scale is different; *open,* meaning open. More than free… open curriculum, open objectives; *online*, meaning moving from scarcity to abundance that happens when we have all these things; *course,* meaning something structured. (Cross, 2013, 1:01:00)

According to Downes (2013), massive is considered to be a course with 150 or more learners. "It's not the raw count of participants that's important, but how the course is structured. It's not simply a big course. … a course needs 150 active participants to be thought of as 'massive'—this because 150 people—Dunbar's Number—is more than any one person can attend to …" (para. 1). While *open* refers to both the course being open to anyone, with no prerequisites or qualifications required, for free, presently some MOOC providers charge a fee in order to earn credit or a certificate, and others charge a fee to access the content (Coursera, 2016; Inamorato dos Santos, 2014). Openness in MOOCs also can be defined as encompassing "accessibility, policy, place, pace, entry, and an open pedagogy, bringing openness to learners' incentives and experiences" (Ossiannilsson, Altinay, & Altinay, 2016, p. 273). *Open* will refer to a course with content that is freely available to any person with a connection to the Internet. *Online* indicates the course content is available online; however, this does not preclude participants from choosing to interact with other participants in person or from accessing alternate analog versions of materials. *Course* indicates a course of study was organized by a person or organization. As an example, learning elements gathered together for the purpose of enabling a learner to complete a specific education goal or goals would be

considered a course, while a Web page simply listing journal articles on a particular subject, would not.

Distance Education. The Association for Talent Development (2016) defines distance education as the following:

> [An] educational situation in which the instructor and students are separated by time, location, or both. Education or training courses are delivered to remote locations via synchronous or asynchronous means of instruction, including written correspondence, text, graphics, audio- and videotape, CD-ROM, online learning, audio- and videoconferencing, interactive TV, and FAX. Distance education does not preclude the use of the traditional classroom. (Distance Education section, para. 1)

Chapter 2: Literature Review

Introduction

A search of Proquest Central and ERIC for peer-reviewed journal articles related to MOOCs for the years 2008 through 2010, resulted in a single article published in late 2009 (Fini, 2009). While three additional peer-reviewed materials followed by late 2011 (De Waard et al., 2011; Kop & Carroll, 2011; Kop, Fournier, & Mak, 2011), it was essential to turn to blogs and other open-source materials in order to obtain some of the necessary background for this research. Using the theory and taxonomy proposed by Schneider (2013), the narrative that follows examines MOOCs, including the history and perceptions of MOOCs, as well as indications of their use in higher education.

Theoretical Framework

In an attempt to define the boundaries of *moocspace*, Schneider (2013) proposed a theory "that characterizes our assumptions about knowledge, the learner, and assessments" (Section 1). This theory focused on the participatory culture of MOOCs, along with personalization of the educational experience, and collective intelligence.

Schneider (2013) stated that participatory culture may be exhibited through the robust communication promoted by MOOCs, with discussion boards and other peer-to-peer communication tools allowing one-to-many communication. She claimed that personalization can be manifested through personal expression and engagement, along with a sense of community—all available to any MOOC participant, depending on their interest and time. In addition, Schneider pointed out that participants are often able to self-select content available to them in the moocspace, only accessing materials they determine to be of greatest interest and/or usefulness to themselves.

In regard to collective intelligence, Schneider (2013) invited MOOC researchers to consider the instructor as both a designer and an expert participant. Her rationale was that this allows the role of expert to be filled by multiple participants.

This theory proposed three stances that can be used to categorize MOOCs: knowledge, learner, and assessment. Schneider (2013) described each of these stances as having two descriptors that are polar opposites, with neither pole being necessarily preferable, as a course can have multiple stances. Knowledge was categorized as instructionist—the knowledge resides solely with the instructor, and only the instructor has the authority to add to the content—or participatory, whereby participants create content and add to the learning experience. The learner feature can be *personalized*, meaning each learner is considered to be unique and learning opportunities are focused on the individual, or *collectivist*, in which learners are considered to be part of a collective body of knowledge, and learning opportunities are focused on the group. The *assessment* feature looked at evaluation and feedback and considered whether learners are able to see their progress, or if feedback guides the learners or lets them know the accuracy of their responses (Schneider, 2013). In addition to this theoretical framework, Schneider devised a taxonomy for characterizing both the course as a whole, as well as course features (see Appendix A).

Community of Inquiry. As defined by D. Randy Garrison et al. (2000), the Community of Inquiry framework consists of three elements: cognitive presence, social presence, and teaching presence. The concept of cognitive presence is manifested as triggering events, exploration, integration and resolution. Indicators include a sense of puzzlement, the exchange of information connecting ideas, and the application of new

ideas. Cognitive presence in the context of a course allows course participants to exchange knowledge and experience an environment that promotes critical thinking. D. Randy Garrison et al. (2000) explained the difficulty of measuring this presence and cited high levels of coding errors as indicators of unreliability. “As essential as cognitive presence is in an educational transaction, individuals must feel comfortable in relating to each other” (p. 94). They also cite the need for the inclusion of social presence in order to achieve the development of higher order thinking skills.

Social presence in a text-based computer-mediated communication (CMC) environment affords participants the ability to express themselves emotionally and to be perceived as real. Social presence takes shape through three categories of interaction: emotional expression, open communication, and group cohesion. According to Garrison et al. (2000), it is also important for participants to have opportunity for risk-free expression of emotions, and encouragement of collaboration. In an online class, emotions indicating social presence may be manifested in a text-based format as emoticons or humor, as visual elements, such as photos or videos, or as audio.

Rounding out the Community of Inquiry model is *teaching presence*. While primarily the responsibility of the instructor, students may fill this role as well (D. Randy Garrison et al., 2000). As an example, consider a discussion forum where students responding to other students introduce new material, ask questions that lead to further discussion, and share experiences that result in a greater understanding of the content.

According to Reupert, Maybery, Patrick, and Chittleborough (2009), the personal presence of instructors, as indicated by self-disclosure, humor, individualized and timely feedback, and other indicators, is perceived as necessary by online students. Focus-group

and survey questions in this study asked students about perceptions regarding the importance of the instructor having a personal presence in the class, the important personal qualities instructors bring to distance teaching, the effect of instructor personal qualities on teaching practices and learning, and what students believe instructors can do to make distance education more personal. Only five of the 68 students stated they believe personal presence of the instructor is not important in distance education, and one indicated belief that instructor and student personalities "interfered" (p. 53) with the ability to focus on learning.

While 63% of respondents in Reupert et al.'s (2009) study reported that instructor personal presence is important, some indicated the opposite to be true, e.g., "I actually find I am less distracted and take more in without all the 'personalities' of staff and students" (Reupert et al., 2009, p. 51). The personal qualities instructors bring to distance education included openness, the ability to engage students, approachability, and enthusiasm. In a phenomenological study examining the xMOOC experience for students, an unexpected feeling of intimacy was reported by some participants as a result of the recorded video lecture content. One participant, a software engineer, reported:

> What ended up being a high degree of intimacy, or rather my sense of intimacy between me and the instructor. Surprising, because initially I think 150,000 people signed up for the course and it seemed like it should have been impersonal. It was about three weeks in when I began to have this sense—while watching the videos— like the instructor was speaking directly to me, almost as if he were just sitting across that table from me. (Adams, Yin, Vargas Madriz, & Mullen, 2014, p. 208)

In addition to the recorded video content, the instructor provided brief messages in the forums addressed to the class as a whole. One participant who completed the class reported these encouraging messages made a difference between quitting and making it through. “The best thing was the short little video segments the instructor posted saying, ‘Hello, 8-O-2-xers! How’s it going? Don’t give up, I know it’s hard, but don’t give up!’” (Adams et al., 2014, p. 210). Participants also reported the videos providing the feeling that the instructor was always there for them, and that the MOOC provided a sense of excitement and belonging. This was described by a participant as like being at a rock concert; feeling connected to the experience, even while being just one of many in the audience.

When asked about how instructor personal presence can influence online teaching and learning, students cited the benefits of instructors sharing their personal experiences. “Making the link to real life, like using examples from his or her [the instructor’s] life so that we can see how it might relate to work situations is important” (Reupert et al., 2009, p. 52). In addition, students expressed appreciation for efforts made by instructors to get to know students. “This was more than just teaching, it was building a relationship with me as a person (Reupert et al., 2009, p. 52).

In regard to the impact instructor personal presence brings to student learning, students in the study by Reupert et al. (2009) reported feelings of motivation and of being more focused and less stressed, depending on the engagement and enthusiasm of the instructor. Suggestions for enhancing instructor social presence in distance education classes included recommendations for Powerpoints with audio, timely feedback, phone calls, podcasts, and videos. Online discussion groups were also mentioned, along with

clear direction from the instructor.

Sheridan, Kelly, and Bentz (2013) undertook a cross-sectional survey in order to examine student perspectives in regard to a variety of indicators of teaching presence. Using indicators drawn from instruments used to measure teaching presence, they surveyed students in several online classes at two U.S. universities in the Midwest. While many of the 64 indicators were directly related to course design, such as "creates a course that is easy to navigate" (Sheridan et al., 2013, p. 74), others addressed instructor behaviors (e.g., "Helps to focus discussion on relevant issues in a way that helps me to learn" (Sheridan et al., 2013, p. 74).

They found that both graduate and undergraduate students placed the highest value on communication, followed by instructor disposition, and suggest the instructor's communication style can influence students' propensity to openly and honestly engage with one another.

History of Distance Education

Distance education has a long history in the annals of higher education, dating back at least 160 years (Simonson, Smaldino, Albright, & Zvacek, 2014). Simonson et al. defined distance education as "institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors" (p. 32). In its early days, distance education took the form of correspondence courses, with learning materials created by an instructor or educational institution and then delivered to the learner via current modes of transportation. By the 1840s, European learners had the advantage of gaining knowledge via correspondence courses about such diverse topics as composition and shorthand

(Simonson et al., 2014).

Simonson et al. (2014) pointed out that educational institutions adopted technological innovations to deliver learning as the technology became available, such as radio stations at colleges and universities in the 1920s, and experimental television stations in the 1930s. They stated that televised courses were offered as for-credit classes for the first time in the 1950s, and the advent of satellite technology allowed for the expansion of televised educational experiences.

By the 1990s, the Internet opened new possibilities for educators to communicate and deliver knowledge to learners separated by space and/or time, as indicated by experiments with digital learning (Cotlar & Shimabukuro, 1993; Norman & Carter, 1994). Simonson et al. (2014) stated that online discussions and emails replaced written communications, and mailing lists and files stored on FTP servers allowed higher education institutions to expand distance education capabilities.

Perceptions of Distance Education

Norman and Carter (1994) studied student satisfaction with computer-mediated communications in a media law class as part of an undergraduate journalism program. Two classes were taught using a traditional face-to-face format, and a third class was taught by the same instructor, using the same text, with similar assignments, only with supplemental—yet required—computer-mediated communication. This communication was comprised of email, read-only bulletin boards, and read/write bulletin boards. Students in this section were required to sign up for an account with which they could email the instructor and other students in the class with an account. The instructor posted instructions and quiz questions to the bulletin board, and students posted responses and

commented on the read/write bulletin board prior to attending the in-person, weekly class on campus. Students could also use email to communicate with the instructor or other students.

Student perceptions of course design elements were mixed. According to Norman and Carter (1994), "While most students ultimately concluded that the new technology 'helped,' a substantial minority hoped never to be subjected to it again" (Discussion and Conclusion section, para. 1). While the final exam results of the three groups were comparable, more effort was required of the instructor and students in the section with the computer-mediated communication components. Norman and Carter noted that the somewhat higher satisfaction levels reported by those with more computer experience indicated the possibility of greater satisfaction in the future as computer use increased. They further suggested improved course design and better software might also increase the effectiveness of computer-mediated communication on increasing knowledge of course subject matter.

Over the next decade following Norman and Carter's (1994) experiment in the early 1990s, as reported by Allen and Seaman (2010b, 2014), student experience with online education increased exponentially. Their research indicated 1,602,970 students (9.6%) in postsecondary institutions in the United States were taking at least one fully online course by 2002, and by 2013, the number had increased to 20,939,293.

As much of the early communication between faculty and students in online distance education classes took place in an asynchronous, text-based setting, questions arose as to what elements were important in this type of learning environment (Garrison, Anderson, & Archer, 2000). As a result, these researchers conceived of a conceptual

framework for explaining what they considered to be the three elements necessary for a successful educational experience in a text-based computer-mediated communication (CMC) environment: cognitive presence, social presence, and teacher presence. This Community of Inquiry theory defines these three concepts and attempts to clarify those categories and indicators that exemplify these elements. While this framework initially focused on text-based online learning, the Community of Inquiry has since been extended to include online learning with other forms of media and communication (Garrison, Anderson, & Archer, 2010).

MOOC History

In 2005, Stephen Downes wrote, “Web 2.0 is an attitude not a technology. It's about enabling and encouraging participation through open applications and services. By open I mean technically open with appropriate APIs [Application Programming Interfaces] but also, more importantly, socially open, with rights granted to use the content in new and exciting contexts" (The Web 2.0 section, para. 7). Rather than just writing about this potential, Downes set the framework for such a learning environment meant to foster this attitude. This came to fruition in 2008 when George Siemens and Downes taught Connectivism and Connective Knowledge (CCK08). With 25 tuition-paying students from the University of Manitoba (Downes, 2012) and 2,200 learners participating for free, from all over the world, this was the first large-scale, open course with distributed content (Downes & Siemens, 2008), or *massive open online course* (MOOC) as coined by Dave Cormier and Bryan Alexander (Siemens, 2010). The term “distributed content” means the content is available all over the web, some created by the learners: “The course, therefore, consists of sets of connections linking the content

together into a single network" (Downes & Siemens, 2008, Distributed Content section, para. 1).

MOOCs were initially delivered and accessed using a multitude of tools to share, access and create information. The thinking was that learners would want to use tools they were familiar with in order to further their learning experience (Fini, 2009). In Siemens and Downes' CCK08, the use of multiple tools was encouraged, however, Fini (2009) surmised a more traditional approach was preferred, citing a preference for the faculty's daily digest rather than the unfiltered experience of dealing with multiple original sources.

As MOOCs grew in popularity, tools were developed specifically to support this educational endeavor. In 2012, Udacity and Coursera developed platforms with the intended purpose of offering higher education classes for free to anyone, even if they were not enrolled in a traditional institution (McPherson & Bacow, 2015). These platforms were soon followed by edX and others.

Online courses for undergraduate students are primarily asynchronous, meaning the facilitator and the students generally interact with each other and the content at different times, and the amount of interaction can vary greatly from one institution to another (McPherson & Bacow, 2015). Another method for offering online classes, blended or hybrid learning, is growing in interest (McPherson & Bacow, 2015). These courses offer a mix of face-to-face instruction with digitized course elements. This might include reading materials and assignments, or videos and other instructional materials. The *flipped classroom*, wherein the lectures are recorded and provided online so that the in-class time can be used for interactive learning and discussion, offers yet another means

of delivering online education.

Connectivism. According to Downes (2007), "connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (para. 2). He further posited that four dynamics were necessary in order for producing connective knowledge within a community: autonomy, diversity, openness, and interactivity and connectedness. These key connectivist dynamics were fostered in the first MOOC, delivered by Downes and Siemen in 2008, through aggregation, remixing, repurposing, and feeding forward (Kop & Carroll, 2011). *Aggregation* included a variety of collections of resources, distributed daily to students; *remixing* involved learners making combinations of the materials and relating them in a blog or other format; *creating* encouraged participants to develop original content; and *feed forward* entailed participants' sharing their work with others. Ossiannilsson, et al (2016), asserted "connectivism works by integrating principles such as chaos, network, complexity, and self-organization" (p. 274) and promotes choice-based learning, which allows learners to differentiate between important and unimportant information.

Perceptions of MOOCs

MOOCs were initially received with a great deal of hype. Headlines in newspapers across the world proclaimed, "This could be huge…" (Corbyn, 2012, p. 34), "Open online courses are changing education forever" (Baker, 2012, Headline section), "College may never be the same" (Marklein, 2012, p. 1A), and "A major shake-up for fee-based learning" (Dodd, 2012, p. 25). One author stated, "Nothing has more potential to unlock a billion more brains to solve the world's biggest problems" (Friedman, 2013).

This worldwide interest led the New York Times to declare 2012 “The year of the MOOC” (Pappano, 2012, p. 26).

It was not long, however, before the negative aspects of MOOC were brought to light. According to Parry (2010), reactions then focused on the challenges involved in offering an open environment, some students found the lack of privacy to be unnerving, and professors were faced with the task of classroom management in dealing with participants who joined solely for the purpose of spamming students or being otherwise disruptive. The tone of newspaper articles also changed, as evidenced by the following: “MOOCs don't work as predicted” (Clemence, 2013, Headline section), “Employers wary of MOOC move” (Mather, 2013a, p. 23), and “MOOCs under microscope” (Mather, 2013b, p. 27).

While 2013 peer-reviewed journal articles primarily explored the MOOC experience (Krause, 2013; Lombardi, 2013; Mackness, Waite, Roberts, & Lovegrove, 2013; Rice, 2013; Waite, M., Mackness, J., Roberts, G., & Lovegrove, 2013), by 2014, reactions indicated mixed perceptions. Peterson (2014) suggested MOOCs were audio-textbooks without the analysis needed for understanding, as Bali (2014) focused on best practices to be gleaned from MOOCs, while acknowledging that some MOOCs “provide more sound pedagogy that develops higher order thinking, whereas others do not” (p. 44).

Figures from 2014 indicated about a million MOOC participants worldwide (Ossiannilsson et al., 2016), and their reasons for enrolling included curiosity (50%), the desire to improve specific skills (43.9%), learn specific skills to be able to change jobs (17%), and to gain knowledge in pursuit of a degree (13.2%). The majority of MOOC participants were young males from highly developed countries, with about half working

full-time, and most (90%) already had a degree.

As academics sifted through the positive and negative possibilities of MOOCs, some others have not been so generous. Baggaley (2015) compared the promotion of MOOCs to the history of junk food marketing: “many have succumbed without question to the idea that supersizing the number of students in a course and dispensing with teaching support is a viable alternative” (The profit motive section).

Even with rising numbers of universities offering MOOCs, academic leaders appear on a trend of perceiving MOOCs as less than desirable. A 2012 survey indicated 26.2% of academic leaders in the United States did not believe MOOCs to be a sustainable method for offering online courses, and by 2014, this number had risen to 50.8% (I. E. Allen & Seaman, 2015). As a comparison, however, academic leaders in the United States also expressed negative perceptions of other forms of online education every year from 2007 to 2009 (I. E. Allen & Seaman, 2008, 2010a, 2010b; I. E. Allen, Seaman, & Garrett, 2007).

In 2015, George Siemens led an online, asynchronous, text-based, online discussion (referred to as a *Jam*) with the intent of possibly developing a framework to conceptualize a MOOCs (Fournier & Kop, 2015). Discussions focused on the possibility of bringing order and institutional alignment to MOOCs, and to promote agreement on standards for MOOC development and delivery. Following this virtual gathering, Mackness (2013) asserted that attempts to structure MOOCs may go against the concept of MOOCs. She expressed concern about the possibility of a framework causing MOOCs to lose their potential for experimentation, promoting creativity, and fostering innovation in higher education. She suggested it could also reduce positive disruption to higher

education, as originally assured by MOOC creators.

Types of MOOCs

cMOOCs. The first MOOCs, delivered in 2008, were cMOOCs. In a cMOOC, "learning develops through the connections and discussions between participants over social media" (Bates, 2016, 5.3.2 section), and content is a collection of materials delivered on many different platforms. This may include blogs, discussion forums, webcasts, tweets, and social bookmarking sites. Bates (2016) explained that cMOOCs place a strong emphasis on networking and knowledge creation and sharing among participants, and there may be no identified instructor. Based on connectivism, cMOOCs deliver content using "a process of generating and linking networks that connect knowledge" (Nordin, Norman, Embi, Mansor, & Idris, 2016, p. 50; Siemens, 2005).

Dron and Ostashewski (2015) indicated cMOOCs have potential for supporting learning, in both formal and informal instances by drawing on the combined knowledge of the large numbers of participants.

> cMOOCs, at least in principle, benefit from scale – they gain value the more people there are engaged in them because, though they coalesce around shared events and resources that resemble the instructivist patterns of publication, learners generate and design their own learning paths, discussing, debating, sharing their learning in rich networks and clusters of networks. (Dron & Ostashewski, 2015, p. 51)

However, they also cited problems experienced by cMOOC learners and noted student confusion due to the complexity of tools and the new approach to self-directed learning. This was reiterated in another study as cMOOCs were reported to cause confusion due to

the vast amount of resources, along with resulting in some learners feeling "a sense of being 'lost' and overwhelmed in the learning environments" (Kop, et al., in Nordin et al., 2016, p. 50).

Dron and Ostashewski (2015) described cMOOCs as being like a tour, wherein the learning management system is the bus, the web administrator is the bus driver, and the instructor is the tour guide. In this analogy, the bus driver provides the transportation to get the tourists (the students) where they want to go. The tour guide has developed an itinerary, planned the stops, and provides direction along the route. At each stop, the tourists have an opportunity to explore on their own, then they return to the bus at a pre-determined time. Back on the bus, they have an opportunity to discuss their findings with the tour guide and share their experiences with fellow travelers.

xMOOCs. In general, xMOOCs share the following characteristics: specially designed platform software, which allows for large numbers of participants to register and provides tools for automated assessments and performance tracking; video lectures; computer-marked assignments; peer assessment; supporting materials; shared comment/discussion space; no, or light, discussion moderation; and learning analytics (Bates, 2016). Bates comments, "xMOOCs therefore primarily use a teaching model focused on the transmission of information, with high quality content delivery, computer-marked assessment…, and automation of all key transactions between participants and the learning platform" (5.3.1.9 section). According to Nordin (2016), the xMOOC learning process is based on behaviorism, with a teacher-oriented environment and a knowledge structure predefined by the instructor and instructional designers. Downes indicated a negative perspective regarding xMOOCS, saying, "'they resemble television

shows or digital textbooks with—at best—an online quiz component'" (Parr, 2013, para. 1).

Blended-learning MOOCs. Although not formally recognized as a MOOC type, in the Fall 2012 semester, a Stanford University MOOC on Machine Learning was used in its entirety with a face-to-face course at Vanderbilt University (Bruff, Fisher, McEwen, & Smith, 2013). While students expressed satisfaction with the flexibility of accessing the MOOC content on their own time and at their own pace, they also expressed dissatisfaction with the lack of cohesion between the MOOC and the on-campus course. In order to increase cohesion, the authors recommended content be drawn from multiple MOOCs, along with other online content: "This is an exciting possibility, which does not require that a MOOC be adopted in its entirely, as is" (p. 197).

Another blended MOOC, developed by faculty at the Massachusetts Institute of Technology, was created with content specifically designed to supplement on-campus classes. This physics MOOC provided additional opportunities for participants to develop problem-solving strategies (Rayyan et al., 2016). The course authors shared lessons learned from their first iteration of this MOOC. The first time it was offered, content was released a week at a time, and timed quizzes were just available for 33 hours, to roughly coincide with the on-campus quiz availability. In the second offering of this MOOC, all content, including quizzes, was released at least 4 weeks in advance, enabling students to better plan ahead.

A second lesson described by the course authors involved online "office hours" (Rayyan et al., 2016). Originally, students were encouraged to ask questions in a designated forum, and vote on questions they wanted answered during the live, scheduled

online office hours. While students submitted questions and voted on the ones of most interest, the largest number of participants who participated in a live session was two. In their revised version, students submitted and voted on questions, and answers were recorded and made available to learners.

MOOC Content

By the time the first MOOCs were created, many universities had initiatives to open up their content and make it available to learners (Inamorato dos Santos, 2014). So in the first MOOCs, openness was embraced, ensuring all content originated from open education resources and was freely available (Downes, 2005; Inamorato dos Santos, 2014). The use of this open content was emphasized, as well as the development and sharing of learner-generated content. However, for some of the MOOCs created on platforms created specifically for MOOC delivery, such as Coursera, the content is not always freely available, and is not available to be repurposed or remixed (Coursera, 2016; Inamorato dos Santos, 2014).

Organizations such as Creative Commons support openness by freely providing legal tools for individual content creators/copyright holders to share their content in "'the commons'—the body of work that is available to the public for free and legal sharing, use, repurposing, and remixing" (Creative Commons, 2016b, para. 1). Users who want to share their content with learners and educators may choose to change their copyright terms from the default, *all rights reserved,* to *some rights reserved*. They can also decide if they want their materials used commercially, if they want to require users of the materials to license the new work using the same license, or if they want to allow users to change the original work (Creative Commons, 2016a).

In creating a MOOC for use in Indonesia, Nordin, Norman, Embi, Mansor and Idris (2016) proposed five factors to consider when developing content. The five factors they proposed include consideration of the type of MOOC, type of lecture, integration of cultural aspects, communication style, and humor effect. Since they had pre-determined to just create video content, their proposed factors primarily relate to videos, however, these factors can be generalized to non-video content as well. *Type of MOOC* referred to either a cMOOC, based on connectivism, or an xMOOC, based on behaviorism. Since Nordin, et al.'s (2016) content consisted of video, *type of lecture* referred to determining what kind of video to create (i.e., fully animated, mainly animated, semi-live action and semi animated, mainly live action, and fully live action). Absent a video, this could also include other multimedia elements, such as text-based lecture transcripts, written correspondence, or audio recordings (Distance Education section, para. 1). *Integration of cultural aspects* related to differing levels of the inclusion of local cultural aspects, ranging from high integration of local cultural aspects to high integration of non-cultural aspects. "Cultural aspects indicate the use of local characters, props, and locations that could better illustrate the scenario in which the video lecture was taken" (Nordin et al., 2016, p. 52). They determined inclusion of cultural aspects was important, as a study by Bronstad and Russell (2007) had indicated individuals are more attracted to characters who are similar to themselves.

Communication style referred to the level of formality in language used in the content. They believed it could be categorized as fully informal language, mainly informal language, semi-informal and semi-formal language, mainly formal language, and full formal language (Nordin et al., 2016). *Humor effect* referred to their use of three

types of speech balloons. A smooth balloon indicated speech, a wavy balloon indicated thoughts, and a zig-zag style of balloon indicated exclamations.

Adaptive hypermedia is another means of providing content within a MOOC environment (Dron & Ostashewski, 2015) and can be used to suggest individualized learning paths for participants. However, if the content is learner-generated, such as that in a cMOOC, the dearth of content metadata delivers few results. They assert that adaptive hypermedia can be more effective in an xMOOC learning environment where the content is more structured, as "learner-generated content is, by definition, ever-growing and constantly filled with novelty" (Dron & Ostashewski, 2015, p. 63).

MOOC Challenges

Even while MOOCs have grown in popularity, challenges remain. The benefits of flexibility, diversity of subjects, openness to anyone, no cost to access, and potential for enhancing digital literacy, contrast with disadvantage, which include "lack of credit for completion and limited hands-on experience" (Ossiannilsson et al., 2016, p. 273). Pappano (2012) pointed out that difficulty in grading the large number of assignments led to some courses adopting peer grading, which initiated concerns about the ability of peers to grade, since participation did not necessarily assure the "peer" was adept at grading. Other challenges cited included low completion rates, high development costs, high propensity for cheating, and absence of a sustainable business model (Brown et al., 2015; Pappano, 2012).

A narrative by a MOOC participant highlighted some of the challenges related to MOOC delivery (Mackness et al., 2010). These difficulties included an overwhelmingly large number of forum posts in the early days of the course, with more than 1,000

messages from 560 participants in the Introductions forum. In an interview, the course instructor said he felt "a bit frustrated that the concept of connectivism that I was trying to communicate… was not resonating with participants" (p. 269).

While much effort goes into MOOC development, in order to provide education to massive numbers of students, with *massive* often being unspecified (Ossiannilsson et al., 2016), the research indicated that just a small percentage of the students who enroll actually complete the classes (Costa, Aparício, & Santos, 2014; Jordan, 2015; McPherson & Bacow, 2015; Mekelburg, 2014; Perna et al., 2014; Schuwer et al., 2015). In four University of Texas MOOCs in 2014, completion rates were from 1% to 13% for a course titled Energy 101 (Mekelburg, 2014). The professor for this course mentioned it had been his goal to have a high completion rate, and he said he set social media goals, using Facebook and Twitter to interact with the students. MOOC completion rate numbers compiled by Jordan (2015), indicated lower completion rates corresponded to higher numbers of course participants.

Determining the percentage of completions can be problematic (Perna et al., 2014), as definitions of completions varied, with reported completion rates ranging from 0.7% to 36.1%, and an average rate of 6.5% (Jordan, 2014). Perna et al. (2014) calculated this number by dividing the number of users who accessed a video lecture in the final module by the number of users who accessed a video lecture in the first module. In contrast, Jordan (2014) calculated completions as being the users who met the criteria for a course certificate. In a study of 279 completed MOOCs hosted on Coursera, EdX, and Udacity, the calculated typical completion rate was 5% (Jordan, 2014), while a study of 16 MOOCs delivered by the University of Pennsylvania reported a median 7%

completion rate (Perna et al., 2014). Rayyan et al. (2016) suggested it may be more relevant to report the percentage of completions by comparing those who complete the second assignment to those who finish a MOOC. In addition to using different methods for calculating completions, educational institutions also simply have different definitions of what it means to complete a course (Rai & Chunrao, 2016), with some schools counting those who earn a certificate as a completion, which may or may not have requirements for earning a certificate, while others count a completion as an individual who has accessed all materials. Rai and Churao also suggested students who do not complete a MOOC according to the institution's definition may still be gaining knowledge from the class and getting what they intended from it.

Open Culture, a website that promotes MOOCs and provides free, curated cultural and educational media, asked readers who had started a MOOC to submit their top reason for not completing the MOOC (Open Culture, 2013). While the number of responses was small, just under 50, they summarized the top 10 responses. The number one response was that it simply took too much time. "As a full-time working adult, I found it exceedingly difficult to watch hours upon hours of video lectures" (para. 2). Following this, conflicting reasons cited both the need for too much base knowledge and that the courses were too basic. Other reasons for dropping the MOOC included unengaging video lectures, poor course design, communication tools that did not facilitate communication well, ineffective or rude peer reviews, and hidden costs. Other MOOC students said they were just shopping around, or stated they were just there to learn, not to receive a credential at the end.

McPherson and Bacow (2015) suggest self-efficacy may have a strong influence

on completion rates, stating, “the need for users to exert considerable self-discipline to stay with a program that is undertaken individually. MOOCs in particular have very low completion rates” (McPherson & Bacow, 2015, p. 136). As an example, a MOOC on global poverty included a registration deadline that was not enforced. The course authors noticed that the students who registered by the deadline performed better in the course than the students who missed the deadline, which may indicate that those with the self-discipline to meet a deadline may be more likely to do well in a MOOC (Banerjee & Duflo, 2014).

Financial implications were also of concern (Mekelburg, 2014; Schuwer et al., 2015). A math professor at the University of Texas said he worked on his MOOC for a year and recorded more than 50 hours of course content (Mekelburg, 2014), while another professor at the same school indicated teaching one MOOC was counted as one-sixth of his salary for the year, plus one course off that year. He suggested educators do not go into MOOCs to make money, and added, “In a real sense, a MOOC that has something substantial to offer to all sorts of people is a kind of public service” (para. 17). In the Frequently Asked Questions section of FutureLearn’s website, the question “How are you able to offer courses for free?” is addressed (FutureLearn, 2016). They responded that Open University provided the initial investment for developing and implementing FutureLearn, and that they were exploring paid-services that could provide a benefit for learners, such as Certificates of Completion, Statements of Participation, and Statements of Attainment. The first two options allowed a learner to prove participation in a course, and the third option, which included an invigilated exam, could be used by a learner to indicate continuing professional development or understanding of a particular subject.

Challenges have also been noted in regard to the use of copyrighted materials in MOOCs (Dames, 2013; Kaushik & Kumar, 2016). Kaushik and Kumar noted that in a cMOOC, learners collected and shared content from innumerable resources, creating both an issue for those holding the copyright to those materials and for students who are creating and sharing new materials. Other copyright challenges cited the inclusion of some content that was not readily accessible to those with disabilities, along with literacy constraints, in that even when the learners all speak a common language, there can still be a wide gap in their abilities to use that language effectively (Dames, 2013; Kaushik & Kumar, 2016). Further issues with copyright have arisen as faculty and universities disagree on ownership of MOOC content (Porter, 2013).

Providing feedback on student submissions is another cited challenge in MOOC delivery, noted Comer and White (2016), who explained that while some grading and feedback can be automated, reading, grading and providing useful feedback can be a challenge in a class with thousands of participants. They described their experience in designing and delivering an English Composition course using peer-assessment for the provision of grades and feedback, for which they developed a highly structured grading rubric. They found peers tended to use the full range of the rubric and graded similarly to assignments graded by experts, although peers tended to be slightly more generous in assigning grades. In spite of this, some students expressed dissatisfaction with peer feedback, with some citing lack of useful or relevant feedback, and others were concerned with the peers' low level of English comprehension.

A challenge for MOOC participants may lie in the protection, or lack of protection, of their personally identifiable information. While this includes information

learners may be required to provide when they sign up for a course, this can also include forum postings in which participants include personal information (Kolowich, 2014). Student privacy in the United States is typically protected by the Family Educational Rights and Privacy Act (FERPA), which stipulates strict rules governing student data. MOOC "students," however, are not technically students. Participants are protected by FERPA when Title IV government funds are supporting the courses. According to Kolowich, however, some MOOC providers disagree, including edX and Coursera, and believe MOOC participants should be considered students.

The Future of MOOCs

While MOOC challenges were identified and obsolescence was declared, MOOCs are changing, and suggestions regarding the potential evolution of MOOCs into other forms of education have emerged. The original MOOC model presents challenges, yet educators continue to experiment with MOOCs in new ways. As an example, small, private online courses (SPOCs), use MOOCs to supplement face-to-face classroom teaching (Fox, 2013) or online classes (Lidoria, 2015). In a pilot program at a university in California, lectures and assignments were used from an MIT-authored MOOC, and during in-class time students worked on lab and design problems with faculty (Fox, 2013). Three sections of the class were offered on campus, and when the 224 students registered for the three classes, the decision had not yet been made to use a MOOC as a supplement to the class, so students were unaware of the intention to pilot one of the sections as a blended class (Ghadiri, Qayoumi, Junn, Hsu, & Sujitparapitaya, 2013). One class, with 86 students registered, was selected as the pilot blended course. Students in the selected class were given the option of switching to a nonblended class held at the

same time, but none chose this option. With 78 in the pilot class completing the final exam, they scored higher on the exams than students using traditional content, and those earning credit for the class (i.e., those with a grade of C or better), increased from 59% to 91%. They used a one-way analysis of variance (ANOVA) to compare beginning cumulative GPAs of students in each section to ensure students were not intentionally assigned to a particular section.

Even as higher education institution administrations are increasingly perceiving MOOCs as being less than desirable (I. E. Allen & Seaman, 2015), they could be a game-changer for developing countries intent on increasing educational opportunities for residents (Dron & Ostashewski, 2015), where the demand for higher education is in excess of what can be provided through traditional, face-to-face courses. Dron and Ostashewski (2015, p. 53) claim that "MOOCs are becoming a regular staple in the global higher education offerings, and are being seen as an effective way to provide online professional development." In Malaysia, the Ministry of Education collaborated with four public universities to develop video content for MOOCs using Bahasa Melayu, the Malay language (Nordin et al., 2016).

A report by the Philippine Institute for Development Studies ([PIDS], 2015) examined the issues, challenges, threats, opportunities and implications of developing and offering MOOCs. They summarized their findings into 10 key lessons:

1. MOOCs should be considered a single tool to be used in higher education for delivering distance education, not as one tool that can single-handedly change traditional education: "We need to stop thinking in terms of a MOOC revolution and instead think in terms of teaching and learning revolution, of which MOOCs are just one (currently very

disruptive) element" (Voss, 2013, para. 11).

2. MOOCs are useful for supplementing traditional face-to-face courses to create blended learning opportunities.

3. A sustainable business model must be created. Universities cannot continue to spend $50,000 to $100,000 or more per course and give it away for free, and investors who have spent millions to develop appropriate MOOC platforms expect a return on their investment.

4. Inadequate infrastructure, along with poor digital literacy, and lack of needed social and language skills mean MOOCs are not yet available to low-income populations in developing countries.

5. While there were initial concerns that freely available MOOCs might negatively affect existing higher education business models, since most MOOC participants already have a degree (Yuan & Powell, 2013), PIDS suggested this negative influence is minimal.

6. There is a trend toward use of MOOCs for vocational learning as companies create custom courses for their employees to fill skill gaps.

7. While the initial investment for creating MOOC can be considerable, created materials can often be repurposed, and a MOOC, once created, can typically be offered multiple times.

8. MOOCs tend to lack interpersonal engagement in the form of both instructor-student and student-student communication for providing feedback and encouragement.

9. MOOCs have provided an opportunity for researchers to learn more about what makes online students successful. Data analytics help inform about levels of effort, areas

of misunderstanding and other relevant data that can be used to improve course design and delivery.

10. MOOCs are not just about technology or the course. MOOCs are a movement that is evolving and maturing. Challenges are being resolved, and MOOCs are enhancing higher education.

Addressing the Issues. As challenges have been identified, educators have developed recommendations to improve MOOC offerings. Fournier and Kop (2015) suggested the creation of shorter, more timely courses along with a continuing education accreditation mechanism. Raposo-Rivas, Martinez-Figueria, and Campos (2015) asserted that there needs to be improvement in the pedagogical design of MOOCs which should include learning, activities and tasks, means and resources, interactivity, and assessment.

Measuring MOOC Quality

The Commonwealth of Learning (COL) (2016) is an intergovernmental organization, based in Canada, and created by Commonwealth Heads of Government to "promote the development and sharing of open learning and distance education knowledge, resources and technologies" (n.p.). Since quality depends on perspective, they advised two main factors should be taken into consideration when measuring MOOC quality: purpose and perspective. In this context, purpose refers to why the MOOC is being created, and perspective refers to the entity measuring the quality. They explained that if the purpose of the MOOC is to raise global awareness of a university, having tens of thousands of enrollments from more than 40 countries might be considered high quality. However, from the perspective of the student, if the platform used for this course has an interface that is not user-friendly, the students might not consider the

MOOC to be of high quality. The COL suggested that "Rather than applying 'standard metrics,' practitioners should focus quality measures on the specific dimension of interest" (2016, p. 11).

A framework initially developed by Biggs (1993) for examining course environments, was adapted by the COL (2016) for use in measuring MOOC quality. With this framework, metrics for measuring course quality were grouped into three categories: *presage*, *process*, and *product*. Presage metrics measure the quality of content before learning, such as the quality of the design and multimedia materials. Process metrics measure the quality of the delivery of instruction; however, "these metrics are not as well-developed as presage metrics, but offer real insight into whether the MOOC supports learning" (p. 5). Product metrics measure quality after learning tasks have been completed, such as completion rates or employment statistics. What follows are two quality measures developed to assess the quality of e-learnings. While not specifically addressing MOOC quality, they are also used in that capacity.

Quality Matters. In 1999, the Maryland Online consortium was established to unify efforts of two- and four-year higher education institutions in Maryland in offering, delivering, and expanding online education. As a result of these unification efforts, the Fund for the Improvement of Post Secondary Education (FIPSE) awarded a three-year grant to Maryland Online for the development of a quality rubric to guide the design of online courses, along with a peer review process for evaluating and improving such courses ("The Quality Matters Program (Distance Learning)", 2016). This resulted in the establishment of Quality Matters (QM), an organization which initially developed standards for measuring quality in online courses and then expanded their efforts to foster

quality online instruction by developing a scalable process for evaluating such courses (MarylandOnline, 2014). QM is based on the principles of promoting continuous improvement; being centered on research, student learning, and quality; providing a collegial environment for providing a peer- reviewed process; and fostering a collaborative approach to the provision of feedback through peers trained in the Quality Matters method.

QM first focused on online higher education courses, providing a rubric based primarily on *Best Practices for Electronically Offered Degree and Certificate Programs*, as endorsed by The Council for Higher Education Accreditation (Legon, 2006) in order to support institutions offering online courses in obtaining and maintaining accreditation. This resulted in the formation of four of the seven standards (see Table 1), which formed the basis of the *QM Rubric*.

Table 1

QM Rubric: General Review Standards Aligned to CHEA Best Practices

Standard III	Assessment strategies use established ways to measure effective learning, assess student progress by reference to stated learning objectives, and are designed as essential to the learning process.
Standard IV	Instructional materials are sufficiently comprehensive to achieve announced objectives and learning outcomes and are prepared by qualified persons competent in their fields.
Standard V	The effective design of instructor-student interaction, meaningful student cooperation and student-content interaction promotes student motivation, intellectual commitment and personal development.
Standard VII	Courses are effectively supported for students through fully accessible modes of delivery, resources and student support.

Note. Adapted from Legon (2006, pp. 3–7).

While this initial focus was on online higher education courses, QM has since developed rubrics to specifically address the needs of other organizations seeking quality

in the provision of online learning opportunities. Four additional QM rubrics are now available, as noted in Table 2, along with a validated set of skills recommended for online instructors. While none of the QM rubrics were specifically created to address MOOC quality, QM suggested the QM Continuing Professional Education (CPE) Rubric be used to facilitate MOOC design (Maryland Online, n.d.). Gao (2013) made use of the QM CPE Rubric as a design guide in creating a developmental education noncredit MOOC at a Florida college covering reading, writing and math. Gao followed the majority of standards, but placed less emphasis on the others.

Table 2

QM Rubrics

K-12 Secondary Rubric Standards	Specifically tailored for assessing quality and assisting course design of middle school and high school online and blended courses.
Continuing & Professional Ed Rubric Standards	Tailored to assist in the design and evaluation of instructor-led, mentored, or self-managed online and blended courses that have pass/fail, skills-based or other completion/certification criteria, but do not carry academic credit.
Higher Ed Publisher Rubric Standards	A set of quality design standards for diverse publisher products provided on Learning Management System (LMS) platforms.
K-12 Publisher Rubric Standards	A set of standards to guide the review of online and blended publisher courses intended for use by K-12 schools and districts.

Note. From MarylandOnline (2017, sec. We Incorporate Best Practices).

The standards Gao (2013) followed, included clearly stating or providing a link to institutional policies; clearly stating prerequisite knowledge; specifying minimal technical skills expected of the learner; provision of ability for learners to introduce themselves to other learners; clearly stating requirements for learner interaction;

explicitly stating or linking to institutional accessibility policies; identifying or linking to support services and resources; and providing information about accessibility of technology (2013; MarylandOnline, 2015). This course was available, free, through the Canvas learning management system (LMS), and was open to anyone. Due to the successful delivery of this course, the school was awarded a grant to create three game-based MOOCs for all Florida State College System institutions (Gao, 2013).

Quality Assessment for E-learning. The European Association of Distance Teaching Universities (EADTU), representing more than 20 European countries, also created a tool for providing a methodology and resources to promote quality e-learning in higher education. This tool is the *Quality Assessment for E-learning: A Benchmarking Approach* (K. Williams, Kear, & Rosewell, 2012). While it does not directly address MOOCs, the benchmarks were intended to be used across all types of e-learning environments and cover strategic management, curriculum design, course design, course delivery, staff support, and student support. For each benchmark, indicators and what is expected at the level of excellence are provided to clarify expectations.

According to K. Williams et al. (2012), benchmarks for strategic management include having an institutional strategy that is well-known across the institution and ensuring related policies are legal and ethical; having a framework for fostering and innovation and development; having plans for implementation of new developments in e-learning technology, including purchases, staff recruitment, training needs, workload, and technology developments. Ensuring e-learning systems are compatible with existing management information systems is also included as a benchmark, as is establishing clear guidelines for using and accessing materials beyond what is available at the institution.

K. Williams et al. (2012) stated that a focus of the curriculum design benchmarks is to examine flexibility, in regard to time and place of study, as it relates to skills development and the sense of academic community. For curriculum design, benchmarks include the ability to personalize the learning experience; the use of formative and summative assessments to measure learning outcomes; the inclusion of e-learning elements that contribute to specific learning outcomes and enhanced ability to transfer educational skills; and the enabling of academic community and collaborative learning by promoting use of social networking tools (K. Williams et al., 2012).

The course design benchmarks included in the Quality Assessment for E-learning provide a conceptual framework for how an e-learning course should be designed, along with development of course materials. Benchmarks require the e-learning strategy, the learning materials and assessment to align with learning outcomes; an explicit rationale for using the selected means of delivering course content; that the course content be designed, developed, and evaluated by those skilled in academic and technical aspects of e-learning; that open educational resource (OER) materials be selected to align with learning outcomes and are adapted, if necessary, to course needs and combined with other selected or custom developed learning materials; course materials allow for interactivity to promote student-content and student-student interactions and have self-assessment capabilities; materials designed for self-study provide opportunities for students to receive feedback; course layout and presentation be generally consistent across a program; formative and summative assessments be provided, with measures in place to promote academic integrity; and the course be regularly reviewed and improved (K. Williams et al., 2012). Ossiannilsson et al (2016) asserted that this learner-centered

approach should foster student construction of their own learning, and should encourage them to share what they have learned with other students.

As proposed by K. Williams et al. (2012), course delivery benchmarks include all facets of the virtual learning environment, with a particular focus on how students receive materials and what communication tools are available. The first benchmark for this category asserts that the e-learning should meet both academic and administrative needs. Further, the communication tools are required to be secure and reliable, with adequate privacy, along with a means for recovery in case of system failure. Additional benchmarks cite the need for system maintenance; a choice of tools for course delivery; the provision of information to educators and learners on how to use the learning system and services; and clarity on the responsibilities for updating and maintaining materials accessible through the system.

Staff and student support are covered under additional benchmarks. Staff support benchmarks focus on requiring staff to adequately support the development and design of e-learning materials; appropriate training be provided to such staff to meet new developments in technology and education; educational research and innovation be regarded highly, with incentives for career development; staff workload be sufficient to manage programs and courses; and technical support, along with tutors and mentors, be available to academic staff. Student support benchmarks are meant to set the expectation for students to be provided with updated and clear information about their class; for clear guidelines to cover student and institutional expectations; for the ability to access online social networking tools; and for access to support services and access to learning resources, which includes library access, along with opportunities to develop study skills

and confer with an advisor (K. Williams et al., 2012).

Research Questions

In order to address the proposed research problem, this study sought answers to the following:

1. What MOOC platforms delivered the highest quality MOOCs?

2. Did certain features within interactive learning environments, as listed by Schneider (2013), indicate higher MOOC quality than other features?

3. What supportive services and tools were provided by MOOC platforms to foster quality course design?

Chapter 3: Methodology

Introduction

In order to examine the proposed research questions, it was important to use a qualitative comparative design in examining MOOCs and delivery platforms to compare quality on each platform. Data measuring quality and instructor involvement, along with MOOC-platform features, supportive services and tools were collected through personal observation. Analyzation of this data may help identify best practices for creating and selecting MOOC platforms.

Problem Statement

The problem addressed by the study is that a variety of learning management systems offer viable platforms for delivering MOOCs, but no study has compared these platforms and the characteristics of these platforms to determine how they promote and sustain MOOC quality.

Purpose Statement

The purpose of this study was to examine MOOC delivery platform efforts to promote quality, measure the relative quality of MOOCs on these platforms using a published instrument, and compare features based on course quality rankings.

Sampling Strategy

MOOC delivery platforms were selected for this study based on the following criteria: (1) MOOCs were offered from accredited higher education institutions that were self-paced or had evidence of instructor participation in 2017; (2) the full MOOC could be accessed during the first full month following acceptance of this dissertation proposal; and (3) the platform had at least 10 MOOCs meeting the following course criteria.

Course criteria included the following: The course had to be offered in English, the primary language of the researcher, had to be offered by an accredited institution of higher education, had to be accessible on a single domain per platform, had to be open to anyone, and the full course had to be available for free, although those offering certificates or other credit for a fee were not excluded. The initial list of platforms was derived from four studies (Brown et al., 2015; Dron & Ostashewski, 2015; Margaryan et al., 2015; Rai & Chunrao, 2016) which included a total of 23 platforms. Four of these platforms, however, were immediately eliminated from the proposed study: Tata Group (Brown et al., 2015), as the company apparently had not yet deployed their MOOC platform; and the Web, Wikispaces, and Wordpress, because courses using those platforms could not be accessed via a single domain.

Table 3
MOOC Platforms Reviewed for Inclusion in Study

Platform	URL
ALISON	https://alison.com/
Canvas Network	https://www.canvas.net/
Codeacademy	https://www.codecademy.com/learn
Coursera	https://www.coursera.org/
COURSEsites by Blackboard	https://www.coursesites.com
Curtin Learning Commons	http://curtincommons.com/
EdX	https://www.edx.org/
FutureLearn	https://www.futurelearn.com/
Google Search Education	https://www.google.com/edu/
Iversity	https://iversity.org/
Moodle	https://moodle.org/
OER Universitas	https://oeru.org/
Open HPI	https://open.hpi.de/
Open2Study	https://www.open2study.com/
OpenEdX	https://open.edx.org/
OpenupEd	http://openuped.eu/
Saylor	https://www.saylor.org
Udacity	https://www.udacity.com/
Udemy	https://www.udemy.com/courses/

Once platforms were selected, courses were selected using the following method: each of the URLs in Table 3 was searched to determine the total number of courses,

courses were identified as starting within the designated time frame, and courses were differentiated between accredited institutions and other organizations. In the final selection, platforms without enough MOOCs adhering to the selection criteria were eliminated.

For the study, five MOOCs were randomly selected from each of the chosen platforms using the Google random number generator (2017). If an identified course was then determined to be ineligible, the next course was reviewed for eligibility. Using this method, 30 courses were selected to be analyzed to determine course quality.

Measurement Instrument

A published instrument was used to collect data regarding these MOOCs. This instrument was used by Margaryan, Bianco, and Littlejohn (2015) to study MOOC quality (see Appendix B), and was adapted from instruments developed by Collis and Margaryan (2005) and Merrill (2013). As an indication of statistical reliability, they selected four courses and two researchers examined each. They then discussed and compared the results, "comparing and contrasting each others' scorings until they agreed on scoring for each item" (Margaryan et al., 2015, p. 80). This particular instrument was selected as it has been used to compare and determine the quality of xMOOCs and cMOOCs, both of which were eligible for examination in this study. This questionnaire was used to collect data regarding course details, objectives, organization, and course resources, and determine how well the courses align to Merrill's First Principles of Instruction, which encompass five areas related to learning.

Table 4

Merrill's First Principles of Instruction (2013)

Principle	Description
Problem-centered	Learning is promoted when learners acquire knowledge and skill in the context of real-world problems or tasks.
Activation	Learning is promoted when learners activate a mental model of their prior knowledge and skill as a foundation for new skills.
Demonstration	Learning is promoted when learners observe a demonstration of the knowledge and skill to be learned.
Application	Learning is promoted when learners apply their newly acquired knowledge and skill.
Integration	Learning is promoted when learners reflect on, discuss, and defend their newly acquired skill.

Data Collection and Analysis

A qualitative comparative design was used to examine course quality as it relates to MOOC delivery platforms. The researcher enrolled in each course selected for the study and examined each of these courses as an unobtrusive participant using the instrument identified above. Qualitative data for each research question, were collected concurrently in an Excel spreadsheet. As any human participants (e.g., instructors, course authors, students, support staff) were not aware of the observation in order to maintain the integrity of the collected data, any information that could be used to personally identify an individual, such as names, email addresses, and course names, was coded to protect their identity. While institution names were collected, they were coded in the report.

All course data accessible as a student were reviewed using the MOOC Scan Questionnaire instrument (Margaryan et al., 2015) and the taxonomy proposed by Schneider (2013). The MOOC Scan Questionnaire (see Appendix B) includes three

sections: course details; objectives and organization; and first principles. Course details include seven items covering basic course information, such as course title, instructor, institution, and dates offered, while Sections 2 and 3 measure course information using yes/no questions and 4-point Likert scales, along with *no information* or *not applicable*, where appropriate, with instructor names coded as aforementioned. As described by Margaryan et al. (2015), the questions in Sections 2 and 3 are mapped as follows to first principles: "map on the principles of instruction as follows: problem-centered (questions 3.1–3.5 and 3.9); activation (3.10); demonstration (3.6–3.7); application (3.11); integration (3.12); collective knowledge (3.14–3.16); collaboration (3.17–3.20, 3.23–3.24); differentiation (3.13); authentic resources (3.8); feedback (3.21–3.22)" (p. 79). The scoring system includes both Likert-scale and binary (yes/no) items.

Additional data were collected, according to the taxonomy proposed by Schneider (2013) (see Appendix A). Schneider's taxonomy (2013) includes 12 categories and 13 subcategories. In addition, it includes four groups of Interactive Learning Environment (ILE) features, covering instruction, assessment, content, and community. All data were collected in an Excel spreadsheet. This covered a variety of course elements, including instructional methods; types of assessments (e.g., group projects, multiple-choice quizzes, open-ended problems, and grading structure); content delivery; course pacing; and communication modes.

The researcher also developed a narrative relating how quality is publicly promoted on each platform and then attempted to identify what supportive efforts provided by the platform to enhance quality might affect course quality. This narrative was prepared using MS Word.

Research Question 1. What MOOC platforms delivered the highest quality MOOCs?

Once data were collected, a quality score was calculated for each course using the scoring method described in the MOOC Scan Questionnaire Instrument (see Appendix B). A median of the raw scores from each of the five courses reviewed for each platform was used to determine relative ranking. This ranking indicated which platform or platforms appear to offer courses with the highest quality instructional design.

Research Question 2. Did certain features within interactive learning environments, as listed by Schneider (2013), indicate higher MOOC quality than other features?

Once the quality ranking was determined, quality scores were used to determine quartiles. Features were then reviewed to determine which were more prevalent in each quartile. The presence or absence of specific features in a particular quartile might indicate the value of that particular feature.

Research Question 3. What supportive services and tools were provided by MOOC platforms to foster quality course design?

The website for each MOOC platform was unobtrusively observed to determine what supportive services and tools were provided to course developers. The review included materials available to enrolled students, unregistered visitors, as well as materials available to registered course developers, when possible. Each item provided by the MOOC platform was described in a narrative, accompanied by screenshots and files, when appropriate to aid in the description. In addition, social media sites (i.e., Facebook and Twitter) were searched to determine what, if any, support tools might be provided by

the MOOC platforms in those locations. Information collected in this stage of the study was used to help explain and interpret the collected course quality data.

Chapter 4: Results

The problem addressed was the need to compare MOOC platforms and the characteristics of these platforms to determine how they promote and sustain MOOC quality. A qualitative comparative approach was used to measure the relative quality of MOOCs on different platforms using a published instrument (see Table 5) and compare platform features based on course quality rankings. A qualitative approach was selected, as the nature of the items in the published instrument required subjective interpretation and did not lend themselves to a quantitative design.

Table 5

MOOC Platforms Excluded from Study

Platform	URL	Inclusion criteria not met
Codeacademy	https://www.codeacademy.com/learn	2
Coursera	https://www.coursera.org/	5
Curtin Learning Commons	http://curtincommons.com/	7
FutureLearn	https://www.futurelearn.com/	5
Google Search Education	https://www.google.com/edu/	2, 4
Iversity	https://iversity.org/	2
Moodle	https://moodle.org/	2
OER Universitas	https://oeru.org/	6
Open HPI	https://open.hpi.de/	1, 6
OpenEdX	https://open.edx.org/	2
OpenupEd	http://openuped.eu/	*
Saylor	https://www.saylor.org	2
Udemy	https://www.udemy.com/courses/	2

Note. Inclusion criteria:
1-Offered in English
2-Offered by an accredited institution of higher education
3-Accessible on a single domain per platform
4-Open to anyone
5-Full course available for free
6-Can be accessed within a research timeframe
7-At least 10 MOOCS available for study
*Apparently not a MOOC platform, it is a portal to courses offered on other portals.

Each of the 19 initially identified MOOC platforms was reviewed to determine the total number of courses meeting the inclusion criteria on each platform. Of the

original 19, 13 had no, or not enough, courses meeting inclusion criteria, and were eliminated (see Table 5). From the remaining six MOOC platforms (Alison, Canvas, edX, Open Education, Open2Study, and Udacity), a total of 30 MOOCs were examined between March 11, 2017 and April 9, 2017. The initial intention was to review courses on Course Sites by Blackboard; however, all Blackboard MOOCs were being transitioned to Open Education. As a result, rather than Course Sites, Open Education MOOCs were examined. This chapter presents the results of this research based on the questions posed in Chapter 3.

Data Collection

Once all courses were identified, the researcher registered as a student on each of the six remaining portals and enrolled in the classes. Each class was scored, using the MOOC Scan Questionnaire (Margaryan et al., 2015) immediately following completion of the review, with data collected in an Excel spreadsheet. As courses were examined, it became apparent that some of the terms in the questionnaire could be interpreted to have different meanings. Term clarification, for the purposes of this study, as other researchers may interpret this information differently, is noted in Table 6.

In addition to the information gathered to determine quality scores, nonidentifiable course information and features were noted as outlined by Schneider (2013). Once course reviews were complete, websites of MOOC delivery platforms were examined to identify potential supportive services and tools that might promote MOOC quality.

Table 6

MOOC Scan Questionnaire Term Clarification

Term	Interpretation (Item numbers)
activity	Activities were considered to be any action, other than reading content or watching a video. This included a quiz or a discussion forum. Discussion forums present by default, not referred to in the course, and offering no discussion prompts, were not considered to be an activity. (3.3, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.21)
problem	Problems were determined to be anything prompting students to consider a solution. This includes relevant non-multiple-choice quiz questions and discussion prompts. (3.2, 3.4, 3.5, 3.6, 3.7)
group	Groups were considered to be either assigned groups or assignments requiring peer feedback (3.19, 3.20, 3.23, 3.24)
require	Anything *required* was interpreted to mean anything necessary for course completion, e.g., in item 3.15, learners might have the opportunity to contribute to the collective knowledge, but if not required, this was scored as *none* (3.11, 3.12, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19)
feedback	This was determined to include any publicly available comment from an instructor or teaching assistant posted once the course was launched. This did not include automatically provided text or video quiz feedback. (3.21, 3.22)

Findings for Research Question 1

Research Question 1 stated "What MOOC platforms delivered the highest quality MOOCs?" Using the MOOC Scan Questionnaire (Margaryan et al., 2015) to measure course quality, a range of 0-72 points was possible, with 0 indicating no principles or criteria were present, and 72 indicating all were present at a very high standard. Of the 30 courses reviewed, the scores ranged from a high of 54 to a low of 7 (see Table 7), with a standard deviation of 14.61, a mean of 26.47, and a mode of 12. Detailed overall results are noted in Appendix C.

Table 7

MOOC Quality Scores, by Quartile

Qu.	ID#	MOOC platform	Score
Q4	13	Open Education	54
	18	edX	53
	19	edX	49
	8	Canvas	50
	17	edX	48
	9	Canvas	43
Q3	11	Open Education	39
	20	edX	39
	16	edX	37
	30	Udacity	35
	29	Udacity	31
	15	Open Education	28
	28	Udacity	28
	6	Canvas	25
	10	Canvas	24
Q2	14	Open Education	21
	25	Open2Study	21
	21	Open2Study	20
	23	Open2Study	19
	24	Open2Study	18
	26	Udacity	16
	27	Udacity	13
Q1	2	Canvas	12
	7	Alison	12
	22	Open2Study	12
	4	Alison	11
	1	Alison	10
	5	Alison	10
	3	Alison	9
	12	Open Education	7

Note. ID# = identification numbers assigned by the researcher to each course included in the study. Qu. = quartile. Mean 26.47; median 27.2; std. dev. 10.91.

There were 29 xMOOCs in the study and one cMOOC. The sole cMOOC, hosted on the Open Education platform, earned the highest quality score. Most of the platforms had courses scoring in multiple quartiles, with Open Education represented in all four, including the courses with both the highest and lowest quality scores. The Alison

platform was the only platform with courses scoring in a single quartile, Q1.

Once individual course scores were determined, a quality score was calculated for each MOOC platform by taking the mean of the scores generated for the five courses examined on each platform (see Table 8). These platform scores indicate that of the six platforms included in this study, the edX platform, with a score of 45.2, delivered the highest quality MOOCs, with a standard deviation of 6.14. Near the end of the study period, after the Alison platform courses had been examined, the Alison platform sent an email to announce updates to their website. The site was reviewed again to determine if the updates might affect course quality scores. Upon examination, it was determined that the updates would not change the scores of the previously examined courses, and a cursory review of other courses on the new Alison site indicated they were set up similarly to those on the original site.

Table 8

MOOC Platform Quality Scores, by Quartile

Qu.	MOOC Platforms	Mean	Median	Std.Dev.
Q4	edX	45.2	48	6.14
	Canvas	30.8	25	13.79
Q3	Open Education	29.8	28	15.94
Q2	Udacity	24.6	28	8.59
Q1	Open2Study	18.0	19	3.16
	Alison	10.4	10	1.02

Note. Quality score = mean of 5 courses examined for each platform. Qu. = quartile.

Findings for Research Question 2

Research Question 2 stated "Did certain features within interactive learning environments, as listed by Schneider (2013), indicate higher MOOC quality than other

features?" Information and features were gathered for each course using Section 1 of the MOOC Scan Questionnaire (Margaryan et al., 2015, Appendix B), as well as the taxonomy suggested by Schneider (2013, Appendix D). The mean of all courses exhibiting each feature was then calculated, along with median and standard deviation (see Appendix E). Table 9 shows the frequency and mean for each feature, along with the difference between the mean for courses with the feature and the courses without the named feature. Features were then analyzed to determine frequency in each quartile (see Appendix F).

In-video quizzes. In-video quizzes appeared on two platforms, Udacity and Open Education. Three Udacity courses had both in-video multiple-choice and open-ended problems; two had just multiple-choice; and one Open Education course had just open-ended problems. The courses with in-video multiple choice quizzes scored 2.24 lower than courses without in-video multiple-choice quizzes, while the courses with in-video open-ended problems were 2.63 points higher than courses without in-video, open-ended problems. In-video quizzes only appeared in the second and third quartiles (see Appendix F, Figure F1)

Homework structure. In that any action conducted by a MOOC student could take place at home, *homework* was considered to be any activity, including the in-video quizzes (see Appendix F, Figure F2). The 19 courses with open-ended problems scored, on average, 15.67 points higher than courses with no open-ended problems, while the courses with multiple-choice questions, 14 of which also had open-ended problems, scored an average of 11.68 fewer points than those with no multiple-choice questions. Of the five courses with multiple-choice questions and no open-ended questions, all were in

the first quartile. Of the courses with open-ended problems, this included one course with three fill-in-the-blank questions in a single quiz.

The inclusion of writing or programming assignments appeared to have a much greater influence on course quality, with the eight courses including this feature scoring 20.33 points higher than courses without writing or programming assignments. Courses requiring the creation of multimedia artifacts or with group projects also scored considerably higher than those without, 21.46 and 27.45, respectively; however, with just two courses requiring multimedia creation and one with group projects, this may not be a reliable comparison for all courses with these features.

Practice problems. Three courses contained practice problems; two quantitative on Udacity, and one qualitative on Canvas. The quantitative courses scored 6.39 points lower than courses without, and the qualitative course scored 17.10 points higher.

Grading structure. Auto-grading and the ability to submit multiple times were prevalent in nearly all the courses, resulting in a mean score 6.39 lower than courses without this ability. Of greater significance may be that courses with peer- and self-assessment scored 21.92 and 18.25, respectively, higher than courses without these features. The 25 courses permitting multiple submission on one or more activities scored 11.68 higher than courses not permitting multiple submissions. Some courses included multiple types of grading structure.

Content. Sixteen courses provided content within the course, as well as links to

Table 9

Feature, Frequency, and Mean of MOOCs With This Feature Compared to Mean Without This Feature

Feature	Frequency	Mean with Feature	Mean without Feature	Comparison
In-video quizzes				
Multiple-choice	5	24.60	26.84	-2.24
Open-ended problems	4	28.75	26.12	2.63
Homework structure				
Multiple-choice	25	24.52	36.20	-11.68
Open-ended problems	19	32.21	16.55	15.67
Assessment: Performance assessments/writing or programming assignments	8	41.38	21.05	20.33
Assessment: Performance assessments/videos, slides, multimedia artifacts	2	46.50	25.04	21.46
Group projects	1	53.00	25.55	27.45
Practice problems				
Quantitative	2	20.50	26.89	-6.39
Qualitative	1	43.00	25.90	17.10
Grading structure				
Auto-graded	27	25.19	38.00	-12.81
Peer assessment	6	44.00	22.08	21.92
Self-assessment	2	43.50	25.25	18.25
Multiple submissions	25	24.52	36.20	-11.68
Content				
All content is within the course	14	20.71	31.50	-10.79
All required content within course; supplemental materials on external sites	6	17.67	28.67	-11.00
Required content is within the course and on external sites	10	39.80	19.80	20.00
Pacing				
Self-paced	21	23.62	33.11	-9.49
Cohort-based	9	33.11	23.62	9.49
Community				
Discussion board (see Note)	30	26.47	(-)	(-)
Social media (part of class/encouraged to communicate)	10	30.10	24.65	5.45
Social media (just links to like or share, or link to platform page)	9	24.44	27.33	-2.89
No social media	11	24.82	27.42	-2.60
Blogs/student journals	1	48.00	25.72	22.28
Video chat	0	(-)	(-)	(-)
Text chat	1	50.00	25.66	24.34

Note. Mean = mean of all courses exhibiting this feature; Comparison = mean of courses exhibiting feature minus the mean of all courses without the listed feature.
When initially examined, all 30 courses included discussion forums; when the Alison platform was re-examined, the discussion feature was no longer in any course.

external content. Of these, 10 courses required students to access the external materials, and six courses provided the links as supplemental materials. Those requiring students to access the external materials averaged 20 points higher than the courses providing the

external links only as supplemental materials and the courses with all content included within the course.

Pacing. Cohort-based courses were considered to be those with specific start and end dates, unless course directions specifically stated it as being self-paced. The cohort-based courses did not necessarily have an instructor actively teaching the class, although there was evidence of some form of instructor feedback in 66% of the cohort-based courses, versus 33% in the self-paced courses. The mean of the cohort-based course scores was 9.49 points higher than the scores for the self-paced courses, and the courses with instructor feedback of any kind averaged higher scores, whether self-paced or cohort-based (see Table 10). All five edX courses included in the study were cohort-based and had evidence of instructor feedback.

Table 10

Compared Means of Self-Paced and Cohort-Based Classes, With and Without Instructor Feedback

Pacing Type	With Evidence of Instructor Feedback	With No Evidence of Instructor Feedback
Self-paced	31.83	26.47
Cohort-based	41.00	17.50

Community. Discussion boards were initially present in all courses. In the new version of the Alison platform, the discussion page in each module was replaced by a topic review page, where students could leave comments and vote up or down on comments of others.

While 19 courses included links or references to social media, those which required or encouraged students to use social media scored, on average, 5.66 points

higher than the courses that just included links to like or share a course or MOOC platform. The courses with no links or references to social media also scored higher than those with links to just like or share. Just one course, with a score of 48, included student journals; and one course, with a score of 50, provided a text chat.

Findings for Research Question 3

Research Question 3 explored "What supportive services and tools were provided by MOOC platforms to foster quality course design?" This review was conducted based on what is publicly available on the website of each of the six platforms included in this study and what is available to enrolled students. Tools and supportive services are identified in Table 11.

Four of the six platforms studied (edX, Canvas, Open Education, and Alison) stated that they provided some type of supportive services to faculty and course designers, including consultation, guidance in course creation, and assistance in course creation. Only one platform, Canvas, publicly posted their design process and the materials they provided to course designers and faculty. Canvas had prepared checklists to use in designing a MOOC, along with their course design process and information on best practices for MOOC delivery. In addition, Canvas assigned an instructional designer to each course to review and provide feedback. While Udacity and Open2Study may provide support and guidance for course designers and faculty, no information was publicly present on their websites.

Table 11

MOOC Platform Tools and Supportive Services

Platform (Quartile)	Tools	Supportive Services

edX (Q4)	--Progress tracking (bookmark pages, view scores, return to where left off) --Can add Twitter feed --Can submit quiz questions individually --Video options (speed control, closed captioning, interactive transcripts)	Design support: Provides training, onboarding, program management, and design consultation Student support: Technical support (knowledgebase and email); customized navigation instructions in each course
Canvas (Q4)	--High-contrast user interface option --Notification preferences --Link account to social media --Upload and manage personal files --Progress tracking track activities submitted, view scores, and pages visited --Can communicate with instructor and other participants (text, audio, video, attachments) --Badge capability --Video options (auto-translate, speed control, closed captioning)	Design support: Instructional designer guided course creation process; two quality reviews; access to Canvas training, community, and guides; design and launch checklists; guidance on course delivery; user experience surveys Student support: Canvas User Orientation in each course, customized to course; help button allows student to message instructor, search Canvas Guides, or submit feature requests
Open Education (Q3)	--Can hide name in roster --Private communication with others --Students can create groups --Video options (auto-translate, speed control, closed captioning)	Design support: "Education services expertise that can help you further define your online strategy" (Blackboard, 2017). The services were not defined. Student support: ticket, live chat, phone
Udacity (Q2)	--Multiple glossary capability --Video feedback on quizzes --Video options (speed control, closed captioning, transcripts, auto-translate) --Zip files with transcripts and videos	Design support: Not apparent in publicly available information Student support: Users can submit questions, and suggestions for improvement; learner technical support (knowledgebase and email)
Open2Study (Q1)	--Progress tracking indicated percent complete, pages and activities visited; latest activity --Video options (interactive transcripts; speed control; closed captioning; auto-translate)	Design support: Not apparent in publicly available information Student support: Social Learning Team provides support via in-class forum; form for reporting technical issues
Alison (Q1)	--Progress tracking – marks lesson as complete and provides progress bar	Design support: Provided e-learning experts to assist in developing and repurposing content Student support: Can contact support via form, phone, social media links

Note. When first examined, discussion forums were available on all platforms; however, they were no longer available on the Alison platform after the site was upgraded in April 2017.

All MOOC platforms appeared to offer technical support of some type to students. This support ranged from provision of a knowledgebase and email support, to in-class support forums, live chat, and phone numbers. Two platforms, Open Education and Alison, in addition to other options, were the only platforms providing phone numbers for student support.

A variety of tools were available across the six studied platforms, with no single

tool standing out as supporting MOOC quality. The category of communication tools, however, did appear in the top three scoring courses, with edX providing the capacity to include live Twitter feeds, and Canvas and Open Education offering the ability for students to communicate privately with the instructor and other students.

Summary

Research Question 1. Of the six MOOC platforms studied, based on the scores derived from the examination of five courses on each of the platforms, edX delivered the highest quality MOOCs. While an Open Education course had the highest scoring MOOC, Open Education also had the highest standard deviation of 15.94, while the edX courses studied had a standard deviation of 6.14, indicating more consistent quality.

Research Question 2. The presence of certain course features appeared to indicate higher quality MOOCs. Writing and programming assignments, along with group projects, peer assessment, blogs/student journals, text chat, and courses requiring use of content both within the course and external to the course, each resulted in quality scores averaging more than 20 points higher than courses without these features. Since there was a low frequency of some of these features, such as text chat and group projects each appearing in a single instance, the appearance of some features may be of more importance in indicating MOOC quality than others.

Research Questions 3. Supportive services provided by the studied platform may be key in fostering quality MOOCs. With the exception of Canvas, however, little information was publicly available to determine the extent of the services provided. Tools varied from one platform to the next and, other than the presence of communication tools in the top three scoring platform and the lack, thereof, in the lowest scoring platforms, no

single tool appeared to add to course quality.

Chapter 5: Discussion

Introduction

This study sought to determine which MOOC platforms deliver the highest quality courses and what factors might indicate quality MOOCs. Findings indicate there is a wide range in the quality of MOOCs currently offered by institutions of higher education, and while a particular platform might offer the necessary tools and features to enable the creation of a high quality course, those involved in the authoring, design, delivery, or certification of a course may choose to not fully implement all elements that result in a high quality course. As a case in point, both the highest and lowest scoring MOOCs were on the Open Education platform. In this chapter, implications from the findings are presented, along with potential avenues for further study and recommendations for improving MOOC quality, platform quality, and instruments for measuring such quality. Study limitations are presented, along with conclusions which can be drawn from the results.

Overview of the Study

From an initial pool of 23 MOOC delivery platforms identified from four studies (Brown et al., 2015; Dron & Ostashewski, 2015; Margaryan et al., 2015; Rai & Chunrao, 2016), six platforms met the selection criteria. For each platform, five courses were randomly selected. Between March 11, 2017 and April 19, 2017, the quality of these courses was measured using the MOOC Scan Questionnaire (Margaryan et al., 2015). This qualitative comparative study examined course quality and features, along with supportive tools and services to answer the following three research questions:

1. What MOOC platforms delivered the highest quality MOOCs?

2. Did certain features within interactive learning environments, as listed by Schneider (2013), indicate higher MOOC quality than other features?

3. What supportive services and tools were provided by MOOC platforms to foster quality course design?

Elaboration of Findings and Linkage to Relevant Research

Findings for Research Question 1 indicate that of the six MOOC platforms studied, edX hosted the highest quality courses. With a course quality mean of 45.2 and a standard deviation of 6.14, edX scored 14.4 points higher than the next highest scoring platform, Canvas, with a course quality mean of 30.8 and a standard deviation of 13.79.

For Research Question 2, findings highlight several features which may indicate higher quality MOOCs. Elements of homework structure, grading structure, content access, and community appear to most greatly indicate higher quality MOOCs. Courses that went beyond multiple-choice assessments with writing or programming assignments, assignments requiring submission of multimedia artifacts, or group projects to measure student ability had quality scores more than 20 points, on average, than courses without those requirements. The inclusion of such homework structure features has the possibility of allowing students to apply what they are learning to real-world experiences, which has been identified as being advantage for students learning online (S. Liu, Kim, Bonk, & Magjuka, 2007; Shijuan Liu, 2009).

As auto-grading and the ability to submit assessments multiple times appeared in most of the courses studied, these features are not indicative of a high-quality MOOC. However, as indicated by the findings, the inclusion of self-assessment and, to a greater degree, peer-assessment, can benefit online students by providing greater opportunity to

reflect on the material. Phillips (2016) asserts there is an emerging view of "assessment as learning" (p. 14), in which students are actively engaged in the learning by participating in peer- and self-assessment and are not just passively receiving feedback. Of further consideration, it may be important to also examine how these types of assessment are approached within a course. As set forth by Kao (2013), there are advantages to using a "positive interdependence" (p. 122) approach in which students are graded both on their ability to achieve on the assignment and their ability to assess the work of others, thus introducing the possibility of greater personal accountability.

MOOCs requiring access to content both within the course and external to the course appear to indicate higher quality than MOOCs with all required materials in the course and links to external, optional material. It should be noted that courses offering opportunities for relating course content to real-world experiences often offered this opportunity through connecting students to resources they would actually reference when seeking resolution to actual work issues. While not measured as part of the quality score, the use of external links also helps keep course content current and reduces the need to update content within a course.

As an element of the Community of Inquiry framework (Garrison et al., 2000), fostering community in online courses is important in establishing social presence in an online class. Based on this study, it is apparent not all features which allow for student-student or student-faculty interactions add to course quality. As an example, simply including access to a discussion forum is not enough, as even the five courses with the lowest quality scores contained this feature. The inclusion of instructions for use as part of an assignment, along with participation by the instructor, appear to have greater

significance in determining quality. The inclusion of links to social media also appear to have little effect on course quality. Nonetheless, those incorporating social media as part of a class assignment or encouraging student use averaged 5.45 quality points higher than those with no social media link or those with links, but no directions or encouragement for use. The only community features that may indicate higher MOOC quality are the inclusion of blogs/student journals and text chat; however, such a conclusion must be tempered by the fact that each of these features only appeared in a single MOOC.

Based on this study, it appears the features indicating a higher quality MOOC include the presence of assessments other than just multiple-choice, such as peer- and self-assessments, and requiring the use of content both within the course and on external sites. The inclusion of blogs/student journals and the ability to text chat may also indicate a higher quality MOOC; however, due to the low occurrence of each of these features, it may not be possible to generalize these results to other MOOCs.

Research Question 3 explored supportive services and tools provided by MOOC platforms and how they might promote MOOC quality. The two MOOC platforms in the top quartile both appear to offer extensive support and guidance to MOOC developers. The support provided by edX is not covered in great detail; however, it apparently includes a wide range of services, including training, onboarding, program management, and design consultation. The supportive services provided by Canvas were described in detail, indicating a comprehensive design process, which included training, quality checklists, and an assigned instructional designer to provide guidance in creating and delivering the course. Open Education provides services, but does not define what services are provided, while Udacity and Open2Study did not publicly indicate provision

of any supportive services. Alison apparently provides assistance in developing and repurposing content. As was evidenced by review of the Alison courses, it appears the support was focused primarily on repurposing, as content for four of the courses studied simply consisted of recordings of live lectures, while the fifth was made up of unnarrated slide presentations.

Platform tools were less conclusive in providing evidence of promoting course quality. Four platforms provided a tool or tools for tracking progress, including the top two highest and lowest two scoring platforms. While it is apparent this tool does not promote MOOC quality, it should be noted that the researcher greatly preferred examining courses with this tool than those with no tracking capability. Courses with no means of tracking progress were more difficult to navigate and, upon exiting and returning, it was frustrating to try to find where one had left off. As frustration with technology may have an effect on student performance (Khanlarian & Singh, 2015), student perceptions of course quality may depend on the availability of such a tool.

The only other tool that was present on multiple platforms provided several video options, such as speed control, auto-translation, and closed-captioning. As these video options were found in each quartile, they also were not indicative of MOOC quality. A miscellany of other tools, none specifically tied to quality, were distributed amongst platforms.

Due to the researcher's previous role in providing support to online students and faculty, one particular tool stood out as having high potential for providing clear direction for MOOC students. This tool, a count-down clock in a course on Open2Study, provided students with the days, hours, and minutes before an assignment was due. Since MOOC

students are often in different time zones, such a tool can eliminate confusion in regard to due dates and times.

Limitations

The strict inclusion criteria for course selection in order to make this study feasible created limitations which could affect the generalizability of the results of this study. As an example, there may have been high quality MOOCs with a primary language other than English or developed by organizations other than accredited institutions of higher education. This study was also limited in that examination of the supportive services and tools was interpreted through the subjective perspective of the researcher. In addition, the five MOOCs selected from each of six MOOC platforms may have been too small a sample to enable generalization of results to all courses on each platform.

MOOC Scan Questionnaire. This study may also be limited due to the nature of the instrument used to measure MOOC quality, as it solely measured the quality of the design of the MOOCs, not delivery, content currency, or accuracy. In scoring for quality, it may be useful to take a more focused approach in measuring MOOCs.

Course organization. Course organization does not appear to be a key indicator of course quality. Nearly all (93%) courses received a score of 3 out of 3 for course organization, meaning they were organized to very large extent, including all five of the courses reviewed on Alison, the lowest scoring platform. If a platform only allows the creation of linear courses, as long as the lessons are placed in order (i.e., 1, 2, 3 … or A, B, C …), it will appear to be organized. It is also possible for a course to be well organized, but still be difficult to navigate. As an example, in Course 11, on the Open

Education platform, there was an introduction, followed by four modules. Clicking on a module in the menu provided an introductory page for the module. Clicking on a link on that page opened a table of contents with links to 64 pages, plus a link to download a document with links to all the readings, both required and recommended. This was in addition to the text and images on each of the 64 unit pages in Module 1, and links on the unit pages go to the URLs of included images. A link on the course home page provided access to a Blackboard zip file, which included all course files; not just course content, but apparently all of the files required to build the content (e.g., dat files, JavaScript files, and image thumbnails). While these materials appeared to be organized, they were not likely to be useful to students, unless the students intended to rebuild the course on another platform. In addition, since Open Education did not indicate which pages had been visited, while the course was organized, it could have been difficult for students to track their progress or find where they left off when returning to the course. The platform did offer a window called Quick Links, which provided some course links, but they appeared to go to random locations in the course. A better measure of quality in regard to course organization might be to rate the navigability of a course.

Social media. The measurement of social media in a MOOC should be more specific than just recording its presence. As an example, in Alison, the lowest ranked MOOC platform, all courses contained links to social media. However, none of the courses included instructions for using social media for communication purposes and appeared to just provide a means of sharing a link to the Alison site. Some courses on other portals shared links to groups on social media sites, providing a means for participants to interact with each other and/or the instructors.

Required activities. Rather than using the term *require* in the questionnaire items, which seem to invite dichotomous responses indicating presence or lack thereof, it might be more meaningful to substitute this with the term *allow*. As an example, in some of the courses there were opportunities to collaborate with other participants, and students were encouraged to do so, but it was not required; while in other courses there was no encouragement to collaborate, and the platform did not permit such collaboration. In each of these instances, however, the courses received the same quality score of zero for this item.

Instructor feedback. The yes/no responses for the items related to instructor feedback do not allow for differentiation between a high level and a low level of instructor feedback. In Course 29, there was a single response to a student question made by a teaching assistant more than a year ago. This received the same quality score of 1 for that item, indicating instructor feedback was present, as Course 16, in which the instructor responded to many discussion posts in a timely manner.

Course functionality. Functionality was not addressed as a quality metric. In one course, with many fill-in-the-blank questions, none was functional. Numerous complaints were posted by students in a discussion forum over a period of many months before a single response was posted by support staff; however, it did not appear the issue had been properly resolved. A course with nonfunctional elements should not be able to rate a quality score as high as a similar course with fully functional elements.

Content appropriateness. As part of quality, content appropriateness should be measured. Does it meet learning objectives? Is it relevant? Does the course author have permission to use the content? One course included an apparently historical article on

how nurses made the best wives. This information was not related to learning outcomes. Perhaps it was included as an attempt to provide an element of humor; however, there was no commentary to introduce its purpose. Another course included pdfs of entire book chapters. It may be that the book was out of print and the book author had provided permission for use, but in the quality scores, there was nothing to distinguish this type of content from the well-produced, highly engaging videos that were present in another course. Other content issues may include out-of-date syllabi or instructions leftover from a face-to-face course.

Access. Collection of the information regarding the supportive services and tools provided by each platform was greatly limited, in that little information was publicly available. While Canvas provided a great deal of information, some sites provided no information about what services are offered.

Self-reported data. Additional limitations may have been introduced by the researcher in interpreting the data. It is likely some course information was scored differently than it would have been by other researchers. To limit this, the researcher defined items that could be construed differently, and then made every effort to measure each course accordingly.

Recommendations for Further Research

This research can be taken further by expanding the criteria for platform selection. There may be best practices for creating quality MOOCs that are only apparent on, perhaps, a platform with courses developed by institutions other than higher education entities. The number of courses selected for study on each platform could also be expanded to provide a more comprehensive examination of quality.

As teaching presence is of importance to a successful online learning experience (Dennen, Darabi, Smith, Aubteen Darabi, & Smith, 2007; Garrison et al., 2000; Kanuka, 2011; Sheridan, Kelly, & Bentz, 2012; Skramstad, 2012), comparing MOOC quality to indicators of teaching presence may also be of value.

During the course of this study, it became apparent that a few institutions of higher education were using more than one platform. However, of the courses selected for this study, only one publisher was present on multiple platforms, with one on Alison, in the first quartile, and two on edX, both in the top quartile. Studying a single institution across multiple platforms may provide better insight into what it is about each platform that lends to MOOC quality.

Further study of the supportive services offered by each platform could also be of value. In that in most cases, so little information was publicly available, it would be important to devise a survey instrument for obtaining such information from the individuals providing such support. Interviews with faculty and course developers could also be of value in identifying the quality of provided support and consultation services.

Implications

It is important to consider that the value of a MOOC should not be measured solely on design factors. Although not covered in this study, other factors, such as rate of completions, student satisfaction and assessments, content currency, and teaching presence, also contribute to MOOC quality. From this research, there are many implications for those creating and selecting platforms as evidenced by what is included in high quality MOOCs. As such, this section will discuss these implications for MOOC platform providers, as well as MOOC designers and faculty.

Implications for MOOC platform providers. Focusing on MOOC quality provides an opportunity for MOOC platform providers to expand on their worthy missions to provide open access to educational opportunities. Providing a well-designed platform with navigation and communication tools may not be enough. It appears the provision of training on how to design and deliver online courses, along with requiring certain quality metrics be met prior to course publication, may be key to ensuring the availability of high-quality MOOCs on a particular platform. The provision of consultation with an instructional designer can help guide the design process so that tools are used appropriately to support course quality.

In supporting MOOC quality, it may be of importance to consider the following when creating or updating MOOC platforms. If students report functional issues with the course, ensure the person responsible for correcting the issue receives the message and updates the courses, as needed. As resources are needed to maintain courses in the form of support personnel, it may be financially beneficial to review courses for potential maintenance issues and advise course designers and faculty to use tools that allow for easy revisions if content requires frequent updating and to remain current, and to check links and tools on a regular schedule to ensure functionality. In addition, if the institution offering the course is expected to provide all course maintenance, ensure that responsibility is clearly communicated prior to MOOC launch.

To assist course designers and faculty in creating and delivering a quality MOOC, ensure there are options for hiding or eliminating elements they do not intend to actively use. This offers greater clarity for students and allows them to focus on the tools and resources necessary for a successful MOOC experience.

Implications for course designers and faculty. Course designers and faculty bear the greatest responsibility in creating and delivering quality MOOCs. As evidenced by Open Education, which hosted both the highest and lowest scoring course in the study, a platform can provide all the necessary tools for a high-quality course, yet improper design can get in the way of the provision of this quality.

In seeking a MOOC delivery platform, it may be beneficial to select one that provides supportive training and instructional design consultation. Even if the designer and/or faculty member are experienced in online course development, the guidance of an individual well-versed in a particular platform can be of value, as they are likely familiar with its intricacies and how students make use of it. If tied into a platform without such services, it may be beneficial to seek out input from peers who are already offering quality courses on that platform.

When designing a MOOC, consider both user interface and indicators of high-quality MOOCs. In regard to user interface, are student expectations clear? Are all aspects of the course functional? Is the course easy to navigate? Since MOOCs tend to be offered multiple times, what kind of course maintenance might be necessary? As an example, once a course is published, if there are broken links or if embedded files become corrupt, will the student support staff provided by the platform be able, or have the authority, to update the course? While a course designer or faculty may consider their work complete once a MOOC is published, it is unlikely platform support staff will have the necessary subject matter expertise to determine appropriate replacement content, and they also may not have access to the development tools used by the course designer, making it impossible to fix embedded files. If it is intended the course will not be

maintained once it is published, ensure it is either designed with longevity in mind, or that it has a predetermined end date, after which it is removed from the MOOC portal or hidden, until such time as the course author can review and revise for future offerings.

In relation to features present in high quality MOOCs, three stand out in contributing to a higher score: homework structure (i.e., assessments, assignments and other activities), grading structure, and content. While multiple-choice choice questions with auto-grading and feedback may help to reinforce course content, consider what other forms of assessment can help students meet learning outcomes, and how peer- or self-evaluation of such elements could be incorporated. In determining what content to include in the MOOC, explore what outside sources could be linked to in order to foster an understanding of how the course topic relates to real-world situations.

Due to the importance of teaching presence in online courses (Adams et al., 2014; Garrison et al., 2010; Reupert, Maybery, Patrick, Chittleborough, & Reupert, 2009; Sheridan et al., 2012), the inclusion of elements promoting such presence is essential. Provision of teaching presence in MOOCs is problematic only if the goals in providing such presence are to provide one-to-one feedback or engage in a dialog with each of the potentially massive number of students. There are many other indicators that provide an impression of such presence without requiring such time-intensive interactions. Examples include a technology course on Udacity in which the two instructors carried on an engaging dialog in their videos, explaining concepts, asking questions of each other, and providing immediate video feedback to questions. In an edX course, instructors reviewed discussion board responses each week and provided a response, in the form of an announcement, to the top questions raised by students.

Conclusions

In spite of the dire predictions of Gartner (2012), Lowendahl (2013, 2014) and Zemsky (2014), the number of MOOCs is growing. As evidenced by their mission statements, the providers of open-education delivery platforms included in this study strive to provide learners with flexible educational opportunities that have the potential to enrich, or even change, their lives. While these efforts are noble, the resources to develop and deliver on such a promise is costly. In order to make best use of available resources, consideration of MOOC quality should be of concern in order to have the greatest progress toward goals.

This qualitative study examined several factors that lend to MOOC quality, including delivery platforms, features, tools and supportive services. While it appears platform choice can make a difference in the determination of quality, the inclusion of certain features can be a clear indication of higher quality MOOCs. This includes assessments other than, or in addition to, multiple-choice; peer assessment; and the presence of required content both within and external to the course. The inclusion of particular tools was inconclusive in determining quality. The supportive services, such as training and instructional design consultation, have potential for contributing greatly to MOOC quality.

While adherence to quality standards allows for the possibility of a successful learning experience for learners seeking to gain knowledge through massively open online courses, it may be that the characteristics of the learners themselves are of greater significance. Other than reaching a global audience, is the concept of massively open online courses really all that different from the free public libraries built by Andrew

Carnegie? The 2,509 Carnegie Libraries were built between 1883 and 1929 for the "industrious and ambitious; not those who need everything done for them, but those who, being most anxious and able to help themselves, deserve and will be benefitted by help from others" (Carnegie, 1889, p. 23). Perhaps MOOC quality should ultimately be measured by the quality of the students completing them and how they are making use of the freely available knowledge.

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Appendix A

Schneider's Proposed Taxonomy

Table A1

Categories and Subcategories for General MOOC Structure
Adapted from Schneider (2013)

- Name*
- Numeric ID**
- Author*
    - Faculty member
- Publisher*
    - Affiliated university or other institution
- Platform
- inLanguage*
    - Primary language of resource
- Domain (about***)
    - Computational STEM—CS, math, science, computational social sciences, etc.
    - Humanist—humanities, non-computational social sciences, etc.
    - Professional—business, medicine, law, etc.
    - Personal—health, thinking, speaking, writing, art, music, etc.
- Level (typicalAgeRange or educationalRole***)
    - Pre-collegiate; basic skills (i.e., gatekeeper courses, college/career-ready); undergraduate; graduate; professional development; life skills
- Target audience (educationalRole***)
    - Current students, current professionals, lifelong learners
- Use (educationalUse*** or educationalEvent***)
    - Public course (date(s) offered, content for *wrapped* in-person course (location and date(s) offered)
- Pace
    - Cohort-based vs. self-paced (learningResourceType***)
        - Expected workload for full course (total hours, hours/week) (timeRequired***)
- Accreditation
    - Certificate available
    - Transfer credit

*Terminology from the Learning Resources Metadata Initiative (LRMI)
**Auto-generated
***LRMI field to which the moocspace category could map.

Table A2

Features of the Interactive Learning Environment (ILE)
Adapted from Schneider (2013).

Instruction
• Lecture
  ○ "traditional": 1-3 hrs/wk. 20+ mins each
  ○ "segmented": 1-3 hrs/wk, 5-20 mins each
  ○ "minimal": <1 hr/wk
• Readings
• Simulations/inquiry environments/virtual labs
• Instructor involvement—range from highly interactive to "just press play"
	Content
	• Domain (in General Structure)
	• Modularized
	  ○ Within the course
	  ○ Connected with other MOOCs/OER
	• Course pacing
	  ○ Self-paced
	  ○ Cohort-based

Assessment
• In-video quizzes
  ○ Multiple-choice vs. open-ended
• Homework structure
  ○ Multiple-choice
  ○ Open-ended problems
  ○ Performance assessments
  ▪ Writing assignments or programming assignments
  ▪ Videos, slides, multimedia artifacts
• Group projects
• Practice problems (non-credit bearing)
  ○ Grading form—Quantitative, Qualitative
• Grading structure (relevant to all credit-bearing assessments)
  ○ Autograded
  ○ Peer assessment, self-assessment, both
  ○ Multiple submissions
	Community
	• Discussion board
	• Social media—Facebook group, Google+ community, Twitter hashtag, Reddit, LinkedIn, etc.
	• Blogs/student journals (inside or outside of platform)
	• Video chat (G+ hangout, Skype)
	• Text chat

Reference

Schneider, E. (2013). *Welcome to the moocspace: a proposed theory and taxonomy for massive open online courses.* Paper presented at the Proceedings of the Workshops at the 16th International Conference on Artificial Intelligence in Education.

Appendix B

MOOC Scan Questionnaire

MOOC Scan Questionnaire

(Margaryan, 2015)

Scoring system	
For Likert-scale items:	
None (0)	
To some extent (1)	= there are serious omissions or problems; the principle is reflected in fewer than 50% of items (eg activities or objectives) being evaluated
To large extent (2)	= generally OK, but there are some omissions or problems; the principle is reflected in between 51% and 80% of items being evaluated
To very large extent (3)	= excellent; the principle is reflected in between 81% and 100% of items being evaluated
Not applicable (88)	
No info (99)	= no information in the course environment about this item
For binary items:	
Yes (1)	
No (0)	

SECTION 1. COURSE DETAILS

1.1. Course name:
1.2. Course dates:
1.3. Course website:
1.4. Course type: cMOOC xMOOC
1.5. Course platform:
1.6. Course director:
1.7. Date of analysis:

SECTION 2. OBJECTIVES AND ORGANISATION

2.1. Does the course specify the learner population that will engage in the course? (Yes; No)

2.2. Does the course specify the change that needs to be promoted in the skill set of the learner population? (Yes; No)

2.3. To what extent are the course objectives measurable? (None; To some extent; To large extent; To very large extent; N/A; N/I)

2.4. To what extent are the course materials well organised? None; To some extent; To large extent; To very large extent; N/I)

2.5. Are the course requirements clearly outlined? (Yes; No)

2.6. Is the course description clear? (Yes; No)

SECTION 3. FIRST PRINCIPLES

3.1. To what extent are the course objectives relevant to real-world problems? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.2. To what extent are the problems in the course typical of those learners will encounter in the real world? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.3. To what extent do the activities in the course relate to the participants' real workplace problems? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.4. To what extent are the problems ill-structured – i.e., have more than one correct solution? (None, To some extent; To large extent; To very large extent; N/A; N/I)

3.5. To what extent are the problems divergent from one another? (None, To some extent; To large extent; To very large extent; N/A; N/I)

3.6. Are there examples of problem solutions? (Yes; No; N/A)

3.7. If there are examples of solutions, to what extent do these solutions represent a range of quality from excellent examples to poor examples? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.8. To what extent are the resources reused from real-world settings? (None; To some extent; To large extent; To very large extent; N/I)

3.9. To what extent do the activities build upon each other? (None; To some extent; To large extent; To very large extent; N/I)

3.10. To what extent do the activities attempt to activate learners' relevant prior knowledge or experience? (None; To some extent; To large extent; To very large extent; N/I)

3.11. To what extent do the activities require learners to apply their newly acquired knowledge or skill? (None; To some extent; To large extent; To very large extent; N/I)

3.12. To what extent do the activities require learners to integrate the new knowledge or skill into their everyday work? (None; To some extent; To large extent; To very large extent; N/I)

3.13. To what extent are there activity options for participants with various learning needs? (None; To some extent; To large extent; To very large

extent; N/I)

3.14. To what extent do the activities require participants to learn from each other? (None; To some extent; To large extent; To very large extent; N/I)

3.15. To what extent do the activities require participants to contribute to the collective knowledge, rather than merely consume knowledge? (None; To some extent; To large extent; To very large extent; N/I)

3.16. To what extent do the activities require learners to build on other participants' submissions? (None; To some extent; To large extent; To very large extent; N/I)

3.17. To what extent do the activities require participants to collaborate with other course participants? (None; To some extent; To large extent; To very large extent; N/I)

3.18. To what extent do the activities require participants to collaborate with others outside the course? (None; To some extent; To large extent; To very large extent; N/I)

3.19. To what extent do the activities require that the peer-interaction groups be comprised of individuals with different backgrounds, opinions, and skills? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.20. To what extent can the individual contribution of each learner in the group be clearly identified? (None; To some extent; To large extent; To very large extent; N/A; N/I)

3.21. Is there feedback on activities by the instructor(s) in this course? (Yes; No)

3.22. If there is feedback, is the way feedback will be provided clearly explained to the participants? (Yes; No; N/A)

3.23. Are the peer-interaction groups given specific directions for interaction? (Yes; No; N/A)

3.24. Does each member of a peer-interaction group have a specific role to play? (Yes; No; N/A)

Appendix C

Detailed Overall Results

Detailed Overall Results

Item #	Questions	Yes	No	None	To some extent	To large extent	To very large extent	N/I and N/A
2.1	Does the course specify the learner population that will engage in the course?	24	6					
		80.0 %	20.0 %					
2.2	Does the course specify the change that needs to be promoted in the skill set of the learner population?	16	14					
		53.3 %	46.7 %					
2.3	To what extent are the course objectives measurable?			2	4		14	10
				6.7%	13.3%	0.0%	46.7%	33.3%
2.4	To what extent are the course materials well organised?				2	2	26	
					6.7%	6.7%	86.7%	
2.5	Are the course requirements clearly outlined?	22	8					
		73.3 %	26.7 %					
2.6	Is the course description clear?	29	1					
		96.7 %	3.3%					
3.1	To what extent are the course objectives relevant to real-world problems?				5	2	13	10
					16.7%	6.7%	43.3%	33.3%
3.2	To what extent are the problems in the course typical of those learners will encounter in the real world?				7		14	9
					23.3%		46.7%	30.0%
3.3	To what extent do the activities in the course relate to the participants' real workplace problems?			2	14		14	
				6.7%	46.7%		46.7%	
3.4	To what extent are the problems ill-structured – i.e., have more than one correct solution?			3	2	1	14	10
				10.0 %	6.7%	3.3%	46.7%	33.3%
3.5	To what extent are the problems divergent from one another?				4	1	15	10
					13.3%	3.3%	50.0%	33.3%
3.6	Are there examples of	10	2					17

	problem solutions?	33.3 %	6.7%					56.7%
3.7	If there are examples of solutions, to what extent do these solutions represent a range of quality from excellent examples to poor examples?			4	2		3	21
				13.3 %	6.7%		10.0%	70.0%
3.8	To what extent are the resources reused from real-world settings?			11	7	1	11	
				36.7 %	23.3%	3.3%	36.7%	
3.9	To what extent do the activities build upon each other?			8	8	4	10	
				26.7 %	26.7%	13.3%	33.3%	
3.10	To what extent do the activities attempt to activate learners' relevant prior knowledge or experience?			9	6	1	14	
				30.0 %	20.0%	3.3%	46.7%	
3.11	To what extent do the activities require learners to apply their newly acquired knowledge or skill?			3	12	4	11	
				10.0 %	40.0%	13.3%	36.7%	
3.12	To what extent do the activities require learners to integrate the new knowledge or skill into their everyday work?			23			7	
				76.7 %			23.3%	
3.13	To what extent are there activity options for participants with various learning needs?			20	6	2	2	
				66.7 %	20.0%	6.7%	6.7%	
3.14	To what extent do the activities require participants to learn from each other?			24	2	1	3	
				80.0 %	6.7%	3.3%	10.0%	
3.15	To what extent do the activities require participants to contribute to the collective knowledge, rather than merely consume knowledge?			23	3		4	
				76.7 %	10.0%		13.3%	
3.16	To what extent do the activities require learners to build on other participants'			27	2		1	

	submissions?			90.0 %	6.7%		3.3%	
3.17	To what extent do the activities require participants to collaborate with other course participants?			25	2	1	2	
				83.3 %	6.7%	3.3%	6.7%	
3.18	To what extent do the activities require participants to collaborate with others outside the course?			27	2	1		
				90.0 %	6.7%	3.3%		
3.19	To what extent do the activities require that the peer-interaction groups be comprised of individuals with different backgrounds, opinions, and skills?			1				29
				3.3%				96.7%
3.20	To what extent can the individual contribution of each learner in the group be clearly identified?							30
								100.0 %
3.21	Is there feedback on activities by the instructor(s) in this course?	13	17					
		43.3 %	56.7 %					
3.22	If there is feedback, is the way feedback will be provided clearly explained to the participants?	6	8					16
		20.0 %	26.7 %					53.3%
3.23	Are the peer-interaction groups given specific directions for interaction?	1						29
		3.3%						96.7%
3.24	Does each member of a peer-interaction group have a specific role to play?	1						29
		3.3%						96.7%

Appendix D

Course Information Summaries

Course Information Summaries

Of the 30 courses examined, 19 were xMOOCs, one was a cMOOC, and all were delivered in English. Identifying information has been removed. Fields were adapted from Margaryan (Margaryan et al., 2015) and Schneider (Schneider, 2013).

MOOC Platform: Alison (https://alison.com/)		
Course No. (Quality score)	**Course Detail**	**Features**
1 **(10)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* n/a *Date of analysis:* 3/11/17 *Author:* Publisher 11 *Publisher:* Publisher 11 *Domain:* Professional *Level:* Pre-collegiate *Pace:* Self-paced	**Instruction** Slides, no narration, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Links to social media
2 **(12)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* n/a *Date of analysis:* 3/11/17 *Author:* Publisher 9 *Publisher:* Publisher 9 *Domain:* Professional *Level:* Post-secondary *Pace:* Self-paced	**Instruction** Video lectures, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Links to social media

3 **(9)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 41; Faculty 42 *Date of analysis:* 3/12/17 *Author:* Publisher 17 *Publisher:* Publisher 17 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Video lectures, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Links to social media
4 **(11)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 43 *Date of analysis:* 3/12/17 *Author:* Publisher 17 *Publisher:* Publisher 17 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Video lectures, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Links to social media
5 **(10)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 44 *Date of analysis:* 3/12/17 *Author:* Publisher 17 *Publisher:* Publisher 17 *Domain:* Professional *Level:* Undergraduate *Pace:* Self-paced	**Instruction** Video lectures, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, fill-in-the-blank, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Links to social media

MOOC Platform: Canvas (https://www.canvas.net/)		
Course No. (Quality score)	**Course Detail**	**Features**
6 **(25)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 1 *Date of analysis:* 3/12/17 & 4/4/17 *Author:* Publisher 4 *Publisher:* Publisher 4 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Course consists of three modules, each with objectives, video lectures (closed-captioning available), links to readings and resources, a discussion board with a question or questions, and a quiz, no apparent instructor involvement **Assessments** Discussion board assignments; Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Videos within the course; readings on external sites
7 **(12)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* n/a *Date of analysis:* 3/15/17 *Author:* Publisher 3 *Publisher:* Publisher 3 *Domain:* Personal *Level:* Life skills *Pace:* Self-paced	**Instruction** Video lectures with transcripts and written summaries, instructor responses in discussion board **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards for course questions, technical problems and subject matter questions

8 **(50)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 55; Faculty 56; Faculty 57 *Date of analysis:* 3/15/17 *Author:* Publisher 19 *Publisher:* Publisher 19 *Domain:* Personal *Level:* Life skills *Pace:* Self-paced	**Instruction** Video lectures; readings from outside sources, instructor involvement in discussions **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted; open-ended problems **Content** Within the course, plus links to a great deal of content outside the course **Community** Discussion boards Link to Twitter to promote course
9 **(43)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 58; Faculty 59 *Date of analysis:* 3/20/17 *Author:* Faculty 58; Faculty 59 *Publisher:* Publisher 2 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Readings, videos, links to outside content, and examples, instructor involvement in discussions, but no apparent involvement this year **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted; discussion prompts **Content** Within the course, and links to a great deal of content outside the course **Community** Discussion boards; introduction map
10 **(24)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* n/a *Date of analysis:* 3/20/17 *Author:* Publisher 15 *Publisher:* Publisher 15 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Video lectures, quizzes, instructor involvement in discussion board **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards

MOOC Platform: Open Education (https://openeducation.blackboard.com)		
Course No. (Quality score)	**Course Detail**	**Features**
11 **(39)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 60; Faculty 61; Faculty 62 *Date of analysis:* 3/21/17 *Author:* Faculty 60; Faculty 61; Faculty 62 *Publisher:* Publisher 21 *Domain:* Professional *Level:* Graduate *Pace:* Self-paced	**Instruction** Videos by course authors and others; external open source readings; readings within course, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted; written, self-graded, open-ended assignments **Content** Within the course Facebook and Twitter links to promote course
12 **(7)**	*Type:* xMOOC *Course dates:* Started 3/12/17 *Course director/faculty member:* Faculty 45 *Date of analysis:* 3/12/17 *Author:* Faculty 45 *Publisher:* Publisher 5 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Video lectures with text supplements, no apparent instructor involvement **Assessments** Multiple-choice, quantitative, auto-graded quizzes; multiple submissions permitted **Content** Within the course **Community** Discussion boards Facebook and Twitter links to promote course

13 **(54)**	*Type: cMOOC* *Course dates:* Ongoing *Course director/faculty member:* Faculty 46; Faculty 47; Faculty 48; Faculty 49; Faculty 50; Faculty 51; Faculty 52; Faculty 53; Faculty 54; *Date of analysis:* 3/13/17 *Author:* Faculty 48 *Publisher:* Publisher 12 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Readings, recordings, content created by students; high instructor involvement **Assessments** Open-ended problems; multimedia artifacts; peer assessment **Content** Within the course, plus outside resources **Community** Discussion boards Link to Twitter, hashtag provided Facebook and Twitter links to promote course
14 **(21)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 63; Faculty 64; Faculty 65; Faculty 66; Faculty 67 *Date of analysis:* 3/20/17 *Author:* Publisher 1 *Publisher:* Publisher 1 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Videos by the lead instructor and others; links to the instructor's blog and other web resources; additional readings and tools; instructor involvement in first offering, none apparently this year (lead instructor provided Twitter username, phone number and email, so non-public interactions could be occurring) **Assessments** Open-ended problems, peer assessment **Content** Within the course, and links to content outside the course **Community** Discussion boards, instructor’s Twitter username and hashtag Facebook and Twitter links to promote course

15 **(28)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 68; Faculty 69 *Date of analysis:* 3/23/17 *Author:* Publisher 5 *Publisher:* Publisher 5 *Domain:* Professional *Level:* Professional development *Pace:* Self-paced	**Instruction** Video lectures, readings from university site and outside web sources; no instructor involvement **Assessments** Open-ended problems, auto-graded, multiple submissions **Content** Mostly within course; plus links to outside resources **Community** Discussion boards Facebook and Twitter links to promote course

MOOC Platform: edX (https://www.edx.org)		
Course No. (Quality score)	**Course Detail**	**Features**
16 **(37)**	*Type:* xMOOC *Course dates:* Start date 3/7/17 *Course director/faculty member:* Faculty 2; Faculty 3; Faculty 4; Faculty 5 *Date of analysis:* 3/23/17 *Author:* Publisher 14 *Publisher:* Publisher 14 *Domain:* STEM *Level:* Graduate *Pace:* Cohort-based	**Instruction** Videos, articles, research, other resources, instructor involvement in discussions **Assessments** Multiple-choice, quantitative, auto-graded quizzes; open-ended problems; self-graded **Content** Mostly within the course; plus links to outside resources **Community** Instructor posts on LinkedIn; student-created Whatsapp group

17 **(48)**	*Type:* xMOOC *Course dates:* Start date 3/15/17 *Course director/faculty member:* Faculty 6; Faculty 7; Faculty 8; Faculty 9, Faculty 10, Faculty 11 *Date of analysis:* 3/24/17 *Author:* edX *Publisher:* Publisher 6 *Domain:* Humanities *Level:* Graduate *Pace:* Cohort-based	**Instruction** Video lectures; readings; images; instructor involvement **Assessments** Multiple-choice, auto-graded quizzes, open-ended problems; peer-assessed writing assignments, multiple submissions **Content** Much is within the course, but most of the course is on another platform, accessed through edX, apparently created just for this topic; student journals **Community** Discussion boards, journals, social media links to edX page
18 **(53)**	*Type:* xMOOC *Course dates:* Start date 3/28/17 *Course director/faculty member:* Faculty 12 *Date of analysis:* 3/27/17 *Author:* Faculty 12 *Publisher:* Publisher 9 *Domain:* Professional *Level:* Pre-collegiate & professional *Pace:* Cohort-based	**Instruction** Video lectures, readings, surveys, discussions, peer-reviewed assignments, multiple instructor involvement **Assessments** Multiple-choice, auto-graded quizzes, open-ended problems, peer-assessed writing assignments, group projects **Content** Within course, makes use of another site to compile writings into a contract for a project **Community** Discussion boards

19 **(49)**	*Type:* xMOOC *Course dates:* Start date 4/4/17 *Course director/faculty member:* Faculty 17; Faculty 18 *Date of analysis:* 4/5/17 & 4/15/17 *Author:* Publisher 18 *Publisher:* Publisher 18 *Domain:* Professional *Level:* Professional development *Pace:* Cohort-based	**Instruction** Video lectures; optional readings, instructor involvement **Assessments** Auto-graded multiple-choice quizzes, multiple submissions; peer-assessed open-ended problems **Content** All required materials within the course **Community** Discussion boards; Twitter feed provided in course; certificate posts to LinkedIn
20 **(39)**	*Type:* xMOOC *Course dates:* Start date 2/14/17 *Course director/faculty member:* Faculty 73; Faculty 74 *Date of analysis:* 4/6/17 *Author:* Author 15; Author 16; Author 17; Author 18; Author 19; Author 20; Author 21; Author 22; Author 23 *Publisher:* Publisher 9 *Domain:* STEM *Level:* Undergraduate *Pace:* Cohort-based	**Instruction** Readings, videos, instructor involvement **Assessments** Open-ended and multiple-choice self-graded quizzes **Content** Within the course **Community** Discussion boards

MOOC Platform: edX (https://www.edx.org)		
Course No. (Quality score)	**Course Detail**	**Features**
21 **(20)**	*Type:* xMOOC *Course dates:* Start date 3/20/17 *Course director/faculty member:* Faculty 22 *Date of analysis:* 3/28/17 *Author:* Faculty 22 *Publisher:* Publisher 10 *Domain:* Professional *Level:* Undergraduate *Pace:* Cohort	**Instruction** Video lectures with transcripts, quizzes, comprehensive assessment for each module, additional resources from external sites, instructor involvement in discussions **Assessments** Multiple-choice in auto-graded quizzes; open-ended problems; multiple submissions **Content** All required for certificate is in the course; additional readings are offsite **Community** Discussion boards; live Twitter feed in course; encouraged to join Google community and post on Facebook
22 **(12)**	*Type:* xMOOC *Course dates:* Start date 3/20/17 *Course director/faculty member:* Faculty 23; Faculty 24 *Date of analysis:* 3/30/17 *Author:* Author 8; Author 9 *Publisher:* Publisher 8 *Domain:* Personal *Level:* Life skills *Pace:* Cohort-based	**Instruction** Video lectures with transcripts, quizzes, comprehensive assessment for each module, additional resources from external sites, no apparent instructor involvement **Assessments** Multiple-choice and open-ended problems for quizzes; video feedback; auto-graded **Content** All required content for course is within course; additional readings at external links **Community** Discussion boards Live Twitter feed in course; encouraged to join Google community and post on Facebook

23 **(19)**	*Type:* xMOOC *Course dates:* Start date 3/20/17 *Course director/faculty member:* Faculty 25 *Date of analysis:* 4/1/17 *Author:* Author 10 *Publisher:* Publisher 13 *Domain:* Humanities *Level:* Pre-collegiate *Pace:* Cohort-based	**Instruction** Video lectures with transcripts, quizzes, comprehensive assessment for each module, additional resources from external sites, no apparent instructor involvement **Assessments** Multiple-choice quizzes and open-ended problems; auto-graded; multiple submissions; video feedback on quizzes **Content** All required for certificate is in the course; additional readings are outside course **Community** Discussion board; live Twitter feed in course; encouraged to join Google community and post on Facebook
24 **(18)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 26; Faculty 27 *Date of analysis:* 4/1/17 *Author:* Author 11; Author 12 *Publisher:* Publisher 20 *Domain:* Humanities *Level:* Undergraduate *Pace:* self-paced	**Instruction** Video lectures with transcripts, quizzes, comprehensive assessment for each module, additional resources from external sites; instructor interaction on discussion boards **Assessments** Multiple-choice quizzes, open-ended problems, auto-graded; multiple submissions **Content** All required for certificate is in the course; additional readings are outside course **Community** Discussion boards; live Twitter feed in course; encouraged to join Google community and post on Facebook

25 **(21)**	*Type:* xMOOC *Course dates:* Start date 3/20/17 *Course director/faculty member:* Faculty 28; Faculty 29 *Date of analysis:* 4/1/17 *Author:* Author 13; Author 14 *Publisher:* Publisher 22 *Domain:* Professional *Level:* Life skills *Pace:* cohort-based	**Instruction** Video lectures with transcripts, quizzes, comprehensive assessment for each module, additional resources from external sites; no apparent instructor interaction **Assessments** Multiple-choice, open-ended problems, auto hints, auto-grading multiple submissions **Content** All required for certificate is in the course; additional readings are outside course **Community** Discussion boards; live Twitter feed in course; encouraged to join Google community and post on Facebook

MOOC Platform: Udacity (https://www.udacity.com/)		
Course No. (Quality score)	**Course Detail**	**Features**
26 **(16)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 30; Faculty 31 *Date of analysis:* 4/1/17 *Author:* Publisher 7 *Publisher:* Publisher 7 *Domain:* Professional *Level:* Graduate *Pace:* Self-paced	**Instruction** Video lectures with closed captioning and transcripts, supplemental materials, quizzes, student-only forums, no instructor interaction **Assessments** Multiple-choice in-video quizzes; auto-graded **Content** Mostly within the course; supplemental links are provided **Community** Discussion boards

27 **(13)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 70; Faculty 71; Faculty 72 *Date of analysis:* 4/3/17 *Author:* Publisher 16 *Publisher:* Publisher 16 *Domain:* Computational *Level:* Undergraduate *Pace:* Self-paced	**Instruction** Video lectures with closed captioning and transcripts, quizzes, no apparent instructor involvement **Assessments** In-video quizzes with video feedback **Content** Within the course **Community** n/a
28 **(28)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 34; Faculty 35; Faculty 36 *Date of analysis:* 4/4/17 *Author:* Publisher 16 *Publisher:* Publisher 16 *Domain:* STEM *Level:* Undergraduate *Pace:* Self-paced	**Instruction** Video lectures with closed captioning and transcripts, quizzes, no apparent instructor involvement **Assessments** In-video, multiple-choice quizzes; open-ended programming problems; multiple submissions **Content** Within the course **Community** Discussion boards.
29 **(31)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 37 *Date of analysis:* 4/8/17 *Author:* Publisher 7 *Publisher:* Publisher 7 *Domain:* STEM *Level:* Graduate *Pace:* Self-paced	**Instruction** Video lectures with closed captioning and transcripts, quizzes, no apparent instructor involvement **Assessments** Multiple-choice, open-ended problems, in-video quizzes; multiple submissions **Content** Within the course **Community** n/a

30 **(35)**	*Type:* xMOOC *Course dates:* Ongoing *Course director/faculty member:* Faculty 38; Faculty 39 *Date of analysis:* 4/8/17 *Author:* Publisher 7 *Publisher:* Publisher 7 *Domain:* STEM *Level:* Graduate *Pace:* Self-paced	**Instruction** Videos, quizzes; final project, no apparent instructor involvement **Assessments** Multiple-choice, open-ended problems, in-video quizzes; multiple submissions; self-assessment rubric; auto-graded; multiple submissions **Content** Within the course **Community** n/a

Appendix E

Feature Summary

Feature Summary

In-video quizzes

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Multiple-choice	Udacity	5	24.60	28.00	8.59
Open-ended problems	Open Education Udacity	4	28.75	29.50	5.12

Homework structure*

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Multiple-choice	Alison Canvas Open Education edX Open2Study	25	24.52	20.00	14.43
Open-ended problems	Alison** Canvas Open Education edX Open2Study Udacity	19	32.21	31.00	13.75
Assessment: Performance assessments/ writing or programming assignments	Canvas Open Education edX Udacity	8	41.38	41.00	8.37
Assessment: Performance assessments/ videos, slides, multimedia artifacts	Open Education edX	2	46.50	46.50	7.50
Group projects	edX	1	53.00	53.00	(-)

Practice problems

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Quantitative	Udacity	2	20.50	20.50	7.5
Qualitative	Canvas	1	43	43	(-)

Grading structure

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Auto-graded	All	27	25.19	21.00	14.16
Peer assessment	Open Education edX	6	44.00	48.50	11.37
Self-assessment	Open Education edX	2	43.50	43.50	4.50
Multiple submissions	All	25	24.52	21.00	13.56

Content

Feature	MOOC Platforms	Frequency	Mean	Median	SD
All content is within the course	Alison Canvas Open Education edX Udacity	14	20.71	12.50	13.01
All required content within course; supplemental materials on external sites	Open2Study Udacity	6	17.67	18.50	2.98
Required content is within the course and on external sites	Canvas Open Education edX	10	39.80	41.00	11.30

Pace

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Self-paced	Alison Canvas Open Education Open2Study Udacity	21	23.62	21.00	13.72
Cohort-based	edX Open2Study	9	33.11	37.00	14.46

Community

Feature	MOOC Platforms	Frequency	Mean	Median	SD
Discussion board	All***	30	26.47	22.50	14.61
Social media					
Social media (part of class/encouraged to communicate)	Canvas Open Education edX Open2Study	10	30.10	21.00	14.96
Social media (just links to like or share, or link to platform page)	Alison Open Education edX	9	24.44	12.00	16.95
No social media	Canvas Open Education Udacity	11	24.82	25.00	11.22
Blogs/student journals	edX	1	48.00	48.00	(-)
Video chat	None	0	(-)	(-)	(-)
Text chat	Canvas	1	50.00	50.00	(-)

*This was classified by Schneider as homework, however, since any element of an online course may be conducted anywhere, including home, so for the purpose of this study, homework is considered to be any course activity.
**For one course on the Alison platform this consisted of 3 fill-in-the-blank questions in a quiz. No other open-ended problems appeared in the courses examined on this platform.
***In the new version of Alison, there are no discussion boards.

Appendix F

Feature Frequency by Quartile

Feature Frequency by Quartile

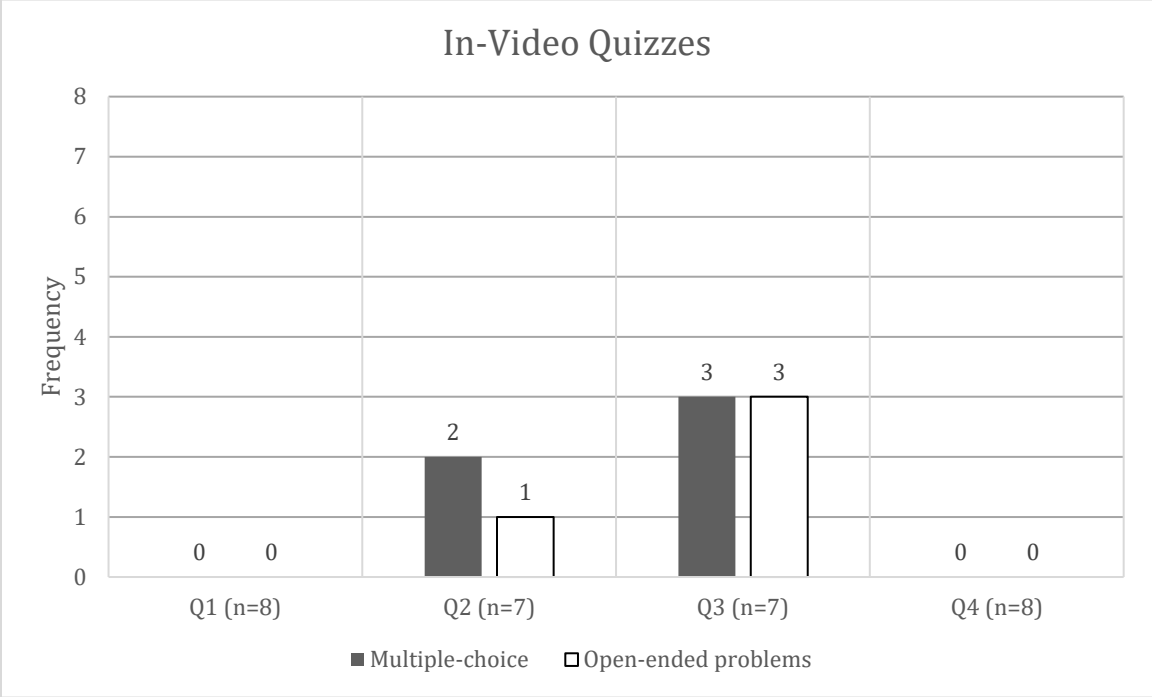

Figure F1. Count of courses in study with in-video quizzes, by quartile.

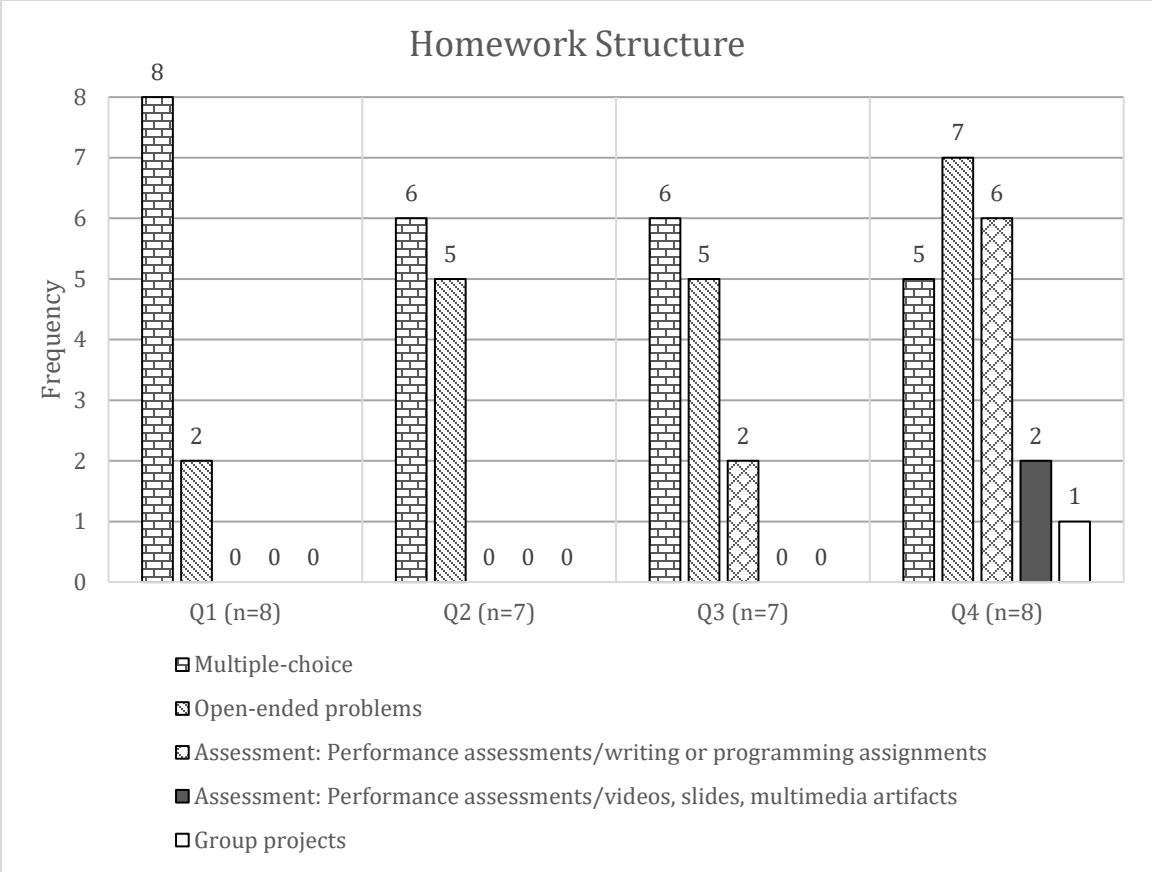

Figure F2. Count of courses in study with different types of homework structure, by quartile.

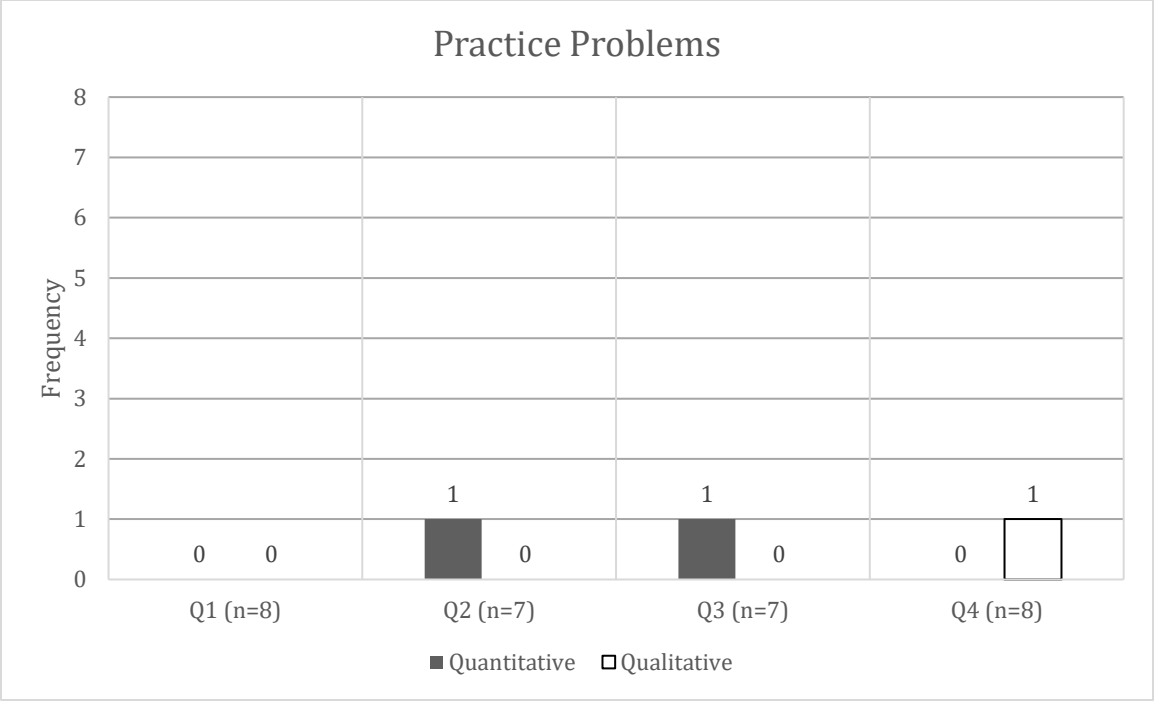

Figure F3. Count of courses in study with practice problems, by quartile.

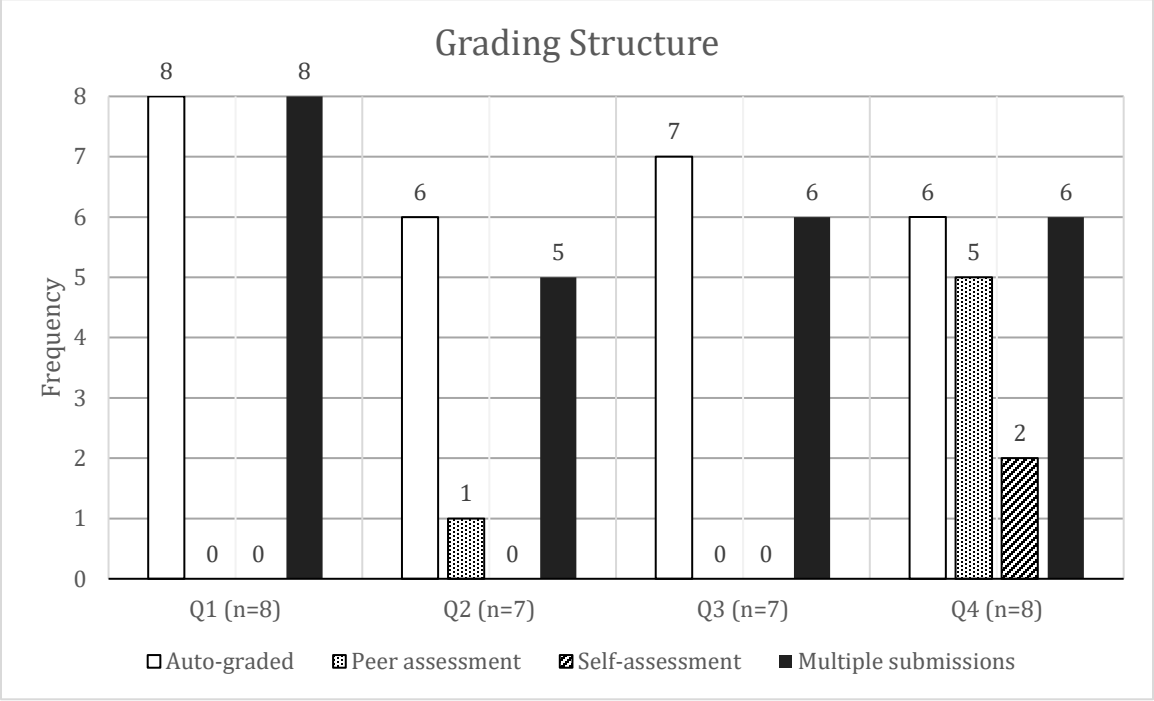

Figure F4. Count of courses in study with different grading structures, by quartile.

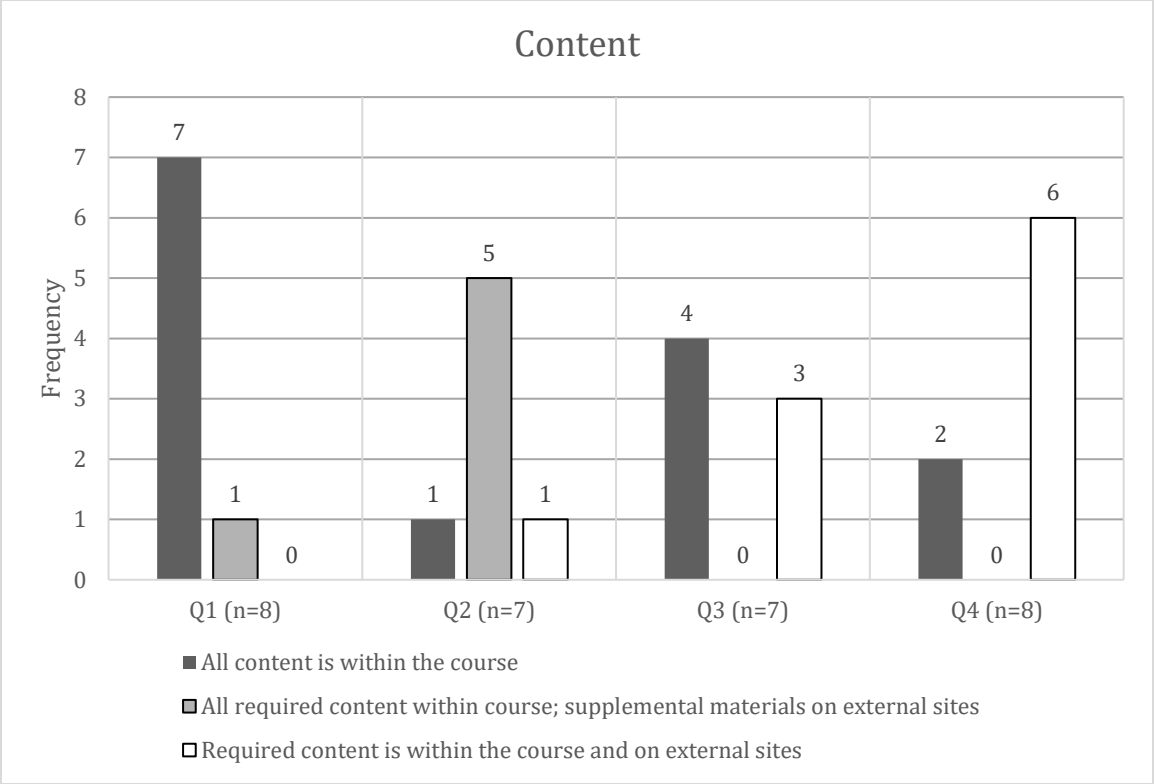

Figure F5. Count of courses in study with different access to content, by quartile.

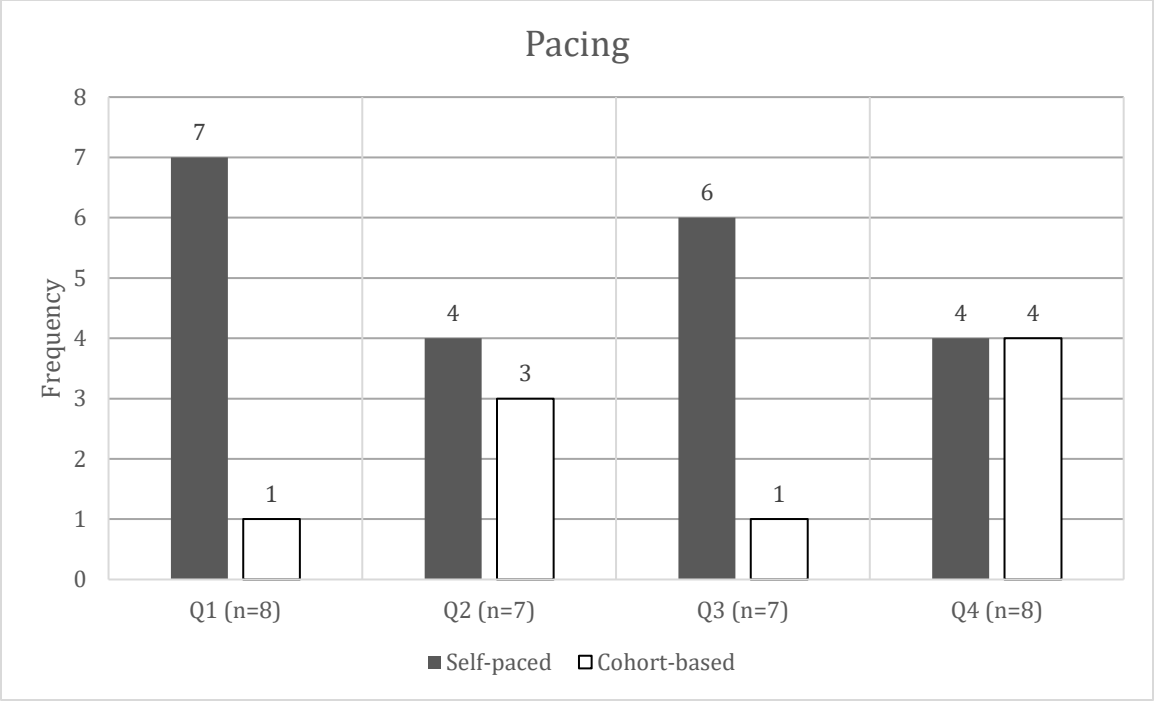

Figure F6. Count of courses in study with different pacing, by quartile.

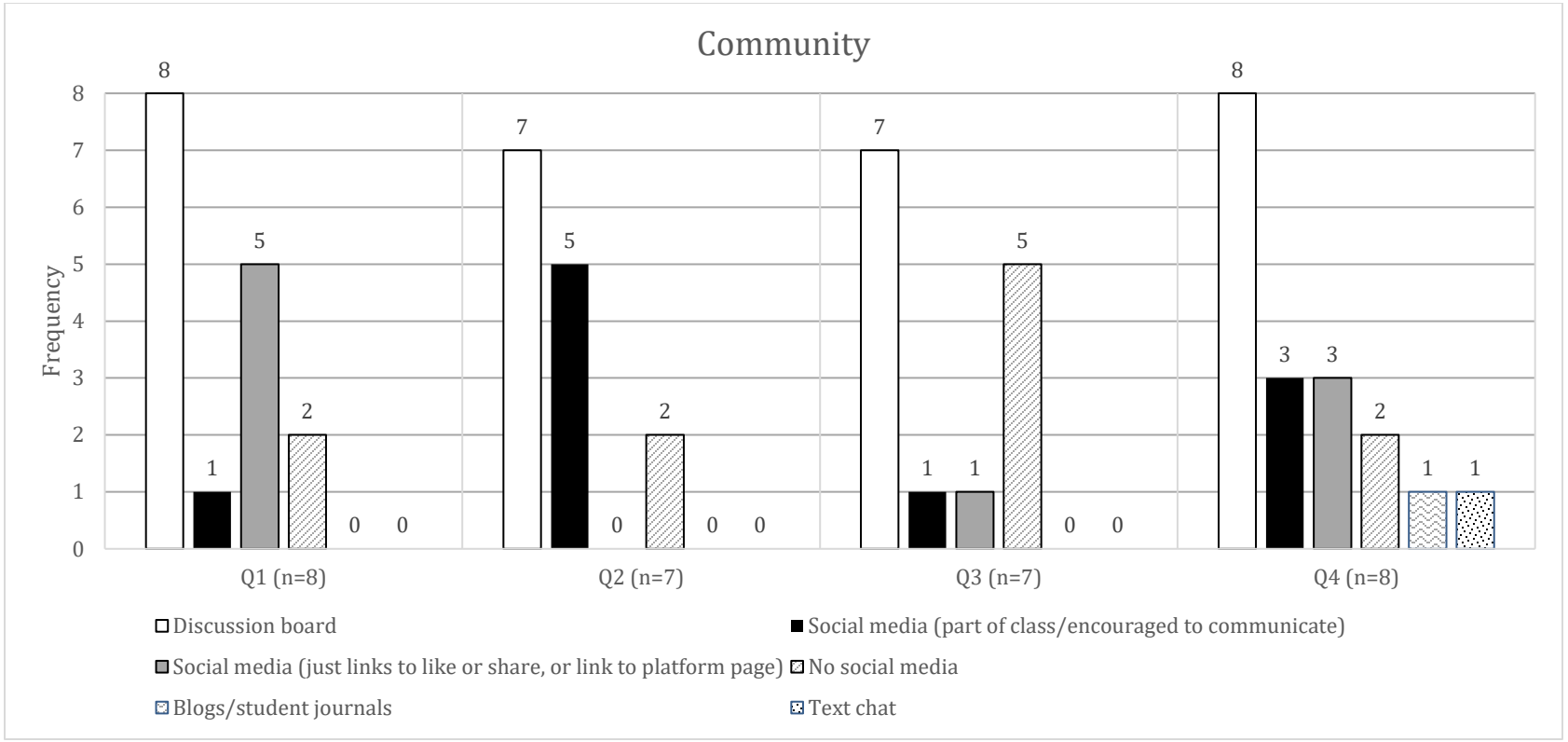

Figure F7. Count of courses in study with different types of community, by quartile.