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Crowdsourcing Cognitive Presence: A Quantitative Content Analysis of a K12 Educator MOOC Discussion Forum

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CROWDSOURCING COGNITIVE PRESENCE: A QUANTITATIVE CONTENT ANALYSIS OF A K12 EDUCATOR MOOC DISCUSSION FORUM

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Abstract

Massively Open Online Courses (MOOCs) offer participants opportunities to engage with content and discussion forums similar to other online courses. Pedagogical components of MOOCs and the nature of learning are worth of examining due to issues involving scale, interaction and the role of the instructor (Ross, Sinclair, Know, Bayne & McLeod, 2014). The Community of Inquiry (CoI) framework provides a basis for measuring cognitive presence in online discussion forums. As voluntary point of entry to a community of learners, it is important to consider the nature of participant contributions in terms of cognitive presence. This study focused on an educator MOOC because MOOCs have been proposed as an efficient vehicle for providing professional development due to the significant self-identification of participants as educators (Ho et al. 2014).

Participant attributes have been categorized, however the discussion forum is difficult to study on a massive scale (Kizilcec, Piech, & Schulz, 2013). Automated measures of cognitive presence may not provide the full view of learning behaviors implicit in messages posted to the forums (Wong, Pursel, Divinsky & Jansen, 2015). To address this gap, the forum messages were hand-coded and analyzed using quantitative content analysis (Neuendorf, 2002). The study found that the measure of exploration increased over the duration of the course. Viewing cognitive presence over time provided a new metaphor for explaining the proportions of cognitive presence in the discussion forum of an educator MOOC. This finding suggests that increased instructor presence during the later stages of the course may increase cognitive presence over time (Akyol & Garrison, 2007; Garrison & Cleveland-Innes, 2005).

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CHAPTER 1: INTRODUCTION

The impact of Internet access has transformed knowledge sharing. Open Education Reform (OER) emerged as a concept prior to 2000, and by 2002 it went global (Kernohan & Thomas, 2012). Instructional models of the 1940s were transformed from passive to active delivery mechanisms capable of promoting student interaction (Maniar, Bennett, Hand, & Allan, 2008). Internet delivery in the late 1990s provided both synchronous and asynchronous activities, expanding the ways students collaborate and share knowledge (Kumar, 2010; Merkt, Weigand, Heier, & Schwan, 2011). Student interactivity plays a key role in learning performance outcomes (Delen, Liew, & Willson, 2014).

Massively Open Online Courses

Concurrent with the development of large-scale educational delivery, the business sector developed ways to leverage Internet access and interactivity by tapping into consumer knowledge on scale. Howe (2008) referred to this as crowdsourcing. It led to adopting the term prosumer, proposed by Toffler in 1980 as part of the post-industrialist model. in crowdsourcing, the consumer assumes the attributes of both a consumer and a producer. This level of engagement between parties allows businesses to explore ways to improve or market their products and services (Ziemba & Eisenbart, 2016). The connection between the post-industrialist models parallels the model higher education employed in the formation of massively open online courses (MOOCs). In MOOCs, the instructor seeks to expand the scope of the course by scaling up the pedagogies to engage

participants. Students assume the role of prosumers in MOOC Discussion Forums by both seeking and sharing information that leads to content creation.

In 2008, Siemens implemented a crowdsourcing strategy by opening a previously closed course to the public. Siemens' first official course was called PLENK 2010, which stood for personal learning environments, networks and knowledge. According to Baggaley (2013), courses like MOOCs began occurring from 2007 onward with varying degrees of openness and experimentation. Siemens extended participation to all members of the community and encouraged a co-creation model of knowledge construction he termed Connectivism because it embraced all communication platforms in support of the educational objective (Siemens, 2008).

Problem Statement

MOOCs are a relatively new phenomenon or, as Christiansen (2013) called them, a disruptive innovation in the educational field. Peer-reviewed studies on MOOCs date back to 2008 (Liyanagunawardena, Adams, & Williams, 2013). Data analysts have experienced difficulties making sense of MOOC participation because most registrants do not complete their courses (Kizilcec & Piech, 2013). According to Anderson, Huttenlocher, Kleinberg, and Leskovec (2014), MOOCs still remain largely misunderstood despite the widespread interest in them and the availability of data about them. Veletsianos and Shepherdson (2016), who produced an in-depth analysis on MOOC research from 2013-2015, determined that the preferred method for data collection is surveys and automated methods, which indicates a need for alternative approaches to data analysis. Other issues such as feedback and the need for peer review evaluations challenge researchers to examine the effectiveness of the content delivery, the

instructor, and the overall pedagogical approach (Smith, 2013). The xMOOC is said to employ a Behaviorist approach to learning; however, studies indicated that participants use social media to continue their conversations and build relationships (Ebner, Lackner, & Kopp, 2014; Hew & Cheung, 2014).

MOOCs may be less of a container and more of an incubator for knowledge due to the self-directed nature of many participants (Reeves & Hedburg, 2014). Little is known about the value of the relationships formed by educators within MOOC discussion forums. Outside of MOOCs, there are links between positive student-teacher relationships and student engagement (Roorda, Koomen, Spilt, & Oort, 2011). Critical Friends Groups are an example of a professional relationship that has been shown to improve learning (Boudreau, Serrano, & Larson, 2014; Costa & Kallick, 1993). It is likely that online relationships established within MOOCs play a similar role in creating community.

Ideally, discussion forums should provide participants with room to form relationships and to create communities of learning, but it is difficult to observe what happens on a massive scale. A gap exists in the literature that would allow researchers to have a better understanding of the level of engagement in the discussion forum aside from message counts. Discussion forum participants have been studied to observe their posting behavior and to qualify the participants' posts (Kizilcec et al. 2013). It is useful to consider what cognitive levels a crowd may produce. The idea that self-directed learners are choosing to participate actively in the discussion forum represents some level of cognitive presence. In order to examine messages holistically for cognitive presence, this study examined one educator MOOC over an eight-week period. The problem this study

addressed is the gap in the literature about whether or not patterns of cognitive presence exist in MOOC discussion forums.

Purpose of the Study

The purpose of this study was to fill the gap in the literature related to MOOC Discussion Forums and cognitive presence. This study investigated the dynamics of participation between educators in a university-level MOOC using the legacy Coursera format. Participant posts were analyzed for cognitive presence levels (CPLs) using messages posted to the discussion forum. The decision to observe messages holistically over time came was based on the idea that course completers are a measure of MOOC success or failure. When the average completion rate ranges between 7-8% it has been suggested that this is a poor metric for the viability of MOOCs (Ho et al. 2014; Nguyen, 2015). This study sought to answer the research question in seven parts as follows:

RQ: Are there patterns of cognitive presence in the MOOC discussion forum?

Part 1: Is there a pattern of cognitive presence from weeks one to eight of the course?

Part 2: Is there a pattern of cognitive presence among demographic subgroups based on educator levels including: elementary, middle school, high school and school administrators?

Part 3: Does the proportion of cognitive presence vary by thread length in each of the five thread length categories?

Part 4: Is instructor reply associated with a pattern of cognitive presence?

Part 5: Is instructor reply associated with thread length?

Part 6: Does cognitive presence mirror the intended pedagogical scaffolding established in the three phases of the course?

Part 7: Is there a pattern of cognitive presence between comments and posts?

Significance of the Study

Many aspects of this research contributed to the study of K-12 teacher professional development and instructional technology. The formation of community is a critical element in teaching and learning (Garrison, 2000). MOOCs provide a challenge for instructional designers because they attract crowds, not manageable groups or predefined communities of learners. The pedagogical tools used in a traditional online course are also used in MOOCs. The discussion forum is considered a tool capable of building community through social interactions (McDonald, 2007).

One goal of this study was to identify literature that can help with identifying new ways to evaluate how online ecosystems such as MOOCs produce evidence of socially constructed knowledge. To date, such literature does not exist, but research by Kanuka and Anderson (2007) has shown that knowledge construction and social interaction are partners in a metacognitive process. As a disruptive innovation, MOOCs may not go far enough to explore the potential for learning because they apply the traditional methods for online pedagogies including discussion forums. Examining the levels of cognitive presence in a MOOC discussion forum may provide insight into community formation. Self-directed learners are attracted to MOOCs and may function without instructor interaction (Milligan, Littlejohn & Margaryan, 2013). Larkin (2002) provided rationale for online scaffolding of course instruction and finding ways to increase interactions that may lead to more substantive and satisfying experiences. This can be applied to MOOC design by scaffolding discussion forum questions over the course (McAuley, Stewart, Siemens, & Cormier, 2010). Literature is needed that addresses methods for

understanding the impact of discussion forum activity as a measure of cognitive presence. Such literature could guide MOOC designers in building better courses for K-12 educators.

Contextual Framework

Initially, MOOCs were offered under a variety of different conditions. Experimentation in learning began in higher education. Like most innovation, MOOCs started independently of one another. In 2008, Athabasca University professors Siemens and Downes (Siemens, Downes, Cormier, & Kop, 2010) opened their course to allow for a massive participation via social media, as did David Wiley of Utah State University in 2007 (Fini et al., 2008). Fini et al. (2008) described their experiences as participants in unprecedented confluence of informal and formal education en masse. The xMOOC is considered the commercial version of a massively open online course because it allows for monetization. HarvardX and MITx were both founded on the principles of access, research, and residential education (Ho et al., 2015). Expectations for MOOCs based on projections for large number of participants and an opportunity to monetize learning in order to pay for course development made MOOCs appealing to institutions of higher education (Hollands & Tirthali, 2014).

MOOCs have begun charging fees based levels on the level of participation. Anyone wanting to earn a badge, certification or college credit must elect to do so early in the course and pay in advance for completion. Ivy League universities, including Massachusetts Institute of Technology (MIT), Harvard, and Stanford, have developed MOOCs (Moe, 2015). These courses are primarily math, science, technology and

engineering courses instructed by world-renowned professors who are experts in these fields.

Studies about completion rates and participant demographics suggest that participants seek to satisfy their curiosity and to gain access to free professional learning. MOOCs have historically low barriers to registration by minimizing the demographic data collected as part of that process (Hansen & Reich, 2015). Due to the growing need to educate teachers in new online practices, Seaton, Coleman, Darie & Chuang (2014) suggest that MOOCs should target educators as potential participants for professional development.

MOOCs provide a low-cost way to deliver content on a massive scale. As such, school districts facing budget cuts find this as an appealing alternative to other forms of professional development (Vivian, Flalner & Falkner, 2014). MOOCs are offered on scalable platforms such as Coursera, one of the top three MOOC providers (Class-central, 2016). According to Vivian et al. (2014) these platforms enable completion certificates for participants, or badge structures and they also provide a unique venue for potential teacher collaboration and community building at the learners' discretion.

Students need to learn how to think critically using written reflection. In a social constructivist context online, this means participating in discussion forums (Vygotsky, 1978). Awareness of thinking is known as cognitive awareness, which is fundamental to developing higher order thinking skills. Online courses can provide communities for learners and challenge learners to improve their fundamental communication skills. Reading, writing, and reflecting within a structured, collaborative discussion forum can improve learning outcomes. If teachers are going to improve these skills, they need to

know how to actively participate in discussion forums to form new communities of practice (Thomas, 2002). A community of practice provides a theoretical framework for examining the health and sustainability of a course (Wenger, 1998).

In the growing contingent of MOOC course offerings, education courses represent over 9% of all courses offered. In theory, the opportunity to commune with like-minded, individuals from around the world is appealing, but the reality of discussion forums in large-scale courses tells a different story. Pedagogical approaches to MOOC delivery mirror traditional epistemological approaches (Swan, Bogle, & Van Prooyen, 2015; Staubitz, Renz, Willems, & Meinel, 2014). Staubitz et al. (2014) supported the notion of increasing interaction between participants by drawing upon their existing social networks.

K-12 Educator Professional Development MOOC

Public school educators are products of the higher education system. In addition to seeking higher education for career advancement, educators are required to obtain regular professional development (Darling-Hammond, 2006). The delivery methods for professional development are shifting. Online alternatives now supply educators with unique opportunities to address individual needs as self-directed learners. K-12 education is in flux, attempting to establish new practices that adopt and adapt to constantly changing technological affordances. Initially, the technological affordances were limited to devices and Internet access.

Increasingly, classroom teachers are being asked to personalize education by leveraging technology. This challenge arises in part from new opportunities for teaching and learning that allow for customization and individualized educational pathways using

cloud-based software programs. A number of approaches to blending the curriculum have been developed as classroom models available to teachers who seek to implement and develop innovative classroom pedagogical practices (Christenson, Horn & Johnson, 2008; Horn & Staker, 2014).

The increased pressure to provide online teaching and learning alternatives has driven educators at all levels of K-12 to seek professional development aligned to the blended models of teaching (Horn & Staker, 2011; 2012; 2014). Based on the research since MOOCs first glimpsed the horizon in 2008, teachers categorically have become the largest group among MOOC participants (Reich, 2015). MOOCs offer university-level courses and provide completion certificates for a nominal charge to anyone, including K-12 teachers. These certificates provide professional learning credits.

Education is mired in a sea of competing initiatives established in an attempt to close the K-12 learning achievement gap. Added to this complex problem is the adoption of blended learning models and pedagogies intended to leverage Internet access. Schools continue to be subject to the impact of policy change and government funding. After years of addressing the issues of diversity and achievement, largely using quantitative measures and performance incentives, the focus on how to improve education has expanded. It now includes online alternatives that support communities of practice and leverage technology infrastructure (Schlager, Fusco, & Schank, 2002).

School leaders are asked to build teacher capacity. Teacher capacity should be reimagined beyond optimization models (Baran & Correia, 2014; Dawley, Rice, & Hinck, 2010; Miller, 2007). The capacity for learning should not be underestimated; learning cannot be contained, and, more and more, situated learning takes place in the

periphery of a Community of Learners (Dufour, 2004; Lave & Wegner, 1991). Learning in informal settings may lead to a badge or certification as proof of participation and or completion. The value of peripheral learning for overall teacher professional development bears consideration, including the use of MOOCs.

Communities of Practice

In view of the high proportion of MOOC educator-participants, researchers have been quick to suggest that these significant numbers justify forming MOOCs specifically designed to meet the professional learning needs of educators. A review of the literature showed that little is known about the teachers who participate in MOOCs because MOOCs protected user anonymity in accordance with educational reform policies (Farrow, 2016). Reich's (2015) study about the characteristics of educator participants in MOOCs showed that educators represented a higher proportion of discussion posts and represented a greater number of peer interactions in discussion forums than do students from other backgrounds.

Reich (2015) suggested that gaps in the research reveal a lack of focus on the particular characteristics that define educator motivation in terms of persistence in MOOCs. The groundwork laid by Rogers' (1995) theory of diffusion examined the adoption and diffusion of technological innovations, including criteria for identifying early and late adopters. While MOOCs as a whole have had wide scale initial adoption, their low completion rates appear to favor a rejection of the innovation. Uncertainty about the purpose of a MOOC may account for the change in behavior (Kostopolous et al., 2012). Participants who are new to large-scale learning may not view it in the same way they view traditional online courses. Participant behavior has been collected primarily

using follow-up surveys of MOOCs. These surveys exposed patterns of teacher-learner behavior within a CoI framework that models social, cognitive and teaching presence (Garrison, Anderson, & Archer, 2010).

Recognizing adoption patterns and student misconceptions about the purpose of a MOOC may signal an instructor to intervene. MOOC instruction requires adaptability. Technological affordances for learning and teaching are a moving target and require flexible alternatives for professional development. Teachers need to have opportunities to successfully network with other teachers to build knowledge, create open resources, and learn how to navigate the changing educational ecosystem successfully. Benefits for teachers as leaders in this effort may be realized once these educator pioneers are successfully identified.

Discussion Forums

Threaded discussion forums are tools for producing collaborative communities of learning (Dringus & Ellis, 2004). Interpreting the activity within a discussion forum poses a challenge for the instructor. Dringus and Ellis (2004) produced the SCAFFOLD, which stands for scale for forums and online discussion assessment, an instrument used to categorize contributions in an effort to determine presence and community within the forum of participation. In their study, content process and premise accounted for 60% of the variance. Guzdial and Turns (2000) noted that simply offering a discussion forum does not make it a useful tool; the instructor should use anchor topics to drive participants to the discussion forum. Their study used discussion thread length as a measure of sustained discussions. Mixed results indicated that the anchor plays a role in participation

levels. Tying anchors or topics to assessments and the curriculum makes them more relevant to student (Guzdial & Turns, 2000).

Rosé, Goldman, Zoltners, Sherer, & Resnick (2015) tasked themselves with designing ways to support CoI online (Garrison, 2010). To improve the threaded discussions, the researchers developed automated methods of analyzing the collaborative process triggering interactive support. Modeling techniques also produce emergent community structures within MOOC discussion forums. Hew (2015) studied student preference for instructor versus peer mediated instruction and found that 65% of participants preferred instructor facilitation.

Reasons for this included subject matter expertise, best a guiding the instruction, resolving conflicts and motivating students. Gašević, Adesope, Joksimović, and Kovanović (2015) addressed propositions that student-led discussions prove effective in producing deeper thinking as well as being a cost effective way to form community when scale is an issue. Kent, Laslo, and Rafaeli (2016) pointed out the centrality of interactivity, using a measurement of replies as one indicator, rather than counting the number of original posts. They found reply count to show significance as an indicator of interactivity.

Definitions of Terms

For the purposes of this study, the following terms are defined:

Blended Learning. Refers to the combination of online learning and traditional face-to-face learning within a formal educational setting (Christensen, Horn, & Staker, 2013).

Community of Inquiry (CoI). Based on the work of Dewey, CoI is provides a framework and a model for studying the formation of knowledge as implicitly social, represented by the confluence of three presences: teaching, social and cognitive. More recently, learner presence has been offered a role in this interaction (Garrison, Andersen, & Archer, 2011; Shea & Bidjerano, 2012).

Collective Intelligence. An individual's ability to interact effectively within its environment (Wechsler, 1964).

Communities of Practice (CoP). A community of practice is any group engaged in shared activities who also share knowledge about the activity in order to increase their expertise and solve problems (Wenger, 2000).

Crowdsourcing. A term made popular following the publication of The Wisdom of Crowds (Suroweiki, 2005). It can be used as a verb as an action related to harnessing the knowledge and skills of all participants to solve a problem or make a decision collectively online through a computer-mediated platform. Wikipedia is a common example of crowdsourcing; the TED Prize is a current example of global crowdsourcing projects.

Collaborative Learning. According to Dillenbourg, (1997) the definition varies based on the context of the learning and the interpretation of the elements of group size, quality of learning and learning output, and time as related to interactions both synchronous and asynchronous. He stated, "…the words 'collaborative learning' describe a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms, but there is no guarantee that the expected interactions will actually occur" (p. 5).

Discussion Forum. Discussion forums replace the face-to-face interaction found in a classroom. The instructor can moderate and modulate a discussion using posts, replies and intentional scaffolding of prompts within each lesson **(**Andresen, 2009). In a MOOC, discussion forums are asynchronous.

Disruptive Innovation. Typically viewed from a marketing perspective, a disruptive innovation provides an alternative for an existing product or service, which supplants the established method and allows for the growth of new business and new markets (Christensen, 2013). MOOCs provide an alternative delivery mechanism for global education and represent a disruptive approach to delivery.

Massively Open Online Courses (MOOC). These online courses are open to global audiences with unlimited potential for participation and opportunity to learn. This is an acronym. (Cormier, Stewart, Siemens, & McAuley, 2010).

Open Education Reform. Open education reform refers to the movement to share educational resources in an informal, intrinsically motivated context for learning and sharing knowledge **(**The Columbia Electronic Encyclopedia®, 2013).

Summary

This empirical study employed a quantitative content analysis to detect the cognitive presence in a MOOC discussion forum. The data collected provided insight into levels of cognitive presence within the group discussion forum during t referred to as course phases over the duration of the course. The CoI framework coupled with a Constructivist view of learning potential in social learning contexts provided a foundation for generalizing the findings. Discussion forums have long been held as a staple tool of online learning pedagogy (Thomas, 2002).

Kizilcec, Piech and Schneider (2013) suggest that despite the widespread use in traditional online courses; the scale of MOOCs poses problems for both instructors and participants when using discussion forums as CoI. There is some concern about the ability for discussion forums to serve an unlimited number of participants. Typically, discussion forums represent a community of learners, but this may not be true on a large scale. By sampling thousands of messages and coding them using the cognitive presence-coding schema (Garrison, Anderson, & Archer, 2010) produced data that showed cognitive presence in each of the three time periods was reported and evaluated.

This study was couched in the concept of freely formed communities of practice in a K-12 professional development MOOC designed for educators where discussion forum messages were the most granular evidence of reflective cognitive activity. The literature review in the next chapter will review the nature and characteristics of MOOCs, an overview of the pedagogies of online learning environments, the potential for K-12 online professional development as a MOOC and the central role of discussion forums in providing a context for student interaction with content and peers. This background information is essential in providing a foundation for this study. The literature review also will provide for the manual coding of the units of analysis and the role that it plays in the methodology and results chapters when looking for patterns of cognitive presence in MOOCs.

CHAPTER 2: LITERATURE REVIEW

Introduction

This study focused on a pedagogical tool common to both traditional and MOOC models, the Discussion Forum. The nature of MOOCs as open-educational platforms positions them as living studies of instructional design and human interaction. In a recent meta-analysis of MOOC research 39% of participants self-identify as educators (Ho et al., 2015). Seaton, Coleman, Daries, and Chuang (2014) surveyed participants and confirmed that a notable fraction of MOOC participants identified as teachers leading to an interest in addressing the professional learning needs of this segment of participants. Ebben and Murphy (2014) produced a study, which highlighted two phases of MOOC research from 2009-2013. Phase One of the study centered on learning theory, experimentation, and innovation, and Phase Two shifted focus to learning analytics, assessment and theory application (Ebben & Murphy, 2014). Research on MOOCs as a professional development tool is of particular interest given the study of social learning in a CoP and the changing instructor roles within MOOCs.

This literature review will:

- Identify gaps in the literature by examining MOOC research
- Contextualize MOOCs within Higher Education and K-12 Professional Learning

- Provide a theoretical framework to support the evaluation and categorization of messages by cognitive presence within a community of practice.

Theoretical Framework

This section describes the larger frameworks for learning and highlights learning theories specific to instructional design and content delivery supported by cognitive load theory. The purpose for including a review of research in brain-based instruction is to help construct a model for measuring the impact of MOOC instructor interventions. Schmid (2014) explained that simulations support cognition while presentations indicate a focus on content.

Three main learning theories inform online learning research: behaviorism, constructivism, and cognitivism. Learning theories offer a way of interpreting the context for learning, the way knowledge is constructed, and why participants behave as they do (Anderson, 2008). They address instructional approaches ranging from teacher-centered to student-centered, but what roles do they play in online instructional practices? A number of variables such as class size, diversity of students, and degree of digital delivery come into play. MOOCs suffer from issues of scalability and sustainability of engagement since they are intended to support the acquisition of knowledge and skills (Anderson et al., 2014; Coppola, 2013; Smith & Killen, 2013).

The behaviorist approach is teacher-centric (Muijs & Reynolds, 2002). An example of a behaviorist approach is an activity associated with memorizing laboratory safety procedures. Students must memorize and apply safety practices in a science lab in order to participate. Understanding of why may come later and may not be the initial

goal; rather, this goal is reflected in discrete behavior. An online student learns web-based social boundaries and Internet safety practices in nearly the same way.

The constructivist view builds on an existing knowledge base and looks to fill gaps in knowledge through scaffolding (Vygotsky, 1978). This can be accomplished in an online environment by creating peer-to-peer teaching activities (Molphy & Pocknee, 2005). According to O'Connor and Hayden (2008), context-base teaching and learning increases student motivation and engagement. McDonnell's (2007) research showed that context-based or authentic lab activities focused more on the process than the solution. Vygotsky (1978), the father of constructivism, explained that people create constructs of understanding within CoPs. Social constructivist learning involves interaction with peers. Social media plays a similar role in social-constructivism (Ashley & Roberts, 2012).

Cognitivists have advised instructional designers to account for cognitive load theory when designing online courses (McDonnell, O'Connor, & Rawe, 2012). Asking students to define vocabulary, learn formulas, or prepare diagrams can help reduce their cognitive load and increase receptivity to new concepts. Cognitive level will determine the need for scaffolding. Sweller (1988) defined cognitive load as the amount of mental energy expended in a student's working memory and Roadruck (1993) argued that students should participate only in labs aligned to their cognitive level. The literature reviewed here supports the notion that cognitive lead the may affect the student experience in MOOC discussion forums.

Online learning communities use the CoI framework to explain and support ways of investigating the effectiveness of online learning. Seminal evidence for endorsing the rigor of this framework came to light in research by Garrison et al. (2000). Later research

by Garrison (2007) provided models empirical research models founded on the concept of practical inquiry and based on Dewey's (1933) reflective thinking model. Garrison defined cognitive presence as "a cycle of practical inquiry where participants move deliberately from understanding the problem or issue through to exploration, integration and application" (2007, p. 65). The goal for employing the CoI model is to ensure that a course meets the requirements for providing a meaningful educational experience in higher education (Garrison et al., 2000).

Between 2009 and 2013, the CoI model became one of the top ten most cited sources referring to research by Garrison and Arbaugh (2007). Their earlier studies favored a self-reporting survey methodology of collecting data to obtain evidence of CoI presences among course participants. A recent meta-analysis on CoI studies (Befus, Cleveland-Innes, Garrison, Koole, & Vaughan, 2014) focused on measuring proportions of CoI components. Cognitive presence accounted for only 4% of the studies examined (Befus et al., 2014). Remesal and Friesan, (2004) stressed the importance of measuring social interaction and cognitive presence within online communities to ensure adherence to Social constructivist practices.

According to Garrison and Arbaugh (2007), online courses lacked a useful theoretical framework for evaluation. Davidson (2013) noted that many courses adhere to the cognitive-behavioral pedagogical approach, a teacher-centered approach to learning, based on Behaviorism (Skinner, 1963; Gagne, 1965). Constructivism, which is based on Vygotsky's (1978) theory of socially constructed knowledge, is the key learning theory associated with all types of learning, including online delivery. Research has provided evidence in support of online delivery as a means to link social interaction with learning

outcomes. Darabi et al. (2011) found that higher order thinking occurred when instructors implemented effective discussion strategies.

Anderson, Goode, Mitchel, and Thompson (2013) conducted a study in which a group of doctoral students responded to a survey using social constructivist approaches to forum discussions. The students reported that each method was appropriate for its specific application (Anderson, et al., 2013). In this study, the participants perceived value of the discussion forum led them to report that each method was equally appropriate. Akyol and Garrison (2011) found that perception of value is a key factor in discussion participation. Learner preference and satisfaction are also factors (Shea & Bidjerano, 2009; 2010). According to Balaji & Chakrabarti (2010), further research is needed to examine links among and between participation, interaction and learning. While DeWever, VanKeer, Schnellens, and Valcke (2010) found that asynchronous discussions promote knowledge construction, Cheung and Hew (2006) found that very little knowledge construction occurred in the discussion forums they studied.

If little knowledge construction occurs in the discussion forums, then it is important to consider other reasons for participation in MOOCs. Based on Anderson's Interaction Equivalency Theorem (2003), if any single interaction in the domains of peer-peer, peer-to-teacher or student-to-content is high, learning outcomes will not be impaired by reductions in the other two domains. This suggests that MOOCs may be successful for participants who can manage to maintain a high level in one of the three domains. Since instructor access is limited or nonexistent, MOOCs must rely on the value of peer-to-peer and student-to-content interactions to sustain the learning trajectory.

Griesbaum's (2014) study helps us consider the value of students as teachers in MOOCs as a way to improve online teaching methodologies.

Massively Open Online Courses

The educational ecosystem tends to produce near-sightedness among the ranks. The cloud of online learning options available to educators for their students has produced a fog that threatens to obscure decision-making. Educators have long endured a series of progressive pendulum swings, ushering in new eras of education. For example, the introduction of educational technology innovations like laptops occurred on a small scale but with budgetary constraints that meant teachers knew they had to wait to adopt new tools fully. In contrast, Whitworth and Chiu (2015) showed that the accelerated pace of change has educators concerned that professional development demands will exert continuous pressure on teachers to acquire new skills and dispositions as opposed to slower cyclical series of initiatives that drove PD in the past. A teacher's ability to keep pace with change is in jeopardy. Teacher-leaders who can navigate technologies are critical for school survival and student success (Whitworth & Chiu, 2015).

New frontiers in education focus on liberating educators from older research-based paradigms for practice and encouraging them to adopt new pedagogies consistent with personalized learning. In higher education, the open access movement gained momentum. Access to knowledge collectives online led to increased access to K-12 teaching materials. These conditions produced efforts to experiment with teaching and learning. Christensen (1997) introduced the concept of disruptive innovations as technologies that change the base and attract a new audience of consumers, just as MOOCs have attracted massive participation from around the world. Scale is one of the

disruptive aspects of MOOCs because it has created unforeseen challenges for the traditional online teaching paradigm. In order to compete in the online forum, universities faced a decision to either partner with for-profit companies capable of hosting a massively open online course, such as Coursera or to design their own scalable learning platorms such as EdX. It should be noted that Kay, Reimann, Diebold, and Kummerfield (2013) saw a lack of personalization in MOOCs and an opportunity to meet the needs of many learners by integrating adaptive systems that would inform learning progress and replace the instructors' presence.

MOOC Instruction. MOOC topics vary widely as do their pedagogical approaches. Conole (2013) produced the 7C's of Learning Design framework to evaluate existing MOOCs and to support future MOOCs to ensure quality and consistency for learners. This framework is similar to the CoI framework and may be used in addition to CoI to evaluate MOOCs. Within this framework, the role of the instructor may or may not play a pivotal role affecting student interaction online. Instructor commitment to MOOCs varies. Some instructors embrace the challenge and use social media to extend their abilities to connect with students, while others simply approve the course and passively observe the interactions generated by module instructions and assignments alone (Hew & Cheung, 2014). In MOOCs, widespread participation poses unique challenges involving scale and the perception of teacher presence by participants. The role of instructor is difficult to ascertain in a MOOC, as is a measure of instructor presence, which is typically measured by teacher-student interaction. Garrison and Anderson (2003) showed that the interactions between student and instructor in an online classroom could produce a meaningful learning environment.

Stakeholders should examine large-scale classes like MOOCs for evidence of instructional leadership to assess the evidence of instructional leadership informing the movement limit and change the role of MOOC instructors (Tirthali, 2015). Using leadership theories as a lens to analyze instructor psychological connectedness to MOOC courses and MOOC students may provide this insight. Northouse (2015) noted that instructors who employ distributed leadership are using a crowdsourcing approach to education, because the role of the participant is to assume responsibilities and to add value to the course.

Crowdsourcing

Crowdsourcing refers to a process of forming communities (Surowiecki, 2005). In his Wired article entitled, "The Rise of Crowdsourcing", Howe (2006) gave the term currency by noting that in the physical world, people and animals self-organize and form decentralized, interest-based systems to meet common goals. In the book, Wisdom of the Crowd, Surowiecki (2005) showed how crowdsourcing could generate collective intelligence used to find solutions to common problems. When crowdsourcing occurs (Surowiecki, 2005), the human computer interaction is mediated by discussion forums in the formation of subgroups and has an impact on participant learning outcomes. In an educational context, the instructor requisitions participants to join a class and to achieve a goal with support. Anderson (2011) described this as a form of directed crowdsourcing in which the leader or instructor, in the case of higher education, guides a large group to meet a set of standards and expectations.

Crowdworkers

For Nickerson (2013), crowdworkers, or participants, find the work attractive in some way. They may see a fit for their skills and knowledge, or they may desire to learn from others who are more adept in their areas of weakness. This sharing of ideas, knowledge, and skills produces value for participants. Motivating factors for participants include personal or professional curiosity about the topic, or course content, or task; networking for career connections or recognition; and obtaining materials or insights (Nickerson, 2013),

As crowdworkers, the participants are the students who arrive with varying skills and degrees of knowledge. They also arrive with independent ideas about their commitment to the course in terms of time, their motivation to learn, and their willingness to contribute to the group as a whole (Nickerson, 2013). Instructors and Learning Management Systems (LMS) have established mechanisms for aggregating and guiding the work in so far as they use strategies to motivate participants (Bigham, Ladner, & Borodin, 2011).

Why is it important to understand the relationship between MOOCs and crowdsourcing activities? MOOCs like the one in this study started off as free and open settings for volunteers to join. Lured by the topic, the instructor, or the promise of some form of credit, participants initially joined but then left MOOCs in record numbers, creating what Clow (2013) called the funnel of participation. Studies about MOOCs have tended to focus primarily on individuals, their motivations for taking and completing a course (Stewart, 2013).

Knowledge Metaphors

Knowledge is a complex construct often represented using a metaphor (Andriessen & Boom, 2007) because it does not contain an inherent structure. Take the following as an example:

> "…if you have an apple and I have an apple, and we swap apples — we each end up with only one apple. But if you and I have an idea and we swap ideas — we each end up with two ideas." (Brannan, 1949)

This quote from former Secretary of Agriculture Brannan illustrates the potential value in exchanging ideas. MOOCs are mediators of idea exchanges between individuals and groups. Interactions link the exchange of ideas and potential for knowledge construction. Nonaka et al. (2008) described knowledge as a product of interpersonal interaction. Interpersonal reactions may be asynchronous as in the encounter between reader and book or as in the discussion forum of a MOOC. Knowledge and the ability to think are abstract concepts and metaphors, like the physical exchange of apples as compared to the rhetorical exchange of ideas provide the structure needed to define them (Andriessen & Boom, 2007). A separate and competing trend has been to adopt problem-based learning models and increased opportunities for collaboration. Assessment takes place in an authentic context. The Table 1 below shows a comparison of MOOCs features and to crowdsourcing characteristics.

Table 1

Comparing MOOCs and Crowdsourcing Characteristics

MOOCs	Crowdsourcing Characteristics
Leader/seeking intelligent agents to fulfill an agenda for a nonprofit	Corporate or non-profit leader of self-organizing group seeking a prosumer relationship
Directed crowdsourcing	Directed or collaborative crowdsourcing
Volunteers	Volunteers or seeking remuneration
Interest-based community	Interest-based community
How can we help each other master this content?	How can we help each other solve this problem?
Multiple discussion forums to support dialog.	Multiple discussion forums to support dialog.
Individual goals, shared individual goals.	Shared goal for the group. Separate individual goals.
Problems with participant reliability or level of participation.	Problems with participant reliability
Workflow protocols include tasks, deadlines, rubrics, detailed instructions, forums all designed to address issues of quality and provide student support.	Workflow protocols to mediate issues: iterative improvement, parallel work, map-reduce, find, fix & verify, crowd clustering. Possible ways to improve consistency and outcomes.

Note. Original table based on research by (Kennedy, 2014; Kohler, 2015).

According to research on crowdsourcing projects in higher education, Solemon, Ariffin, Din, and Anwar (2013) showed that the crowdsourcing approach leverages the principles of collective intelligence by honoring diversity, independence, and decentralization and facilitates effective aggregation. Designers organize MOOCs to allow for diversity of thought, independent action, and some provide for decentralization

through sub-group formation (deWaard et al. 2011). The LMS aggregates the MOOC data. Examining a MOOC as a crowdsourcing event may change attitudes toward motivation if participants value the opportunity to engage in the task (Solemon et al., 2013). One consideration for designing courses to resemble crowdsourcing opportunities is to examine crowd behaviors over time. Examining the levels of cognitive presence in the discussion forums provides a window into group dynamics (Kanuka & Garrison, 2004). The xMOOC in this study provided insight into the behavior of independent, volunteer participants who chose to share their thinking with other forum participants.

Learning analytics

Data mining harnesses indicators of interaction and activity from a LMS platform. Chesbrough (2003; 2007) provided a look at open innovation in industry and the potential to harness distributed knowledge by capturing the value of open innovation contributions. Since 2008, the online segment of the education industry developed to meet the needs of large-scale data, particularly given the scale and opportunity for research in the MOOC field. Optimizing education at scale is a great challenge. Siemens and Baker (2012) identified two groups who emerged as leaders in the field of education. One group, the Educational Data-Mining group, obtains data from computer-mediated learning environments to show how students behave in those contexts. This data serves to inform interventions or system changes that better meet students' learning needs. The other group, called the Learning Analytics and Knowledge, differs somewhat in that it acknowledges the lead role of a human decision-maker as interpreter of the data to meet stakeholder needs.

This study aligns most closely with the Learning Analytics and Knowledge philosophy by striving to combine the human interpretation of textual data with observable patterns in the data analysis of a MOOC. In addition to the Educational Data-Mining and Learning Analytics and Knowledge, Social Network Analysis provides the additional strategy for observing the interactions in social networks. Researchers can even mine social networks within closed systems or platforms like MOOCs to produce visual displays of collaborative structures and social interactions (Otte & Rousseau, 2002). Shea et al. (2013) used a mixed-methods approach that combined quantitative content analysis with Social Network Analysis. When they used the CoI framework to compare the results to the Social Network Analysis, they found a correlation between self and co-regulation within their networks.

Cognition

As previously stated, knowledge as a concept lacks an inherent structure. Using metaphors promotes a clearer understanding of this concept (Andriessen & Boom, 2007), and context-mediated interactions generate knowledge (Nonaka et al. 2008). Knowledge and cognition differ from each other in that cognition facilitates the absorption of knowledge, with the level of cognition in cognitive presence having a link to higher-order thinking levels (Bloom, 1968). Mastery is the difficult to assess and often misunderstood, application of knowledge (Guskey & Anderson, 2013). For the purposes of this study, the researcher recognizes the level of collective intelligence as indicated by the levels of cognitive presence for each phase of the course and for each of the three main participant groups in the course.

MOOC Instructional Strategies

This section includes a review of instructional strategies, discussion, peer grading, and assessment types. The Open University of Toronto MOOC Initiative (2014) reported several priorities for exploring the impact of MOOCs as a pedagogical conduit. They stated the need for evaluating pedagogical models, design support, building capacity and developing better ways to collect data for future research. Pappano declared 2012 as the year of the MOOC (Pappano, 2012), and Steward (2013) pointed out the need to explore the connections between learning and pedagogies.

MOOCs may differ in structure and intent based on content. In a recent study by Horton (2014), a STEM course used a teacher-centric approach, leading to mastery with heavy content creation. Course design informs learning outcomes that guide the types of activities required to support the instruction. They also suggest the type of learning analytics necessary to help facilitators adjust the pedagogical approaches. Most MOOCs score poorly on instructional design and high on organization and presentation of materials. (Margaryan, Bianco, & Littlejohn, 2015). Margaryan et al. (2016) evaluated 76 MOOCs (a combination of xMOOCs and cMOOCs) using Merrill's (2015) five design principles to reach this conclusion.

MOOCs: Learning Theory

This section identifies literature about online instructional strategies. Learning strategies that work in face-to-face settings may not translate into online environment (Wuensch, Aziz, Ozan, Kishore, & Tabrizi, 2008). Using a psychological approach to learning theory, research has shown ways that science of learning can be applied to pedagogical approaches in the classroom (Benazi, Overson, & Hakala, 2014). Several

areas of cognitive research stand out as challenges to the online environment. Many studies have identified challenges related to cognitive load theory and expertise reversal (Sweller, Ayres & Kalyuga, 2011), effective feedback (Hattie & Timperly, 2007), student disposition (Willingham, 2009), the continuum of active learning and retention (Chi, 2008), and self-explaining (Chi, Leeuw, Chiu, & LaVancher, 1994).

Introduced as a new online learning theory in 2008 by Siemens and Downes, Connectivism is the type of learning made possible using a cMOOC. Dave Courmier (2008) coined the phrase MOOC because of similarities between the massively open online gaming community and the new open educational model. The name stuck, and ignited fervor for exploration. Subsequent courses that employed this model, cMOOCs, diverge from their next generation counterparts, xMOOCs, which use a less-open educational approach by directing participant interactions.

For some university professors, MOOC exploration has focused on ways to leverage social media by allowing students to act rhizomatically as content co-creators of the course (Mackness & Bell, 2015). This means that students are on a level playing field with instructors as content creators. The absence of a hierarchy within a framework is similar to the crowdsourcing strategy. In a cMOOC, the learners actively construct knowledge through social interactions as the facilitator yields control of the learning process. For some instructors, the allure of increasing professional notoriety, the production of education for the masses, or an opportunity to monetize and scale education for universities seeking to increase their income has made MOOCs a source of untapped potential. MOOCs already have disrupted the distance learning landscape (Conole, 2015).

Theoretical implications

MOOC studies are still in the process of maturing as a well-researched segment of the learning industry (Raffaghelli, Cucchiara, & Persico, 2015). MOOCs moved from the experimentation phase between 2009-2011 to the current phase, which showed a shift from experimentation to monetization. Conceptually, MOOCs are platforms leveraging a social constructivist framework as defined by Vygotsky (1978) and Piaget (1950). The nature of social constructivist learning and the pedagogical implications for online learning make MOOCs fertile ground for experimentation. George Siemens asked, “Can 200,000 students really be taught by one professor, a few teaching assistants and some clever algorithms?” (2015).

Equitable access to education

MOOCs were a potential revenue source for higher learning (Raffaghelli et al., 2015). As a disruptive innovation, they raised concerns about the equity and ethics of course delivery and the management of the massive datasets. According to Liyanagunawardena et al. (2013), MOOCs must overcome design and delivery issues from a cultural perspective in order to meet the needs of a global community of learners. Design and delivery must meet the user experience demands of a global audience. In countries where cell phones are the primary devices and where bandwidth issues interfere with file downloads, populations experience difficulty participating in online courses.

Innovative pedagogies

MOOC innovations focused on finding ways to incorporate pedagogies that would increase student engagement and motivation. Given such large participant pools, some researchers became interested in understanding which factors maximize retention-

potential as a way to measure the overall effectiveness of a MOOC (Boston et al., 2014; Hill, 2013). Clow's (2013) funnel of participation metaphor describes the decline in participation in large-scale social learning networks. Applying this metaphor suggests that MOOCs should expect a steep drop off in participation, because not all participants have the same motivation for continuing and completing the course. Filreis (2014), whose interests centered on participants forming relationships within the context of the course, supported the notion that MOOC completion is relative to the individual rather than to the course itself.

Themes in MOOC Research

The interest in MOOC research grew primarily from the higher education sector. Gasovic et al. (2014) recently conducted a large-scale content analysis on MOOC research. Findings revealed that the social learning theme attracted the greatest interest as an area for funding future MOOC research. The study concluded that social knowledge construction and individual learning experiences might be more akin to Connectivist principles than previously considered (Siemens, 2005). This is in contrast to the knowledge transmission model associated with Coursera and other xMOOCs (Smith & Eng, 2013).

Salmon et al. (2015) explored the topic of MOOC structure by investigating the potential for external structures found in social media to support social learning. These researchers suggested that MOOC instructional designers should consider participant preferences for formal and informal methods of social learning by providing choices rather than requirements to extend their learning networks to informal spaces.

Engagement

Much of the initial research on MOOCs centered on completion rates and learner demographics (Jordan, 2014). Researchers have developed participant profiles to help predict which participants are most likely to complete a MOOC (Kizilcec et al., 2013). Clow (2013) identified patterns of user behavior and characterized them using his funnel of participation model, which showed a steep decline in activity after an initial burst of engagement. Engagement, a cousin to participation, shares the idea of adding value to self or community. Raschid et al. (2009) devised a method for exploring ways to provide feedback to participants about the value they add to an online community. The results confirmed that explaining value increases participation when the participant identifies as a member of the community. Cognitive presence as a characteristic of CoI, adds strength to both the participant and the learning community.

Issues with MOOCs

Reich and Ho (2014) studied 39 MOOCs and found an average completion rate of 9.8% adjusted for active users, which accounted for 50% of all enrollees. Hew and Cheung's (2012; 2014) MOOC study suggested four challenges: (1) student assessment, (2) lack of timely feedback (3) time intensive and (4) low participation in discussion forums. The results of these two studies indicated that the challenge seems to be scaling these areas to support learning.

Students in some MOOCs reported a sense of solitude and futility in participating when they received no feedback. In a meta-study of MOOC pedagogical tools, Toven-Lindsey, Rhoads, and Lozano (2015) considered the quality of MOOC instruction by examining the learning experiences provided for students. Despite differences in scale,

researchers found little attention to new pedagogical approaches addressing the disparities presented by scale and student learning outcomes. The findings from these studies suggested that building community is problematic for MOOCs.

The potential economies of scale afforded by MOOCs set off an Ivy League race to explore the potential for monetizing intellectual property and branding names of the institutions and professors alike (Daniel, 2012). In Christensen's (2012) estimation, MOOCs are a symptom rather than a solution: they represent an attempt to keep up with accelerated change by helping participants maintain skills and extend knowledge. If MOOCs are in fact a response to greater training needs, then the K-12 teaching population is the single greatest professional demographic (Ho et al., 2015).

Examining the Role of Instructor

Since MOOC delivery does not support a traditional teaching model, how do MOOC participants interact with the instructor? Do instructors employ leadership theory in their instructional models? MOOCs vary widely in their individual characteristics, demographics and learning objectives. Instructor involvement also varies widely. An important aspect of this study was to extract evidence from current research about instructor roles and the potential impact of instructional leader interaction in MOOC discussion forums. Large-scale classes may challenge the ability of instructors to model transformational teaching, which, according to transformational leadership, should reach all participants (Northouse, 2014). The degree to which instructors take ownership and motivate students in MOOCs may make an impact on student engagement in large-scale courses.

Bonk (2015) assembled a guide to MOOCs and open education to help the community understand this amorphous entity. The authors who contributed to the guide called for more research and experimentation of this massive area of educational research (Bonk, 2015). Some desired social justice and equity in global education through MOOCs. Others called for ways to make higher education more profitable (Breslow, Pritchard, & DeBoer, 2013).

Raffaghelli et al. (2015) sought to examine the nature of MOOC scholarship. They identified 60 MOOC studies and found that three journals accounted for nearly half of the published studies. These journals included The International Review of Research in Open and Distance Learning, eLearning Papers, and the Journal of Online Learning and Teaching. The authors categorized the studies into nine separate approaches, isolated the methodological paradigms, and provided a critical review and comparison of the results. One third of the studies fell into the category "Learning Process in MOOCs", while "MOOCs for Institutional Development", "MOOC Pedagogy", "Contributions of MOOCs" and "Design for Learning in MOOCs" represented the focus of over half of the remaining papers.

In terms of paradigms, one third of the papers addressed the conceptual and theoretical implications for MOOCs. Raffaghelli et al. (2015) suggested that mixed-methods papers neither clarified their positionality nor built a case to support their research questions. In terms of methods used for data collection, the conceptualizations describing MOOC characteristics were most prevalent, followed by the use of survey instruments. Data analysis revealed that most studies were exploratory rather than experimental and used descriptive statistics rather than factor analysis. This trend became

visible using learning analytics, because all LMSs produce clickstream data automatically.

Recommendations

The meta-analysis by Raffaghelli et al. (2015) provided the basis for a rationale to adopt non-traditional methods of data collection that focus on the process rather over product and to engage in experimental design rather than post-course data analysis. Swan, Day, Bogle, and van Prooyen (2014) conducted a pilot study to assess MOOC pedagogies. Their assessment involved rating a collection of MOOCs on 10 pedagogical dimensions, each with a five-point scale. Initial findings suggested that the greatest differences between knowledge acquisition, participation and self-direction. Ho, Stump, and Breslow (2014) identified relationships between MOOC participants and their self-directed behaviors and suggested this as an area of further study. Since the MOOC in this study allowed for self-direction in the discussion forum, the notion of peer-to-peer interactions and their ability to generate cognitive presence will be addressed in a later chapter.

In their collection of articles entitled “MOOCs and Open Education Around the World”, Bonk, Lee, Reeves, and Reynolds (2015) examined seminal works on MOOC studies. Bonk et al. (2015) considered the past, present and future impact of MOOCs on education and connected the MOOC concept with that of Open Education Reform. The report contained a section about applying MOOCs in teacher professional development that contributed to the development of this literature review. Reich’s (2015) paper “Rebooting MOOC Research” emphasized the need to understand the learning rather than the participant behavior. Reich, who is an Edx researcher, suggested using intentional experimental design built into the MOOC course structure. In order to

accomplish this large-scale task, Reich recommended promoting inter-university collaborations and initiatives. In a MOOC study spanning three years, Kennedy (2014) concluded that pedagogical barriers to completion exist. The cMOOCs structure applies an open learning philosophy that is fundamental to Connectivism (Siemens, 2004), while the Coursera-type course fosters a more traditional form of teacher-directed learning (Kennedy, 2014).

Rationale for MOOCs

Over the years, communication technologies have evolved. Changes in technological affordances, specifically in two-way interactions, have made online education a viable alternative to face-to-face instruction (Zhao, Lei, Yan, Lai, & Tan, 2005). Zhao et al. (2005) found that increased student-to-student interactions and student-to-instructor interactions led to improved learning outcomes. Enrollment in online programs continues to soar based on a survey of 2,800 colleges and universities in the United States (Allen & Seaman, 2014). This survey revealed that universities offer MOOCs for four primary reasons: to increase institutional visibility, to recruit students, to implement innovative pedagogies, and to offer flexible learning options. The survey also identified sentiments demonstrating that MOOCs may prove to be an evolutionary step in the quest for ever-growing innovative online learning pedagogical approaches. Means, Bakis, and Murphy (2014) explained that universities are adapting to online learning through the proactive development of MOOCs.

Social learning is related to the formation of communities of knowledge builders. Informal collaborative communities are plentiful online. Rovai (2002) pointed to the need for establishing a community of learners to support online instruction. Thompson and

McDonald (2005) found that student perceptions of learning correlated positively to their perceptions of community. Gladwell (2001) introduced the term “social contagion”, which refers to crowd psychology and shows how crowds grow from initiation to propagation and, ultimately, to termination once the crowd drivers become exhausted. In online environments, propagation takes place through seed members who attract and assist new members. This interaction is akin to the concept of swarm intelligence introduced by Bonabeau (2004), which highlighted the difficulties in forming communities because of their unpredictability. In view of the vast scale of participants in a MOOC, the likelihood of online communities forming is questionable.

Online Course Standards and MOOCs

This section explains the range of methods for evaluating and delivering online instruction. Bernard (2014) defined classroom instruction, distance education, and blended learning as contexts for learning. Bernard’s study (2014) defined blended learning as having a minimum of 50% of a student’s time online rather than in class. MOOCs, a form of blended learning, first emerged in 2009 as part of the growing Open Education movement (Siemens, 2009). The effectiveness of the pedagogy modeled in online courses corresponds to the effectiveness of the learning. Student collaboration and teacher-directed expository studies indicate the presence of an active learning environment, which is associated with deeper learning (Bernard, 2014; Means, 2013).

It is interesting to note, that while MOOCs maintain the acronym, they rarely retain the intention of the original meaning of the acronym. Fuller (2015) explained that open education means there is no barrier to entry and the course is free of charge and free of place and pace. In fact, the open education movement has established learning

materials that have minimal Creative Commons copyright restrictions and may be remixed and reused by anyone. In this study, the instructor complied with this aspect of open education by making certain all course materials were freely available. The course, however, had the typical Coursera limitations on pace and, in part, on place. Place is defined as keeping the course activities in one place rather than distributing them onto other Internet platforms. The locus of control rested within the Coursera LMS.

One of the issues challenging MOOCs may be addressed by research that compares instructor replies with the measure of cognitive presence found in discussion forum messages. Previous research measured enrollment versus completion rates (Khalil & Ebner, 2014). Surveys detailing student perceptions and attitudes have been collected and analyzed qualitatively to develop participant profiles (Hew & Cheung, 2014). Coursera has since decided to turn MOOCs into turnkey systems of education that are available on demand rather than as instructor-led courses.

Professional Development and Self-Directed Learning

Berry (2011) launched a site called “Teacher Leadership Standards”, a site that includes the seven teacher leadership standards as set forth by the Association for Supervision and Curriculum Development. These standards describe a successful teacher-leader and harken back to some of the original conditions for andragogy, or adult learning (Knowles, 1984): teacher background experience, teacher problem-solving ability, and teacher approaches to adapting lessons to meet the needs of their students. Desimone (2009) linked high quality professional learning with the differences found between high quality teaching and poor teaching, noting that high quality teaching is linked to improved learning outcomes.

Adult learners generally are self-directed and need the opportunity to share and receive information as valued members of a learning community (Blaschke, 2012). Mezirow (2000) defined transformational learning as what occurs when learners make a paradigm shift triggered by new situations and experiences that allows them to see themselves differently in relationship to the world. Teachers who are coached to employ new pedagogical strategies in the classroom can transform their own views of what is possible and potentially improve learning outcomes for their students. Understanding the relationship between teacher inquiry and transformative learning is a vast topic that encompasses both formal and informal avenues for professional learning.

According to Guskey and Yoon (2009), the influence of outside experts may contribute to improvements in student learning. In a MOOC designed for professional development, these experts might take the form of peer learners. This suggests that formal efforts to provide instruction in a MOOC may be less effective than the informal learning opportunities already available within a MOOC context. Guskey and Yoon (2009) show that four significant factors are responsible for leading successful professional learning experiences: time, follow-up, activities, and content. Time designated for professional learning is maximized by well-structured encounters and self-directed, and self-selected, learning opportunities such as web-based courses or communities of practice. Follow-up is another critical area of professional learning that is sustained through consistent, systematic instructional support. Guskey and Yoon (2009) recommended four requirements that lead to effective professional learning outcomes:

- The teacher must establish measurable goals.

- Prior to adopting a program, a careful study must examine the research supporting professional learning implementation.
- New strategies require testing on a small scale to reduce waste of time and money.
- Teaching professionals should insist on rigor based on empirical evidence found in research.

A K-12 Professional Learning MOOC

According to a study by Fuller, Dias, Lokey-Vega, and Langub (2016), one MOOC titled *K-12 Blended and Online Learning* targets an audience of K-12 educators as a professional development opportunity to gain the knowledge and skills of a K-12 blended and online educator. Designed by a collaborative team of faculty members and instructional designers at a large southeastern, comprehensive university, the MOOC served both institutional and faculty goals. The institution strove to increase brand awareness and enrollment while simultaneously engaging in innovative teaching practices. The faculty and staff members sought to share their expertise in online learning more broadly and to address the needs of K-12 professional development on a massive scale based on research. This combination indicated a need to offer quality professional development for teachers. Coursera hosted the MOOC on their legacy platform; it consisted of eight modules bound by designated start and completion dates.

The course design used available research-based strategies in online teaching and learning as well as available data from the relatively experimental field of MOOC research to inform course design (Fuller et al., 2016). The researchers aligned instructional objectives with learning outcomes using the principles of backward

instructional design (Wiggins & McTighe, 2005). They also included a remnant of the cMOOC approach (Siemens, 2008) by providing social learning features that extended the element of open access to connections beyond the MOOC platform (Rodriguez, 2013).

Peer evaluation played an integral role in developing the assessment protocol. Neuendorf's (2002) recommendations for ensuring inter-rater reliability required three peer evaluations of each participant artifact. Additionally, principles of universal design were included (Rose & Meyer, 2002) in anticipation of a wide range of learner backgrounds, languages and skills. The content consisted of open source materials and university-funded videos by the instructor. Instructional video models provided students with building blocks for mastery (Guo, Kim, & Rubin, 2014). Discussion forums served as activities but not as artifacts. Forums provided an opportunity for participant interaction.

MOOCs as K-12 Professional Development

Lock (2006) hailed online learning as a mechanism for delivering teacher professional development. Even before the advent of MOOCs, asynchronous online learning reduced barriers to participation presented by time and space. As of 2012, the three largest MOOC providers were Coursera, EdX and Udacity, all of which resulted from the initiatives of prestigious universities (Pappano, 2012). The rise of MOOCs coincided with the economic decline of 2008 and opened up opportunities to experiment with new models for delivering professional learning to P-12 educators. Jordan (2014) reported that 63% of participants did not engage with the discussion forum and were considered lurkers who behaved more passively, yet view counts indicated they had seen

the discussion posts. Chuang and Ho (2015) determined that 39% of MOOC participants identified themselves as either current or former educators. Despite strong numbers, little research addresses effectiveness or best practice of using MOOCs for K-12 teacher professional development purposes.

K-12 Education Policy and Reform

In the history of educational policy and reform, bridging the achievement gap stands out as the underling goal for all initiatives (Barton & Richard, 2009). Since the Civil Rights Act of 1964, there has been a persistent attempt to make systemic changes in education (Henson, 2015). Experts have proposed many hypotheses and changes to test the impact of new initiatives on student achievement. States adopted laws regulating school funding, class size, student distribution, and diversity initiatives in order to receive federal funding. Despite more than fifty years of effort to address the achievement gap, data indicated that little has changed to produce the desired learning outcomes in K-12 public schools (Henson, 2015).

Debate continues to address the value added by teachers and measures of teacher quality as they relate to the achievement gap (Hanushek & Rivkin, 2010). Poor preparation and lack of experience generally result in low-quality teacher preparation programs (Barton & Richard, 2009). Attempts to accurately measure teacher performance via statewide evaluation systems and a shift from a salary model to a pay-for-performance model have increased the pressure on classroom teachers to produce successful students (Tucker & Strong, 2005). Teacher evaluation systems focus on accountability for student growth. This growth can be attributed to the alignment of specific teaching methods that represent the instructional strategies that show significant

impact of student learning outcomes (May, 2005). According to Darling-Hammond, Amrein-Beardsley, Haertel, and Rothstein (2012), teacher evaluations also pose problems of validity and reliability. These inconsistencies raise questions about the value of the evaluation process and its ability to measure teacher effectiveness in relationship to student growth.

Federal school improvement initiatives such as Teach for America and the Knowledge is Power model did not address the scalability of the level of need for outstanding teachers (Henson, 2015), but the search for outstanding teachers persisted opening the doors for innovative commercial options to take root (Christensen, 2008). A shift in practice from traditional direct instruction to personalized learning has occurred. This shift, in turn, created a need to revamp teacher training and professional development. The growth of blended learning models (Horn, 2014) and the trend toward constructivist methods such as personalized learning and project-based learning have school districts considering online approaches as a means of efficient, cost-effective, large-scale professional development. In addition to seeking online professional development, administrators have leveraged teacher leadership as a vehicle to reinforce instilling sound pedagogies by establishing communities of practice within the schools (Harris & Spillane, 2008).

K-12 Leadership, Learning and Teaching

Pedagogic leadership is dedicated to influencing a change in teaching practices and encompasses the aspects of how children learn rather than how they are instructed (Macneill, Cavanagh, & Silcox, 2005). The pedagogic leader is one who constantly engages in influencing changes that impact student learning. As the pedagogic leader, a

K-12 principal must determine the focus of the professional learning. Ongoing dialog involving all stakeholders in the learning process facilitates change over time. These interpersonal relationships have the greatest influence on participation (Wade, Cameron, Morgan, & Williams, 2011). Distributed leadership plays a pivotal role in establishing collaborative support for the implementation of new teaching strategies (Spillane, Halverson, & Diamond, 2001). Katzenmeyer and Moller (1996) showed by extension the importance of teacher-leader involvement in decision-making processes related to teaching strategies, while Yost, Vogel, and Liang (2009) underscored the importance of building a bond of trust between administrators and teacher leaders.

Professional learning conducted by teacher-leaders may influence peers more than books and lectures (Reeves, 2008). Reeves (2008) examined the impact of teacher influence and the value of strong teacher models as an aspect of professional learning. Reeves suggested that the learning environment for teachers should be safe and allow for others to consider alternatives to mastery that meet their own classroom needs. Additionally, teacher-leaders should encourage teachers to share case studies that demonstrate how they overcame academic or behavioral challenges. Creating a sense of community and fostering a common approach to inquiry are attributes of strong professional learning models (Fullan et al., 2006). Teachers are more likely to adopt new practices within a supportive environment (Guskey, 2002).

Teacher professional development on social media and within MOOCs takes place in peripheral settings and has become increasingly self-directed. The impact of teacher participation in informal learning settings such as these raises some important questions for school leaders to consider: (a) Does a relationship exist between teacher

inquiry in informal learning environments and student learning outcomes? (b) Which informal activities constitute informal learning? (c) What informal learning practices by teachers' impact student learning? Blaschke (2012) described the features of Heutogogy, a form of self-determined learning that requires higher-order thinking skills and reflection. The four course design elements of Heutogogy also describe MOOC learning: (1) individual learning paths, (2) learner-defined curriculum, (3) learner-defined questions, and (4) learner-negotiated assessments. Blaschke (2012) also pointed out the challenges inherent in this learning scheme by questioning how, when, and with whom these decisions are made. When the responsibility for learning shifts to the learner, accountability for learning also shifts. The rise of this model came on the heels of increased distance learning initiatives such as MOOCs where instructional design can help the learner build capacity.

Discussion Forums

Discussion forums have served as the primary means for generating student conversation online. The roles of reading and writing cannot be underestimated for discussion forum participants. It is possible that the decision to participate in a discussion forum is linked to a participant's view of their ability to communicate in writing. In their article "Writing as Thinking", Oatley and Djikic (2008) showed how authors of fictional literature externalize their thinking and produce mental models for their readers to inhabit. Far from literary devices, discussion forums still must rely on participants' abilities to externalize thoughts in writing. Schrire (2006) explored collaborative knowledge construction by analyzing written interactions in discussion forums. She used three different models to study cognition and concluded that synergistic interaction

correlated most with higher-order thinking. Synergistic interaction refers to participant-centered rather than instructor-centered interactions in discussion threads.

Dawson (2006) compared the number of forum posts to participant satisfaction and found a negative correlation, suggesting that unanswered posts led to lower engagement. In contrast, his data showed a significant correlation between learner-to - learner interactions and participant satisfaction. This lent credence to the CoI element known as, social presence, one of three presences in the CoI triad (Garrison, 2001). Research by both Patel and Aghayere (2006) and Taradi and Taradi (2004) supported the notion that higher levels of forum participation correlate to better learning outcomes. Many factors might explain this correlation, including participant profile, writing ability, and motivation to complete the course. Neither study concluded that discussion forums are a useful tool; rather, these forums proved useful as a variable for measuring participation levels.

Haythornwaite (2009) provided segues into MOOC behaviors in her research on crowdsourced, community-based knowledge collectives in academia. Haythornwaite made a distinction between lightweight and heavyweight collectives based on three dimensions of participation. In all three of these dimensions, the distinguishing characteristics were the depth of contribution, personal commitment, and degree of need for association with the knowledge base. The introduction of MOOCs provided an academic context and structure for crowd-based learning. Like the lightweight knowledge collectives, MOOCs offered a low barrier to admission and low expectations for performance.

In the instance of heavyweight collectives, MOOCs offered student participants the leadership, the reputation, and the opportunity to become part of an elite group of course completers. MOOCs established the means for self-regulated learners to manage their time and commitment to knowledge acquisition and network affiliation. Some self-regulation involves negotiating the online environment (Azeveda, 2005). Lust, Elen, and Clarebout (2013) made the connection among learning outcomes, goal orientation, and a student's ability to select the appropriate online tools. Some students engaged as mastery-oriented while others participated as performance-oriented. The mastery-seekers engaged at a deeper level, using the available tools more fully and showing greater participation. Means, Toyama, Murphy, Bakia, and Jones (2009) performed a meta-analysis of discussion forums, and found them useful in developing metacognitive strategies that included self-reflection, self-explaining, and self-monitoring.

Research on the pros and cons of online learning continues to inform instructional design, pedagogical choices, and modes of delivery. Since online learning removes barriers associated with face-to face instruction, online discussion forums can be more collaborative. They are also less likely to be dominated by one individual and less likely to be bound by convention (Karapacapilidis & Papadias, 2001; Redman & Burger, 2004). Active participation and increased engagement are other factors that support the use of online instruction (Dorman & Fraser, 2009; Thomas, 2002).

Conversely, online interfaces can be prone to misunderstandings or misinterpretations, because they suffer from the lack of nuances produced in face-to-face settings (Murphy & Coleman, 2004; Wang & Woo, 2007). Consider the amount of self-regulation needed in a MOOC, a course without expectations. Beaudoin (2002) noted the

feeling of invisibility in the context of an online class as having a negative impact on student performance; however, when Pena-Shaff, Altman, and Stephenson (2005) studied the effect of evaluating discussion posts, students rebelled, because they did not want to be observed. In discussion forums, students may fear exposing their own shortcomings (Murphey & Coleman, 2004). Valle and Duffy (2009) concluded that the amount of freedom in online learning requires more self-regulation.

Discussion forums are central to developing a sense of community in an online course (Li, 2004). Darabi, Arrastia, Nelson, Cornille, and Liang (2011) concluded that properly structured forums facilitate discourse leading to high levels of thinking. Careful planning that accounts for scaffolded discussions throughout the course allows participants to embrace ownership of their learning, and relies on student-student interactions may reduce the need for an instructor (Gulberg & Pilkington, 2007).

According to Mick and Middlebrook (2015), asynchronous resources currently seem to enjoy a wider use in online learning settings, primarily because of lower barriers to implementation. Pelz (2010) identified asynchronous discussion as an important principle of online learning design. When implemented properly, asynchronous discussion permits students to do the heavy lifting and provides a high level of interactivity and presence in online settings. Presence in this instance refers directly to the three CoI presences: social, teaching, and cognitive.

Online discussion forums support pedagogy in a number of ways. They provide a forum for questions and answers, a way to seek clarification on assignments, and a means of developing peer interactions instead of instructor to peer interactions (Darabi et al., 2011; Walker, 2007). Discussion forums are capable of producing learning communities

(Li, 2004). Self-directed learners are more likely to seek peer assistance (Young, 2013), and online forums have the potential to produce higher order thinking among self-directed participants (Leong, 2003).

Gillani, Osborne, Roberts, Eynon, and Hjorth (2014) posed questions related to participation in MOOC discussion forums. They described participants as people who demonstrate crowd behavior by gathering and dispersing anonymously rather than as members of a community. They determined that participation in discussion forums was an indicator of potential for higher performance.

In view of the voluntary nature of MOOC participation, the low barrier to membership, and the opportunity for participants to self-regulate their learning, questions arise regarding the nature and value of discussion forums in MOOCs. In a general sense, the discussion forum represents only a sliver of MOOC participants. A fraction of MOOC participants chooses to post or reply in discussion forums, and those who do show a steep drop off in participation over time with course completers representing the highest levels of forum activity (Kizilcec et al. 2013). The value of the discussion forum may vary depending on participant motivation (Yang, 2014). Winne, Jamieson, and Noel (2012) found that most of the past research on MOOC discussion forums centered on self-reported surveys of participants following course completion. This means that participant responses consisted of biased perceptions of their MOOC experience after courses ended instead of real-time revelations from active participants. As such, the data instead represented distorted memories, yielded inaccuracies, and in many cases did not present a true random sample (Winne, Jamieson, & Noel, 2012).

Threaded discussion forums are tools for producing collaborative communities of learning (Dringus & Ellis, 2004). Interpreting the activity within a discussion forum poses a challenge for instructors (Dringus & Ellis, 2004). Simply providing a venue for a discussion forum doesn't make it a useful tool (Guzdial & Turns, 2000), because the instructor must intentionally drive participants to the discussion forum and guide the dialog. Anchors or topics should be tied to assessments and the curriculum to make it relevant to the students.

Rosé, Goldman, Zoltners, Sherer, & Resnick (2015) used CoI to improve the threaded discussions by developing an automated method for analyzing the collaborative process that triggers interactive support for learners. Rovai (2002) found a significant relationship between community formation and cognitive learning. Hew (2015) found that 65% of participants prefer instructor facilitation because they have subject matter expertise, are best at guiding instruction, resolving conflicts and motivating students. Gašević, Adesope, Joksimović, and Kovanović (2015) found that student-led discussions are both effective in producing critical thinking and provide a cost-effective way to form communities of learners on a large scale.

Based on Rafaeli's (1988) framework for interactivity, Kent, Laslo, and Rafaeli, (2016) used the metric of replies to posts rather than original posts as a measure of interactivity and social presence. Online course design can support community development; however, threaded discussions have demonstrated a lack of interconnection between posts in threads (Zhu, 2006). Kent et al. (2016) suggested focusing on the holistic community rather than the individuals as a unit of analysis.

Summary and Implications

For many, future economic opportunities for students are tied to equitable educational opportunities in K-12 settings (Ainscow, 2013). Additionally, as the cost of education rises, educational providers want more efficient forms of course delivery. Different assumptions underpin these initiatives, including 1) the notion that social constructivist strategies can and do translate to virtual classroom practices, and 2) the notion that discussion forums are pedagogical tools that assist with the development of CoP and CoI and lead to higher levels of cognition and knowledge construction (Stacy, 2013; Conole, 2013; Thomas, 2002). MOOCs have proven a disruptive force for changing the availability of university coursework equitably (Christensen, 2008), but not all nations have populations equipped with devices and Internet access. MOOCs contain structures common to other online courses for building communities, including discussion forums. The questions most frequently asked by researchers about MOOCs concern course completion. Some studies examined participants using self-reported survey data. Kizilcec et al. (2013), for example, developed participant profiles to characterize the phenomenon of participation (Clow, 2013). Of the four types of participants, there were those who stayed engaged without taking assessments.

Other MOOC studies considered the changing role of the online instructor where the teacher-to-student ratio makes it impossible to develop a rapport with students (Garrison & Anderson, 2003). Teachers respond to leadership roles when instructional leaders use a distributed approach, which are akin to crowdsourcing models (Northouse, 2015; Spillane et al., 2001). Crowdsourcing announced its intentions to harness crowd intelligence around the same time that MOOCs began emerging as conduits for learning.

Crowdsourcing engages consumers in product development and problem solving for an array of social issues (Anderson, 2011; Surowiecki, 2005).

Fundamentally, the massive scale, openness, and curiosity about taking part in a great online experiment attracted many participants. The goals of MOOCs and crowdsourcing are similar in that they use social constructivist principles to invite participants to engage with a collaborative community devoted to solving problems (Bynam, 2013; Kohler, 2015). In a MOOC, the problem to be solved is how to gain more knowledge, more skills and more mastery related to a given subject. In crowdsourcing, the problem lies in determining finding a solution to a proposed problem and recognizing the value added when participants contribute to the solutions while collaborating with others. In a MOOC context, there is some reliance on participants to add value, but only when serving as peer reviewers or peer editors in the capacity for spreading the responsibility for assessments in lieu of instructor presence. Kohler (2015) recognized that crowdsourcing participation poses problems that mirror participation in MOOCs. The student-instructor dynamic in a MOOC exists much like the paradigm of expert and novice, whereas crowdsourcing uses a peer-to-peer model that assumes everyone brings a form of expertise, and is capable of contributing to solutions. Presently, crowdsourcing serves as a tool for problem-solving rather than a form of education (Anderson, 2011). It falls under a business paradigm where participants become partners and earn recognition, bonuses, or free products for serving as a crowdworker (Nickerson, 2013). Solemon et al. (2013) considered the potential for increased participation if MOOCs were viewed in crowdsourcing terms.

Educators represented a significant portion of the participant population, because they have a vested interest in meeting the needs of students and satisfying their own curiosity about new delivery methods and online teaching pedagogies (Ho et al., 2015; Seaton et al., 2014). Research has suggested that since MOOCs attract educators, they would benefit from MOOCs as professional development delivery platforms (Vivian, Falkner, & Falkner, 2014), an idea that supports using MOOCs in this way to decrease overall MOOC delivery costs and increase the efficiencies related to distributing professional learning on scale.

This literature review focused on issues related to the MOOC phenomenon, teacher professional and self-directed learning, developing an online community, and the pedagogy of discussion forums. The connection between forming online communities and discussion forums is well-documented (Garrison et al., 2010); however, a gap in the literature showed that the quality of the cognitive presence is rarely measured using human coding methodology to identify visible signs of thinking and learning. MOOCs generate big data that show indicators for interaction (Chesbrough, 2003; 2007), but cognitive presence rarely is measured, because hand coding is time intensive. The next chapter will use the results of this literature review to describe how this study used human interpretation of textual data in combination with observable patterns in preparing to analyze a particular K-12 MOOC using Quantitative Content Analysis (QCA).

CHAPTER 3: METHODOLOGY

Introduction

MOOCs have demonstrated the massive potential for global education. The link between the MOOC trends in higher education and K-12 professional learning is full of untapped potential (Lokey-Vega, 2014). Educators represent the largest single category of participants and provide a potential market for blended and fully online professional learning (Seaton, Coleman, Daries, & Chuang, 2014). In keeping with the Community of Inquiry (CoI) framework and underscoring the importance of establishing a community as the basis for cognitive presence in an online course, this study is rooted in a Relationalist paradigm (Erikson, 2013). This explains the transactional nature of the dynamic relationships that occur within these structures (Emirbayer, 1997). Akyol and Garrison (2014) recommend taking a holistic approach to interpreting network interactions. This study seeks to determine if a large-scale MOOC discussion forum is capable of showing cognitive presence level (CPL) patterns. If so, this may be as an indicator of crowdsourcing behavior.

The methodology section presents research questions aligned to the data collection and analysis of discussion forum messages. The study design explains the selection of variables, followed by a section on the context of the study. Next, a discussion of quantitative content analysis establishes the foundation for data collection, followed by a rationale for the unit of analysis. This study used archival transcripts and a

valid coding scheme to objectively view the levels of cognitive presence generated in the MOOC discussion forum.

Framing the Study

This study plans to examine the medium of a MOOC discussion forum; a CoP, capable of to producing socially constructed knowledge in keeping with a Constructivist theoretical perspective of knowledge construction (Vygotsky, 1978). Unit selection in content analysis can be problematic. Rourke et al. (2007) produced a study to assist researchers of unitization by qualifying issues associated with selection. Of the nineteen studies reviewed, five of them used messages as the unit of analysis. Variables used by these studies included interaction and complexity of response, critical thinking, levels of argumentation and interaction with topics. The reported a percentage of agreement after discussion, along with Cohen's kappa, were used to find reliability. Research designs were either descriptive or experimental. Replicability of results is dependent on reliable coding schemes and coder training.

In this MOOC study, quantitative content analysis (QCA) is able to support the investigation of a hypothesis by testing the relationship between variables. Using archival transcripts to produce a cognitive presence profile of discussion forum participation over time requires the coding of latent projective variables subject to coder interpretation (Rourke et al., 2007). This study relies on a single aspect of the community of inquiry framework, cognitive presence, which has been confirmed through factor analysis (Garrison & Arbaugh, 2007). In addition, several aspects of messages, found in transcripts, support their selection as a unit of analysis. Messages are easily identified as posts or replies and all coders can agree that a message is intact as a single unit. Messages

can be counted, sorted and segmented by the researcher based on filter criteria and can be randomly sampled within large-scale discussion forums. Based on these characteristics of messages as a unit of analysis, intercoder reliability tends to have high levels of agreement, over 90% and with (r) of 0.71 or higher.

This study focused on message content as the unit of analysis in a QCA and used CPL as the dependent variable. Cognitive presence is one of three elements in the CoI framework (Garrison, 2000) and exists only when social presence and teaching presence have been established. There are four levels of cognitive presence. Cognition refers to levels of critical thinking and was coded 0-4 based on the message content. Instructional design intentionally scaffolds a course to give participants time and opportunity to build and co-construct knowledge. In some respects, the four levels of cognitive presence mirror the instructional phases of a course. While cognitive presence represents the dependent variable, time represents the independent variable across the three intentional phases of instruction. Additionally, a moderating variable, teacher reply, was established to group messages and account for documented teacher presence within discussion threads. The term “Instructor reply” will refer to any faculty member’s post in a threaded discussion.

Research Questions

This study addressed the following overarching research question comprised of seven parts that the researcher tested separately:

RQ: Are there patterns of cognitive presence in the MOOC discussion forum?

H0: Patterns of cognitive presence in the discussion forum show no significant difference.

H1: Patterns of cognitive presence in the discussion forum show significant difference. The following are seven parts of the primary research question to determine patterns significance by using several different variables:

Part 1: Is there a pattern of cognitive presence from weeks one to eight of the course?

Part 2: Is there a pattern of cognitive presence among demographic subgroups based on educator levels including: elementary, middle school, high school and school administrators?

Part 3: Does the proportion of cognitive presence vary by thread length in each of the five thread length categories?

Part 4: Is instructor reply associated with a pattern of cognitive presence?

Part 5: Is instructor reply associated with thread length?

Part 6: Does cognitive presence mirror the intended pedagogical scaffolding established in the three phases of the course?

Part 7: Is there a pattern of cognitive presence between comments and posts?

Design of the Study

This study used quantitative content analysis (QCA) to compare the similarities and differences in randomly selected messages from the participant discussion forums in a single educator MOOC. The selection of QCA for this study permitted explicit analysis of message content, and coupling it with scientific method allowed application of QCA for collecting datasets specific to the design of this study. A typical QCA investigates cause and effect relationships, although the results must be interpreted and alternative explanations for these results must be considered in light of triangulated data. For this reason, the community of inquiry (CoI) framework established a triadic relationship to

describe the educational experience that included three distinct expressions: teacher presence, cognitive presence and social presence.

A quantitative approach best suited this study given the massive size of the dataset and the potential for patterns to emerge based on the validated scheme for cognitive presence. One could argue in favor of emergent coding and discourse analysis as viable options for studying the messages within a discussion forum. However, the massive scale of this particular discussion forum meant that applying qualitative methods such as emergent coding and discourse analysis was neither practical nor applicable to the subject (Gee & Green, 1998). Emergent coding is generally an iterative process of identifying themes that may lead to grounded theory, while discourse analysis looks at the interpretation of meaning in conversations. A MOOC discussion forum cannot be viewed as a conversation due to the vast scale of messages posted. It therefore is equally impractical and illogical to extract themes from the content of the discussion forum conversations when they all consist of responses directed at targeted questions posed by the instructor of the course.

Community of Inquiry

The fundamental structure of the CoI framework is a model with three overlapping circles that represent the three elements critical to producing a community of inquiry. Communities of Inquiry (CoI) is the basis for interpreting the data (Garrison, Anderson, & Archer, 2010). The following section provides greater detail on each of the three CoI presences shown below in Figure 1.

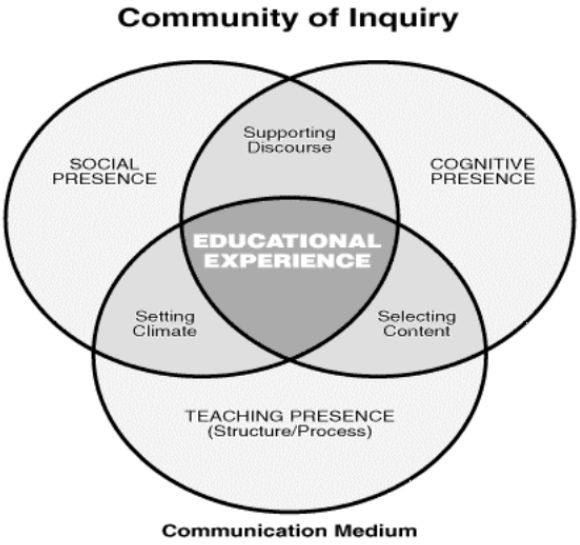

Figure 1. Community of Inquiry triad of educational experience. Reprinted with permission from Garrison, Anderson, and Archer (2000).

Social Presence.

Social presence is a measure of community, a prerequisite to socially constructing knowledge. Garrison (2008) explains that social presence relates to the way an actor establishes relationships within the social network. The concept of social necessarily overlaps with cognitive and teaching presence. It may shift over time as the actor awareness of these intersections occurs. Boston et al. (2014) concluded that there is a correlation between social presence and reenrollment in MOOCs linking the concept of social presence to student persistence.

Cognitive Presence.

Cognitive presence refers to the discovery side of learning. Cognitive presence as described by Garrison (2010) consists of four dimensions representing the four phases of practical inquiry. The first level is called the Triggering Event. At this level, participants are coming to acknowledge the problem and developing an interest in finding a solution.

The second phase is Exploration. During this phase, the participants begin to question and launch ideas for finding solutions. Disagreements and debates may be part of this phase. In the third phase, Integration, discourse becomes more connective and convergent. Solutions are created; members are in agreement, synthesizing their ideas. The fourth phase, Resolution, demonstrates ownership of ideas and deeper discourse to test possible solutions in real world applications.

Teaching Presence.

Teaching presence in the CoI model demonstrates a link between student satisfaction with the course and a high level of teaching presence (Garrison, 2009). In a MOOC, the instructor-to-student ratio prevents a high-level of interaction. This study used the instructor-replied measure to isolate responses linked to threads with instructor replies to see if their presence related to CPLs.

Strengths and Limitations

In determining the flow of the QCA approach, it then became necessary to choose between machine and human coding. Human coding is time intensive and MOOC data can be daunting due to the scale. The coding method selected for this study was human coding, a method for transcribing written communication. Based on research and elements inherent in the study design, machine coding tends to be less accurate than human coding because humans can excel at detecting nuances that machines often omit in their algorithms (Krippendorf, 2004; Neuendorf, 2002). Intercoder reliability is successful when efforts are made to minimize coder bias and to maintain objectivity and consistency by using a specific coding scheme.

Despite careful adherence to the QCA process, the researcher refrained from drawing explicit conclusions from the data. Instead, inferences were made based on the combination of data and literature about the context and content of the study. It is important to note that the inferences were made based solely on the variables provided and in no way reached outside of the scope of the study to infer behaviors of individual participants. Linking data to the participant was not an objective of this study. The goal was to capture the nature of CPL for the discussion forum as a whole using QCA. The unit of analysis, messages, precluded deeper interpretation. In this study, the researcher anonymized the messages and obtained them in a random sampling from the discussion forum database. The data showed the CPL proportions in the discussion forum and revealed patterns which if desired could serve as a footprint for future CPL comparisons of discussion forum. In this instance, all of the variables were tied to the nature of discussion forum interactions based on CPL. The dependent variable (DV) was the level of cognitive presence coded by the human coder according to the validated CoI codebook for CPL (Garrison et al., 2000). The independent variables (IVs) included:

- thread length
- instructor replies (IR)
- posts and comments.

Time was the moderator between the IVs. Figure 1 shows how CPL overlaps with teacher presence and social presence to create the educational experience within the CoI framework.

Answers to the overarching research question came from statistical analysis based on seven specific combinations of variables and CPL as the dependent variable. Variables

included: IR's, which represented instructor interaction in a thread; time period, referred to as course phase (CP) or week; thread length; and the categories of posts and comments, as well as the demographic categories of elementary, middle and high school, plus administrators as a separate demographic. Message analysis occurred by grouping them into categories such as "IRs" and "No IRs" and analyzing the data for significance. Additionally, the eight modules in the course represented three specific phases of pedagogy scaffolded in the course. The forum prompts differed for each week of the course.

K-12 educators received tailored professional development along with an opportunity to earn college credit. The MOOC was the first of three courses in a series of blended and online certification courses. As such, it contained a built in element of social structure. The course offered a certification track for completers. Additionally, the course ran on the Legacy Coursera platform in the spring of 2015. Using CPL alone, it was possible to capture the overall cognitive presence within a forum of educators, using the CoI framework. This framework held great value for investigating the way learning occurs in an asynchronous online learning environment.

Setting

For the purposes of this investigation, the researcher chose a teacher professional development course to examine the ways educators produce meaning in a voluntary discussion forum. Participants' self-selection of course as well as their optional engagement in the discussion forum made this study unique. Typically, online courses for credit require a certain number of posts and replies in the discussion forum. Designed to credential teachers in online and blended learning, the course evolved collaboratively

through iterative design by the professor of record and an instructional designer, in conjunction with Coursera, the LMS provider. Offered by a large public university in the southeastern United States (Appendix A contains the IRB report), the course met a specific need for teachers interested in gaining online teaching expertise. The second iteration of the course served as the focus of this study because it represented improvements and other changes made based on survey data from the first course offered in the previous year. The discussion forum, like the courses themselves, was student-driven. Table 2 below shows the level of participation in the MOOC discussion forum.

Table 2

Discussion Forum Participation

Total Participants	Forum Participants	Total Forum Messages	Average thread length	Total participants who posted <20 messages	Total participants who posted >20 messages
6695	669	11680	14	11647	33

According to Margaryan, Bianco, and Littlejohn (2015), instructor motivation levels are predictors of quality in course design and delivery. This MOOC design team reportedly felt motivated to accomplish the goals and aligned with institutional goals. The team placed a high value on instructor participation, so it became an integral part of the course design. The instructor of record established training guidelines and expectations for the teaching assistants in the course. Designers planned an eight-week course consisting of eight course modules for delivery in three scaffolded phases.

Each learning module in the course contained an introduction, readings section, instructional videos, and activities. In module 1 of the MOOC discussion forum, the initial prompt was part of the pre-assessment reflection. Based on the revised Bloom's

taxonomy (Krathwohl, 2002), the learning objectives included key terms indicating a range from knowledge to evaluation over the duration of the eight-week course. The discussion questions varied somewhat by including prompts designed to elicit higher order thinking such as analysis and synthesis earlier in the course, asking students to make comparisons or to anticipate changes in teaching and learning based on course reading and video materials. In MOOCs, participants enroll at various points in time, so discussion posts are not necessarily bound by a weekly time frame. All forums were open and accessible for participation throughout the course. The instructor used a participation count as proof of participation, which was required for anyone seeking professional learning credits. To all other participants, the discussion forum was an optional activity.

The MOOC design team also partnered with the Online Learning Consortium, an organization offering guidance on research-based strategies to improve online learning. Readings, video clips, instructional guides and templates represented content delivery. The instructional team designed many of the videos to strengthen instructor presence. The discussion forum appeared as a weekly task in each module. Forum prompts design aligned with course learning objectives and providing opportunities for scaffolding through reflection.

Quantitative Content Analysis

The quantitative approach to content analysis involves a set of properties such as words or phrases for tabulation. The choice of messages as a unit of analysis warranted the application of Quantitative Content Analysis (QCA) because of its usefulness for specific units of observation. Using a quantitative approach yielded empirical data instead of qualitative data and offered an objective approach for removing some researcher bias.

Procedures must be followed carefully during the codification process to ensure the reliability and validity of the approach (Rourke & Anderson, 2004). Rourke and Anderson (2004) also recommended using an existing coding scheme that had previous validation.

The CoI theoretical framework (Figure 1) drove the study design and used one of the three areas of presence to guide and inform the selection and codification of words and phrases as units of study. This study obtained a random sample of all messages posted to the discussion forums. Messages were clustered, grouping them according to course phase and category of response. The data was reduced and summarized, and the inferences made were discussed in Chapter 5.

QCA applies scientific method to answer the research question and test the hypotheses. It requires no direct contact with subjects, relying instead on archival data. The unit of analysis, a single message, was a sub-unit of discussion topics. Discussion threads represented dialogues or conversations, and all messages were associated with a forum topic. The relationship between messages was not within the purview of this study, nor was the association between message and participant. Instead, the messages were samples from the whole discussion forum and represented a measure of the group CPL rather than the individual CPL. Discussion forum pedagogy was based on social constructivist learning theory and social interaction related to thread count.

Theoretically, knowledge is constructed in social, collaborative, online conversations (Doolittle, 2014). In this study messages were evaluated individually using a validated coding scheme for CPL that defined thematic units within the levels of cognitive presence found in Appendix C. Codes were represented in ordinal terms from

0-4. The decision to code CPLs as ordinals resulted from a discussion within the dissertation committee. Unlike a Likert scale, the CPL needed to indicate of a unit rather than a part of the whole.

Table 3

Coding Scheme for Units of Analysis

Code	Label	Descriptor	Indicator
1	triggering	evocative	recognition, puzzlement
2	exploration	inquisitive	divergence, info exchange
3	integration	tentative	convergence, synthesis
4	resolution	committees	testing, applying, defending

NOTE. Coding Scheme for cognitive presence modified and based on the work of Garrison et al. (2002).

Study Variables

Creating a Model of Framework Variables for this study helps to show the relationships between the variables as seen in Figure 2 below.

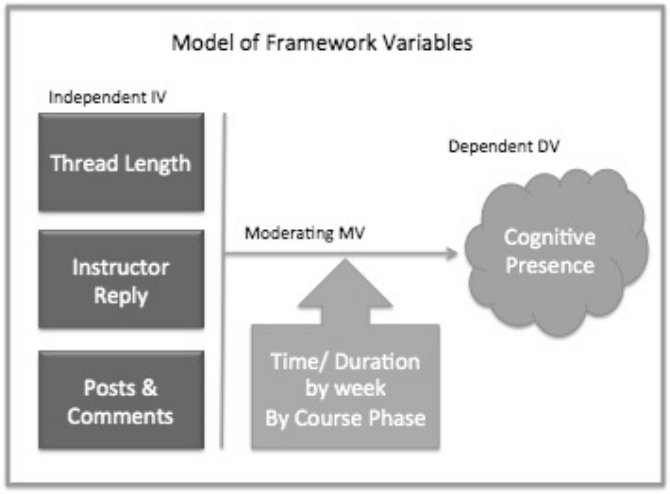

Figure 2. Model of Framework Variables (Shields, 2017).

Research supports replicating studies using validated instruments rather than constructing something that requires validation (Rourke & Anderson, 2003). The choice

of Cognitive Presence (CP), one of three elements in the CoI framework was selected based on research by Garrison et al. (2001). CP is one of three elements of CoI that represents the dynamic of an educational experience. All three elements were present to varying degrees. Out of one thousand individual messages, a 10% sample was randomly selected and evaluated. Neuendorf (2002) gave recommendations for coding. Sample data was coded by three unique coders, comparisons made, understandings negotiated and a second set of messages were subsequently coded to provide the final dataset. It was analyzed for intercoder reliability. This process established a high degree of inter-rater reliability, with Krippendorff's alpha of coefficient of .90, which is sufficiently strong to support coding reliability (Neuendorf, 2002).

The cognitive presence schema as described in detail by Garrison et al. (2010) has four dimensions that represent practical inquiry. Practical inquiry describes the relationships between the levels within cognitive presence. The first level was called the Triggering Event. At this level, participants are coming to acknowledge the problem and developing an interest in finding a solution. In the second level, Exploration, participants begin to question and launch ideas for finding solutions, which may include disagreements and debates. In the third level, Integration, discourse becomes more connective and convergent. Members create solutions and are in agreement, which synthesizes their ideas. In Resolution, the fourth and final level, members demonstrate ownership of ideas and engage in deeper discourse to test possible solutions for real world applications.

Sample Context

The data for this study consisted of four separate datasets that required matching,

merging and transformation in order to produce a single workable document for examination and analysis. Table 4 below shows the variables contained within each of the four datasets. The totals reflect the original totals prior to data cleaning. The units of analysis for the study include *forum_posts* and *forum_comments*, which combined totaled 11,680 message units. After cleaning the data and removing messages related to the general forum and technical support, 10,193 messages remained. These required additional adjustments to reduce outliers including posts associated with the thread categories for stakeholders since they did not apply directly to the study.

Table 4

Description of Archival Coursera MOOC Datasets used in Study

	forum_forum	*forum_threads*	*forum_posts*	*forum_comments*
Totals	68	1680	7745	3835
id	x	x	x	x
parent_id	x			
thread_id			x	x
user_id		x	x	x
date/time		x	x	x
text			x	
name	x			
desc	x			
display_order	x			
forum_id		x		
instructor_reply		x		
num_posts		x		
num_views		x		
title		x		
post_id				x
comment_text				x

NOTE. forum_forum = Instructor created prompts; *forum_thread* = Student-generated threads based on prompt; forum_posts = Student/ Instructor responses to posts in threads; forum_comments = Student/ Instructor responses to individual posts within threads.

The research question directed the selection of variables within the dataset to consider patterns of cognitive presence. CPL was the dependent variable for the study. Time served as a moderator of data both weekly and in CP. Weeks represented the eight modules that made up the course. Phases represented the scaffolded course work and forum prompts intentionally built into the course. These three CP's combined weeks 1-3, 4-6 and 7-8 to bound the activity in alignment with scaffolded learning. The independent variables included thread count, generated using *thread_id*, *instructor_reply* associated with *thread_id*, *comment_text* and *post text* as well as the number of posts per *thread_id*.

Unit of Analysis

Units of Analysis are defined as individual messages within the discussion threads, representing thoughts and actions of the collective whole, rather than the individual. Interactions were evidenced by messages that received or acted as responses to others within a threaded dialogue or conversation. These messages were a combination of types such as: student-to-student, student-to-instructor, or instructor-to-student within a single thread. Huang, Dasgupta, Ghosh, Manning, and Sanders (2014) have examined the roles assumed by students within forums, such as the super-poster phenomenon. For the purposes of this study, distinctions made only between messages and their associations with thread counts and time. Threads contained topics separated by category. Individual messages were traced back to threads in order to examine their relationships to thread topics, categories and time of post.

Threads were identified using unique identifiers, as were messages within threads. Messages were non-sequential subunits of discussion threads. They were examined individually for CPL and holistically to gauge the proportion of CPL over time. Messages were also examined for CPL as part of select threads by coding each of these sub-units of messages by thread. A random selection of messages from each of the three course phases (CP) was generated. The time periods were sequential and represented the CPs of introduction, integration and resolution. These phases were similar to the categories of CPL in that they represented scaffolding to construct knowledge over time.

Messages represented asynchronous actions. Interaction occurred when more than one post or reply registered for a single thread. The dependent variable was the CPL found in each of these randomly selected messages. The independent variables included instructor replies, representing instructor interaction within a thread, CP, and thread count representing the level of interaction and discussion topic, the root of each message. Within each CP, messages were coded for each of the four facets of CPL using the Community of Inquiry (CoI) framework (Garrison et al., 2001). The absence of CPL was coded as well. Messages with no CPL were omitted from the analysis. Human coding and the CoI schema for CPL were used to measure message complexity on an ordinal scale from 1-4.

Discussion Forum Structure

In this study the discussion forum structure refers to the relationships between the variables. Figure 3 below was created to illustrate these relationships. Patterns were observed in messages, the unit of analysis. The LMS supported participant anonymity. The data set was obtained from a course specifically designed for teacher professional

development so the assumption was made that the majority of the participants/actors are educators (Hanneman & Riddle, 2005). Educator behavior were observed and described in the context of a MOOC discussion forum. Randomly selecting sample data for coding produced objectivity and inter-subjectivity and limited sample bias. A codebook containing a list of CPLs (see Appendix C) to be coded according to the instructions provided (see Appendix B) ensured coder consistency and reduced the incidence of chance agreements.

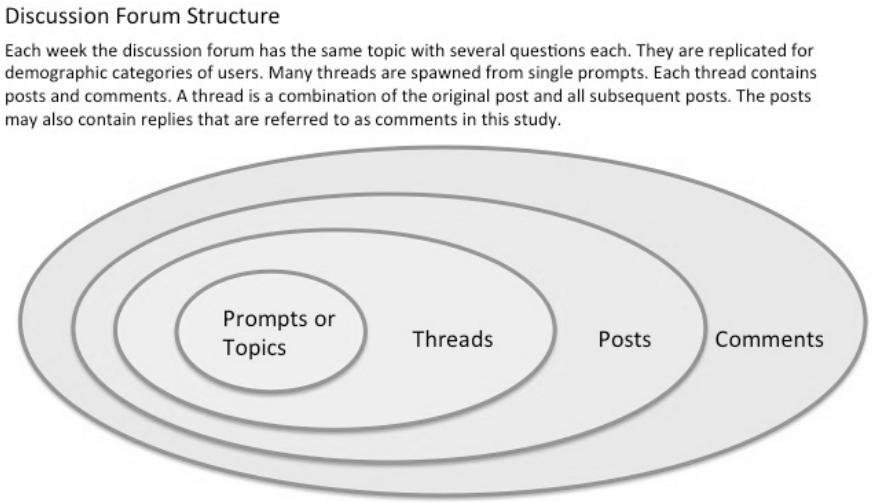

Figure 3. Discussion Forum Structure.

Coursera established several tiers for obtaining datasets from their MOOC platform. According to the Coursera Export Policy, Tier 2 data was available for researchers. Figure 4 (see below) shows the Coursera Tier Structure.

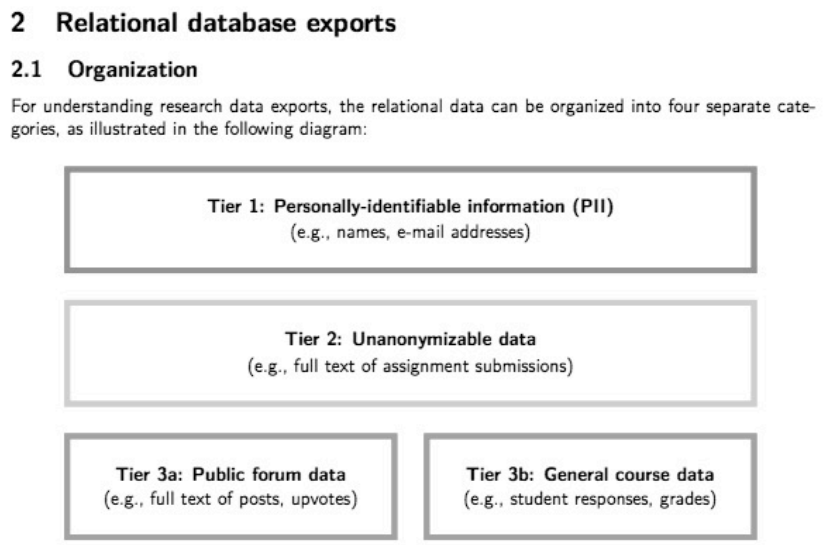

Figure 4 Screenshot from the Coursera Export Policy (2013).

Intercoder Reliability

Initially, the researcher enlisted the support of two additional coders to verify coding consistency of the researcher and provide maximum validity to this study. A subsample of 100 messages from 21 threads representing the three CPs served as practice material. The coders and the researcher trained together on the coding protocol and engaged in a blind coding session assessed on each of the four categories within cognitive presence. They used examples that resembled the messages found in this type of online discussion forum. See Appendix C, for an example of the coding instrument and sample messages. Using intercoder reliability was important for this study to reduce the bias and subjectivity of the researcher as single coder (Neuendorf, 2002). Comparing multiple coders requires a statistical test of two variables that are in agreement and co-variation using Cohen's kappa, designed specifically for ordinal variables through SPSS. The researcher obtained a reliability kappa = of 0.96, which indicates a very strong correlation among the practice coding results far exceeding a 0.85 benchmark (Neuendorf, 2002).

Sampling Method

SPSS provides a sampling function to randomly select messages from the dataset. The sample size was based on a sample of 10% of the 10,000 plus messages posted. Intercoder reliability tests used a subset sample of the 10% to provide a parallel coding experience for the coders. The coding process supplied quantifiable data used to produce statistical reports with SPSS (Macnamara, 2005). The subset sample provided a basis for comparing and evaluating for coder agreement.

Instrumentation

The course scaffolding consisted of three phases containing eight weekly content modules. Each content module had an online asynchronous discussion forum component consisting of questions that participants answered based on how the questions related to their performance tasks. Educators were able to find online peers using the categories set up by the instructor of record. There were elementary, middle and high school categories as well as an administrator and stakeholder category. Only a handful of stakeholders participated, too few to isolate as a category for this study. In all, there were 68 separate forums. Because of the intentional sub-division by teacher category, there was redundancy in the questions posed in each of these forums, resulting in a total of 15 unique forum questions each week. Several topics isolated interest in technical feedback, general forum, and a signature track for those interested in obtaining credit. All messages associated with technical questions, general forum and signature track were eliminated due to their small numbers. It is interesting to note that discussion forum participation was counted among the completion requirements but not as a percentage of the final grade.

The following four Coursera archival files provided the data for this research: *forum_forum, forum_thread, forum_post,* and *forum_comments*. A discussion forum forms a tree of participation, linking comments, to posts, posts to threads and threads to the original forum. It is important to note that *forum_comments* are replies to *forum_posts* and together provided the total number of posts to the discussion forum as a whole. This MOOC data set contained 7,745 *forum_posts* and 3,835 *forum_comments* for a total of 11,680 messages posted to the discussion forum and originating from specific threads. Posts were made between January 14, 2015 and March 31, 2015, for the purposes of this study; the cut-off was made two weeks after the course end date. Several posts occurred later and at random intervals because the course remained open. However, since the course was designed to have a specific start and end date, the decision was made to use closed parameters.

Validity, Generalizability and Replicability

QCA validity relies on the researcher's ability to stay true to the theological framework and to adhere to the accepted standards consistently (Neuendorf, 2002). Validity can be increased by carefully selecting a relevant sample by using a power and choosing the appropriate effect size. This study used a large sample; therefore, it had a large effect size and further ensured the validity of this study. Validity may also be viewed as part construct validity, relying on the data collection and composition, by establishing a sequence of events and multiple data-sources. The data originated with a single reliable source, Coursera, the LMS provider.

Internal validity is based on careful attention to pattern matching and the application of logic models (Neuendorf, 2002). For this study the examined the data and

cleaned it by removing unrelated events. In generalizability, the population is represented by the messages in the discussion forum. Since the data comes from a single MOOC it was not possible to generate generalizable results. Replicability occurs when methodology and procedures are transparent and easy to repeat they are considered replicable. Explicit instructions must accompany the study to allow for potential replication and examination of possible errors. This study contained a simple methodology that may be repeated using message data from other MOOC discussion forums to look for proportional distribution of CPL.

Data Analysis

This study included several statistical measures as a basis for analyzing results. Based on the research question and its associated parts, an Independent Sample t-test was performed along with a factorial ANOVA and repeated measures ANOVA to account for the variables of independent variables including teacher participation and time. Factors included in this ANOVA are the three time periods or phases of the course along with the four codable categories for cognitive presence. The four areas include: triggering event, exploration, integration and resolution. Refer to table 4 for clarification of the elements of CPL. Results displayed variations and statistical significance. Results were stated as effect by time (p=x) and category interaction effect (p=y). A scatterplot for each category provided a graph of the results. Quantitative measures are collected by a binary coding each thread for teacher interaction (TI). TI can vary and was an independent variable.

Statistical Tests

Parametric and nonparametric statistical analyses were conducted to determine the answers to the RQ and seven parts of the question. The Mann-Whitney test was used in to compare differences between two independent groups when the dependent variable was ordinal. The Kruskal-Wallis test, a rank-based nonparametric procedure, was also used to test for a statistically significant difference between two or more groups on an ordinal dependent variable. Several analysis of variance tests (one-way analysis of variance and *t* test) were used to test for differences between two or more groups on a continuous variable. Each analysis was evaluated at $\alpha = .05$.

The following explanation states the research question followed by an explanation of the statistical test that was used to answer the question.

Procedures

The overarching research questions asked, “Are there patterns of cognitive presence in the MOOC discussion forum?” Seven individual questions, each of which provided an answer to part of the larger research question.

Part 1: Is there a pattern of cognitive presence from Week 1 to Week 8 of the course? Kruskal-Wallis test analyzed CPL and showed the proportions of each CPL over the 8 weeks in the course. The mean rank was displayed for each week.

Part 2: Is there a pattern of cognitive presence among demographic subgroups based on educator levels including: elementary, middle school, high school and school administrators? The Kruskal-Wallis test showed the proportions of each cognitive presence level among the five categories of users.

Part 3: Does the proportion of cognitive presence vary by thread length in each of

the five thread length categories? Thread length was analyzed in two different ways. A one-way analysis of variance determined if the continuous variable, thread length, was different across the four levels of cognitive presence. A second analysis was conducted by categorizing the number of messages in a thread. The distribution of messages in each thread was divided into groups containing approximately 20% of the messages in each. The Kruskal-Wallis test showed the proportions of each CPL among the five categories of thread count.

Part 4: Is instructor reply associated with a pattern of cognitive presence? There is no statistical significance here. Mann-Whitney test analyzed the proportion of CPL by *instructor_reply*. Table 8 contains the proportions of each CPL among the five types of users. The analysis showed a measure of significance between CPL and the presence or absence of an *instructor_reply* in the associated thread.

Part 5: Is *instructor_reply* associated with thread length? A *t* test was used to determine if thread count was different between the presence and absence of an instructor reply within associated threads.

Part 6: Does cognitive presence mirror the intended pedagogical scaffolding established in the three phases of the course? If the patterns of cognitive presence show a significant difference using the Kruskal-Wallis test a post hoc pairwise comparisons, using the Bonferroni correction, looked for significant pairwise comparisons in course phase.

Part 7**:** Is there a pattern of cognitive presence between comments and posts? The proportions of CPL by type of message was analyzed using the Mann-Whitney test to

show the proportions of each cognitive presence level between the two types of messages and displayed the mean ranks for posts and comments.

Summary

Educators represent a large percentage of MOOC participants so MOOC professional learning is seen as a viable delivery system. The Blended and Online Learning MOOC studied her relies on a discussion forum to build community. It is difficult to build community without the CoI and the triad of presences needed to support the educational experience. In order to examine the value of the discussion forum as a means for creating CoI in a MOOC, QCA was selected as the methodology. This chapter explains the benefits of using human coding instead of machine coding of cognitive presence. Additionally, this chapter shows why it is necessary to use individual messages as the unit of analysis rather than participants.

Seeking patterns of cognitive presence, the dependent variable, in a MOOC discussion forum is done so with the use of time as a moderator. Time takes two forms in this study, weeks, also known as modules and phases that represent the three scaffolded phases of course instruction. The independent variables include posts, replies; thread count; and a separation between threads with and without instructor reply. Garrison et al. (2010) show the relationship between the three presences in discussion forums. This study hypothesizes there is low teacher presence due to the ration and low social interaction due to the voluntary nature of the discussion forum. Without teacher presence and social presence, it follows that there should be no cognitive presence either.

Based on the procedures for QCA described in this chapter as defined by Neuendorf (2002), the next chapter will contain all of the SPSS test data, tables and a description of the results that will address each of the seven parts of the RQ.

CHAPTER 4: FINDINGS

One overarching research question comprised of seven separate parts provided the basis for these data. RQ: Are there patterns of cognitive presence in the MOOC discussion forum? The question embodies a holistic approach to quantifying the cognitive presence in messages produced by educators in a university-level MOOC using the legacy Coursera format. This study analyzed participant actions for cognitive presence using messages posted to the discussion forum. The unit of analysis for the purposes of this study was each message in the discussion threads. These separate messages represented individual thoughts and actions. More than 10,000 messages from one MOOC were provided to the researcher. From that message database of 10,000 records, 1,000 were randomly selected and coded using the community of inquiry (CoI) coding scheme to determine the cognitive presence level (CPL) of each message.

The 1,000 records were examined for missing data and inappropriate coding. Fourteen of the messages received a (CPL) code of 0 indicating a lack of CPL. Because that code did not fit into the four levels of cognitive presence analyzed in this study (triggering, exploration, integration and resolution), these messages were deleted from the sample. Nine other messages came from individuals identified as stakeholders, and an additional 69 messages stemmed from a group identified as FB, which indicated a special request for feedback on an assignment. Accounting for the records with a CPL code of 0 and those identified as either a stakeholder or FB yielded 89 inappropriate cases, which subsequently were removed from the study. The researcher then conducted analyses of the research questions on the remaining 911 records.

Description of the Data

The researcher used records from 911 messages to answer the seven research questions. Table 2 contains a description of the variables used in the analyses. The number of messages posted was higher at the beginning of the course (Week 1 = 252) and gradually decreased to only 80 by Week 8 of the MOOC. The same held true across the three phases of the course. More than half of the messages originated during the first 3 weeks with less than 20% occurring during the last 2 weeks of the course. Nearly half 48% of the 911 messages were coded at the CPL of exploration, while only 8% were coded as resolution messages. The instructor replied to slightly more than half of the messages 53%. The messages were either posts 65% or comments to those posts 35%. High school educators accounted for one-third of the participants in this sample of messages. Elementary educators accounted for another 23% of participants, and the remaining 20% were classified as "All" because of the drop-in participation by the final phase of the course.

Limitations

The nature of the sample combined with the fact that the dependent variable was ordinal necessitated the application of statistical tests based on mean and mean rank. Due to the large sample size, the datasets performed statistically as independent samples without removing messages that trace back to the same participant. Since 95% of the date was from single users, the decision was made to keep the dataset intact as a true representation of the CPL in any given week. Treating each week or CP as an independent sample justified the use of the non-parametric statistical test, Kruskal-Wallis.

Analysis of the Research Questions

Parametric and nonparametric statistical analyses were conducted to determine the answers to the seven research questions. The Mann-Whitney test was used to compare differences between two independent groups when the dependent variable was ordinal. The Kruskal-Wallis test, a rank-based nonparametric procedure, was also used to test for a statistically significant difference between two or more groups on an ordinal dependent variable. Several analysis of variance tests (one-way analysis of variance and *t* test) were used to test for differences between two or more groups on a continuous variable. Each analysis was evaluated at $\alpha = .05$.

Research Question Part 1

Is there a pattern of cognitive presence from Week 1 to Week 8 of the course? The proportions of CPL in each of the 8 weeks of the course were analyzed using the Kruskal-Wallis test. Table 5 contains the proportions of each CPL at each of the 8 weeks. Table 4 contains the mean ranks for each week. The analysis showed statistically significant differences in CPLs among the 8 weeks, $\chi^2 (7) = 25.52$, $\mathbf{p} < .01$. Post hoc pairwise comparisons using The Bonferroni correction, $p = .0018$ (.05/28), found three significant pairwise comparisons. In each case, Week 2 was greater than Weeks 4 and 7.

Table 5

Description of the Sample

Variable	*n*	*%*
Week		
1	252	27.7
2	104	11.4
3	118	13.0
4	96	10.5
5	84	9.2
6	83	9.1
7	94	10.3
8	80	8.8
Phase		
Weeks 1-3	474	52.0
Weeks 4-6	263	28.9
Weeks 7-8	174	19.1
Level of cognitive presence		
Triggering event	41	4.5
Exploration	439	48.2
Integration	358	39.3
Resolution	73	8.0
Instructor reply		
No	427	46.9
Yes	484	53.1
Type of message		
Post	591	64.9
Comment	320	35.1
Type of user		
Elementary	212	23.3
Middle school	168	18.4
High school	303	33.3
Admin	54	5.9
All	174	19.1

*All represents a combination of all demographic categories in phase 3 of the course.

A close look at the sample indicates that participation in the discussion forum started close to 30% and leveled off to an average of 10% across subsequent weeks. Viewed in phases, the highest number of messages was found in Phase 1 with 52% of all

messages in the forum. This was followed by 28.9% in Phase 2, and 19.1% in Phase 3. Overall, CPLs measured 4.5% triggering or the base level, 48.2% for exploration, 39.3% for integration, and 8% for resolution, which is the highest CPL according the codebook. Combined, exploration and integration accounted for 77.5% of the CPLs found in the message sample. Instructor Reply occurred in 53.1% of the threads from the sample.

As a category, Posts represented 64.9% of the messages versus 35.1% for Replies. The distribution of participant demographic affiliations showed that high school teachers were the largest group with 33.3%, followed by elementary school teachers at 23.3% and middle school teachers with 18.4%. Administrators represented the smallest proportion of participants with 5.9%. The "All" category shows the number of messages from Phase 3. Since Phase 3 had only 174 participants, the instructor of the course grouped them together rather than separately into demographic segments and provided only single prompts for each of the remaining modules rather than one prompt for each category of participant.

Table 6

Patterns of Cognitive Presence from Week 1 to Week 8

	n	1	2	3	4	5	6	7	8	Total
Triggering event	41	1.2	3.8	7.6	10.4	6.0	2.4	6.4	2.5	4.5
Exploration	439	52.4	32.7	40.7	54.2	42.9	45.8	56.4	57.5	48.2
Integration	358	40.9	48.1	44.9	31.3	44.0	41.0	28.7	30.0	39.3
Resolution	73	5.6	15.4	6.8	4.2	7.1	10.8	8.5	10.0	8.0

* Percentage of CPL at each week

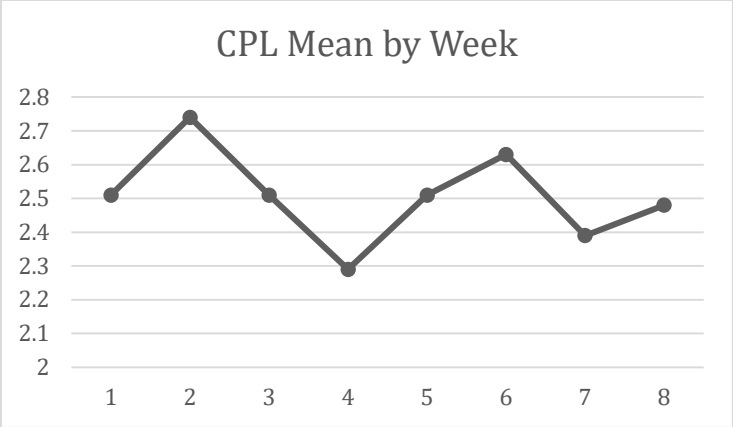

Figure 5. The mean Cognitive Presence in Weeks 1 through 8

Table 6 shows the patterns of CPL over each of the eight modules in the course. The Total column shows the average CPL over the period of the entire course, which can also be seen in Table 1 breaks down the distribution by module also shown as week. Triggering was above average in weeks 3, 4, 5, and 7. It was below average in weeks 1, 2 and 6. Week 4 had the highest level of triggering at 10.4%. Exploration averaged 48.2% overall. Weeks 1, 4, and 6 were very close to the average, while Weeks 2, 3, and 5 were below average. Weeks 7 and 8 showed the greatest proportion of exploration with 56.4% and 57.5% respectively. Integration averaged 39.3% overall. Weeks 1 and 6 were very close to average with weeks 4, 7 and 8 at well below average. Weeks 2, 3, and 5 showed the greatest proportion of integration during the course. Week 2 was the greatest with 48.1% integration. Overall proportions of cognitive presence can be viewed in Figure 5.

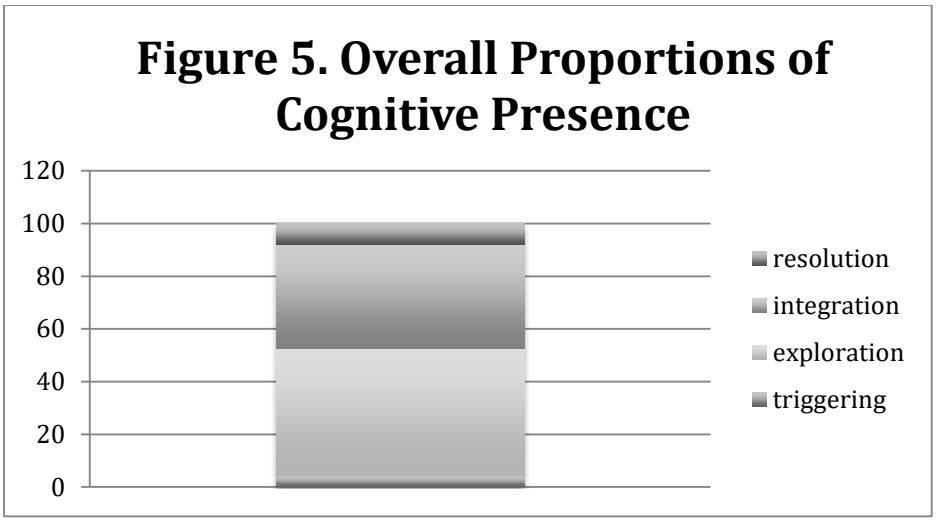

Figure 5. Overall Proportions of Cognitive Presence.

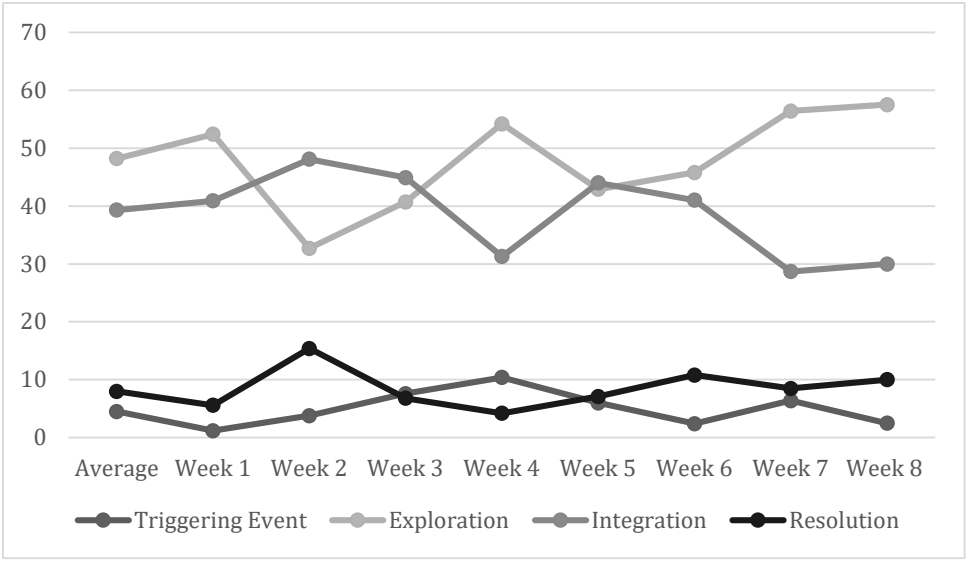

Figure 6. Patterns of Cognitive Presence from Weeks 1 through 8

Table 7 contains the mean ranks and standard deviation for each week. The analysis showed statistically significant differences in CPLs among the 8 weeks, χ^2 (7) = 25.52, p < .01. Post hoc pairwise comparisons using The Bonferroni correction, *p* = .0018 (.05/28), found three significant pairwise comparisons. As shown in Table 8, in each case, Week 2 was greater than Weeks, 4 and 7.

Table 7
Mean Ranks of Cognitive Presence by Week in Course

Week	*n*	*Mean rank	*Significant differences	Mean	Std. Deviation
1	252	455.13	Week 2>Week 1	2.51	.622
2	104	537.82	Week 2>Week 4	2.74**	.763
3	118	463.31		2.51	.737
4	96	386.11		2.29	.710
5	84	466.10		2.51	.703
6	83	485.04		2.63**	.728
7	94	412.40	Week 2>Week 7	2.39	.736
8	80	435.95		2.48	.711

* Mean rank refers to the H statistic in the Kruskal-Wallis test. ** Above the mean

Research Question Part 2

Is there a pattern of cognitive presence among demographic subgroups based on educator levels: elementary, middle school, high school, school administrators, and the combined group "All" from phase 3? The proportions of CPL for each user type were analyzed using the Kruskal-Wallis test. Table 7 shows the CPL proportions for each of the five user types identified for this study. The analysis did not find a statistically significant difference in CPLs among user types, χ^2 (4) = 4.85, **p** = .30.

Table 8

Patterns of Cognitive Presence according to User Types

		Type of user*					
	n	Elementary School	Middle school	High school	Administration	All	Total
Triggering event	41	1.9	4.2	5.9	7.4	4.6	4.5
Exploration	439	49.5	46.4	45.2	37.0	56.9	48.2
Integration	358	43.4	39.9	40.9	44.4	29.3	39.3
Resolution	73	5.2	9.5	7.9	11.1	9.2	8.0

*Percentage of CPL for each demographic subgroup showing user preference

Table 8 shows the how the discussion forum categories represent CPLs. The overall CPL distribution can be seen in the Total column where triggering and resolution were less than 10% while exploration and integration accounted for 77.5% of CPLs overall. Messages found in the elementary group had below-average levels of triggering at 1.9%, close to average exploration at 49.5%, above-average integration at 43.4% and below-average resolution at 5.2%. Messages found in the middle school group contained about average triggering with 4.2%, near-average exploration with 46.4%, average integration with 39.9%, and slightly above-average resolution with 9.5%. Figure 6 below shows the representation in each of the four demographic categories.

Messages sampled from the high school group showed an above-average triggering at 5.9%, a slightly below average exploration at 45.22%, integration at 40.9%, which is close to the average, and resolution as average at 9.5%. The administrator category was high in triggering with 7.4%, low in exploration at 37%, above average in integration at 44.4% and above average in resolution at 11.1%. In Phase 3 of the course,

all participants were able to answer only one prompt, which resulted in creation of the "All" category. When combined, all participant groups showed an average level of triggering at 4.6%, above-average exploration at 56.9%, below-average integration at 29.3%, and slightly above-average resolution at 9.2%. Figure 7 below shows the breakdown of CPL by demographic category.

Table 7 illustrates the significant differences in effect size by week. Weeks one through eight are listed and to the right is the n value for the number of messages sampled by week. The number starts at 252 for week 1 and declines to 80 in week 8. The mean rank represents the comparable measure of overall cognitive presence. Significant differences occurred in the effect size between Week 2 and 1, Week 2 and 4, and Week 2 and 7. In all three cases, Week 2 demonstrated the highest mean rank of cognitive presence. Figures 7 and 8 show the breakdown of demographic categories and patterns of CPL by category.

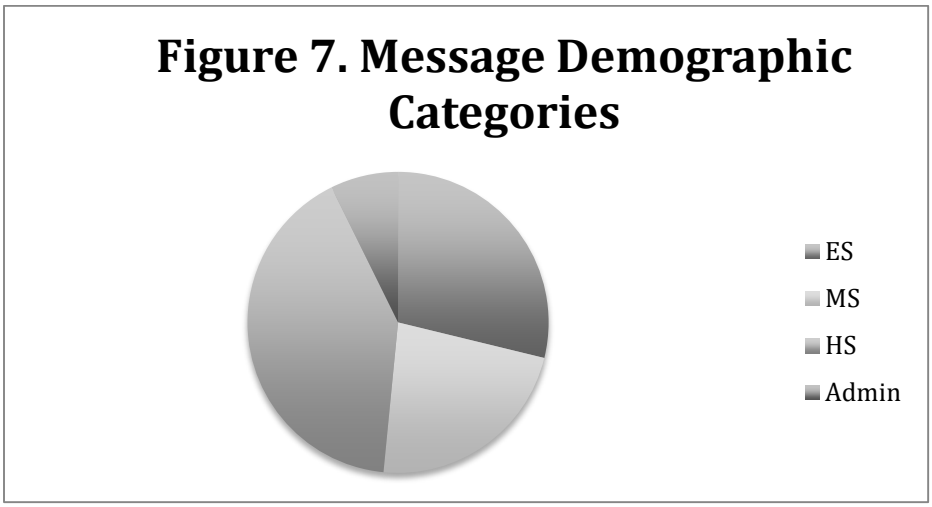

Figure 7. Message Demographic Categories.

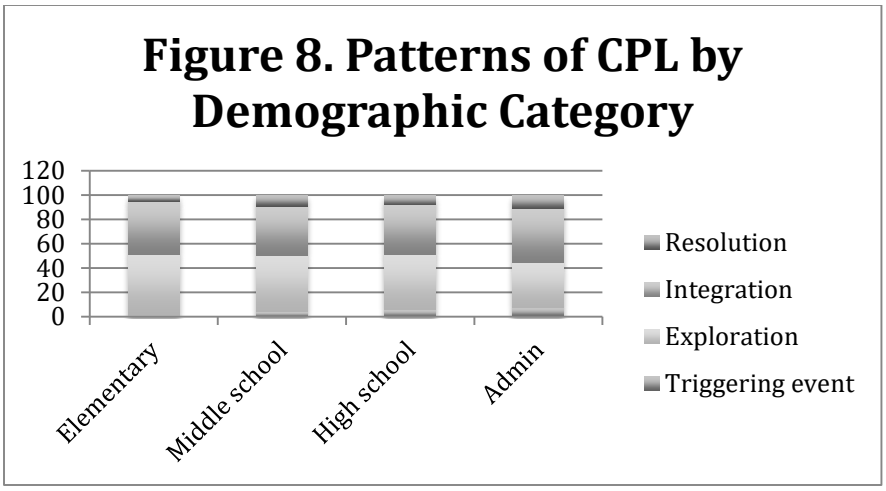

Figure 8. Patterns of CPL by Demographic Category.

Research Question Part 3

Does the proportion of cognitive presence vary by thread length (i.e., number of messages in a thread)? The researcher analyzed thread length in two different ways: using a one-way analysis of variance and categorization according to the number of messages in a thread. The one-way analysis of variance helped examine for differences in continuous variable thread length across the four CPLs (see Table 9). The results presented in Table 5 show that no significant differences in thread count occurred among the four CPLs ($F = 1.77$, $p = .15$). To categorize the number of messages in a thread, the researcher divided the distribution of messages in each thread into groups with each containing approximately 20% of the total messages (see Table 10). The proportions of CPLs by thread count category then were analyzed using the Kruskal-Wallis test. Table 8 contains the proportions of each CPL among the five categories of thread count. The analysis did not find a statistically significant difference in CPLs among categories of thread count, $\chi^2(4) = 4.97$, $\mathbf{p} = .29$.

Table 9

Means and Standard Deviations of Thread Count by Levels of Cognitive Presence

Level of cognitive presence	*n*	*M*	*SD*
Triggering event	41	37.76	43.29
Exploration	439	60.76	69.75
Integration	358	62.85	64.03
Resolution	73	58.84	68.51

Table 10

Patterns of Cognitive Presence Among Categories of Thread Count

		Level of cognitive presence (CPL)*				
# of messages	*n*	Triggering event	Exploration	Integration	Resolution	Total
1–5	193	24.4	21.0	19.8	27.4	21.2
6–15	169	22.0	21.0	15.4	17.8	18.6
16–54	183	26.8	19.4	21.5	13.7	20.1
55–113	187	22.0	18.9	22.3	20.5	20.5
114–249	179	4.9	19.8	20.9	20.5	19.6

* Percentage of CPL presence for each category of messages

As mentioned previously, Table 10 shows the distribution of CPL by thread length with the sample of messages representing about 20% of all messages in the discussion forum. Regardless of the thread length or the number of messages contained within a singular response to a topic, length was not found to be a factor influencing CPL. The column containing the number of messages shows that in threads consisting of fewer

than 6 messages in length, triggering was 24.4%, exploration was 21%, integration was 19.8% and resolution was 27.4%.

Threads containing fewer than 16 messages had 22% triggering, 21% exploration, 19.8% integration, and 17.8% resolution. Threads containing 16-54 messages showed 26.8% triggering, 19.4% exploration, 21.5% integration, and 13.7% resolution. Threads containing 55-113 messages contained 22% triggering, 18.9% exploration, 22.3% integration and 20.5% resolution. Threads ranging 114-249 messages in length contained 4.9% triggering, 19.8% exploration, 20.9% integration, and 20.5% resolution. For n=193 messages found in the thread count 1-5, resolution was greatest among all thread length categories at 27.4%. Triggering stood out as above average (26.8%) for counts of 16-54 messages while those with thread counts of 114-219 appeared on the opposite extreme with only 4.9%. While these numbers show variation, they do not represent statistical differences.

Research Question Part 4

Is instructor reply associated with a pattern of cognitive presence? The proportions of CPLs by instructor reply were analyzed using the Mann-Whitney test. Table 11 contains the proportions of each CPL among the five types of user. The analysis did not find a statistically significant difference in CPLs between the presence and absence of an instructor reply, $U = 98920.50$, $\mathbf{p} = .22$.

Table 11

Patterns of Cognitive Presence by Instructor Reply

		Instructor reply*		
	n	No	Yes	Total
Triggering event	41	5.9	3.3	4.5
Exploration	439	48.7	47.7	48.2
Integration	358	37.2	41.1	39.3
Resolution	73	8.2	7.9	8.0

* Percentage of CPL in each type of instructor reply

Research Question Part 5

Is instructor reply associated with thread length? A *t*-test was used to determine if thread count was different between the presence and absence of an instructor reply. The results (See Table 12) showed a statistically significant difference ($t = -30.13$, $p < .01$) in the message count of threads containing instructor replies ($M = 103.28$) as opposed to those that did not contain instructor replies ($M = 11.78$).

Table 12

Means and Standard Deviations of Thread Length by Instructor Reply

Instructor reply	*n*	*M*	*SD*	*t*	*p*
No	427	11.78	13.98		
Yes	484	103.28	65.12	-30.13	< .01

Table 12 shows that the mean for Instructor Reply by thread length was 103.28 compared to 11.78 for those with no instructor reply. Statistical significance is clear between thread length and likelihood of instructor reply.

Research Question Part 6

Does cognitive presence mirror the intended pedagogical scaffolding established in the three phases of the course? When the patterns of cognitive presence were analyzed by phase of course (See Table 13), a significant difference was found using the Kruskal-Wallis test ($\chi^2(2) = 7.14$, **p** = .028). Table 13 contains the mean ranks used in the analysis. Post hoc pairwise comparisons, using the Bonferroni correction, $p = .0167$ (.05/3), found one significant pairwise comparisons. Phase 1 was significantly greater over Phase 3.

Table 13

Patterns of Cognitive Presence by Phase of Course

		Phase of course*			
	n	Weeks 1–3	Weeks 4–6	Weeks 7–8	Total
Triggering event	41	3.4	6.5	4.6	4.5
Exploration	439	45.1	47.9	56.9	48.2
Integration	358	43.5	38.4	29.3	39.3
Resolution	73	8.0	7.2	9.2	8.0

Percentage of level of cognitive presence at each phase of the course

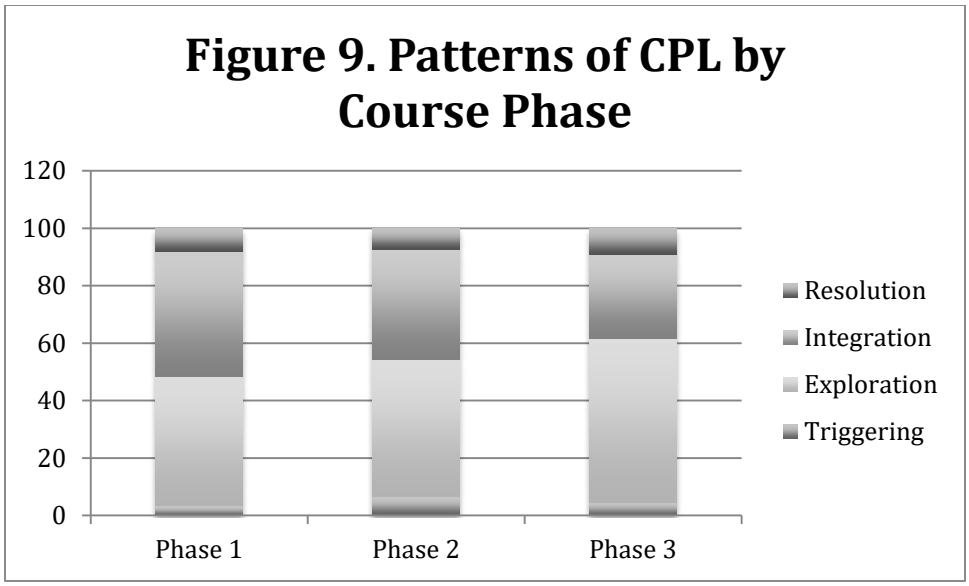

Figure 9. Patterns of CPL by Course Phase.

Higher CPLs resulted when the integration and resolution CPLs are combined. The overall proportions can be seen in Figure 9 above. Combining integration and resolution for Phase 1 is 51.5% compared to Phase 2 at 45.6% and Phase 3 at 38.5%. Phase 1 demonstrated a significantly greater CPL than Phase 3 and a greater CPL than Phase 2, In terms of lower levels of CPL, Phase 1 was 48.5%, Phase 2 was 54.4% and Phase 3 was 61.5%. Similar to the results cited for higher CPLs, the greatest and most significant contrasts for low CPLs existed between Phases 1 and 3.

Table 14

Mean Ranks of Cognitive Presence by Phase of Course

Phase	*n*	Mean rank	Significant differences
1	474	475.31	Phase 1 > Phase 3
2	263	442.88	
3	174	423.23	

Table 14 simply confirms the significance shown in Table 13. The table shows mean ranks of CPL for each phase. Only Phase 1 shows a statistically significant difference as compared to the mean CPL in Phase 3.

Research Question Part 7

Is there a pattern of cognitive presence between comments and posts? The proportions of CPLs by type of message were analyzed using the Mann-Whitney test. The results appear below:

Table 15

Patterns of Cognitive Presence Between Posts and Comments

		Level of cognitive presence (CPL)*				
Type of message	*n*	Triggering event	Exploration	Integration	Resolution	Total
Post	591	68.3	61.0	67.3	74.0	64.9
Comment	320	31.7	39.0	32.7	26.0	35.1

* Percentage of total messages by type of message

Table 15 shows the proportions of each CPL between the two types of messages. The analysis found a statistically significant difference in CPLs between the posts and comments, $U = 87330.50$, $\mathbf{p} = .034$. Table 15 shows the mean ranks obtained in the analysis, with posts having significantly higher CPLs than comments.

Table 15 shows a comparison between posts and comments and their CPLs. Posts contained higher proportions of CPLs than did Comments. For triggering, the ratio was .46, for exploration, it was .64, for integration, it was .49 and for resolution it was .35. Posts are the initial response in a thread. Comments are the replies to individual posts within a thread.

Table 16

Mean Ranks of Cognitive Presence by Type of Message

Type of message	*n*	Mean rank
Post	591	468.23
Comment	320	433.41

Table 16 shows a comparison of the mean ranks for CPL in the group of messages categorized as post and comments. The mean rank for posts is significantly higher than it is for comments.

Summary

The overarching research question asked, "Are there patterns of cognitive presence in the MOOC discussion forum?" Participant messages as representations of thinking in a collaborative setting were analyzed for cognitive presence. More than 10,000 messages from one MOOC were provided to the researcher, and 1,000 messages were selected randomly and subsequently coded using the community of inquiry (CoI) coding scheme to determine the cognitive presence level (CPL) of each message. This data was used to provide a clear picture of the patterns of CPL present over time.

The analysis indicated that CPLs were higher in Week 2 than in Weeks 1, 4, and 7. Similarly, when the patterns of cognitive presence were analyzed by course phase, Phase 1 levels were significantly greater than those of Phase 3. The message count of threads in which the instructor replied was higher than those messages to which the instructor did not reply at all. Posts had significantly higher CPLs than did comments. However, in other analyses, no significant differences in CPLs were found among the

type of user or thread count. Lastly, no significant differences were found in CPLs between the presence and absence of an instructor reply. A discussion of these results is in Chapter 5. Conclusions drawn from the results and recommendation for further research are also discussed. In addition to finding some significance, the data revealed patterns of CPL that are discussed in the final chapter.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

MOOCs are a disruptive innovation (Christiansen, 2013). Peer-reviewed studies of MOOCs date back to 2008 (Liyanagunawardena et al., 2013). Researchers have difficulty making sense of MOOC participant behavior because most registrants do not complete their course (Kizilcec & Piech, 2013). According to Anderson, Huttenlocher, Kleinberg, and Leskovec (2014), MOOCs still are largely misunderstood. Veletsianos and Shepherdson (2016) identified surveys and automated methods of analysis as the preferred methods for collecting MOOC data during 2013-2015, which suggested a need for alternative methodologies. Researchers were challenged by the need to examine the overall effectiveness of MOOC pedagogies (Smith, 2013), by using MOOCs as knowledge incubators for self-directed learning (Reeves & Hedburg, 2014).

Despite studies on individual participants' emotive expressions (e.g., Koutropoulos, 2012), holistic study of discussion forums proves difficult. Brinton et al. (2014) found in one MOOC that discussion forum volume declined steadily and that the high volume of posts in general made it difficult to keep up with students or teachers, which makes it difficult to determine the value of the cognitive thought generated by self-directed participants under these circumstances. QCA with automated coding cannot provide a complete view of message CPL within a learning context (Neuendorf, 2002). For this reason, this study employed manual coding of forum messages followed by an analysis of the coding results to identify levels of cognitive presence in a self-selected group of discussion forum of MOOC participants.

Little is known about the value of performing voluntary tasks in an online course settings related to the way this leads to the formation of CoIs and CoPs. Despite the large scale of MOOCs, they do contain elements of a CoP (Dufour, 2004; Lave & Wenger, 1991) and, within discussion forums, have the potential to become CoIs (Garrison et al., 2010). Ideally, discussion forums should offer participants room to connect and form communities of learning. Acccording Wu, Yao, Duan, Fan, and Qu (2016), studies using social network analysis have tried to track relationships based on posts and replies within discussion forums in an attempt to understand how knowledge construction takes place in a MOOC discussion forum.

A discussion forum tool serves the purpose of building and sustaining a CoI under the right conditions, but determining what those conditions are remains a question. Measuring the CPL of the group of discussion forums isolates one part of the CoI triad. In this study, levels of CPL proportions changed as participation eroded over time. There is a gap in collecting data that provides evidence of visible thinking in MOOC discussion forums.

Summary of Findings

The premise of this study was to examine a discussion forum for CPLs in order to identify patterns of proportions. One might expect potential patterns of CPL to occur based on course phase, group affiliation, or thread length. Hypothetically speaking, if the discussion forum questions are scaffolded to elicit responses that build in content and complexity over time, then a pattern of cognitive presence would emerge to mirror this intent. No such pattern emerged from the analysis in this study. There was no CP with a higher degree of cognitive presence. The findings also did not yield any unexpected

significance in thread length, instructor reply, or among and between comments and posts.

Several possible explanations exist as to why data at times shows little or no significance. According to Shea and Bidjerano (2009), CoI provides an overlapping set of three elements in a CoI. These are relational elements that do not exist in isolation; however, social presence alone often is used as a measure to evaluate experiences in a discussion forum. In this study, it was necessary to isolate these elements in order to produce the coding scheme. Social presence was isolated by Rourke, Anderson, Garrison, and Archer (1999) and can be described as communication behaviors that enhance closeness including an aspect of teacher immediacy. Additionally, the social presence uses interactive cues such as questioning or referencing others' posts as ways of showing social interaction levels. The Rourke et al. (1999) study took place prior to MOOCs, such that the authors had no way to anticipate the impact of scale on their model. In 2008, Swan et al. stated, "Cognitive presence may be the least researched and understood of the three presences, yet it is cognitive presence that goes to the heart of a community of inquiry" (p 4). One reason for the lack of progression through the phases of inquiry is course design that lacks an explicit intention for resolution (Garrison & Arbaugh, 2007). Additionally, absence of higher CPLs were considered to be subject to the instructors' ability to coach students through misconceptions and help them over the hurdles to resolution (Garrison, 2007).

In a MOOC, the role of instructor is marginalized by the scale of participants and yet is a critical component of the CoI model. The underwhelming report of presence in the discussion forum may be due to the lack of social engagement and instructor

presence, both of which characterize a MOOC. Another plausible explanation might lie in the methodology. For this study, a large sample was culled from the total number of messages posted to the forum, and the units of analysis were coded by hand. Although the coder's validity and reliability were confirmed statistically, it is possible that the coding team employed consistent but incorrect coding, which would indicate a shared bias. Such circumstances could skew the distribution of presences.

It is possible to assume that MOOC scale may rob participants of their need for meaningful socialization; however, that presupposes a sincere desire for socialization in the first place. Course survey results indicated that participants had numerous reasons for registering for MOOCs among them was finding a way to connect around common themes (Skrypnyk, Joksimović, Kovanović, Gašević, & Dawson, 2015). Briton et al. (2014) found that while instructor interaction caused discussion to peak, it did not lead to greater retention of MOOC participants over time. A study by Rose et al. (2014) used a predictive model to show a participant's likelihood of leaving a course. The researchers considered the possibility that the emergence of spontaneously created sub groups may hold the answer in that when a person leaves the group, others may follow suit.

Analysis of Research Question

Research Question Part 1

Is there a pattern of cognitive presence from Week 1 to Week 8 of the course? Overall, the CPL measured in the course represented 4.5% as triggering or the base level, to 48.2% for exploration, 39.3% for integration and finally, 8% for resolution, the highest level of cognitive presence. Combined, exploration and integration accounted for 77.5%

of the CPLs found in the message sample. Figure 5 illustrates the distribution of CPLs in the course as a whole.

Instructor Reply displayed 53.1% of the threads from the sample. As a category, Posts represented 64.9% of the messages while Replies accounted for 35.1% of all messages. The distribution of participant demographic affiliations showed that high school teachers were the largest group (33.3%) followed by elementary school teachers (23.3%) and then middle school teachers (18.4%). Administrators represented the smallest proportion of participants with 5.9%. Figure 6 shows the message demographics.

Hansen and Reich (2015) showed that the low barrier to participation afforded by anonymity allowed for high levels of participation. It is possible that this low barrier to entry is actually a barrier to continued participation. The anonymity may make participants feel devalued and they may leave in part because their activity is not acknowledged. Discussion forums may be collaborative learning tools when social presence (Garrison et al., 2001) is explicit rather than implicit. Guzdial and Turns (2000) noted that simply offering a discussion forum does not make it a useful tool for participants. While the instructor did establish a purpose for the discussion forum and sub divide the community by demographic affinity groups, aside from the structured threads, the participants had not impetus to connect as a community.

Phase 3 combined all groups together rather than maintaining them as separate demographic segments. This was done by providing a single prompt only for each of the remaining modules instead of one prompt for each participant category. The patterns observed in this study showed greater proportions of both exploration and integration than for triggering and resolution over the duration of the course. Instructor Reply was

present in over half of the threads sampled, and the largest group of messages represented participants who selected the respondent category, high school teachers.

Research Question Part 2

Is there a pattern of cognitive presence among demographic subgroups based on educator levels: elementary, middle school, high school, school administrators, and the combined group "All" from Phase 3? The analysis did not produce a statistically significant difference in CPLs among user type. Messages from the high school group showed an above average triggering at 5.9%, a slightly below-average exploration with 45.22%, integration at 40.9% (close to the average) and an average resolution of 9.5%. The administrator category was high in triggering with 7.4%, low in exploration at 37%, above average in integration at 44.4% and above average in resolution at 11.1%. Figure 7 shows the distribution of CPL among the four message categories.

Despite the best application of available research in designing the discussion forum, as noted by Smith (2013), effective communication at scale is still a challenge for instructors who leverage peer review feedback. While forming a community is a critical element in the learning process (Garrison et al., 2000) it appears that creating the sub groups based on grade level and role affinities produced similar results regardless of the group with the exception of the smallest group, administrators who showed a higher level of CPL.

Research Question Part 3.

Does the proportion of cognitive presence vary by thread length (number of messages in a thread)? The distribution of messages in each thread was divided into groups containing approximately 20% of the messages in each. The analysis did not find

a statistically significant difference in cognitive presence levels among categories of thread count. Regardless of the thread length, or the number of messages contained within a singular response to a topic, length was not found to be a factor influencing CPL. Triggering stood out for thread counts of 16-54 as above average with 26.8% and on the opposite extreme was only 4.9% in thread counts of 114-249. While these numbers show variation, they do not represent statistical differences. In prior studies thread length is associated with individuals not messages as a unit of analysis so there is little to compare. Considering that the exchange of ideas and potential for knowledge construction are linked by interactions (Nonaka et al. 2008), one might infer that longer thread lengths showed greater CPL, but that was not the case.

Research Question Part 4

Is instructor reply associated with a pattern of cognitive presence? The analysis did not find a statistically significant difference in cognitive presence levels between the presence and absence of an instructor reply. The researcher was interested to know if instructor reply might increase the likelihood of obtaining scores for CPL 3 and 4 by increasing student engagement. No correlation was identified in this instance. Numerous variables may account for this lack of impact on CPL. The possibility exists that instructor replies are noticed only by those in close proximity to the reply. Also, since replies were noted to contain lesser amount of CPL, the instructor replies likely did not contain material sufficient enough to generate engagement. On the other hand, longer threads did attract more participants.

According to Hew (2015) participants prefer instructor interaction to peer interaction. Due to the large scale of the discussion forum, the instructor replies did not

have a measurable impact on the CPL, so this may support Hew's (2015) research because there was not enough instructor interaction to change the proportion of CPL. In addition, the participants may view the instructor as a passive observer (Hew & Cheung, 2014).

Research Question Part 5

Is instructor reply associated with thread length? The results (See Table 8) showed a statistically significant difference (t = -30.13, p < .01) in the message count of threads that the instructor replied to (M = 103.28) that those that the instructor did not reply to (M = 11.78). The relationship between thread length and instructor reply is not surprising given the sheer volume of posts and the ratio of instructors to students. Instructors were more likely to weigh in on threads with the potential for viewing by the greatest number of students. Since the thread count is a feature available to all students, one can assume that threads with higher counts attract more students; hence, these threads are likely to attract instructors as well.

Research Question Part 6

Does cognitive presence mirror the intended pedagogical scaffolding established in the three phases of the course? A significant difference was found using the Kruskal-Wallis test ($\chi^2(2) = 7.14$, **p** = .028). Higher levels of cognitive presence can be seen when the integration and resolution CPL's are combined. Phase 1 is 51.5% compared to Phase 2 at 45.6% and Phase 3 at 38.5%. Phase 1 demonstrated significantly greater CPLs than Phase 3. The larger number of participants in Phase 1 may account for the higher CPLs in that particular phase.

Research suggests that the relationships between MOOC participants and their self-directed behaviors are an area for further study (Ho, Stump, & Breslow, 2014). The change in proportions over the phases may indicate a degree of self-directed rather than guided learning. Participants chose to stay in the exploration stage of CPL. According to Garrison et al (2001), this may indicate a need for increased instructor intervention. Another possible explanation is the complexity of the participants as members of a crowd, having difficulties forming community due to a lack of predictability (Bonabeau, 2004). The decrease in the number of messages may also indicate the lack of a truly active learning environment and strong pedagogy, which is associated with deeper learning (Bernard, 2014; Means, 2013).

Research Question Part 7

Is there a pattern of cognitive presence between comments and posts? Posts had significantly higher levels of cognitive presence than did comments. Posts are the initial response in a thread; comments are the replies to individual posts within a thread. In this study, CPLs were higher in Week 2 than in Weeks 1, 4, and 7. Similarly, when the course phases were analyzed for patterns of cognitive presence, Phase 1 patterns significantly outnumbered those from Phase 3. The message count of threads containing instructor replies was higher than those to which the instructor did not reply. Posts had significantly higher CPLs than did comments. However, in other analyses, no significant CPL differences were found among user type or thread count. No significant differences in CPLs were found between the presence and absence of an instructor reply.

Patterns of cognitive presence appeared in the data derived from the various statistical tests performed in this study. Kent, Laslo, and Rafaeli, (2016) used the number

of replies rather than posts as one measure of interactivity. While interactivity was not measured in this study, it is possible that the lower CPL of replies is an indicator of low interactivity as well. The ordinal data represented codified segments or layers of cognitive presence, which form stratifications when viewed as a graph. Each layer contains a proportion of the whole, with each representing a percentage of the units of analysis harvested from each week and phase of the course. The data yielded reports that indicated weak overall levels of significance. There was a disproportionately high level of exploration in Phase 1 as compared to Phases 2 and 3. Additionally, there appeared to be a correlation between instructor reply and length of thread. This result confirmed the hypothesis that instructors are attracted to threads with higher counts because they are seeking to connect with the greatest number of participants.

The CPL distribution in Phase 1 showed a higher proportion of exploration correlating to level 2 in the codebook. This indicated higher levels of thinking than triggering which is level 1 of CPL. This was expected because the modules were scaffolded to elicit lower levels of thinking, represented by CPL categories, triggering and exploration, rather than integration or resolution which are higher levels of CPL. During Phase 1, participants should exhibit active exploration because it indicates that they are constructing meaning. They would be expected to build to higher levels of CPL in Phases 2 and 3. A pattern of increasing proportions of higher CPLs did not present over the duration of the course. MOOCs generally suffer from issues of scalability and sustainability of engagement in effort to support the acquisition of knowledge and skills (Anderson et al., 2014; Coppola, 2013; Smith & Killen, 2013).

Several factors may explain this. First, the initial phase of the course serves to attract the greatest number of participants. At this point in the course, half of the total number of participants chose to make a post in the discussion forums. The other half of the participants opted out. The initial energy infused the discussion forum and, was short lived. Another possible explanation is the mixture of participants. All discussion forum participants were self-selected. In general terms, all were elementary, middle, or secondary school educators, administrators, or stakeholders—potentially a heterogeneous group, that represented a mixture of abilities and interests in education. The CPL distribution throughout the remainder of the course changed after the initial phase when the number of active participants dropped off dramatically. It is possible that as the number of participants drops, the heterogeneous group becomes more homogeneous. In other words, as the rich topsoil which represents the initial flood of messages into the discussion forum is washed away, the remaining participants are likely to be an increasingly more homogeneous a group. Since Fullan et al. (2006) stated, that creating a sense of community and fostering a common approach to inquiry are attributes of strong professional learning models, MOOCs may not offer a strong enough model for teacher professional development. Additionally, teachers are more likely to adopt new practices within a supportive environment (Guskey, 2002) so the disparity between posts and replies in CPL may indicate that the environment is less than supportive for teachers.

Assumptions and Limitations

The Connectivist model represents an emerging theory of learning. MOOCs were founded on Driscoll's (2002) definition of learning and pioneered by Siemens (2005) and Downes (2005). There are four principles of learning that can be summed up in these four

words: contextual, active, social and reflective. Behaviorism, cognitivism, and constructivism have limitations when applied to explanations of large-scale interactive learning. Siemens (2014) established a convincing case in support of a nonlinear alternative learning theory, Connectivism, which extends beyond the confines of the learning management system (LMS) into the realm of informal learning through the use of social media. Integral to this theory is the concept of flow, found in the applied method of social network analysis (Kleiner, 2002). As stated earlier in this study, Siemens (2005) and Downes (2005) were the originators of the Connectvist Theory. They stated that the communication flow in social contexts is an indicator of the organizational knowledge-ecology vitality. Siemens (2005) referred to Connectivism as a model for learning that acknowledges the impact of digital tools on the learning process. The MOOC instructor builds in social media and the possibility of connecting with external sources of information. Informal or unofficial learning spaces are limitless in a cMOOC. While notable, this theory applies best to cMOOCs rather than an xMOOC, like the one in this study.

A CoP contains three essential elements: context, participants and structure. These elements provide the basis for interaction and knowledge construction (Wegner, 1998). Since there are many types of CoP. Jones, Stephens, Branch-Mueller, and de Groot (2016) examined MOOC virtual learning environments to see if they could make a distinction between a CoP and affinity spaces (Gee, 2005). Jones et al. (2016) concluded that both terms are needed to fully describe the MOOC learning environment with implications for course design.

CoP is a concept that allows us to observe the relational nature of knowledge construction. An element of CoP is social context. Cognition takes place in a social context among people engaged in similar work. This can happen in informal groups such as MOOCs where participation in the discussion is voluntary; groups form organically in the forum, the primary source of peer-to-peer interaction (Wenger, 2000).

MOOCs provide a CoP in the educational world, and Crowdsourcing provides another kind of CoP in the business world. Bynam (2013) described crowdsourcing as the way businesses entreat consumers to provide skills and content in exchange for resources and the opportunity to solve problems collaboratively. The context is social, the participants are voluntary, and the contribution is knowledge development, which occurs at the intersection of people within a defined structure. If we compare the crowdsourcing model to MOOCs, we see several distinct differences stemming from the invitation to enter into a working relationship. MOOCs offer an opportunity to acquire knowledge and credentials while businesses offer a chance to become part of a company's research and development team in exchange for an extrinsic reward.

Kohler (2015) considered the untapped potential for crowdsourcing for business development. As an open source of innovation, crowdsourcing has the potential to capture value, convert it to profit and share it with the crowd. Participants are resources who contribute to the bottom line and should be rewarded. What is the value proposition of MOOC education? Due to scale, peer-to-peer pedagogies, like peer editing and discussion forum dialogs, are leveraged. This puts students in the roles of instructor, value creators and meaning makers. Unlike the business model, MOOC participant contributions are used as a measure of engagement. It seems that in education,

engagement demonstrated by interactions, is currency or, when described in business terms, value.

A limitation of this study is applying a single lens to look at cognitive presence. In identifying units of analysis, the messages themselves become like packets or objects containing information for transfer. Hagar and Hodkinson (2009) showed how assumptions associated with the metaphor of learning as transfer are limited by the idea that learning is a byproduct of the learner. They maintained that transfer is about an object and that learning is not necessarily contextual and may be separated from the context.

Learning as skills acquisition is another common lens with an inability to account for the transfer skills to across contexts. Learning by participating is very much akin to the CoI premise (Garrison et al. 1998; Lave & Wenger, 1991). This lens assumes that the individual is subordinate to the whole: it occurs externally from the learner, and learner activity and engagements are hallmarks of this lens. It sets apart peripheral participation as less engaging. Context is critical in contrast to the propositional and skills acquisition lenses. Learning and the learner are viewed on parallel evolutionary journeys; they change but mastery is relative to their contexts. The fourth common lens is one of learning as transformation, embodied in the theory of constructivism. Constructing understanding is an individual task (Garrison et al. 2001). Hagar and Hodkinson (2009) propose a new metaphor that allows for more possibilities to explain learning as a process. They say learning is the process of becoming.

Reflecting on the Study

This study examined the discussion forum holistically so it is difficult to make any direct comparisons between studies that focused on user behavior and interactivity. The most frequent types of messages were identified as either exploration or integration level. Throughout the three courses phased, the level of integration decreased as the exploration rose. This is counter to what would be expected if the participants were guided by the discussion forum prompts. Scaffolding in the discussion forum questions was designed to elicit increasingly higher levels of thinking as the participant progressed to completion. The prompts, divided in the first two phases by demographic category, were designed to engage participants by appealing to their role in education. Within these instructor-crafted threads, participants initiated additional threads within those topics.

During Week 2 the level of cognitive presence was at its peak within the discussion forum. If discussion forums are to be employed, then why shouldn't they play a greater role in developing communities of inquiry? What does this say about pedagogical implications for community building? If the forums are voluntary, then the participants are seeking something of value. Is it affirmation; is it a way to go on the record? These are the non-passive participants. They need to be treated differently than the passive participants. They are a subset of the whole MOOC community of learners who are responding to the instructor's intentional learning design (Onah, Sinclair, & Boyatt, 2014).

They chose to answer the questions, observe the posted messages and in some cases they also reply or post new threads. Discussion forum participants are generating their own content guided by the instructor-led prompts. "The heterogeneous composition

of discussion forum sub-communities enhances the scaffolding of knowledge by putting the broad range of experience of both experts and novices in league with one another." (Sharif & Magrill, 2015). The group is a self-selected heterogeneous group, however, the data in this study does not support the need for scaffolding directly. In fact, it has no significant impact of the CPL. Sharif and Magrill (2015) suggested that passive learners can become active learners when provided with incentives to create course content. The need for a redesign of the discussion forum is clear.

Several significant patterns of cognitive presence emerged in the discussion forum messages based on the statistical analysis of each of the RQ tests in Chapter 4. Only one of these results however is significant in view of previous studies on the subject. During module 2, which is also in Phase 1 of the course, the level of exploration was the highest. This aligns with results from studies (Akyol et al., 2009). However, by observing the proportion of cognitive presence in each core sample perhaps these results can produce a new way of thinking about how to measure CoI in a CoP. In the age old discussion of learning, one thread has remained consistent: knowledge and learning are constructs, and, as such, can only be described in the light of a metaphor.

Metaphors. Paavola, Lipponen, and Hakkarainen (2004) compared two learning metaphors that permeate our present view of learning. They show the origins of CoI stemming from two metaphors that we take for granted. One is the concept of knowledge building a metaphor that explains learning, as participant, and interaction-driven (Bereiter & Scardamalia, 1993) with a basis in Popper's (1973) three-worlds model for learning. Learning takes place in world 2, the mental realm, whereas, knowledge is built in world 3, the realm of theories and ideas. In this three worlds model, personal agency drives the

learning process. The second metaphor conceives of learning as knowledge expansion by acquisition from a cognitive standpoint (Engestrom, 1999). Anderson (2000) embraces the two, as not being mutually exclusive. Instead he develops a framework to explain the confluence of the two learning theories.

In their qualitative self-study Nye, Foster, and Edwards (2013) considered the way metaphor shapes our learning and thinking. In “Metaphors and Learning”, Boud and Hagar (2010) wrote, “Learning is discovered and generated together with others from a complex web of contextual, interactional and expectational factors” (p 360). The idea that learning is transformative and reflective conjures metaphorical images that help us understand the magic of learning. In terms of context, Barnett (2010) offered that people inhabit multiple learning spaces that vie for attention. These spaces can be described metaphorically speaking as informal, non-formal or formal and translate to different aspects of a person’s life experience.

Learning as an experience is best described as reflective or transformative, but how does the learner perceive the experience? Various metaphors, including the nomadic learner (one who crosses disciplines to explore) or those who weave threads into the fabric of knowledge can help us understand the experience from a learner point of view. So how does thinking in metaphors help to explain the activity related to levels of cognitive presence in the MOOC discussion forums?

When the threads are untangled to expose the individual strands, called messages, they represent a level of cognitive presence. They are parts of a whole. This study takes a representative core sample of thoughts and puts them into a metaphorical jar with some water and shakes them up, much as you can with soil to see how the particles settle into

layers or horizons. Some float to the surface while others sink to the bottom of the jar. When everything settles, what remains is a new way to examine the layers of complexity represented by the different proportions of cognitive presence in the discussion forums.

With cognitive presence, a distribution of layers or horizons of presence occurs. Using horizons rather than levels as the operative metaphor changes the view. All horizons are expected in a soil sample, the concern comes from the expected use of the soil and the related expectation for the proportion of each horizon. If the products of discussion forums were viewed in these terms, then all horizons would be indicators not of value on their own but as a proportion of the whole.

Soil generally is tested for nutrients and the results inform the recommendations for sustaining plant life and fertilizers to adjust the condition of the soil. Like soil testing, it may be possible to extract a core sample of messages from a discussion board and analyze the components, assess the quality and make recommendations for adding nutrients to produce growth. In the practice of analyzing soil samples, the layers that form are known as horizons. There are four main horizons: the dark rich topsoil, the zone of accumulation, geologic sediment and bedrock (Prothero & Schwab, 2014). A soil sample is a historic record. It tells a story that includes time, materials, climate, living organisms and position on landscape. Discussion forums, too, are like a historic record. They contain markers for time, materials, climate, participants as living organisms, and position indicated by the course content, platform and provider.

In comparing the levels of cognitive presence to the horizons in a soil sample, see Figure 10, to consider the organic surface as a triggering event. It appears to be a healthy characteristic of the soil, however, alone it contains no nutrients to feed plant life.

Beneath the organic surface layer is the topsoil, dark and rich in nutrients. This layer represents the rich discourse and questioning that occurs in fertile conversations. The next level is generally clay or silt, and acts like a filter in soil and in discussion forums can be represented as the integration or tentative discourse phase. In this phase of cognitive presence, filtering is what leads to stronger connections and ownership of ideas. Finally, we reach the bedrock, not part of soil but upon which solid rests. It is solid and immovable like the resolve phase of cognitive presence.

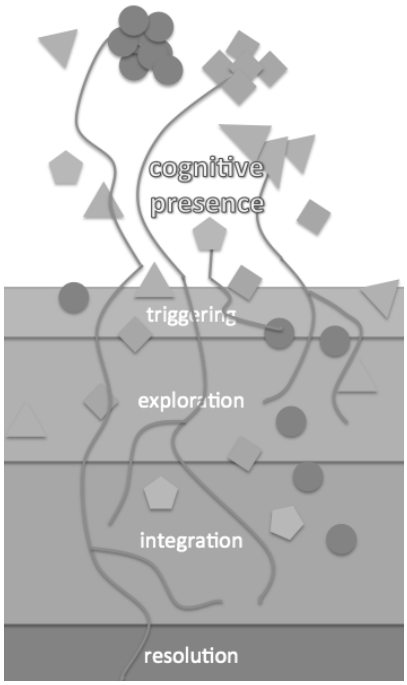

Figure 10. Soil Horizon Metaphor for Sampling Cognitive Presence in a MOOC discussion forum.

Discussion forum profiles are to soil profiles as messages are to soil samples. In soil testing, the profile informs nutrient management. By examining soil scientists measure its fertility based on several measures. It looks at the horizons and the Ph. In a discussion forum the amounts of cognitive presence can represent the horizons. The Ph value, an indicator of acid or base is beyond the scope of this study suggest that Ph value

would be comparable to the activity level measured as social presence. The instructor might be analogous to the region because they play a role in determining the climate of the course.

All courses proceed from a contrived environment rather than a natural setting. It produces a clinical environment for the user through the structure of the platform interface. So, within this laboratory structure, participants interact with the content in general by completing tasks and interact with the population by engaging with the discussion forum. Posts or messages posted to the forum are like potato peelings and dried leaves, but also rocks, minerals, water, and air. They decompose at various rates and pile up churning like matter in the big bang. Once the flurry of activity settles, we can analyze the remains as a whole artifact. The whole is sampled and settles into layers, like the horizons in the earth's surface.

With clues provided by discussion profiles, we may predict how a discussion forum performs under certain conditions. What proportions are necessary for lively discussions that increase cognitive presence? Or, is it really imperative that cognitive presence increases? Why is a changing proportion an advantage? Perhaps the proportion of water, air, minerals and organic matter in discussion forums should represent conditions for cognitive presence and not cognitive presence itself. The purpose of learning is to achieve growth and growth is measured in terms of mastery of skills and knowledge. The soil metaphor works in this case because it recognizes that value of the ingredients. Alone they may represent nutrients, organize materials or minerals, but together they are capable of producing a rich, growth oriented environment.

Soil horizons vary in depth and cover the earth's surface in levels from shallow to deep covering a layer of dense bedrock. Bedrock alone could not sustain life. Like higher educational institutions that provide the bedrock for education, they need the participants to create layers of soil, to enrich it with nutrients that come from their thoughts and experiences. The content generated by participants in a discussion forum forms the very richness capable of supporting growth in academia with its intricacies and diverse composition.

A message is a form of waste, an emission like breath itself. Once expelled, the breath is also inhaled and the body is flooded with a renewed source of oxygen. The process of reflection seems to be similar. The exhaling of thoughts and ideas leads to an inhaling of digested thoughts and ideas.

CoI is a form of community of practice, which according to Garrison, Anderson, and Archer (2001), operates as three interconnected pieces: instructor presence, social presence, and cognitive presence. Each presence is dependent on the other to sustain its role in forming the educational experience. MOOCs are at once a social magnet and a social wasteland. They attract many participants, but the sheer numbers result in flurries of discussion forum posts that make following a thought a challenging task. Knowledge germination—a metaphor used by Piaget, Vygotsky and other cognitive scientists—refers to the new developing from the old (Reddy, 1979). In "The Conduit Metaphor", Reddy (1979) demonstrated the transformational power of metaphors in education and elevated the discussion of metaphors as tools to essential conditions for producing conceptual foundations for education. Metaphors help to explain processes. It seems metaphor and theories are inseparable twins, knowledge and cognition. The value of using a variety of

metaphors is in their ability to shift thinking by changing the base. Depending on the observer, discussion forums, in common terms, could be described as hives of activity or as places where ideas go to die. Figurative language shifts our thinking. The metaphors we adopt are part of our worldview, and can be indicative of behaviors, decision-making and written responses.

Implications for Discussion Forums

Reframing the ways we look at discussion forums requires considering new metaphors for communication, new ways of weighing the value of discussion forum communication and the measurements we currently use to assess their value. We may examine individual participation looking for signs of cognition, but in a community, we need to ask ourselves if the potential of the community is supposed to outweigh the value of any one individual contribution.

The idea that language is a conduit communicating thoughts and ideas using written expression is an assumption that colors our understanding of the very purpose of discussion forums. They are viewed like open-air markets where people barter for good and services. In fact, the reason to participate is to become part of the process. We are told that participation is a form of interaction and that the exchange of internal ideas via external platforms leads to a building of knowledge and skills. In order to ascertain a level of cognitive presence I was involved in a process that involved listening for meaning, making assumptions based upon word selections that cognition could be measured within the context of cognitive presence.

Examining soil over a period of time one sees how changes in the environment cause erosion on one hand or conversely, add nutrients. Like participants in a forum, their

messages show how much of themselves they cared to reveal at a given point in time and in response to a variety of stimuli. Many of them remain at a superficial level of anonymity after a single post and the cognitive presence levels show an increase in exploration and a decrease in integration over the course. However, even a single message represents a contribution of nutrients to the soil.

Hagar and Hodkinson (2009) asserted the following:

> Much contemporary educational policy continues to make simplistic, 'common-sense' assumptions about the transfer of learning that are directly contradicted by much of the research and theorizing of learning that has occurred … further complicated by the fact that some researchers wish to hold on to the concept of learning transfer even though this is rooted in those same simplistic notions of learning (p 1).

They noted that the two different metaphors, learning as transfer and learning as acquisition, are used interchangeably. Transfer is a slippery slope, and defining both the intent of transfer and the outcomes are in dispute. Hagar and Hodkinson (2009) were convinced that the oversimplification of these metaphors leads us to view knowledge as discrete units rather than as a complex process. They concluded that learning should not be viewed through a single lens.

When crowdsourcing cognitive presence in a discussion forum, the approach to learner support must be both intentional and consistent. Every contribution represents an act of construction and should be valued as such if engagement is to be sustained.

Implications for MOOC Research

In 2016, Velestianos and Shephard published a meta-analysis of MOOC research. In it, they reached several conclusions and made recommendations for future research. According to their scholarship, a majority of the studies relied on click stream data and quantitative analysis. In addition, automated data analysis was found in 26.8% of the studies. The meta-analysis revealed that only 1% of the studies used a form of textual analysis. Context and impact accounted for only 10.9% of the studies. The researchers recommended taking a broader look at MOOC methodologies, focusing on sub-populations and attempting to reach a better understanding of the differences between MOOC types, like cMOOC and xMOOC.

This study took a unique approach to quantitative analysis by employing QCA and employing a human coding methodology to look at discussion forum from a specific sub-population, namely educators. The study looked at the context and the impact of the discussion forum by evaluating the cognitive presence that was produced over the course. Because the approach did not use the typical measures, which include survey instruments completed by participants after the course, or click stream data to observe the behavioral characteristics of participants, researchers should consider new ways to examine the value of MOOCs.

While the study showed few patterns of significance in the discussion forum, it did allude to a potentially valuable way of viewing the impact of discussion forums on a massive scale. Instead of focusing on individual participation, researchers should focus on the holistic contributions of the group, looking at them as a crowd, rather than as individuals. Bali (2014) noted that in MOOCs, learning is more important than

completion. In her study, Bali (2014) compared four courses. In each of the courses, discussion forums were optional and noted that some instructors promoted the social constructivist interaction while others allowed forums to exist without intervention or mediation from the instructor. The MOOC in this study used the discussion forum to scaffold learning, but it was an optional activity. The results of the study indicated that beyond the initial rush to interact, participants who remained showed a consistent proportion of cognitive presences. In designing future MOOCs, the value of discussion forum interactions should be more closely measured using content analysis to see if patterns of cognitive presence correspond to patterns of learning outcomes.

Reich (2015) stated his concern for the value of MOOC research and the need to advance the science of learning, warning that big data doesn't inherently contain answers that will inform learning design. Reich pointed to a shift from student engagement to student learning. This study purposefully moves from individual student engagement to examine student learning in the context of cognitive presence. It provides a new way to consider the value of MOOC discussion forums. Researchers should consider using discussion forums as barometers for climates suitable for sustaining knowledge construction.

In addition to taking a unique approach to the methodology for studying MOOCs, this study also took a unique thesis, stating that MOOCs might be better viewed as a crowdsourcing opportunity. Using this lens to evaluate MOOCs, the priorities for success shift. Prpić, Melton, Taeihagh, and Anderson (2012) made a detailed comparison of MOOCs and crowdsourcing platforms. They showed distinctive differences and similarities between the two. This study asks researchers to consider more than what

MOOCs designers can learn from crowdsourcing and vice-versa; it asks them to consider whether MOOCs will benefit from restructuring and adopting a crowdsourcing approach to education. In crowdsourcing, the learning is the job of the participant because they are expected to solve problems and add value to the process. The role of learning becomes central to the crowdsourcing solution. According to a meta-analysis by Means et al. (2009) if participants are given a task to solve a problem they become more engaged in seeking the solution. In addition, Blanschke (2012) pointed out that in order to move participants from pedagogy to heutogogy it requires opportunities for self-determination and knowledge of participatory skills. In order to accomplish this, forums would need to be redesigned. It requires a paradigm shift that radically changes the notion of educational exchange.

Online courses have been designed to adapt the face-to-face Social constructivist theories of learning (Canole, 2013). MOOCs challenge that paradigm on one hand by attracting learners who are autonomous and self-directed but who want to participate in a group activity. This study shows that in an asynchronous discussion forum, participants voluntarily share their thinking in the form of messages and that these messages contain various levels of cognitive presence. MOOC designers should consider developing a reward system for active forum participation that feeds the intrinsic motivation of participants, which is what attracted them to the course in the first place.

Educators represented a significant segment of MOOC participants interested in exploration, experimentation and acquiring new skills (Ho et al., 2015). They demonstrated self-directed learning and autonomy, but like participants in general, educator participation wanes over time. This study suggests that as a group, the messages

did produce a pattern of cognitive presence in spite of the lack of teacher presence and social presence typically found in smaller contexts. While unremarkable, the results indicated that CPL activity was taking place the discussion forums in spite of the unfavorable conditions for CoI. MOOCs have tended to value the product of completion over the process of production. In production, cognitive presence is a changing variable. In any given moment a sample of messages can produce a unique snapshot of the collection of presences at work. This study suggests that learning to observe the climate of the discussion forum as fertile soil for knowledge construction has inherent value. If researchers could ascertain the ideal conditions for knowledge construction in a MOOC, then it is conceivable that instructors could adjust the conditions needed to retain the interest and engagement of more participants for a longer time.

Recommendations

The aim of this study was to examine the inner workings of a collective intelligence by studying a sample of thoughts posted by participants. Instead of looking at these thoughts as part of one individual, they were sorted and sifted as independent units of thought and coded for cognitive presence. Is it possible to look at the forum as a collective intelligence? Consider what each of these messages represents as part of the whole. They represent action, motivation, engagement and curiosity to name a few. Researchers should consider the conditions necessary to sustain the relationship between participants and the learning that lead to high levels of cognitive presence.

What metaphors resonate with the activity present in the discussion forum? How does the metaphor describe the activity the process? What if the metaphor is causing confusion and misinterpretation of discussion forums? MOOCs might not be as

disruptive as they seem. It is possible that MOOCs do not go far enough to feed the needs of educated adult participants. On some level, adults are seeking validation, a higher purpose, and a way to become part of a greater consciousness.

The question that begs consideration is the valued added by participants in a MOOC framework. There are more differences than similarities. Both models are structured to attract and support massive participation online. Both offer a semblance of affinity space where people who have something in common come together to engage in thinking activities. The difference resides in the relationship between the provider and the participant. Crowdsourcing is generally considered to be a business model, although the TED Prize and educational offshoot of TED embraces this model to generate solutions to world problems.

Kohler (2015) noted problems in crowdsourcing ventures that mirror MOOC issues, such as initial traction that doesn't translate into retention. From the business perspective, Kohler understands how important it is to capture value but also to share it with the participants as a reward (2015). Contribution has merit and should be recognized. MOOCs offer a way to engage with content in exchange for credentials, but is that enough to sustain the interest of a well-educated population? According to Gaevic et al. (2015), the quality of activity trumps the cognitive level of a student. Participants seek challenge in order to be engaged. Hew and Cheung (20140 identified the challenges inherent in MOOCs that still remain: student access globally, the obscurity of communication at scale, a lack of targeted feedback and relatively low forum participation. Instructor preparation time is also costly and time consuming.

Crowdsourcing strategies may be employed to increase activity and to raise engagement among the discussion forum participants. Forum expectations should be valued by the course itself. If community of practice is valued, then the instructor should consider designing more incentive to participate. They may create smaller affinity groups, leadership roles within the discussion forum, and ways to share and raise the awareness of users who are contributing to the greater good. Classifying learners as Kizilcec, Piech, & Schneider, (2013) suggests by using learning profiles may help course designer to create more adaptive responsive courses.

Discussion forums were designed as a place to exchange ideas. How are MOOC participants determining the value of the asynchronous exchange? In order for an exchange to take place, there is intent to share. In the case of discussion forums, the participants share ideas, questions, metacognitive thoughts on processes and way they apply their understandings in authentic conditions. It isn't a stretch to infer that those who voluntarily enter the discussion forum have something to exchange, a question for an answer, an observation for some feedback or a confirmation for their thought process. At the application stage, the participant may be looking for recognition or validation that they have solved a problem successfully. In every case, a participant is engaged in active learning by entering into a forum. But the forum itself is not responsible for the outcomes. It provides a venue and a structure to record the sharing, itemize the interactions and tally the words and threads contributed by participants.

Hew, Cheung and Ng (2009) gathered a list of barriers to participation from their broad meta-analysis study. The barriers were (1) not recognizing the need to participate (2) poor behavior or lack of response (3) participant characteristics such as lack of

interest or curiosity (4) difficulty following the discussions (5) lackluster contributions (6) inability to initiate a topic (7) superficial thinking and (8) technical difficulties leading to frustration. Each of these is an opportunity for improvement. Technical barriers relate to structural irregularities that impede conversation. Thomas (2002) found that the nonlinear structures of discussion forums were not supportive of realistic conversation. Threaded discussion forums pose challenges for participants wishing to continue or expand conversations and ideas. If discussion forums are a synonymous with the value placed on conversation, then participants may struggle to add value, find value and perpetuate an interest in the nature of this disjointed conversational structure.

The benefits of discussion forums as enumerated by Cavanaugh (2001) include: individualization, autonomy, increased think time, non-hierarchical exchange, time independent, and they provide resources and peer expertise. Typical discussion forums require posting and act as repositories of structured reflections and responses. In an open MOOC discussion forum, participants choose to contribute.

- Offer scaffolding as an option rather than a required pace for discussion forum prompts.
- Implement instructor strategies to move participants from exploration to integration levels of cognitive presence.
- Consider new approaches to discussion forum dynamics, such as using a crowdsourcing model to elicit expertise, engagement and problem-solving skills.
- Consider ways to recognize voluntary contributions to discussion forums.
- Reward participants creating content weekly rather than as an outcome of the course.

- Consider using CPL proportion as an indicator of forum health and allow this to drive instructor-led interventions
- Consider the outdated and impracticality of threaded discussions on scale and seek social media alternatives.
- Measure communities of learners in MOOCs using a new metric that accounts for value added contributions and content creation rather than by course completion.

Future Research

If the discussion forum is the primary means for participants to form communities, then community-building strategies need to be investigated and studied. Active participants represent untapped resources they are displaying a pattern of behavior that requires further investigation. Participants who willingly enter the discussion forum space are taking control exercising agency and self-direction. They are seeking to make a contribution. How can we encourage and support this initiative? Active participation should be rewarded. Something is happening in MOOC discussion forums independent of the well-placed scaffolding, regardless of the lack of social interaction and in spite of the absence of instructor interventions. Consider the other potential outcomes if this happen organically without duress in an imperfect structure. The messages show patterns of cognitive presence throughout the course. They show that as the numbers decrease, the thinking activities shift between exploration and integration.

Conclusion

According to Fournier, Kop, and Durand (2014), the impact of social media has been largely excluded from the learning potential in online environments. This is important because there are opportunities for informal collaboration and knowledge

construction beyond the scope of a MOOC. Connectivism in the form of crowdsourcing or some new truly disruptive technology will cause a shift in the way people learn. There is still much to learn about the self-directed online learner. Stacey (2013) highlighted the opportunities to embrace social constructivism by incorporating pedagogies that leverage wikis and blogs. Stacey (2013) wrote, "The best online pedagogies are those that use the open web and relationship to mine veins of knowledge, expertise…" (p. 4). However, the idea of mining knowledge and expertise sounds rather proprietary and raises concerns about intellectual property. For this reason, higher education should consider recalibrating its roles and relationships with the knowledge community. Zhang (2016) referred to learning that occurs online as supplementary to the face-to-face learning found in a real classroom. His research suggests ways to tap into the participant engagement style to meet their different needs.

Turning the focus back to K-12 teachers, it is important to consider what MOOCs can offer them in terms of 21st century skills. Kereluik, Mishra, Fahnoe, and Terry (2013) found an intersection of three singular frameworks including: foundational, meta, and humanistic. "Fundamental change is change in underlying institutions" (Waks, 2007). Have MOOCs fundamentally changed the underlying institutions of education? Higher education reacted to MOOCs as if responding to a new epidemic. In fairness, higher education plans ahead and according to budgets. Funding innovative teaching and learning proposals must go through a process and the outcomes must be considered according to the bottom line. Those concerns able to monetize MOOCs sustained interest in promoting them. Platform providers like Coursera have moved to a new delivery model that removes the instructor from the equation. Universities now can offer a MOOC

year round. MOOCs are a place to find content and students with shared interests or affinities. Evidence from a study by Glance, Forcey, and Riley (2013) suggests that MOOCs may actually offer an advantage for learning outcomes as compared to face–to–face classes.

Massively open online courses (MOOCs) represent a unique experiment in higher education. MOOCs offer participants opportunities to engage with materials, resources and discussion forums similar to other online courses. Pedagogical components of MOOCs and the nature of learning provide interplay worthy of examination due to issues involving scale and the role of the instructor (Ross, Sinclair, Know, Bayne & McLeod, 2014). The Community of Inquiry (CoI) framework provides a basis for measuring cognitive presence in online discussion forums. MOOC Discussion Forums are a form of active learning (Dewey, 1916). As peer dominated, voluntary points of entry to a vast community of learners it is important to consider the value of participant contributions in terms of cognitive presence. This study focuses on an educator MOOC because MOOCs have been proposed as a vehicle for professional development due to the significant self-identification of participants as educators (Ho et al. 2014).

Much is known about participant attributes; however, the discussion forum is difficult to study on a massive scale (Kizilcec, Piech & Schulz, 2013). Brinton et al. (2014) found a decline in discussion forum volume and identified a challenge for students and teachers to keep track of dialog with the high volume of posts. Automated measures of cognitive presence using content analysis have been used but may not provide the full view of the learning behaviors implicit in messages posted to the forums (Wong, Pursel, Divinsky & Jansen, 2015). To address this gap, the forum messages were hand-coded and

analyzed using quantitative content analysis (Neuendorf, 2002). The study found that the measure of exploration increased over the duration of the course. Viewing cognitive presence over time provided a holistic way to observe the change in the proportions of cognitive presence in the discussion forum of an educator MOOC. Rather than evaluating the success of a course by the yield of completers (Nguyen, 2015), this study suggests that evidence of cognitive presence may be a useful measure of activity led by self-directed learners. The designers of large-scale educational courses should consider deliberately incorporating strategies that appeal to self-directed learners such as problem solving which is a characteristic of the crowdsourcing model. In addition, the increase in exploratory cognitive presence indicates a need to find ways to increase instructor presence during the later stages of the course to increase cognitive presence over time (Akyol & Garrison, 2007; Garrison & Cleveland-Innes, 2005).

This study suggested that patterns of cognitive presence over time may provide a view of MOOCs as a crowdsourcing opportunity rather than as an online course that yields completers. If so, the implications for the future of education in large-scale course designs may include deliberately incorporating the crowdsourcing model. Course designers may want to consider designing online courses to elicit crowd-sourced patterns of cognitive presence that take into account the relative value of heterogeneous messages as evidence of rich soil for participant growth.

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APPENDICES

APPENDIX A

Kennesaw State University

Institutional Review Board

Exemption Request for Research with Human Participants

(Prior to submission of this form, review the IRB Exemption Screening Checklist at http://www.kennesaw.edu/irb/decision-tree.html)

1. Project Identification

Project Title:	Finding Cognitive Presence in a Crowd: A quantitative content analysis of an educator MOOC discussion forum
Principal Investigator (PI):	Kathryn D. Shields
PI Department:	Instructional Technology
PI Phone:	c: 404-386-0164
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Proposed Study Dates:	June 27, 2016 – June 27, 2017
Name of External Funding Agency:	NA
Funding Agency's Deadline:	NA

2. Mark each category describing the proposed research:

☒	Category 1	**Educational Purposes.** Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods. Research is not FDA regulated and does not involve prisoners. Submit questionnaire(s), surveys and consent documents.
☐	Category 2	**Educational Tests, Surveys, Interviews, Public Observation.** Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation. If research involves children as participants, procedures are limited to educational tests and observation of public behavior where investigators do not participate in the activities being observed. Research is not FDA regulated and does not involve prisoners. Submit questionnaire(s), surveys, and consent documents.
☐	Category 3	**Elected or Public Officials.** Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under category (2), if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter. Research is not FDA regulated and does not involve prisoners. Submit questionnaire(s), surveys and consent documents.
☒	Category 4	**Research with Existing Data.** Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. Research is not FDA regulated and does not involve prisoners. No additional documentation needs to be submitted.

☐	Category 5	**Public Benefit or Service Programs.** Research and demonstration projects which are conducted by or subject to the approval of federal department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. (This category may be used for federal programs only.)
☐	Category 6	**Taste Tests.** Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe by the FDA or approved by the EPA or the FSIS of the USDA. The research does not involve prisoners as participants. Submit consent documents.

3. Briefly describe the intent of the proposed research. **-The intent of this experimental research is to answer the following questions: What evidence of cognitive presence can be found in the MOOC discussion forum? Does instructor interaction impact the level of cognitive presence found in messages? Is the phase of the course related to the levels of cognitive presence found in the forum?** Individual messages from the discussion forums will be used as the unit of analysis. These messages come from a set of annonymized, archival data, from a 2015 Massively Open Online Course (MOOC) offered by the Instructional Technology KSU. The archive will provide textual data for conducting a quantitative content analysis. Coding of the dependent variable, cognitive presence, based on the Community of Inquiry framework (Garrison, Anderson & Archer, 2000) will be accomplished using the researcher and two additional internal coders, trained to apply the coding scheme. Coders will meet online, code, discuss, resolve and then continue coding to reach the acceptable level of agreement based on the Cohen's kappa (Nuendorf, 2002). Following the coding process, the data will be analyzed using SPSS for descriptive, comparative and correlational statistics to answer the research questions.

4. Describe how participants, data, and specimens will be selected. -Messages will be the unit of analysis. A proportional percentage from each time period/phase will be selected randomly selected using SPSS and sorted into two groups based on their interaction association with an instructor or instructor agent. This sets up the analysis to examine instructor interaction as a potential moderator of the dependent variable, cognitive presence. The independent variable is the time period or phase of the course. Data will be sorted into three phases to study the relationship of course phase on cognitive presence. Course phase is also associated with the instructional design and scaffolding of knowledge construction.

5. Does the research involve deception? ☐ Yes ☒ No

6. Describe why research procedures will not cause a participant either physical or psychological discomfort or be perceived as harassment above and beyond what the person would experience in daily life. Course participants are anonymous (non-identifiable) and there will be no representations of participant posts that may be associated with individuals. If names appear in posts, they will be removed and disregarded since the message is the unit, rather than the individual.

7. Describe provisions to maintain the confidentiality and security of data both during and after study completion. Internal researchers will be used to review the textual discussion data by coding the content in order to provide inter-rater reliability (Neuendorf, 2002).

8. Describe provisions to protect privacy of participants (e.g., interviews will be conducted in a private area of classroom; individuals will not be publicly identified, etc.).

There will be NO participant interviews. Qualitative and descriptive data about the course will be obtained from existing research papers published by the MOOC instructor of record, Anissa Lokey-Vega. Any reference to the course will be inferred and indirect. All parties will be kept anonymous.

9. Will the research involve obtaining data through intervention or interaction with participants? (e.g., physical procedures, manipulations of participants or their environment, communication or interpersonal contact between researcher and participant, including interviews, surveys, focus groups, online surveys, etc.) ☐ Yes ☒ No

   a. What age groups will be included?
      *Within the consent document, include a statement of age groups to be included in the study.

   b. Describe the consent/assent process to be used.

10. Will an online survey be utilized in this study? ☐ Yes * ☒ No
    *If yes, use the Online Survey Cover Letter template at http://www.kennesaw.edu/irb/consent_documents.html.

11. List all survey instruments to be used (pre-/post-tests, online surveys, interview questionnaires, focus group questionnaires, etc.). Submit these documents along with this form. **NA**

Submit all survey instruments, consent documentation, etc., with this form to irb@kennesaw.edu. Be advised that if your study cannot be granted an exemption by the IRB, you may be directed to submit the IRB Approval Request form to assist the board with further review of your study. This will require additional processing and review time. Direct all questions to the IRB at (470) 578-2268 or irb@kennesaw.edu.

APPENDIX B

Codebook Instructions for Coders

This codebook is designed to assist the coder in the process of coding the one thousand forum messages. You will find a table defining the five levels of cognitive presence as defined by the Community of Inquiry research (Garrison, 2008). It has been simplified for application in this study. You are to refer only to these definitions while coding for this study. You may be aware of other definitions of these words, but those do not apply to this study. In addition, you are to code the each of the messages as individual units. You may have previous experience in research or coding but because each study is different you are to code only according to these instructions.

Instructions:

1. You have been provided with a date entry form with your coder ID. Please use this form to complete the task.

2. A coded sample has been provided to demonstrate how and where to indicate your rating for cognitive presence.

3. For each unit of analysis defined as an individual message, refer to the schematic and select the number associated with the level of cognitive presence detected in the message. Chose that level best described by the unit.

4. On the database form provided, use the drop-down arrow to select the level you judged to best describe the recording unit for each of the messages in your dataset.

5. When you are done, notify the researcher and she will help you save your coding work to the combined coding document.

Levels of Cognitive Presence

Level 0: No observable cognitive presence associated with the course work.

Level 1: Triggering

Level 2: Exploration

Level 3: Integration

Level 4: Resolution

APPENDIX C

Coding Examples

Screenshot of a coding table.

Type: FP-forum post, CP-2, comment post-1	Course Phase	post_text	Score	Rationale/ Adjustments
2	1	I definitely agree with everyone. iNACOL does benefits teacher, students and parents because if their were no standards then teachers would not have set standards.	3	Integration
2	2	Greetings xxx and Classmates. I apologize for the multiple posts of my Unit 6 assignments. However, I don't think I submitted it as a PDF. Please forgive. Thanks.	0	Nothing
2	2	I agree with both of you. An instructional design is really important in all the courses. It helps to understand the unit or course structure. In my opinion, a syllabus or unit plan it helps to understand how is going to be the course or unit. Instructional design improve alignment of objectives, instruction, and assessments, because first you analysis the needs and educational goals to achieve and then you designed and implemented a mechanism to achieve these objectives. It's valuable because first you have analysis the needs and educational goals to achieve, which helps you to have a better design of the course, and find more mechanism to achieve the objetives when you implemented them.	4	Resolution
2	3	xxx, you have offered very useful information in this discussion thread. (I am mentioning this with a smirk on my face because I just finished reading some of your thoughts on the discussion forum requirements for this course.) I, like xxx, am putting non-social information online for the first time. I have mixed feelings about the requirements of discussion forums, but I am appreciative of the information that is shared by you and others.	3	Integration
2	2	Hello, why is there no option for late submission of syllabus?	0	Nothing
2	2	I am not a computer person. I do like the on line course for students I think they will learn a lot. I think it is a problem for some because they don't have computers at home. I am glad I took this class	1	Triggering
2	2	What factors determine if a system should embrace online learning?	1	Triggering
		Using the INACOL standards is necessary, at least at this stage of my learning, to ensure that I have		