MAKING MOOCS: IDENTIFYING PRIMARY WORK SYSTEMS

IN THE CREATION AND DELIVERY OF LEARNING AT SCALE

by

REBECCA LYNN JOHNSON

CLAIRE HOWELL MAJOR, COMMITTEE CHAIR
JENNIFER ENGLERT
DEBRA NELSON-GARDELL
MARGARET RICE
VIVIAN WRIGHT

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ABSTRACT

Massive open online courses provide virtually unlimited numbers of learners with access to instructors and course materials from high-status institutions. These courses are technologically intensive in ways that traditional online courses are not, which invites an examination of how the work to create these new forms may or may not work within traditional university structures and hierarchies. Socio-technical systems theory (STS) states that organizations are comprised of interdependent technical and social subsystems. The technical subsystem is concerned with tools, tasks, and processes. The social subsystem is concerned with people and their attitudes, skills, values, and roles. A change in one subsystem will require an adjustment in the other. Hollands and Tirthali found that MOOCs require more time, resources, and personnel to create and deliver then traditional online courses (2014). They identified the major cost drivers as increased numbers of personnel and more intensive use of technology, which is consistent with socio-technical systems theory. If the technical subsystem of online learning has shifted to accommodate more resource-intensive MOOCs, socio-technical theory requires that there be an adjustment in the social subsystem—more personnel are required. This study describes the roles, tasks, tools, and people involved in creating and delivering MOOCs and learning at scale courses.

LIST OF ABBREVIATIONS

IBSTPI	International Board of Standards for Training, Performance, and Instruction
ID	Instructional design or instructional designer
IHE	Institutions of Higher Education
KSA	Knowledge, skills, and abilities
MOOC	Massive Open Online Course
SME	Subject Matter Expert
STS	Socio-technical systems theory
U1, U2, U3	These refer to the universities in this study
U1 Division, etc.	The administrative units responsible for learning at scale development
U1 Course, etc.	These are the three primary courses under discussion in this study

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1. INTRODUCTION

Background

MOOCs, or massive open online courses, provide anyone with an internet connection and a digital device an opportunity to participate in a learning experience with many thousands of other learners. The first massive open online course in 2008 was an exploration of participation and connectedness, afforded by newly created digital content platforms, such as blogs and Second Life, and an increasingly robust Internet. These “connectivist” MOOCs explored the phenomenon of thousands of learners being connected to one another even as they documented the product of that connectedness through aggregation and analysis of digital content (Andreasen & Buhl, 2015). There was no cost to enroll in a MOOC, the materials were free, and participants could do whatever they liked with the content they created. In a few years, MOOCs had shifted to a different focus and pedagogy. These xMOOCs were less an experiment in connectedness than an experiment in increasing access to course content from the world’s highest-profile universities. Participation in these xMOOCs is free, but there is often a fee association with documenting and certifying one’s successful completion of a course.

While MOOCs might be seen as a form of traditional online learning but with a much larger enrollment, Hollands and Tirthali found that MOOCs require more time, resources, and personnel to create and deliver then traditional online courses (2014). They identified the major cost drivers as increased numbers of personnel and more intensive use of technology. At the same time, institutions of higher education (IHEs) face dire challenges since the Great Recession of 2007-2009. As IHEs prepare students to take on the complexities of contemporary life, nearly every state since 2008 has reduced funding to public colleges and universities (Sullivan & Jordan, 2017). The birthrate in 2008-2011 declined, likely due to economic factors, and has not rebounded with the economy (Barshay, 2018). Many regions of the United States, particularly the Northeast, are seeing fewer students enrolling in IHEs. Those declining numbers are expected to continue through 2029, the year when children born in 2008 are due to enroll in colleges and universities. The declining birthrate and shrinking enrollments mean trouble for institutions that rely on tuition dollars (Alexander, 2018). Institutions building resource-intensive learning at scale courses are doing this in an era of uncertainty and cost-cutting. Money may be tight, but university administrators are motivated to find new students. It is difficult to find recent figures, but in 2013, edX was charging universities $250,000 to offer a course on the edX platform, with a smaller fee each time the course was re-offered (Kolowich, 2013). The more recent financial details of becoming an edX partner are not described in edX materials, but in conversations with personnel at edX Partner Schools, the fee structure has shifted to an initial membership fee with additional annual costs. While the fee to join edX as a partner is not insignificant, and I do not have access to exact figures, one administrator at an edX partner school described the amount as about what they would pay for four billboards in the Los Angeles area for four months. In other words, as a marketing ad buy, it may be worth the investment for some university administrators who want to boost enrollment numbers or awareness of their university.

Any uncertainty or concerns about long-term declining enrollment numbers before March 2020 and COVID-19 now seem quaint. In response to the risks associated with crowded campuses and dorms in a global pandemic, colleges and universities sent their students home in

March 2020. Universities refunded room, board, and parking to students and lost additional revenue from canceled athletic seasons, which added up to losses at some institutions as great as $100 million (Binkley & Amy, 2020). Concerns about fall 2020 enrollment numbers were described by 86 percent of college presidents as at the top of their most pressing issues in the face of COVID-19 (Kim et al., 2020, p. 2).

For universities responding to COVID-19 uncertainties by taking all courses online for the fall 2020 semester, they may address social distancing challenges but the decision may also greatly affect enrollment. Published in May 2020, a survey of almost 1,500 high school seniors who were asked what effect the prospect of a wholly online fall semester would have on their college plans indicated that 15 percent of respondents would be very likely to defer by at least a semester, and up to 45 percent would be very likely to look for a different school (Kim et al., 2020, p. 6). Indeed, a final tally of the Fall 2020 enrollment data showed a 2.5 percent decline in enrollment overall, with a 13.1 percent decline among first-time freshman (Berrett, 2020), though these numbers do not reflect why student enrollment declined.

While COVID-19 has wreaked havoc with traditional higher education, MOOC platforms have seen spikes in enrollment and engagement. Coursera, a MOOC platform founded by Stanford computer science professors Daphne Koller and Andrew Ng, saw over 30 days from mid-March to mid-April a 644% increase in enrollments over the same number, one year before (Shah, 2020a). In 2020, edX, the MOOC platform founded by MIT and Harvard, became one of the world’s 1,000 most-visited websites and added 13 new partners (institutions that have paid a fee to host courses on the edX platform) that include Stanford, Cambridge, and Google. According to the Course Central website, edX now hosts the world’s most prestigious universities—MIT, Harvard, Oxford, Cambridge, and Stanford—while Coursera hosts only

Stanford (Shah, 2020b). The top five courses on the edX platform for 2020 reflect a year of traditional content and that produced during a global pandemic.

1. "Mechanical Ventilation for COVID-19" from Harvard University
2. "CS50's Introduction to Artificial Intelligence with Python" from Harvard University
3. "How to Learn Online" from edX
4. "Inglés básico: conversacional y networking" from Universidad Anáhuac
5. "Exercising Leadership: Foundational Principles" from Harvard University (Shah, 2020b).

The third most-popular course was created by Nina Huntemann, Robyn Belair, and Ben Piscopo of edX to aid learners across the world who had suddenly shifted from in-person to online, or those people who were upskilling and new to online.

The basic function of colleges and universities, teaching learners, is performed by degreed subject-matter experts who work within administrative units arranged by academic discipline. At many universities, only a third of university employees are in teaching occupations, and they are outnumbered by managers and professional staff (Rothwell, 2016). The integration of learning management systems and other instructional technologies requires that universities have professional staff to administer these tools and train users. MOOCs are an even more technologically intensive educational form (Hollands & Tirthali, 2014).

This relationship between technology and personnel is a central focus of socio-technical systems theory (STS), which provides researchers with a framework for analyzing complex systems. STS states that organizations are comprised of interdependent technical and social subsystems. The technical subsystem is concerned with tools, tasks, and processes. The social subsystem is concerned with people and their attitudes, skills, values, and roles. A change in one subsystem requires an adjustment in the other. If the technical subsystem of online learning has shifted to accommodate more resource-intensive MOOCs, socio-technical theory requires that there be an adjustment in the social subsystem—more personnel are required. The increase in technology associated with MOOC development and the associated creation of roles on university campuses involved in producing courses for the edX platform are consistent with socio-technical systems theory.

This project was an opportunity to learn more about the tools, tasks, people, and roles within the social and technical subsystem associated with MOOC work in universities. In addition, a goal of STS research is to increase the efficiency of complex systems that are the sites of socio-technical interdependency and interaction. My focus in this, the first stage of this project, was not how to improve these systems. An important first step toward making systems more efficient is clearly describing these systems. Bostrom and Heinen describe the importance of a well-described system to those who work within them.

> An additional goal of the STS approach is to create a flexible "learning system"--a work system which is able to adapt and adjust within a constantly changing environment. In order to create a learning system, members of the work system must have usable and understandable "maps," or clear pictures, of both the social and technical systems. STS analysis produces such maps. (1977a)

In this project, I sought to describe the work associated with making massive open online courses and focused on the work of two prominent roles within the system, instructional designers and videographers.

Statement of the Problem

MOOC creation and delivery are more resource-intensive than the creation and delivery of a traditional online course, yet there is little research that has attempted to systematically map the primary work systems within institutions of higher education that create learning at scale.[1] At a time when IHEs are under increasing budgetary and enrollment pressures, this resource-intensive product has no industry development standard. In addition, the pressure of shifting technical requirements in these learning at scale systems may be changing the social subsystem—the roles and required skills of those who perform this work. An examination of the knowledge, skills, and abilities of the personnel who work on these learning at scale courses is necessary to staff these projects appropriately and to train personnel properly.

Purpose

By mapping the primary work systems of learning at scale providers, I am able to describe how the technical and social subsystems interact in learning-at-scale course development. With this project, I provide a description of the work associated with these courses.

Significance

This descriptive qualitative research project provides both an overview of the work involved in creating learning at scale and an understanding of the ways that this work is performed by individuals at three different institutions. This work has the potential to save time and resources for IHEs engaged in this work. In addition, this study provides a description of how course creation and delivery personnel roles may be evolving in these systems, which will be important for those involved in training or staffing. Finally, for those educational technologists, instructional designers, and videographers who wish to work in these systems,

[1] From a phone conversation with Yakut Gazi, associate dean, learning systems at Georgia Tech University. She described "learning at scale" as a more inclusive term for those massive online courses that are open and those that are limited to those accepted into a degree program at the IHE offering the course. I used the more inclusive term in this project when I intended to refer to the larger category. (Y. Gazi, personal communication, September 30, 2019)

knowing about the knowledge, skills, and abilities required in these systems will allow them to focus their coursework or professional development activities.

2. LITERATURE

The purpose of this chapter is to review the literature that supports an investigation of the socio-technical systems associated with the design, development, and delivery of massive open online courses (MOOCs) in Institutions of Higher Education (IHE). The literature surveyed here describes the tools, tasks, personnel, and roles associated with the design, development, and delivery of online learning at scale in higher education, focusing in particular on the instructional designer or educational technologist and videographer roles. This review closes with a section on socio-technical-systems theory, the theoretical framework for this project.

My primary interest is to describe the work of instructional designers and videographers who make learning at scale courses at universities on the edX platform. The literature associated with massive open online courses is recent, with the first MOOC identified in 2008. Much of the MOOC literature includes case studies, analyses of learner behavior, and attempts to measure effectiveness of MOOCs. There is also much in the popular academic press that anticipates the MOOC destroying higher education, and then a few years later, thought pieces on the failure of MOOCs to take down higher ed. I have sought out recent literature, since 2010, that describes the practice of instructional design, the practice of instructional design in higher education, instructional design models, and some on the relationships between staff and instructors in higher education. I also wanted to establish the knowledge, skills, and abilities associated with instructional design and educational technology work and have cited two validated inventories, “Development and Validation of the Educational Technologist Competencies Survey (ETCS): Knowledge, Skills, and Abilities” (Ritzhaupt et al., 2018) and the International Board of

Standards for Training, Performance and Instruction Instructional Designer Competencies (Koszalka et al., 2013).

The literature section begins with an overview of MOOCs and learning at scale. Following that is a survey of instruction design literature relevant to learning at scale course building. Instructional design is “a system of procedures for developing education and training curricula in a consistent and reliable fashion” (Gustafson & Branch, 2002b, p. 17). This section begins with a history of instructional design that describes two approaches to understanding the field—one focused on instructional design models and tools grounded in behaviorism and another focused on the people who do instructional design work. The next section investigates the instructional designer and educational technologist roles, focusing particularly on the knowledge, skills, abilities, and competencies associated with those roles. This section is followed by an overview of instructional design models, tools developed for use in instructional design work. Once ID roles and tools are discussed, there follows a description of instructional design work in higher education and particularly on online courses. Finally, this chapter closes with the proposed theoretical framework for this study: socio-technical systems theory.

MOOCs and Learning at Scale

The first MOOCs were an expression of the open educational resource movement of the 1990s and early 2000s (Czerniewicz et al., 2017; Toven-Lindsey et al., 2015). The term “MOOC” was first used by Dave Cormier to describe Connectivism and Connective Knowledge, a course on learning theory created in 2008 by Cormier and George Siemens (Fournier & Kop, 2015; Toven-Lindsey et al., 2015; Zhu et al., 2018). A goal of this first MOOC was to invite the world to join the 25 students who were taking the course for credit. More than 2,300 learners participated (Parry, 2010). The course Connectivism and Connective Knowledge was both an expression of connectivism and an exploration of connectivist learning. The theory of connectivism focuses on the capacity for learning that is generated through connections made among diverse opinions. The theory integrates principles of "chaos, network, complexity, and self-organization theories," (Toven-Lindsey et al., 2015, p. 2) that find expression among digital communication and collaboration tools. Accurate and up-to-date knowledge, or "currency," is the goal of connectivist learning activities (Siemens, 2005).

The "About This Course" page for the 2011 version of Connectivism and Connective Knowledge, which was taught by Siemens and Stephen Downes, describes the course as a collection of resources spread across the Web. Students were told that the course didn't represent a body of content that they needed to remember, but an opportunity to pursue individualized instruction. Learners were asked to aggregate, remix, repurpose, and feed forward (Siemens & Downes, 2011). This type of MOOC, one that prioritizes self-discovery, connection, and collaboration, is described as a connectivist MOOC or cMOOC. Another important feature of a cMOOC is that there is an expectation that the networks and connections built during the course are sustained beyond the course itself. The artifacts created during a cMOOC are open and continue to exist on blogs and individual social media accounts (Anders, 2015).

Another type of MOOC focuses on affording access to unlimited numbers of students for organized and tightly structured courses offered by prestigious universities. These "xMOOCs," with the "x" standing for "extended or extension" (Bozkurt et al., 2017, p. 129), were offered on platforms created specifically for these types of courses in 2011 and 2012: Coursera, edX, Udacity, and FutureLearn (Zhu et al., 2018). The xMOOC that first focused public and media attention on the form was Sebastian Thrun and Peter Norvig's 2011 Introduction to Artificial

Intelligence. This course, built by prestigious academics from Stanford University, enrolled more than 160,000 participants from all over the world (Anders, 2015).

The pedagogical approach of an xMOOCs is predominantly cognitive-behaviorist or instructivist (Rodriguez, 2012). These courses are comprised of series of brief, high-production videos, interspersed with quizzes and sometimes readings and practice problems. The curriculum of an xMOOC is similar to a traditional university course and largely occurs within a single platform, as compared to the learner-directed cMOOC that is diffused across multiple digital platforms. Some xMOOCs, such as the University of Pennsylvania's 2012 Modern and Contemporary American Poetry (or "ModPo"), attempt a hybrid approach to massive open learning, leveraging social media platforms such as Facebook and Twitter to create opportunities for learners in the class to connect with one another. Rather than feature a single instructor lecturing to learners in the course, ModPo videos were of collaborative close readings of poems by the professor and several teaching assistants (Poplar, 2013).

Even though it would seem that cMOOCs and xMOOCs can clearly be differentiated, the research record on MOOCs suggests otherwise. Before 2011-12, there was no distinction between cMOOCs and xMOOCs—the platforms that host xMOOCs did not yet exist. Arguably, before 2011-12, all MOOCs were cMOOCs, if the presence of a central platform is used as the distinguishing factor. When cMOOCs were the only type of MOOC, only 27 articles on MOOCs were published between 2008-13 (Bozkurt et al., 2017). Even after Coursera and edX began to host MOOCs, in the literature on MOOCs between 2008 and 2015 (n=159; 44%), almost half the literature did not distinguish between cMOOCs and xMOOCs. For these reasons it is difficult for researchers to make definitive claims about MOOC type (Liyanagunawardena et al., 2013; Veletsianos & Shepherdson, 2016).

In a phone conversation with Yakut Gazi, associate dean for learning systems at Georgia Tech University, she described the distinction that her university makes between MOOCs and learning at scale as one that is based on the product. For Georgia Tech, the most inclusive term is "learning at scale," as this describes both the one-off MOOCs that they offer on the edX and Coursera platforms, and the full master's degrees that they offer on edX and Udacity (Y. Gazi, personal communication, September 30, 2019; Georgia Tech: Massive Open Online Courses, 2019). The two different products, MOOCs and full degrees offered on the MOOC platforms, are both designed and developed for hosting on MOOC platforms. The full degree programs, however, are not "open," nor are they free. They require students to submit an application to be accepted into the degree program, tuition for which is nearly $10,000 USD (Master's Degree in Analytics, 2018).

MOOCs in Context: Resource Requirements and Rationale

MOOCs are radically dissimilar from a typical course due to the resources associated with the design, development, and delivery of learning at scale. Hollands and Tirthali's 2014 article on the resource requirements and costs associated with developing and delivering MOOCs describes this type of course as being more technologically robust and resource-intensive than a traditional online course. They describe course design and delivery as shifting from an individual effort for a traditional online course to a team effort for a MOOC. They describe teams that often include "administrators in offices of digital technology, instructional designers, instructional technologists, videographers, and project managers" (2014, p. 126) in addition to faculty members.

The increase in resources to build a product that is offered free to the public has prompted a number of researchers to study financial models for MOOCs (Bulfin et al., 2014; Hollands &

Tirthali, 2014; Liyanagunawardena et al., 2015). Bulfin, et al, in an analysis of the language used in news stories about MOOCs suggests that the popular narrative of democratizing education and access to star professors ignores real economic issues. The obscured issues that the researchers cite include the largely unexamined infusion of funds from venture capitalists into MOOC platforms, the army of "far less securely employed foot soldiers of higher education who are actually responsible for the bulk of teaching" in the MOOCs (2014, p. 302), and the learners in the MOOCs who are largely already employed and degreed (Emanuel, 2013). Another study recognizes that the cost of MOOCs is unsustainable given the resources required to develop them and the money that they bring in. Liyanagunawardena, et al, propose a range of financial models that they suggest may make MOOCs financially sustainable (2015). They suggest that the first step is to acknowledge that MOOCs may be free for learners to participate in, but they are not free to create or support. They cite an early adopter, the University of Edinburgh on the Coursera platform, as spending on average £30,000 (at that time, appr. $45,000 USD) per course from development to delivery (Parr, 2013). The main method of generating funds at the time of the study was through certificates that recognized learner completion of the course material. The researchers suggested that any of the following may reduce the gap between income and expenditures for IHEs that offer MOOCs: "freemium model, sponsorships, initiatives and grants, donations, licensing fees, branded merchandise, the sale of supplementary material, selective advertising, [and] data-sharing" (Liyanagunawardena, et al, 2015, p. 108).

A discussion of the gap between income and expenditures on resource requirements necessary for learning at scale courses should be grounded in context. Institutions of higher education (IHEs) face dire economic challenges since the Great Recession of 2007-09. As IHEs prepare students to take on the complexities of contemporary life, nearly every state since 2008 has reduced funding to public colleges and universities (Sullivan & Jordan, 2017). The birthrate in 2008-11 declined, likely due to economic factors, and has not rebounded with the economy (Barshay, 2018). Many regions of the United States, particularly the Northeast, are seeing fewer students enrolling in IHEs. Those declining numbers are expected to continue through 2029, the year when children born in 2008 are due to enroll in colleges and universities. The declining birthrate and shrinking enrollments mean trouble for institutions that rely on tuition dollars (Alexander, 2018).

For many institutions, a strategy for addressing this complex and evolving set of challenges and find more learners at lower cost is through growing enrollment via online courses (Hollands & Tirthali, 2014b), and, more recently, massive open online courses (MOOCs). While MOOCs are in many cases free for students and not directly a money generating activity, edX, a MOOC platform, has been experimenting with fees for certain types of course access. In June 2018, Anant Agarwal, CEO of edX, said that they would be shifting from their model of offering all courses for free to a freemium model—with some content and features still accessible for free, and others requiring a “modest support fee” (2018a). This fee is a requirement for learners to pay, from nine dollars up to the cost of a certificate (often hundreds of dollars), in order to maintain the access to a course they would have had in the previous free model. In December 2018, edX further narrowed unpaid access for learners by creating audit and verified tracks. “Audit” means that learners have free access to a MOOC, “verified” means that the learner has paid for a certificate and will receive it assuming all course requirements are met. (Agarwal, 2018a, 2018b; IBL News, 2018). The fees paid by verified users are split with the partner institutions, meaning those universities and corporations that have paid a fee to offer courses on the edX platform and in which these verified students enroll (Agarwal, 2018a, 2018b; IBL News, 2018). Whether these fees will make much of a dent in the financial shortfalls caused by declining tuition dollars for some universities is unknown.

In an early study on why institutions of higher education offer MOOCs, Holland and Tirthali found that MOOCs are an attempt by IHEs to innovate and navigate economic challenges. The six most frequently cited reasons institutions gave for offering MOOCs are, in order of frequency—"extending reach and access, building and maintaining brand, improving economics, improving educational outcomes, innovation in teaching and learning, and research on teaching and learning” (2014b, p. 6). The top three are related to economic and demographic pressures. Recent data on MOOCs suggests that these economic and outreach goals have not been realized or that they have been met with mixed results (Reich & Ruipérez-Valiente, 2019). In an October 2019 blog post, Feldstein is less circumspect, describing a great MOOC die-off, with “zombie courses” being archived to the dismay of the institutions that created them (2019). In a post on EdSurge, an educational technology news organization, Young describes Coursera’s pivot to selling courseware to universities, taking the content that partner institutions have created and selling that content to other universities, essentially transforming Coursera into an online program management company (2019).

In a report on innovation and managing change in higher education, Selingo suggests that while MOOCs are no longer “grabbing the breathless headlines” they once did, “their greatest legacy is that they changed the conversation on campuses about how colleges could become more agile yet remain committed to their mission and shared governance” (2018, p. 4). In this project, I examine how this “institutional agility” is performed by the personnel associated with designing, developing, and delivering learning at scale courses.

Histories of Instructional Design

There is tension between “camps” of instructional design researchers. One camp might be described as the behaviorists or the “tool-makers”—those researchers who seek to make processes more efficient by articulating and promoting instructional design process models. The other camp are the constructivists or the “context-scholars”—those researchers who study instructional design professionals in the field to understand more about the practice of instructional design. To oversimplify the conflict in instructional design, the tool-makers wonder why instructional designers persist in ignoring their models, while the context-scholars insist that instructional design is too complex and situated for most general instructional design process models to prove useful. Two historical overviews by Reiser and Gibbons exemplify these two schools of thought in instructional design.

Another source of confusion in instructional design is what the field and its practitioners are called. Reiser begins his two-part history of instructional design and technology (IDT) by defining his terms. Reiser provides a rationale for his use of the term IDT, rather than educational technology, to describe the field:

> The field of instructional design and technology encompasses the analysis of learning and performance problems, and the design, development, implementation, evaluation and management of instructional and non-instructional processes and resources intended to improve learning and performance in a variety of settings, particularly educational institutions and the workplace. Professionals in the field of instructional design and technology often use systematic instructional design procedures and employ a variety of instructional media to accomplish their goals. Moreover, in recent years, they have paid increasing attention to non-instructional solutions to some performance problems. Research and theory related to each of the aforementioned areas is also an important part of the field. (2001, p. 53)

In this article, originally published in *Educational Technology Research and Development*, Reiser barely mentions technology in the tasks associated with his definition of IDT. Much of the definition focuses on learners and their learning gaps, the process of IDT (design, development, implementation, evaluation, and management), and the use of instructional and non-instructional strategies. He does mention that instructional media is often deployed to help accomplish learning or performance goals, but there is no suggestion that tools are central to the work of IDT practitioners. The rest of Reiser's article describes the history of IDT in terms of those instructional media innovations that were expected to "revolutionize education" (2001, p. 61)—Thomas Edison and instructional films, audiovisual instruction and instructional radio, World War II and a systems approach to training and training films, and integration of personal computers in the early 1990s. Each innovation brought high hopes about new ways of managing learning, and eventually each innovation failed to fulfill the initial predictions of revolution. In his conclusion, Reiser discusses the boom-and-bust cycle of educational innovation and suggests that it is not tools alone that will change the system of learning. He notes, however, that while computers and the Internet have not provided the revolutionary change predicted by some, they do have a growing presence. There is a kind of technological accretion of media, personal computing, and the Internet that are taking a larger role in all fields--business, industry, and education. Reiser suspects that because of this universal infusion, these tools will bring about "greater changes in instructional practices than the media that preceded them," (2001, p. 62). Even so, given his own history of boom and bust, it would seem more likely that there will be incremental change rather than revolution.

The second part of his history of instructional design and technology focuses on instructional design. In this history, Reiser describes the origins of instructional design procedures in efforts during World War II to research associated with the development of training materials for military purposes (2001, p. 58). He mentions the wartime work of Gagné, Briggs, and Flanagan as being particularly influential. The approach to training military personnel carried over into postwar efforts to address instructional problems, and a systems approach to instruction became prevalent. Reiser describes Miller's detailed approach to task analysis as being particularly important. Reiser goes on to describe Skinner and programmed instruction as the next major factor in the development of a systems approach to instruction; indeed, Reiser describes the effect of Skinner's 1954 article, "The Science of Learning and the Art of Teaching," as revolutionary in the field of education. Skinner's programmed instruction required instruction to be presented in "small steps, require overt responses to frequent questions, provide immediate feedback, and allow for learner self-pacing" (2001, p. 59). Skinner also believed that because each step was small, it was likely that the learner would get all questions right and be positively reinforced by the satisfaction associated with successful forward progress. Reiser describes Skinner's approach as being foundational for and containing many of the steps in current instructional design models. Reiser's history of instructional design continues through the 1970s and 1980s, identifying Gagne's articulation of learning hierarchies and the importance of component skills, the advent of criterion-referenced testing to assess student progress, and the Sputnik-era explosion in math and science education. He describes the expanding influence through the 1970s and 1980s of a systems approach to instructional design in the military and in industry as well as the expanding then contracting influence across the 1970s and 1980s of interest in a systems approach to instructional design in education.

Reiser brings his history of instructional design to a close in the 1990s with a discussion of performance assessment, computerization of training and distance learning, and knowledge management—which is described as the investigation, articulation, and dissemination of expert tacit knowledge. Throughout Reiser's history of instructional design, his focus is on behaviorism, performance, and on enhancing performance through application of assessment models and the use of tools to train and evaluate.

Reiser's history of instructional design focused on behaviorist tools and protocols is in stark contrast to the chapter by Gibbons, et al, "Instructional Design Models" in the *Handbook of Research on Educational Communications and Technology* (2014), which articulates a design-focused history of the field. Gibbons locates the advent of instructional design not in the build-up to World War II, but in the "Plans" implemented in public schools in the early 20th century. Gibbons also shifts focus from the technology and tools associated with instructional design to the human actions and interactions at the heart of the field.

Gibbons locates the origin of instructional design as occurring nearly a quarter of a century earlier than Reiser's wartime origin. For Gibbons, instructional design begins with the "Plans," grassroots attempts to localize and individualize "efficient, mass-administered, standardized treatments based on the knowledge-reception model of learning" (2014, p. 608). This origin story is in stark contrast to Reiser's history of instructional design as standardized training methods designed during wartime and exported for use in civilian life. Gibbons describes the Burk plan in California (1913), Washburne's adaptation of the Burk plan for his Winnetka plan (1920), and the Morrison plan (1926) and its emphasis on mastery learning. The table that Gibbons created to compare Plan elements is relevant to the comparison with Reiser's history and is shown as Table 1 (2014, p. 608).

Table 1.
Comparative features of three major "Plans" between 1915 and 1935.

Feature	Burk (1915-19)	Washburne (1919-40)	Morrison (1925-35)
Self-pacing	X	X	-
Self-instructional	X	X	-
Individual practice	X	X	X
Prepared materials	X	X	X
Based on objectives	X	X	X
Diagnostic tests	X	X	X
Self-administered tests	X	X	X
Criterion referencing	X	X	X
Remedial tutoring	X	X	X
Adaptive reteach	-	-	X

The criterion-referenced testing that Reiser describes as beginning in the 1970s and 1980s, Gibbons finds in the earliest of the Plans. The revolutionary promise of self-pacing and self-instruction in Skinner's 1954 article can be found in both the Burk and Washburne plans. Gibbons describes the Plans' reliance on specially designed materials, which were created using a deliberative design process. The Plans' reliance on objectives, self-pacing, individual practice, and self-administered and diagnostic tests and other elements would seem to call into question Reiser's suggestion that Skinner's work, done decades later, is the basis for formalized instructional design models.

Gibbons continues his discussion of Plans with Tyler and the Eight-Year Study (1930-42). Like the earlier Plans, Tyler's focuses on the importance of local expertise and individualization. Tyler believed that teachers should be responsible for how they bring about instructional reform in their classrooms, and over time the study explored how instruction is designed and evaluated. Based on the findings from this study, Tyler wrote a book on instructional design for teachers, *Basic Principles for Curriculum and Instruction* (1949), in which he articulated four questions that should be asked at the beginning of any development of a plan of instruction:

> What educational purposes should the school seek to attain?
> What educational experiences can be provided that are likely to attain these purposes?
> How can these educational experiences be effectively organized?
> How can we determine whether these purposes are being attained? (1949, p. 1)

Gibbons describes these questions and the heavily process-based answers Tyler provided as contributing to later models that were generated out of public schools.

The next third of Gibbons' articulation of the history of instructional design and instructional design models provides the starkest contrast with Reiser. Gibbons describes the postwar (WWI and WWII) infusion of media into the culture at large as "contributions" to emerging instructional design models. Where Reiser described the central role of these technologies in shaping instructional design practice, Gibbons downplays their importance. He dispatches silent instructional film (early 1900s), instructional radio (late 1920s), sound film (early 1930s), and the post-World-War-II innovations--educational television, programmed instruction, and computers--in a single sentence as "ascending in turn, each viewed at the 'new medium' of its time" (2014, p. 609). Rather than focus on the tools, Gibbons focuses on the new professional organizations that were forming after 1953 and James Finn's role in professionalizing the field of audiovisual education.

Gibbons describes Finn articulating six criteria that he hoped would professionalize the field of audiovisual education: an intellectual technique, application of the technique to practical affairs, a long training period to reach expertise, a professional organization, ethical standards, and a constantly expanding, organized body of intellectual theory. This focus on reflection in the field led to Finn anticipating the role of the designer as a specialist separate from media production specialists. By 1960, Finn "clearly considered media devices to be distractions from the abstract questions concerning their use in instruction, setting up what Shrock describes as '. . . a tension between "media people" and "developers" [which] remains in the field today'" (2014, p. 609).

It is in Gibbon's description of Skinner and his teaching machine as a kind of failure that we see the tension between "media people" and "developers" play out in the literature. Gibbons describes Skinner's role in instructional design:

> The period from 1950 to 1970 was marked—and complicated—by the extraordinary success of Skinner's teaching machines (1958), which he expected to address growing needs for schools and teachers. For a brief period, teaching machine manufacturers entered the market at the rate of two per week (Silvern, 1962), although interest waned when it became clear that comparatively expensive programming and not the machines themselves were responsible for the learning effect. (2014, pp. 609–610)

This is the only mention of Skinner in the article, and the emphasis is not on his machine, but on the expensive human-generated programming that made it go. Gibbons continues to talk about the importance of the "abstract questions" associated with design, discussing Briggs' founding of the design process model and his articulation of a new way of practicing for "a new class of workers called educational specialists" (2014, p. 610). For Briggs, the

> discovery that it was the program and not the teaching machine that made the difference left open the question what media combinations could or should be used for instruction. This led to a divergence between device-thinking and abstracted thinking about strategic design structure. (2014, p. 610)

Throughout the rest of his brief history of ID and ID models, Gibbons emphasizes the people associated with the work, downplaying the tools they may employ. He describes Gagne's seminal edited volume *Psychological Principles in System Development* (1965) as having for the instructional design community "represented a monolithic statement about the systems design process whose influence even today silently dominates the discourse of instructional design practice, though few designers today could claim to have read it or even know of its existence"

(2014, p. 611). Gibbons describes design practice amidst an explosion of different models in the 1960s and 1970s. Accompanying this trend was the notion that designers need have only

> a half-dozen really different models in his/her tool bag and know how to modify them for each new situation," (Gustafson, 1981; p. 4). This points to a growing and ultimately entrenched set of ideas: that there can/should be distinctly different kinds of models, that models can be selected for projects using known rules or guidelines, and that there is a process for tailoring models to projects. What these kinds, rules, guidelines, and processes may be has not been articulated (Smith & Boling, 2009). (2014, p. 613)

Over time, Gibbons describes these multiple, unwieldy instructional design models as falling out of use. At the same time, Gibbons says that other design fields, architecture and product design specifically, were pursuing "empirical studies of designing which led to robust descriptions of a designer's 'conversation' with a design problem. . . . [S]oon, process models were being repositioned outside of instructional design circles as tools with severely limited utility" (2014, p. 613). Gibbons closes his article by describing how a narrative of instructional design and instructional design models founded in behaviorism can limit an understanding of the contemporary scope of the field and obscure the intention of the original models.

The comparison of Reiser's and Gibbons's histories of instructional design is illustrative of the divide in the instructional design literature between model or tool-focused design, and the research on the practice of design and the experiences of designers. As I transition to the next part of the literature review, the following must be acknowledged. The concreteness of an instructional device with its associated affordances and constraints, compared to performance of design and "abstracted thinking about strategic design structure," (Gibbons et al., 2014, p. 610) represents a stark contrast in the instructional objectives associated with training new designers or educational technologists. There is no question that it is easier to teach someone about a tool and its intended use than to teach a learner how to apply concrete knowledge within a complex, shifting, and situated system. The ability to develop heuristics comes with experience in the field. Studies that compare problem solving strategies of novice and expert instructional designers, such as Rowland's seminal 1992 study "What Do Instructional Designers Actually Do?", reveal the challenges of creating instructional design instruction that aligns with the actual skills required to do the work. Whether a researcher finds Skinner and programmed instruction at the center or at the periphery of the founding of instructional design sets the tone and approach for that researcher's description of the scope and practice of the field. This divide between "tools" and "people" is found throughout the literature. This divide is a focus in the rest of this literature review and leads to the selected theoretical framework.

KSAs of Instructional Designers and Educational Technologists

Ritzhaupt, et al, describe the confusion associated with job titles in educational technology.

> The term ''educational technologist'' is used to describe the many professionals that practice in the field of educational technology. This term does not only include instructional designer [but] is also often interchangeably used with the term instructional technologists. Additionally, this term includes job titles like learning designer, instructional developer, instructional technology specialist, e-Learning developer, performance improvement consultant, chief learning officer, director of training, training and development manager, educational project manager, and several more professional roles in the field. (2018, p. 6)

In Ritzhaupt's definition above, educational technology "contains" instructional design. Another study describes similar confusion in the field of instructional design and technology (IDT) and the implications of this imprecision. Wilson and Ozyer describe a study in which,

> researchers asked IDT students about the meaning of IDT (Smith et al. 2006, p. 23). Findings indicated that emerging professionals struggle to explain to people what IDT is, and to delineate the boundaries and structure of the field. Sharif and Cho (2015) present survey results confirming that the public cannot answer the questions of "who IDT professionals are" and "what they do." Sharif et al. (2014) found that most people working with instructional designers are not aware of what instructional design is. Wagner (2011, p. 33) notes the difficulty designers have when explaining to outsiders what we do for a living (2019, p. 561).

This crisis in confidence among instructional design and technology professionals is not new and it is not confined to this field, Schön argues in his book *The Reflective Practitioner* (1983).

Schön describes tension between a work culture grounded in the early-twentieth-century model of technical rationality and work as it is actually practiced in the latter half of that century. Technical rationality describes the work of a professional as “instrumental problem solving made rigorous by the application of scientific theory and technique [and] . . . based on specialized scientific knowledge” (1983, p. 21). Schön cites Glazer’s articulation of major professions (law, business, medicine, and engineering) and minor professions (social work, librarianship, town planning, education) to draw attention to the context and products of these professions. Glazer describes the major professions as

> disciplined by an unambiguous end—health, success in litigation, profit—which settles men’s minds’, and they operate in stable institutional contexts. Hence, they are grounded in systematic, fundamental knowledge, of which scientific knowledge is the prototype. (1983, p. 23)

In contrast, the minor professions,

> suffer from shifting, ambiguous ends and from unstable institutional contexts of practice, and are therefore unable to develop a base of systematic, scientific professional knowledge. (1983, p. 23)

The technical rationality model requires a concrete problem, which will be solved by the application of expert knowledge. Minor professions must contend with ill-structured problems and shifting contexts. Schön argues that in the mid to latter part of the twentieth century, it became apparent that the professions as framed by Glazer were operating with a model of problem solving that was unprepared to handle the complexity of contemporary issues. Schön describes the transition from a conception of work as technical-rational problem solving to work and expertise as reflection-in-action:

> From the perspective of Technical Rationality, professional practice is a process of problem *solving*. Problems of choice or decision are solved through the selection, from available means, of the one best suited to established ends. But with this emphasis on problem solving, we ignore problem *setting*, the process by which we define the decision to be made, the ends to be achieved, the means which may be chosen. In real-world practice, problems do not present themselves to the practitioners as givens. They must be constructed from the materials of problematic situations which are puzzling, troubling, and uncertain. (1983, pp. 39–40)

Schön describes the conflicted nature of contemporary ideas of expertise as desirous of, even nostalgic for, a scientific foundation and reliable problem-solving methods. At the same time, Schön cites research on professional practice that acknowledges the insufficiency of these scientific and reliable models for addressing the complexity of real-world problem setting. This tension that Schön describes between a desire for a foundation in science and a reality that is based in shifting context is reflected in the instructional design literature.

The divide in how one describes the origins of instructional design—whether it is to be found in a tool-focused, technical-rational-military origin, or in a reflection-in-action situated, organic practice—can also be seen in how we describe the knowledge, skills, abilities, and work of instructional designers and educational technologists. This divide between tool and practice begins with the training that instructional designers and educational technologists receive. In 2014, Smith and Boling found in an analysis of the most widely adopted textbooks in the field that little had changed for forty years. Instructional design was described as “a systematic process, represented by models, based on theory and grounded in data while focused on problem solving” (Tracey & Boling, 2014, p. 653). Indeed, even today, in a series of massive open online courses on the edX platform, the University System of Maryland offers a course called Instructional Design Models that promises to help learners learn how to employ “a careful and systematic design process” to “apply instructional design models to develop online learning experiences” (“Instructional Design Models,” 2018).

One of the most well-known representations of instructional design process and practice is ADDIE: an acronym that represents the stages of instructional design practice: Analysis, Design, Development, Implementation, Evaluation (Peterson, 2003). In a study of ADDIE, the conceptual model that serves as the basis for most other instructional design models (Becker, 2007; Branch & Kopcha, 2014; R. A. Reiser, 2001), Boling, et al, found that ADDIE was not used by designers in practice. Even those designers in their study who recognized the value of ADDIE as an idealized, conceptual model said that due to time, money, and lack of status needed to effect change, it was easier to follow established institutional processes rather try to align them with the steps in a design model (2011, p. 36). Boling's study is one of many that calls into question whether the focus on design models in the training of instructional designers is effective (Becker, 2007; Brill, 2016; Christensen & Osguthorpe, 2004; Dicks & Ives, 2008; Gray et al., 2015; Kenny et al., 2005; Leigh & Tracey, 2010; York & Ertmer, 2011).

An entertaining, if sometimes too polemical, resource for navigating the debates in instructional design research is Carr-Chellman and Rowland's, *Issues in Technology, Learning, and Instructional Design: Classic and Contemporary Dialogues*. Each essay presents two views of an instructional design topic. In "Instructional Design Models and the Expertise Required to Practice True Instructional Design," Reiber and Branch discuss whether instructional design models or heuristics are preferable. Branch begins with an essay on the importance of applying models correctly in order to practice "true" instructional design (Carr-Chellman & Rowland, 2017, pp. 50–51). Reiber responds by suggesting that heuristics are critical for good practice.

> Instructional design process offers some general principles for initiating and managing a complex process, but it never leads far to the kinds of specific decisions that all designers ultimately have to make. As Michael Streibel (1991) long ago pointed out, instructional design is ultimately a situated act that depends 'on the specific, concrete, and unique circumstances of the project' (2017, p. 51).

Like those studies calling into question the centrality of instructional design models in instructional design practice, we see the echoes of Schön's formulation of the divide between an understanding of expertise grounded in technical rationality and one grounded in context and reflexivity. The desire for order and efficiency implicit in the creation of models would seem to be in conflict with the practice of designers operating in context.

One method for addressing this perceived mismatch between training and practice is to learn more about what it is that instructional designers do (Gray et al., 2015; Kenny et al., 2005; Kumar & Ritzhaupt, 2017; Rowland, 1992). Rowland, in 1992, studied the differences between novice and expert designers by posing a typical problem set in industry. Along with the problem, designers were provided with a set of resource materials that included a description and diagrams of machines being used by workers, the problems encountered, and some pages from a physics textbook. Rowland, et al., studied how eight designers--four experts and four instructional design students--approached the problem and identified a solution.

In Rowland's study, when novices approached the problem, they read the materials and used the information within to understand the problem and proceed to an instructional solution. They did not question the representation of the problem and they kept the solution scoped to the problem as described in the materials. They referred to their own experiences as students to understand the implications of instruction. Their solutions could be characterized as a well-defined instructional solution based on a surface understanding of the problem.

Expert designers in Rowland's study were more likely to view the problem as ill-defined, and they spent more time investigating a deeper understanding of the problem. They also used their own experiences as designers to propose potential solutions, not as solutions to be implemented but rather to explore the implications of the solutions and thereby better understand the problem. Expert designers were interested in understanding the system within which the problem was located, while novices considered only those staff who would be the recipients of the instruction. The expert designers produced solutions that were a mix of instructional and non-instructional interventions, and which were based on a deep understanding of the problem and an acknowledgment of the importance of performance assessment. Experts seemed to depend on their own experiences to understand the problem, not necessarily any procedures or processes associated with instructional systems design, which presents a problem for instructional design educators. Rowland describes the mismatch between how IDs are trained and the behavior of expert practitioners,

> Experts retrieved and selected templates and applied design principles based on correspondence between the case at hand and specific cases in their experience. . . Our current teaching methods . . . do not contribute directly to this type of knowledge. . . . [W]e teach ISD as a set of procedures and use different, clear examples to illustrate each procedure. . . . The clear-cut examples used in teaching do not match the complexity of real situations, and, unfortunately, the ISD procedures may be set aside to get the job done (1992, p. 84).

For Rowland, et al, there was no clear strategy for effectively bridging the gap between novice and expert designers, given how much experts relied on their experiences and an understanding of the implication of past solutions. One cannot supply novices with a pre-packaged set of heuristics, for without the experiences that ground the heuristics, the set would just be another list of rules. Rowland, et al., suggest that a case-based method, particularly if the cases represent real-world complexity, may be beneficial. They suggest that a focus on understanding systems and developing creative and generative solutions may also be beneficial for novice designers (1992, pp. 84–85).

Kenny, et al, suggest that we do a disservice to instructional designers when we focus exclusively on their skills and competencies. The richness of the work calls for a more robust analysis of the context of the work. They called for further research into what it means to be a designer and how we might understand designers as agents of change (2005, p. 9). Kumar and Ritzhaupt, in a study of instructional designers in higher education, describe the particular complexity of the role. When one's primary work as a designer is to support online instructors, this creates an overlap of roles that are otherwise separate in a corporate context. In a corporate context, the subject-matter expert and the client are likely two different people. For an instructional designer in higher education, instructors are their main audience, their subject-matter expert, and their client. In addition, they find that though instructional designers are often thought to be experts in applying technology, their more valuable skills are communication and management. "Knowing how to use information and communication technology is important, but knowing how to apply it meaningfully to instructional design and educational problems is much more important" (2017, p. 389). Finally, York and Ertmer, in a study of instructional design heuristics, echo other researchers in finding that, in practice, models are applied neither consistently nor uniformly. While instructional design models may not help us to understand the work of instructional designers, the authors did discover (contrary to the urgings of Kenny, et al) that we can learn from knowledge, skills, and ability statements after all. The heuristics developed and valued by instructional designers map well to the IBSTPI instructional designer competencies (2011). The IBSTPI competencies inform analysis of the interview transcripts.

York and Ertmer suggest that there is a connection between competencies and heuristics in practice. To prepare for an investigation of MOOC making and course personnel involved in learning at scale, two resources provided an important overview of the knowledge, skills, abilities, and competencies associated with instructional design and educational technology work. The International Board of Standards for Training, Performance, and Instruction (IBSTPI) published the fourth edition of instructional design competencies (Koszalka et al., 2013). Ritzhaupt, et al, validated an educational technologist competencies survey that was created to evaluate the knowledge, skills, and abilities associated with the work of a competent educational technology professional (2018). A competency, according to Koszalka, et al, is a “short statement, each one providing a general description of a complex effort” (2013, p. 12). A knowledge, skills, and abilities (KSA) statement “represents the processes and resources needed by educational technologists to be effective in their professional roles” (Ritzhaupt et al., 2018, p. 5). Both forms can serve as a resource for an investigation into the work of instructional designers.

Instructional Designer Knowledge, Skills, and Abilities

The International Board of Standards for Training, Performance and Instruction (IBSTPI) has created and validated a set of instructional designer competencies intended to guide the practices of instructional designers for the past 30 years. This work, now in its fourth edition, is described by the editors as “rooted in a traditional notion of design competence” while also acknowledging the “explosion of technologies that have entered into the designer’s and educator’s communities of practice” (Koszalka et al., 2013, chapter 1, paragraph 3). For the IBSTPI, a competency is “a knowledge, skill, or attitude that enables one to effectively perform the activities of a given occupation or function to the standards expected in employment” (2013, end of section, “Competency and the IBSTPI competency development model”). Unlike the Ritzhaupt, et al, KSAs of educational technologists discussed later, IBSTPI does not distinguish among knowledge, a skill, and an ability.

The most recent version of the competencies emerged from an investigation into contemporary instructional design practice, in which designers have “moved from working as individuals to working in interdisciplinary design teams, both in person and now more commonly through distributed communication channels" (Koszalka et al., 2013, "Changes that led to this current version," paragraph 1). Mobile technologies and personal computing have been widely disseminated. Industries and educational institutions are now producing instruction, accessible at any time and intended for use on a variety of devices. Consequently, instructional designers must factor in this mobile and distributed pattern of use into their design work. Other contemporary issues that affect their articulation of instructional design competencies include increased expectations for evaluation of instruction effectiveness, aligning ones work with learning science, and creating instruction mediated by technology that is aligned with strong practice in visual literacy, message design, and interaction (Koszalka et al., 2013). The broad competencies required for contemporary instructional design work are most practically assembled by strategic selection of design team members.

The editors of the most recent volume have articulated a set of assumptions about ID work that underlie the ID competencies. Five of the ten assumptions are relevant to this investigation of the work associated with building learning at scale, and may illustrate some of the challenges in an analysis across institutions. The first assumption, "Instructional designers are those persons who demonstrate instructional design competencies on the job regardless of their job title or training" (2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 1"), addresses the multiplicity of roles that perform similar tasks and the challenge of finding a single person in whom might reside all of the competencies associated with contemporary design. In addition, the editors of the ID competencies allow that instructors often perform instructional design tasks, but the same should not be said for those who concentrate totally on development tasks. For their purposes, graphic artists or programmers are not instructional designers. Koszalka, et al, explain:

> [I]f one's work pertains to planning and analysis, design and development, implementation and evaluation, and project management for an instructional project, that person is considered to be an instructional designer subject to these competencies, except as noted in the description of developers above. Whether a designer performs his or her job in a skillful manner is not relevant to one's general classification as a designer. Consequently, these competencies can pertain to a wide variety of persons and jobs. (2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 1," paragraph 4)

This recognition that tasks associated with particular roles in the design of instruction are flexible and may overlap is important for tracing the tasks associated with particular roles in designing learning at scale.

The second assumption, "ID competencies pertain to persons working in a wide range of job settings" (2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 2") means to include all ID work, across corporate and educational institutions. The editors describe some of the competencies as being more likely found in a business environment. The two they cite are creating cost-benefit analyses or managing large design teams. They describe the implementation and management domain of the competencies as reflecting a business rather than educational context.

The fourth of their assumptions, "Instructional design is a process most commonly guided by systematic design models and principles" (2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 4") reinforces the importance of models in instructional design work. Part of the analysis of tools used by course personnel includes an investigation of instructional design models or theories used by course personnel in designing learning at scale. The ninth assumption "instructional design is most commonly seen as resulting in transfer of training and organizational improvement" (2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 9”) may provide a perspective on the nature of learning at scale in institutions of higher education. It is not clear what the role of MOOCs may be at the institutions of higher education that may offer them. If helping a population of learners achieve outcomes is not the goal, how may that affect our ability to evaluate the success of a learning at scale venture?

Finally, the tenth and last assumption made by the editors of the IBSTPI volume, “few instructional designers, regardless of their level of expertise, are able to successfully demonstrate all ID competencies” (2013, “Assumptions underlying IBSTPI the ID competencies: Assumption 10”). This tenth assumption paired with the editors’ first assumption complicates the work of connecting roles to tasks in a predictable way. Tasks shifting among roles or among particular personnel, depending on who is available and what their skill sets may be, may be one of the sources of the nomenclature problem in instructional design—different titles do not necessarily describe different tasks. This fluidity must be considered when formulating a data collection plan for the roles and tasks associated with designing, developing, and delivering learning at scale.

The IBSTPI competencies are based on research, including reviews of current literature, oversight by experts in the field, and international validation by more than 1,000 international instructional design practitioners from across industries (Koszalka et al., 2013). These statements describe those competencies associated with instructional design work along with those that are essential for all practice, those that are considered advanced, and those most likely in a managerial position. The top-level competencies are shown in Table 2 (IBSTPI, 2012).

Table 2.
Instructional designer competencies

Professional Foundation	1. Communicate effectively in visual, oral and written form. (*essential*)
	2. Apply research and theory to the discipline of instructional design. (*advanced*)
	3. Update and improve knowledge, skills, and attitudes pertaining to the instructional design process and related fields. (*essential*)
	4. Apply data collection and analysis skills in instructional design projects. (*advanced*)
	5. Identify and respond to ethical, legal, and political implications of design in the workplace. (*essential*)
Planning and Analysis	6. Conduct a needs assessment in order to recommend appropriate design solutions and strategies. (*advanced*)
	7. Identify and describe target population and environmental characteristics. (*essential*)
	8. Select and use analysis techniques for determining instructional content. (*essential*)
	9. Analyze the characteristics of existing and emerging technologies and their potential use. (*essential*)
Design and Development	10. Use an appropriate design and development process appropriate for a given project. (*essential*)
	11. Organize instructional programs and/or products to be designed, developed, and evaluated. (*essential*)
	12. Design instructional interventions. (*essential*)
	13. Plan noninstructional interventions. (*advanced*)
	14. Select or modify existing instructional materials. (*essential*)
	15. Develop instructional materials. (*essential*)
	16. Design learning assessment. (*advanced*)
Evaluation and Implementation	17. Evaluate instructional and noninstructional interventions. (*advanced*)
	18. Revise instructional and noninstructional solutions based on data. (*essential*)
	19. Implement, disseminate, and diffuse instructional and noninstructional interventions. (*advanced*)
Management	20. Apply business skills to managing the instructional design function. (*managerial*)
	21. Manage partnerships and collaborative relationships. (*managerial*)
	22. Plan and manage instructional design projects. (*advanced*)

Table 2 provides a reference point for the analysis of tasks and roles associated with the work of designing, developing, and delivering learning at scale.

Educational Technologist Knowledge, Skills, and Abilities

Tables 3, 4, and 5 (Ritzhaupt et al., 2018, pp. 25–27, 28-29, 29-30) describe the knowledge, skills, and abilities associated with the work of educational technologists, as articulated by Ritzhaupt, et al. A quick scan of the tables indicates a greater presence for technology, whether processes, languages, or hardware or software in these KSAs, than in the competencies associated with working as an instructional designer. However, the validation of the KSA statements reveals that the core KSAs overlap with those competencies described by Koszalka, et al.

In 2018, Ritzhaupt, et al, drafted and validated an inventory of educational technologist competencies. They define educational technology as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (2018, p. 5). They based their statement of competencies on a literature review, a thematic analysis of job announcements, and feedback from industry professionals. The authors created a survey of 176 key competency areas organized into knowledge, skills, and ability statements, and released it to a large sample of educational technology professionals, asking those respondents to rate the relevancy of each of the KSA statements to their work. The 170 statements below were validated by respondents as being relevant to contemporary educational technology work. Those items shown in bold with a parenthetical number are those statements that were rated the most relevant, ranked from first to tenth most relevant for all respondents within one of the three knowledge, skills, or abilities domains. Those items shown in italics are the lowest scoring statements for all relevant statements.

In creating this list of educational technologist KSAs, Ritzhaupt, et al., employed a definition of educational technology that emphasizes technology. And yet, only 2 of 30 of the most relevant KSA statements mention technology. Across the three domains the most relevant factors/items have to do with communication, teaching and learning, and interpersonal skills. Even in a set of competencies targeted toward technologists, one can see overlap with these most relevant skills and the instructional designer competencies. The top five ranked factors and items in the “knowledge of” table are a clear description of instructional design practice: online teaching and learning, formative and summative evaluation, cognitive learning theory, blended learning techniques, and instructional design models and principles. Technology only appears once in this top ten list, and it represents not technology in online learning but the classroom-based integration of technology. Perhaps even more striking, the top ten most useful skills are all related to communication, problem-solving, and interpersonal relations. The only valued skill that might be seen as related to technology is troubleshooting. Finally, in the abilities table, the most useful ability is adapting to evolving products and technology.

Table 3.
Knowledge domain of educational technologists—knowledge of . . .

Factor 1: Production and productivity software	Audio software (e.g., Audacity)
	Authoring tools (e.g., Captivate)
	Bitmap image software (e.g., Photoshop)
	Data communications (e.g., FTP)
	Educational authoring software (e.g., Articulate, Lectora)
	Operating system software (e.g., Windows 7)
	Presentation software (e.g., PowerPoint)
	Screen recording software (e.g., Camtasia)
	Social media technologies (e.g., Twitter)
	Spreadsheet software (e.g., Excel)
	Streaming video technology (e.g., Windows Media Server)
	Video software (e.g., Premiere)
	Virtual classrooms (e.g.,Wimba or Elluminate! Live)
	Virtual environments (e.g., SecondLife)
	Web 2.0 technology (e.g., Wikis, Blogs, Podcasts, etc.)
	Web authoring tools (e.g., Dreamweaver)
	Web-based data collection tools (e.g., SurveyMonkey)
	Word processing software (e.g., Word)
Factor 2: Development methodology, software, and programming	3D modeling tools (e.g., Maya)
	Accessibility software (e.g., JAWS)
	Agile methodology (e.g., Scrum)
	Business intelligence (e.g., SAP BW)
	Cascading Style Sheets (CSS)
	Client-side scripting languages (e.g., JavaScript)
	Database software (e.g., Access)
	Desktop publishing software (e.g., PageMaker)
	eCommerce application development
	Flash (and ActionScript)
	Markup languages (e.g., HTML/XHTML/XML)
	Mobile application development
	Programming languages (e.g., C ??)
	Server-side scripting languages (e.g., PHP)
	Six Sigma
	Statistical analysis tools (e.g., SPSS)
	Vector image software (e.g., Illustrator)
Factor 3: Organizational development and management Cost–benefit analyses	Customer service
	Global and local training planning
	Human resources management
	Organizational development
	Professional development
	SWOT analysis
	Theories of leadership

Factor 4: Learning theory and human performance technology	**(7) Adult learning theory**
	(3) Cognitive learning theory (e.g., Cognitive Load Theory)
	Constructivism
	Human Performance Technology principles
	Motivation theories (e.g., ARCS)
Factor 5: Assessment, evaluation, and teaching techniques	Accessing and analyzing data
	(9) Assessment methods (e.g., criterion-referenced)
	(4) Blended learning techniques
	(6) Face-to-face teaching and learning
	(2) Formative and summative evaluation
Factor 6: Curriculum standards and frameworks	**(8) Classroom-based technology integration techniques**
	Common Core State Standards (CCSS)
	STEM (i.e., Science, Technology, Engineering, and Mathematics)
	Twenty-first-century skills frameworks (e.g., P21)
Factor 7: Learning management software and higher education	Assessment software (e.g., Respondus)
	College/university administration
	Learning Management Systems (e.g., Blackboard)
	Synchronous distance learning methodologies (e.g., Blackboard Collaborate)
Factor 8: Instructional design, development, and online facilitation	e-Learning development
	(5) Instructional design models and principles (e.g., Dick and Carey)
	(1) Online teaching and learning
	Online/blended program management
Factor 9: Computer and communication hardware	Communications hardware
	Computer hardware
Factor 10: Web and interface design	Interface design
	Web design principles
Factor 11: Cloud and mobile technologies	Cloud technologies
	Mobile learning platforms (e.g., Android)
Factor 12: Content management systems and learning objects	Content management systems (e.g., Joomla)
	Learning object standards (e.g., SCORM)
Factor 13: Project management	Project management principles (e.g., PMBOK)
	Project management software (e.g., Microsoft Project)
Factor 14: Games, simulations, and the flipped classroom	Flipped classroom
	Game engines (e.g., Unity)
	Instructional simulation and game design
Factor 15: Copyright laws, policies, and procedures in training programs	**(10) Copyright laws**
	Laws, policies, and procedures in training programs

Table 4.
Skills domain of educational technologists—skills

Factor 1: Communication, problem-solving, and interpersonal skills	Analytical/technical documentation skills
	(2) Collaboration skills
	(10) Content development skills
	(3) Creative problem-solving skills
	Editing and proofing skills
	(4) Interpersonal communication skills
	(5) Logical problem-solving skills
	(1) Oral and written communication skills
	(8) Organizational skills
	Relationship building skills
	(9) Self-management skills
	(6) Time management skills
	(7) Troubleshooting skills
Factor 2: Development and production skills	*Animation design skills*
	Audio production skills
	Computer software skills
	Game and simulation skills
	Graphic design skills
	Print design skills
	Typing skills
	Video production skills
	Web development skills
	Storyboard design skills
Factor 3: Leadership and team development skills	Coaching skills
	Leadership skills
	Mentoring skills
	Negotiation skills
	Tactical and strategic planning skills
	Talent management skills
	Team building skills
Factor 4: Business and research skills	*Business analysis skills*
	Finance/budgeting skills
	Research skills
	Statistical analysis skills
Factor 5: Customer service and resolution skills	Conflict-management skills
	Coping skills
	Customer service skills
	Interviewing skills
Factor 6: Project and quality management skills	Project management skills
	Quality control skills
Factor 7: Computer and database programming skills	*Computer programming skills*
	Database programming skills

Table 5.
Ability domain of educational technologists—ability to . . .

Factor 1: Project management and providing feedback	Manage multiple projects
	Manage multiple tasks
	Prioritize tasks
	Provide critical feedback
	Share constructive feedback
	(9) Work independently
	(7) Work under deadlines
	(3) Work well with others (in teams)
Factor 2: Teaching and delivery of instruction	Act as a liaison with other departments
	Create workshops
	Deliver training to learners
	Demonstrate policies, procedures, and new information
	Develop in-person training
	Teach face-to-face
	Teach in virtual learning environments
Factor 3: Application of instructional design, development, and evaluation	Accommodate different learning styles
	(2) Apply sound instructional design principles
	Articulate the basic concepts, terms, and theory of instructional design
	(5) Create effective instructional products
	Develop assessments
	Develop course materials
	Evaluate learning products and programs
	Use data to make educationally sound decisions
	Write learning objectives
Factor 4: Analysis and strategic management	Advise or supervise employees
	Analyze complex data
	Analyze industry trends in learning technologies
	Breakdown a business process
	Manage teams
	Manage vendors
	Translate strategic goals
Factor 5: Adaptability to technology and process	**(4) Adapt and acquire new things quickly**
	(1) Adapt to evolving products and technology
	(8) Learn quickly and independently
Factor 6: Work and communication with diverse constituencies	Advise and consult with faculty
	Build strong client relationships
	(10) Collaborative with different team members (e.g., working with designers, programmers, engineers, and project managers)
	Communicate complex material
	Work with diverse constituencies (e.g., SMEs and clients)
	Advise and consult with faculty

Factor 7: Trouble-shooting and use of hardware	Troubleshoot technical problems
	Use audio/visual equipment
Factor 8: Initiative and focus	Be a self-starter
	Be goal-oriented
Factor 9: Leadership and ethical judgment	Evaluate complex issues
	(6) Exercise ethical judgment
	Inspire and influence people
	Integrate theory and research into practice
	Recognize opportunities and take action
	Think strategically

The IBSTPI instructional designer competencies and the KSA statements associated with the work of educational technologists describe, in more or less granular form, the work associated with these roles. The educational technologist role contains instructional design knowledge, skills, and abilities, but requires a more dedicated understanding of particular tools than the knowledge, skills, and abilities described in the IBSTPI instructional designer competencies.

A glance at those knowledge, skills, and abilities that educational technologists judged most important to their work reveals that the instructional design component of their KSAs are regarded as more important than those associated with technology. In this extended quotation, Ritzhaupt, et al, explains:

> Across the three domains, we can see . . . the importance of the craft of instructional design from analysis to evaluation was detected in the factor scores across the domains. For instance, in the knowledge domain, Assessment, evaluation, and teaching techniques, and Instructional design, development, and online facilitation were highly rated constructs. From the ability domain, the factor Instructional design, development, and evaluation had a high average score. . . . Also notable was, the emphasis on project management in the practice of our labor. . . . While the most important cross-cutting KSA statements are worthy of discussing, so too are those constructs that were not rated as highly by the professionals. A surprising finding was the lower than average scores assigned to computer programming related tasks with Development methodology, software, and programming from the knowledge domain having the lowest average score and Computer and database programming skills from the skills domain having the lowest average score. Computer programming knowledge and skills are not required in all educational technology programs; however, there is evidence of these skills in the job announcements within our field for positions like instructional developers or e-Learning developers . . . . Also notable, even the development tools for authoring content did not

> fare as highly as some other factors with Production, authoring, and productivity software from the knowledge domain having an average score, and Development, authoring, and production skills from the skills domains with an average score. Several of our academic programs emphasize authoring and development tools (e.g., Adobe Captivate), and professional development experiences from our professional associations often include these tools and topics (2018, pp. 22–23).

Tables 6, 7, and 8 map the most relevant skills from Ritzhaupt to the IBSTPI competencies.

Table 6.
Top 10 knowledge domains aligned with IBSTPI competencies

Top 10 Knowledge Domains of Educational Technologists (Ritzhaupt et al., 2018)	IBSTPI Competencies That Align
(1) Factor 8: Instructional design, development, and online facilitation: Online teaching and learning	2, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19
(2) Factor 5: Assessment, evaluation, and teaching techniques: Formative and summative evaluation	12, 13, 14, 16, 17, 18, 19
(3) Factor 4: Learning theory and human performance technology: Cognitive learning theory (e.g., Cognitive Load Theory)	2, 8, 9, 12, 13
(4) Factor 5: Assessment, evaluation, and teaching techniques: Blended learning techniques	2, 7, 8, 9, 12, 13, 14, 15
(5) Factor 8: Instructional design, development, and online facilitation: Instructional design models and principles (e.g., Dick and Carey)	2, 3, 10, 12, 13
(6) Factor 5: Assessment, evaluation, and teaching techniques: Face-to-face teaching and learning	2, 7, 9, 11, 12, 13, 14, 15, 16
(7) Factor 4: Learning theory and human performance technology: Adult learning theory	2, 6, 7, 8, 9, 12, 13
(8) Factor 6: Curriculum standards and frameworks: Classroom-based technology integration techniques	2, 7, 9, 12, 14, 15
(9) Factor 5: Assessment, evaluation, and teaching techniques: Assessment methods (e.g., criterion-referenced)	4, 6, 7, 8, 16, 17, 18, 19
(10) Factor 15: Copyright laws, policies, and procedures in training programs: Copyright laws	3, 5

Table 7.
Top 10 skills domains aligned with IBSTPI competencies

Top 10 Skills Domains of Educational Technologists (Ritzhaupt et al., 2018)	IBSTPI Competencies That Align
(1) Factor 1: Communication, problem-solving, and interpersonal skills: Oral and written communication skills	1
(2) Factor 1: Communication, problem-solving, and interpersonal skills: Collaboration skills	1, 15, 21, 22
(3) Factor 1: Communication, problem-solving, and interpersonal skills: Creative problem-solving skills*	6, 7, 8, 9
(4) Factor 1: Communication, problem-solving, and interpersonal skills: Interpersonal communication skills	1, 21
(5) Factor 1: Communication, problem-solving, and interpersonal skills: Logical problem-solving skills*	6, 7, 8, 9
(6) Factor 1: Communication, problem-solving, and interpersonal skills: Time management skills	11, 21, 22
(7) Factor 1: Communication, problem-solving, and interpersonal skills: Troubleshooting skills	
(8) Factor 1: Communication, problem-solving, and interpersonal skills: Organizational skills	1, 11
(9) Factor 1: Communication, problem-solving, and interpersonal skills: Self-management skills	
(10) Factor 1: Communication, problem-solving, and interpersonal skills: Content development skills	12, 15

Table 8.
Top 10 abilities domains aligned with IBSTPI competencies

Top 10 Ability Domains of Educational Technologists (Ritzhaupt et al., 2018)	IBSTPI Competencies That Align
(1) Factor 5: Adaptability to technology and process: Adapt to evolving products and technology	3, 9
(2) Factor 3: Application of instructional design, development, and evaluation: Apply sound instructional design principles	2, 6, 10, 12
(3) Factor 1: Project management and providing feedback: Work well with others (in teams)	1, 15, 21, 22
(4) Factor 5: Adaptability to technology and process: Adapt and acquire new things quickly	3, 9
(5) Factor 3: Application of instructional design, development, and evaluation: Create effective instructional products	6, 7, 8, 9, 10, 11, 12, 14, 15
(6) Factor 9: Leadership and ethical judgment: Exercise ethical judgment	5
(7) Factor 1: Project management and providing feedback: Work under deadlines	22
(8) Factor 5: Adaptability to technology and process: Learn quickly and independently	3
(9) Factor 1: Project management and providing feedback: Work independently	
(10) Factor 6: Work and communication with diverse constituencies: Collaborative with different team members (e.g., working with designers, programmers, engineers, and project managers)	1, 15, 21, 22

The mapping across the studies does not indicate equivalence, but resonance. The articulation of the KSAs does not match the language of the IBSTPI competencies. Some of the Ritzhaupt KSAs in this analysis seem repetitive. What is the difference between having a skill in collaboration and an ability to collaborate with others? One more difference between the two publications may have to do with the prominent role of job announcements in the drafting of the Ritzhaupt KSA statements. The initial bank of KSA statements that were then validated with surveys was based on a literature review of competencies and an analysis of job announcements. The IBSTPI competencies were all based on interviews with and oversight from practitioners. It may be that the most general KSA statements such as "ability to work independently," "ability to work under deadline," and "self-management skills" may have more to do with a generally desired set of KSAs in the contemporary workforce than anything specific to the work of educational technologists. Nevertheless, the three mapping tables do show that what is valued in the Ritzhaupt study often finds expression in the IBSTPI competencies.

Video Production Workflow and Instructional Design

Video is a core element of learning at scale course content. Ritzhaupt's study mentions knowledge, skills, and abilities related to creating video and using audio/visual equipment, but it does not appear in those "most-valued" lists. Given the prominent place of video in learning at scale, this section helps to describe more about what KSAs may be needed by videographers.

In the *Video Production Handbook*, Owens walks readers through the full video production process. Most broadly, video production is a three-step process: pre-production, production, and post-production. Pre-production, or planning and preparation, takes up 90 percent of total work of producing video. Production consists of the work to shoot the video, and post-production is editing the final project. Pre-production begins with identifying the subject of the video, the context for the video (determining where it will be shown), and the audience of the video. Then, Owens recommends articulating goals and objectives for the video,

> What do you really want your audience to know after they have viewed your production? The goals and objectives will determine what is used as a measuring stick throughout the production process. *Goals* are broad concepts of what you want to accomplish:
>
> Goal: I want to explain how to field a Formula One racing team.
>
> *Objectives* are measurable goals. That means something that can be tested for to see that the audience did understand and remember the key points of the program. Take the time to think through what the audience should know after seeing your program:

> Objectives: When the viewers finish watching the program, 50 percent of the audience should be able to:
>
> - identify three types of sponsorship;
> - identify four crew positions;
> - identify two scheduling issues.
>
> All three of these are objectives because they are measurable. The number of objectives is determined by the goals. (2017, pp. 28–29)

The considerations undertaken in early pre-production, as described in this extended quotation, are identical to the early questions that direct the design of instruction—who is your learner, what is to be learned, and how will you measure learning? The similarity continues through identification of the audience/learners and their context with recommendations to consider where and how often the video will be watched. There are considerations specific to the medium of video. These include what are the best shot angles, whether the background should be visible, and so on. Once these decisions have been made, directors and their crew create storyboards, which are visual maps that represent "how the director hopes to arrange the camera shots for each scene or action sequence" (2017, p. 36). Storyboards contain descriptive text about the shots and the sequence of the shots, as well as rough sketches of the focus of each shot. They document both the sequence and substance of the video.

The IBSTPI competencies and Ritzhaupt, et al's, KSAs are important in an investigation of the roles and tasks associated with work on learning at scale. In this study it is helpful to recall the first assumption by IBSTPI in drafting their competencies that "Instructional designers are those persons who demonstrate instructional design competencies on the job regardless of their job title or training" (Koszalka et al., 2013, "Assumptions underlying IBSTPI the ID competencies: Assumption 1"). There is confusion among job titles in this field for a reason. Among instructional designer and educational technologist competencies and KSAs, there is significant overlap. For the purposes of this study, I used the term "instructional designer" (ID) and “instructional design” to refer broadly to those aspects of the ID and educational technology roles that overlap. While Ritzhaupt may argue that “educational technologist” is the more inclusive term, an examination of the research on competencies and KSAs suggests that “instructional design” more accurately describes the work. I do not use this same reasoning to refer to videographers as instructional designers, even though one might argue that videographers are educational technologists who work with a particular set of tools. The socio-technical systems framework traces the interacting and interdependent technical and social subsystems. For the purposes of this study, IDs are often, but not exclusively, associated with the edX Studio course-authoring tool for the edX platform, while videographers are associated with the tools for creating course media. Keeping these roles separate helps us to more clearly understand the socio-technical systems involved in learning at scale course creation.

Instructional Design Models

In the previous section, the competencies and KSA statements associated with instructional design work were discussed. One of the tools available to instructional design practitioners is the instructional design model. While I have already described the complicated working relationship that designers have with models, it is still important to collect data about instructional design models and other tools used in MOOC and learning at scale course creation. This section of the literature review describes types of instructional design models.

Instructional design is an iterative process of articulating outcomes, selecting strategies for teaching and learning, choosing relevant technology and media, and assessing learning. A model is a “simple representation of more complex forms, processes, and functions of physical phenomena or ideas” (Branch & Kopcha, 2014, p. 79). There are two types of instructional design models—procedural models that illustrate a sequence of steps, and conceptual models that represent theories of learning. Both procedural and conceptual models are grounded in learning theory and are tools designed to guide the design and development of instruction. This section of the literature review describes one exemplar each of behaviorist and constructivist learning theory models and one learner-focused conceptual model that combines both behaviorism and constructivism. In addition, important for this project on MOOC making and learning at scale is a tool for categorizing instructional design models based on the product of instructional design.

Traditional instructional design models, such as Dick and Carey's Instructional Systems Design and Gagné, Briggs, and Wager's Principles of Instructional Design, are associated with objectivism, behaviorism, and a prescriptive understanding of the relationship between the conditions of learning and the achievement of learning outcomes. Objectivism, the idea that there is objective truth that exists external to a learner, suggests that the role of instructional design is to aid learners in achieving prescribed outcomes. Dick and Carey's Systematic Instructional Design Model employs Gagne's categories of learning outcomes, conditions for learning (see Table 9) (Gagné et al., 1992), and nine events of instruction (see Table 10) (Gagné et al., 1992) as a source for both conceptual framework and procedural model, respectively (Moallem, 2001). Gagne introduces his conditions of learning with an overview followed by the associated outcomes and conditions displayed in Table 9.

> This theory stipulates that there are several different types or levels of learning. The significance of these classifications is that different types of learning require different types of instruction.
> Principles:
> - Different instruction is required for different learning outcomes.
> - For different learning to occur, specific conditions of learning need to be present.
> - The specific operations that constitute instructional events are different for each different type of learning outcome.

Table 9.
Gagne's conditions of learning

Learning Outcomes		**Conditions for Learning**
Verbal Information		Draw attention to information to be learned. Link the new, incoming information with prior knowledge. Provide and clarify the hierarchical relationships among ideas. Use associational (e.g., mnemonics, images, analogies), organizational (e.g., clustering, chunking, using graphics organizers), or elaborative techniques when appropriate. Use spaced practice. Provide cues for effective recall and generalization
Intellectual Skills	Discrimination	Provide examples that clearly embody all of the necessary (critical) attributes (characteristics) of the object, event, and phenomenon. Have the learner examine the example and non-examples. Provide practice. Provide feedback.
	Concepts	Present the best examples. Guide learners to discover the underlying concept and its attributes. Present learners with matched non-examples. Guide learners to discover the non-relevant attributes of the concept. Encourage learners to think of their own examples of the concept. Provide feedback.
	Rules/Principles	Guide learners in reviewing the concepts underlying the principle/procedure. Make sure that learners have more than declarative knowledge of the underlying concepts. Present the learner with a statement of the principle/ procedure and with subsequent examples of the principle’s application. Guide learners to identify the features of a situation that suggest a particular principle/ procedure should be used.
	Problem solving	Confront learners with an actual problem or represented problem situation not previously encountered.

		Guide the learner in defining and decomposing the problem into sub-problems. Guide learners in recalling general problem-solving strategies and developing an appropriate plan for attacking the problem. Guide learners in searching, selecting and combining rules and cognitive strategies to solve the problems. Guide learners to compare and contrast alternative ways of solving the problems given identified rules. Guide learners to use monitoring techniques for appraising the appropriateness of the solution.
Cognitive Strategies		Frequently present learners with novel and challenging problems.
Attitude		Provide models, reinforce proper behavior and provide verbal guidance.
Motor Skills		Provide models; provide verbal directions; provide and reinforce practice.

Table 10.
Nine Events of Instruction

1. Gain attention	Present a good problem, a new situation or a novel idea to gain students' attention. (Use John Keller's ARCS (Attention, Relevance, Confidence & Satisfaction) Model).
2. Informing Learner of the Objective	In some manner or other, the learner should know the kind of performance that will be used as an indication that learning has, in fact, been accomplished. Objectives are to be communicated effectively to the learner (use words, even pictures, if appropriate).
3. Stimulate Recall of Prerequisites	The previously acquired capabilities must be highly accessible to the learner. This must be ensured by having learners recall previously acquired capabilities just before the new learning takes place.
4. Presenting the Stimulus Material	Stimuli that are to be displayed are those involved in the performance that reflects the learning. For example, if learning a concrete concept is the objective of the lesson, the concept's physical characteristics are to be emphasized. This can be done by enlarging the differences and similarities among examples and non-examples of the concept to be identified.
5. Providing Learning Guidance	The amount of hinting or promoting will vary with the kind of learner and the difficulty of the task/the lesson objective.
6. Eliciting Performance	Having learners show that they can carry out the task. This is usually done informally.
7. Providing Feedback	Once the correct performance has been exhibited by the learner, there should be feedback concerning the degree of correctness/appropriateness of the learner's performance.
8. Assessing Performance	At this level the teacher gathers formal and convincing evidence (valid and reliable) regarding the learner's performance.
9. Enhancing Retention and Transfer	Varieties of new tasks are to be assigned to enhance the learner's understanding and to assure the transfer of learning.

Consistent with a behaviorist approach to learning, if the steps in the Dick and Carey approach to the nine events of instruction are followed, the eventual result will be effective instruction (Moallem, 2001).

A cognitive-constructivist approach to learning suggests that truth and knowledge are actively created by the learner and are internal and individual to that learner. A constructivist approach to instructional design emphasizes supporting the learner's active role in managing their schema, or organized knowledge structure. Constructivist instructional design emphasizes "collaboration, learner autonomy, generativity, reflectivity, and active engagement" (Moallem, 2001, p. 114). Unlike behaviorist models with their series of proscribed steps that lead to learning, constructivist instructional design models employ the following concepts:

- Learning is embedded in a rich authentic problem-solving environment
- Authentic versus academic contexts for learning are provided
- Provisions for learner control are incorporated
- Errors are used as a mechanism to provide feedback on learners' understanding
- Learning is embedded in social experience (B. Wilson, 1991)

This distinction between behaviorist and constructivist models here and earlier in this literature review echo Schön's descriptions of the conflict between technical rationality and reflection-in-action.

Moallem suggests that among several constructivist instructional design models (Bednar, Cunningham, Duffy, and Perry, 1995; Hannafin, Land, and Oliver, 1999; Willis, 1995), Jonassen's constructivist learning environment is often used to design constructivist instruction for online learning environment (2001, p. 116). Jonassen's eight design principles are as follows:

1. Create real world environments that employ the context in which learning is relevant;
2. Focus on realistic approaches to solving real-world problems;
3. The instructor is a coach and analyzer of the strategies used to solve these problems;
4. Stress conceptual interrelated-ness, providing multiple representations or perspectives on the content;
5. Instructional goals and objectives should be negotiated and not imposed;
6. Evaluation should serve as a self-analysis tool;
7. Provide tools and environments that help learners interpret the multiple perspectives of the world, and
8. Learning should be internally controlled and mediated by the learner (1999).

Moallem takes Jonassen's model and articulates implications for instructional designers working to create a constructivist learning environment online. These include recommendations to

- identify the learning domain (boundaries of the content)
- identify fairly complex problems or cases to be studied within the identified learning domain

- identify learning elements which the designer feels are most important within the defined domain (declarative and procedural knowledge that make up the learning domain)
- map multiple paths through cases (guided paths that create trails through the domain leading the learner to optimal results from the designer's perspective)
- provide tools for learner-controlled path (where the learner sets [their] own objectives and decides where to go from there)
- encourage self-reflection (questions, guidance)
- provide tools that help the learner decide what to do next based on self-reflection (2001, p. 116)

In articulating implications for designing constructivist online learning, Moallem makes it possible for designers to apply a general framework across instances of constructivist online learning, while also emphasizing the importance of learner autonomy and control.

While behaviorism and constructivism can be seen as opposing sides of an instructional argument, each approach has important and valid applications. Jonassen, McAleese, and Duffy's Continuum of Knowledge Acquisition Model, shown in Table 11, recognizes that in learning environments, behaviorism and constructivism can have beneficial roles to play depending on what is to be learned by a population of learners (Jonassen et al., 1993).

Table 11.
The Continuum of Knowledge Acquisition Model

<table>
<tr><td colspan="3">Ignorance > Expertise</td></tr>
<tr><td colspan="3">Learning Phases</td></tr>
<tr><td>Introductory</td><td>Advanced</td><td>Expert</td></tr>
<tr><td>Learners have very little directly transferable prior knowledge about a skill or content area.</td><td>Learners have some prior knowledge and need more advanced knowledge to solve complex and domain-specific problems.</td><td>Learners have extensive experience that can be transferred from previous phases of learning, and require little guidance</td></tr>
<tr><td colspan="3">Traditional IS Models > > > > > > > > > > > > > > Constructivist Models</td></tr>
</table>

The challenge of this continuum model for learning at scale is that learners at all levels are likely in an open course. Learner populations are more predictable in degrees at scale, where learners must meet program admittance requirements. For open, massive course, instructors must decide which population of learners will serve as the focus of their course design.

Finally, Gustafson and Branch's taxonomy of instructional design models focuses on the scope of intended use of that which is being created, whether an activity, a curriculum, or some other instructional object. Having a classroom orientation indicates a product that is designed for individual classroom instruction. A product orientation suggests products that would be implemented by users other than the developers. A system orientation indicates "larger and more complex instructional systems directed at an organization's problems or goals" (2002a, p. 13). In the small book in which this table is featured, Gustafson and Branch associate a number of contemporary design models with one of three orientations. They include models by Morrison, Ross, and Kemp; Seels and Glasgow; Dick, Carey, and Carey; and many more. Gustafson and Branch also conclude their small book by saying that while authors of the instructional design models they include in the volume insist on their usefulness, there is no data to back up those claims, nor has any data been generated in the decades since (Branch & Kopcha, 2014; Gustafson & Branch, 2002a). It is the taxonomy itself, shown in Table 12 (2002a, p. 14), and not the categorization of models that may result from its use, that is relevant to this study. The taxonomy suggests that traditional models of producing classroom instruction do not apply once the classroom context is removed and the role of the instructor changes.

Table 12.
A taxonomy of ID models

Selected Characteristics	Classroom Orientation	Product Orientation	System Orientation
Typical Output	One or a few hours of instruction	Self-instructional or instructor-delivered package	Course or entire curriculum
Resources committed to development	Very low	High	High
Team or individual effort	Individual	Usually a team	Team
ID skill/experience	Low	High	High/very high
Emphasis on development or selection	Selection	Development	Development
Amount of front-end analysis/needs assessment	Low	Low to medium	Very high
Technological complexity of delivery media	Low	Medium to high	Medium to high
Amount of tryout and revision	Low to medium	Very high	Medium to high
Amount of distribution/dissemination	None	High	Medium to high

This taxonomy serves as a resource for understanding the difference between the work of designing, developing, and delivering traditional online course and learning at scale courses.

Models and ID Work

Almost thirty years ago, Rowland noted, “it has become increasingly apparent that in our literature we have abundant information on what authors/designers say they do, or say others should do, but little idea of what expert designers actually do themselves” (1992, p. 65). In his study, Rowland asked eight instructional designers, four novices and four experts, to solve an instructional design problem. He found that rather than follow a process from beginning to end, experts spent much more time than novices in interrogating the initial problem statement and in identifying potential solutions in order to frame their understanding of the problem. Rather than following a step-by-step deterministic design model, the expert IDs focused on understanding the system that was represented by the problem and using their experiences as IDs to inform their approaches. He also noted that while the greatest differences in proposed solutions existed between novices and experts, the four experts each proposed a different solution and a different understanding of the problem. For Rowland, one of the implications was that to support designers in the field, designers do not need a step-by-step design model. Useful tools would be those that help IDs understand the system of concern more deeply and the implications of proposed interventions.

The tension between the two branches of ID literature, mentioned earlier between the literature on instructional design models and that on instructional design practice, is cited explicitly by Dick and Ives in their study of instructional design work.

> We uncovered a range of social and intellectual skills that our sample of working IDs deployed in their daily efforts to collaborate with their clients to create effective instruction. None of these skills are explicitly prescribed in any of the extant 'instructional design models.' In fact, some of these activities are the sorts of things the designer must do to fill one of those boxes ('Analyse', for example in the ADDIE model), and some are things that fill the "white spaces" (Rummler and Brache, 1995) that the designer crosses in moving on to the next box ('Design'). In short, while the models may list milestones or deliverables in the design of instruction, the skills we have uncovered are the means of reaching these milestones and producing these deliverables. (2008, p. 13)

Instructional design models require implementation and it is in that implementation work that instructional designers perform their expertise. Dicks and Ives describe this work as performed in the spaces between the boxes on ID model diagrams. It is this interstitial work that moves the product through the process.

Visscher-Voerman and Gustafson studied how instructional designers work through the generalized ADDIE model and also found design practice differs from designer to designer. They analyzed the rationales that designers used for the choices they made in their work. Visscher-Voerman and Gustafson proposed a theoretical framework composed of four paradigms--instrumental, communicative, pragmatic, and artistic--to explain the different ways of performing instructional design work. Although only three of their paradigms were supported with data from their study, the researchers suggest to instructional design practitioners that they become aware of the value of each of their paradigms and use the one that is most appropriate for their particular situation. They warn that "To do less is to be less than a complete and competent practitioner" (2004, p. 87). In contrast, Lachheb and Boling in their research on the tools used by instructional designers find:

> [Instructional design practitioners'] use of tools certainly shows some constraints and influences, often from the workplace and from their personal, professional preferences. It does not show that they are seeking or using tools created to scaffold or direct their designing in a predetermined way. Their ability to discuss the instrumental judgments they make regarding tools implies that this proclivity on their part is a valid feature of their practice, not ignorance of such tools or a willful refusal to use what is good for them (2018, p. 48).

The descriptions cited here of instructional design work in and among the phases of the instructional design models supports an investigation of the use of models by instructional designers and others working on learning at scale.

Instructional Design Work in Higher Education

With an understanding of what an instructional designer may need to know, and what (and whether) instructional design models may be employed, next is an investigation of how those KSAs and competencies and tools are deployed in practice. According to a recent survey of practicing instructional design professionals in higher education, instructional designers who work in institutions of higher education are most often on a team of 2-5 people, in a center for online learning within academic affairs at a research/doctoral institution (Intentional Futures, 2016, p. 11). While working with instructors who are building online courses is an important part of their role, instructional designers also manage projects, conduct technology and pedagogical training, and teach, among other tasks. One aspect of this study that illustrates how learning at scale work may be different is learning more about where individuals doing learning at scale work are located within the institution.

In a higher education context, instructional designers assist instructors with integrating technology, course design, and pedagogy (Chiasson et al., 2015; Dempsey et al., 2007; Koepke & O'Brien, 2012; Oomen-Early & Murphy, 2009; Rubley, 2016; Tate, 2017); with interdepartmental knowledge sharing (Grincewicz, 2018); and are expected to assist instructors with a shift to learner-centered and evidence-based strategies (Ko & Rossen, 2010; Koszalka et al., 2013; Nilson & Goodson, 2017). In a survey of 179 instructional designers, more than 75 percent of respondents described the following as primary responsibilities of their role:

- Work with faculty to revise or adapt existing courses, lessons, activities, assessments and learning resource (85 percent)
- Work with faculty to plan and design new courses, lessons, activities, assessments and learning resources (84 percent)
- Research emerging trends in technology tools and pedagogy (84 percent)
- Attend/receive professional development to stay current in the field (79 percent)
- Train and support faculty in using new instructional technologies and learning managements systems (77 percent) (Rubley, 2016, p. 10)

Whether these responsibilities reflect those associated with working on learning at scale is a focus of this study.

One element of learning at scale that is distinctive among modes of online instruction is the presence of high-quality course video. Guo, et al, describe MOOCs as "mostly organized as sequences of instructor-produced videos interspersed with other resources such as assessment problems and interactive demos" (Guo et al., 2014). MOOC making is more time consuming and resource intensive than traditional online courses due to "MOOC-specific components such as high-quality video, quizzes to substitute instructor-graded assignments, and peer-to-peer learning technologies" (Hollands & Tirthali, 2014, p. 119). The phrase "high quality video" requires some analysis. Participants in Hollands and Tirthali's study described the high level of polish required in MOOCs, largely because of the public nature of MOOCs compared to traditional small, private online courses (2014, p. 119). It might be assumed that a video exhibiting a "high quality" would be technically proficient, with excellent lighting, audio, and high-definition video quality. However, creating high-quality video for the global audience of a learning at scale course is more complex than simply following technical requirements.

The research associated with course videos in MOOCs presents a bewildering range of recommendations, depending on the profile of learners being studied. Global learners respond to, or are repelled by, cultural tells in course videos, such as how the speaker is dressed and how they are filmed (Bayeck & Choi, 2018). Audio narration over text-based images in a video can aid native English speakers but hamper the learning of English-language learners (Uchidiuno et al., 2017). Videos that seem to provide "access" to faculty can help students develop a feeling of mentorship and intimacy with the instructor in a video (Adams et al., 2014). Teachers pursuing professional development in MOOCs do not watch video. They are there to connect with fellow learners (Bonafini, 2017). While these findings based on particular learner populations provide conflicting advice, Guo et al, looked at student engagement more broadly to understand the watching habits of learners at scale.

Guo, et al, analyzed the video-watching habits of learners on the edX platform to measure learner engagement. They elected to measure engagement rather than effectiveness because of the data available to them through the edX platform. They measured the amount of time learners spent watching a video, and whether learners then interacted with an associated problem set. From their analyses of learner video watching and question answering, they made seven recommendations. These recommendations are shown in Table 13 (Guo et al., 2014).

Table 13.
Summary of main findings and recommendations

Finding	Recommendation
Shorter videos are much more engaging.	Invest heavily in pre-production lesson planning to segment videos into chunks shorter than 6 minutes.
Videos that intersperse an instructor’s talking head with slides are more engaging than slides alone.	Invest in post-production editing to display the instructor’s head at opportune times in the video.
Videos produced with a more personal feel could be more engaging than high-fidelity studio recordings.	Try filming in an informal setting; it might not be necessary to invest in big-budget studio productions.
Khan-style tablet drawing tutorials are more engaging than PowerPoint slides or code screencasts.	Introduce motion and continuous visual flow into tutorials, along with extemporaneous speaking.
Even high-quality pre-recorded classroom lectures are not as engaging when chopped up for a MOOC.	If instructors insist on recording classroom lectures, they should still plan with the MOOC format in mind.
Videos where instructors speak fairly fast and with high enthusiasm are more engaging.	Coach instructors to bring out their enthusiasm and reassure that they do not need to purposely slow down.
Students engage differently with lecture and tutorial videos	For lectures, focus more on the first-watch experience; for tutorials, add support for re-watching and skimming.

Guo and his co-authors found that the length of a video was the most significant indicator of engagement. In their conversations with video producers at edX, Guo, et al, described why video producers thought short videos may be more engaging:

> One hypothesis that came out in our interviews with video producers was that shorter videos might contain higher-quality instructional content. Their hunch is that it takes meticulous planning to explain a concept succinctly, so shorter videos are engaging not only due to length but also because they are better planned (2014).

The researchers said that they did not have the data they needed to properly investigate whether it was video length alone that increased learner engagement.

No matter the modality, instructional design work in higher education is centered on supporting faculty. Three of the roles described in the Rubley study involve instructional designers working directly with faculty members. These collaborations can be positive (Kumar

& Ritzhaupt, 2017; Richardson et al., 2019) when they occur, but many instructors may not have the opportunity to work with an instructional designer. Inside Higher Ed produces the annual report *Faculty Attitudes on Technology*. One set of questions asks faculty members to disclose whether they have worked with an instructional designer to create or revise an online or blended course or a face-to-face course. While the responses to one question indicate that 96 percent of faculty who teach online have worked with an instructional designer, over the past three years, slightly fewer faculty each year are working with an instructional designer in the courses they create or revise across all modalities. This is shown in Table 14 (Jaschik & Lederman, 2017, p. 13, 2018, p. 16, 2019, p. 20). There is also a slight decrease across instructors seeking general professional development to design an online or blended course.

Table 14.
Percent of faculty who work with IDs or receive faculty development

	2017	2018	2019
Percent of faculty who have worked with an instructional designer to create or revise an online or blended course	25	25	22
Percent of faculty who have worked with an instructional designer to create or revise a face-to-face course	23	22	17
Received professional development about designing an online or blended course	44	45	43

According to these reports, more than 75 percent of faculty created online or blended courses without the aid of an instructional designer in 2019. A recent study of faculty who design online courses found that they do not view it as a specialized undertaking that requires expert personnel or highly specialized resources. While they do not follow established instructional design models (Baldwin et al., 2018; Bennett et al., 2017), they do follow steps that generally correspond to a broad interpretation of ADDIE, and yet do so without knowing that this is what they are doing (Baldwin et al., 2018). Baldwin, et al, also found, ironically, that even instructors of instructional design who teach instructional design models do not use them in their course design activities.

Many faculty members who teach online describe benefits of the experience in online transferring to their face-to-face classes. In the 2017 and 2019 reports on faculty attitudes toward technology, 71 and 77 percent of faculty replied in the affirmative to the question, “Has your experience teaching online courses helped you develop pedagogical skills and practices that have improved your teaching, both online and in the classroom?” (Jaschik & Lederman, 2017, p. 30, 2019, p. 14). In both years, faculty responded that their online teaching experiences helped them to think more critically about ways to engage students with the content and it helped them to make better use of multimedia content (Jaschik & Lederman, 2017, p. 30, 2019, p. 15). In a study on the influence of online teaching on face-to-face practices, Scagnoli, et al, found that those instructors who were more learner-centered in the classroom, acting as a facilitator and leaving time for learner-centered activities, were more likely to bring online applications back to the classroom. Those faculty who occupied the central, expert role in the face-to-face classroom were less likely to transfer applications back to the face-to-face classroom and most often wanted online to replicate the on-campus instructor-centered teaching context (2009, p. 124). Flexibility and a willingness to experiment are key features of a successful online instructor (Martin et al., 2019; Meyer et al., 2007; Oomen-Early & Murphy, 2009; Scagnoli et al., 2009; Stevens, 2013).

Instructional designers must also be flexible when they work with faculty members (Intentional Futures, 2016; Rubley, 2016; Scoppio & Luyt, 2017; Stevens, 2013). According to the Intentional Futures report on instructional design work in higher education, IDs described “faculty buy-in” as one of the greatest barriers to the success of their work. Faculty buy-in is described in the report as “part lack of knowledge, part lack of understanding. Faculty may be having a difficult time integrating new methods and practices when they are comfortable teaching what they know” (2016, p. 15). A 2016 report describes the top three frustrations instructional designers face with faculty as “faculty miss project deadlines/do not provide necessary content on time; faculty members do not understand what instructional designers do; and faculty members do not believe that online learning is an effective way to teach or that it will work for the way they teach” (Rubley, 2016, p. 23). This frustration may find its foundation not in interpersonal issues but in broader systemic issues.

Of importance for this study is that the learning at scale at the center of this project is being produced by institutions of higher education. Having a brief overview of some of the complicating factors associated with working within an academic institution, particularly the factors involved if one is promoting change, will help with understanding the work of building learning at scale. Bälter describes three divides that represent the challenges facing technology-enhanced learning in higher education—the divide between involved academic subjects and the related competences; the divide between involved occupational and academic levels; and the divide in attitudes toward teaching. The first of these divides recognizes that disciplinary differences exist among faculty in an institution and that these disciplinary differences can be significant. In Bälter’s study, respondents suggested that pedagogical researchers were

> too theoretical and have no connection with real teaching or didactics. As a counter to this, pedagogical researchers suggest those trained in other subjects are too focused on experimental methods alone and do not know anything about the science of teaching and learning. (2017, p. 173)

Regarding the second and third divisions, staff and academics operate in different systems with different priorities, hierarchies, and rewards. Staff and pedagogical developers have an important role to play in assisting faculty to integrate technology into their classrooms in a pedagogically robust way. Bälter notes that academics may not take kindly to being told by a staff person how to teach their class, particularly if this person is not an academic or does not have a Ph.D.

The last divide represents the most "devastating" to progress in technology-enhanced learning. Balter notes that in the academy, "excellent teaching is not rewarded nearly as much as mediocre research" (2017, p. 173). He describes lecturers (contrasted with tenure-track professors) who are trapped in an academic hierarchy where they "do not have a PhD, are not supported to do research, and are expected to teach well in a system that does not provide promotion opportunities on the strength of good teaching alone" (2017, p. 173). It should not be surprising that in this context faculty may be resistant to requests from instructional designers.

Two other studies on resistance to change are useful to consider. Macfayden and Dawson's 2012 analysis of the failure of learning analytics to inform an institutional plan. They suggest that educational institutions are particularly resistant to change. They suggest that institutions of higher education are a combination of agrarian and industrial institutions and that elements of each of those systems work against institutional-level change. They describe the agrarian features of an academic department as learning that is regulated in a semester system, with faculty being responsible for all aspects of teaching from materials to assessment, and transitions of power being apprenticeship based, with lengthy supervised graduate study within a discipline. At the institution-level they describe the following features of the modern IHE as obstacles to change:

> consensus governance (rather than industrial-style hierarchical management); faculty control over the major goal activities (teaching and research); an organizational culture that supports change by adding resources rather than by strategically reallocating resources, and a curriculum structure that makes false (though some would argue, necessary) assumptions about learner homogeneity. . . . [W]hile university presidents are expected to be inspiring leaders, any direct interference in faculty democracy is not welcome. Similarly, introduction of policy that is seen to impinge on faculty autonomy in teaching is usually strenuously resisted, especially if it is perceived to derive from the "cost-consciousness-and-efficiency" culture of a management bureaucracy or corporate/industrial model for education (2012, pp. 160–161).

Staff and faculty in institutions of higher education often exist in separate spheres and have their work judged by very different metrics. The interaction of staff and faculty who create and deliver learning at scale, and an understanding of their roles and tasks, is a focus of this research.

Henderson and Dancy's article on the barriers to use of research-based instructional strategies echoes findings by Macfadyen and Dawson. In this study, the researchers wanted to understand why faculty do not employ the evidence-based teaching strategies that they espouse. They found that the situational factors imposed by the system of higher education were responsible more so than faculty attitudes toward pedagogy. They quote Tobias,

> Physics education reform has been focusing largely on classroom-based innovation rather than on the more political and institutional conditions required for long-lasting change. There appears to be a presumption at work among reformers that innovation inevitably leads to change. But anyone who has been seriously engaged in the propagation of innovation or in the wholesale alteration of departmental offerings knows that it is often the exogenous variables that get in the way of real reform, perhaps because they appear to be out of our control (2000, p. 103).

Like Tobias, Henderson and Dancy suggest that pedagogical reform is larger than the classroom and that educational researchers must "begin to unravel the nature of these political and institutional structures that influence the landscape of educational change" (2007, p. 12) before these barriers can be overcome. Instructional designers work with faculty to design and revise online and face-to-face courses. This study analyzes the systemic foundation of "faculty buy-in" or contrarily, faculty resistance, as part of learning at scale work.

Theoretical Framework: Socio-Technical Systems (STS) Theory

One body of instructional design literature describes and promotes a multiplicity of instructional design models created to make learning more efficient and learners more successful. Another body of instructional design literature examines the practice of expert instructional designers and finds that few of them employ instructional design models in their work, and that their work is greatly affected by context. Socio-technical-systems theory provides a way of analyzing these two bodies of literature within a framework designed to investigate the intersection and interplay of the technical and the social.

Socio-technical systems (STS) theory provides researchers with a framework for describing and analyzing complex work systems by focusing on four variables—tasks, people, roles, and technology. STS is a refinement of general systems theory, in which organizations are viewed as a collection of interacting parts working toward a goal (O'Hara et al., 1999). In STS, a work system is described as being comprised of two sub-systems—the social and the technical. Each separate subsystem is interdependent, meaning that what happens in one subsystem affects the other subsystem. The social subsystem is comprised of people, their relationships, their attitudes toward work, their skills, values, and roles. The technical sub-system is comprised of processes, technology, and tasks (Bostrom & Heinen, 1977a).

This framework emerged from research at the Tavistock Institute of Human Relations in Great Britain on British coal worker resistance to adoption of technological innovations meant to increase productivity (Trist & Bamforth, 1951). Trist, et al., found that any intended implementation of technology to improve efficiency must consider the effect on workers: "It is through the people who comprise this system that technological and economic changes are successfully or unsuccessfully implemented" (2013, p. 7). Further, Bostrom and Heinen suggest that it is not merely "through" the people that change is successful--the goal of using STS to design a system is to "optimize the uniqueness of the organization's technical requirements along with the needs and values of its individual members into a productive organization with a high quality of working life" (1977a, p. 14). Bostrom and Heinen describe STS as tending toward a Theory Y, or human resources, set of assumptions about workers and their work in a system.

Theory X and Theory Y, postulated by Douglas McGregor in his 1960 book *The Human Side of Enterprise*, describe two theories of management. At the time, Theory X predominated in management practice, suggesting that strong management was required to lead workers who would otherwise be lazy, incapable of self-direction, and had little to offer in terms of ideas about improving effectiveness. McGregor suggested that the opposite may be considered, that employees may not be lazy, may be capable of self-direction, and could provide advice on organizational effectiveness (Kopelman et al., 2008, p. 255). Bostrom and Heinen describe their own definitions of Theories X and Y from the perspective of socio-technical systems approach to MIS. Theory X, or machine theory, "assumes a person is one who likes order, wishes to work within tightly specified boundaries, and does not want to have a great deal of personal control over one's activities" (1977b, p. 20). Theory Y, or human resource theory, "assumes a person is a responsible, self-achieving individual who can take full control of one's work environment" (1977b, p. 20). Further, a work system design based on Theory X would

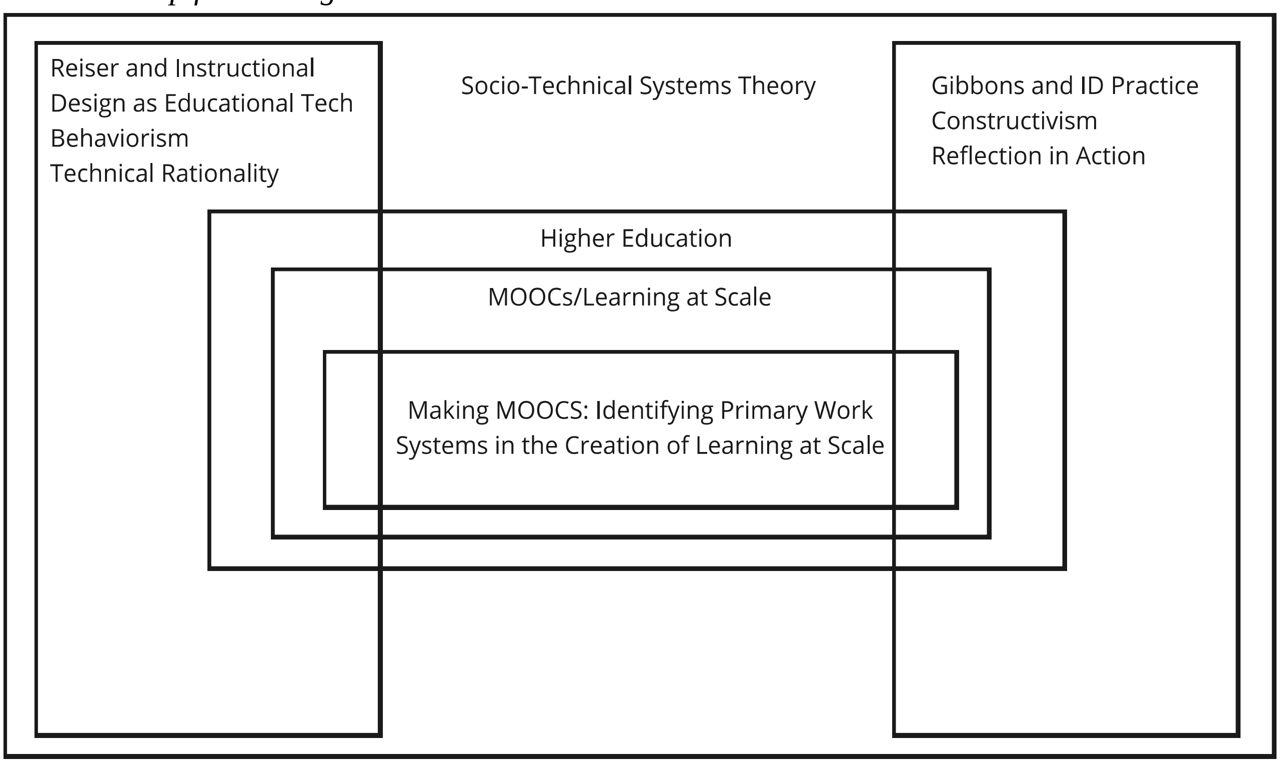
> tend to create a tightly structured organization, with precise job definitions and clear lines of hierarchical authority, emphasizing order and stability as necessary to obtain technical efficiency. On the other hand, Theory Y assumptions would tend to create a flexible organization which has a great deal of self-direction and self-control at all levels because the integration of individual growth with technological improvement is seen as the key to organizational effectiveness (1977b, p. 20).

For me, Theory X and Theory Y resonate with the two bodies of instructional design literature, with Theory X aligning with technical rationality, behaviorist instructional design models, and Reiser, while Theory Y aligns with reflection in action, instructional design heuristics, and Gibbon's humanistic view of ID practice. Not only does STS provide a way of analyzing complex systems, but it would also seem to be an appropriate theoretical frame in multiple disciplines for navigating between two disparate approaches to design work.

Summary and Literature Map

Literature in instructional design follows some predictable themes. The next educational technology will revolutionize or destroy education. Instructional design researchers have models to promote. Instructional design researchers wonder why instructional designers do not follow instructional design models. Researchers also wonder what instructional designers actually do if they are not following models. My research falls somewhere in the middle of all of this, looking at what instructional design and educational technology professionals do when they work on one of these transformative technologies.

Figure 1.
Literature map for Making MOOCs



The literature map above describes the themes of the literature that underpin this study. It notes the tendency for ID literature to be located in one of two camps—tools and models and questions about effectiveness and efficiency, and instructional design practice, the context of learning, and how reflection feeds iteration. Speaking of context, the location of these studies, universities, provides an additional layer of interpretation in this study as questions of authority and expertise affect instructional design practice. The map above represents interacting domains as well as overlapping contexts. The socio-technical systems framework provides a foundation for sense making. In this project, with its focus on the social and technical subsystems, I examine which tools and tasks are associated with which roles and personnel during MOOC or learning at scale course development.

3. METHODOLOGY AND METHODS

The primary purpose of this research is to learn more about the work of instructional designers, educational technologists, and videographers on learning at scale courses. I have selected a descriptive qualitative approach framed by Socio-Technical Systems theory to explore the two subsystems of MOOC making—social and technical. More specifically, I have taken Bostrom and Heinen's STS approach to understanding Management Information Systems as my guide. They suggest that any "organizational work system," such as a department or administrative unit within a university, can be described as a socio-technical system. For these authors, a socio-technical, or work, system

> is made up of two jointly independent, but correlative interacting systems. The technical system is concerned with the processes, tasks, and technology needed to transform inputs to outputs. The social system is concerned with the attributes of people (e.g., attitudes, skills, values), the relationships among people, reward systems, and authority structures. It is assumed that the outputs of the work system are the result of joint interactions between these two systems. (1977a, p. 17)

I have used Bostrom and Heinen's approach as a *guide*, not a template. Emery reminds researchers that there is no one way to apply the STS framework: "Concepts in use range from highly abstract ones drawn from general system theory to descriptive ones, such as task interdependence and the primary work group" (1993, p. 160). In this study, I focus on describing the four dimensions of the STS framework—roles and personnel (the social subsystem) and tasks and tools (the technical subsystem)—in order to learn more about MOOC making.

Following are my research questions:

Research question: What are the primary work systems associated with designing, developing, and delivering learning at scale?

Sub Q1: How do course personnel visually and verbally represent their work on MOOCs?

Sub Q2: How do course personnel describe their experiences of working on MOOCs?

Method

In the interviews, I employed an arts-based approach to the retrospective critical incident method of eliciting information about a complex system. In the retrospective critical incident method (Sugar & Luterbach, 2016) participants are asked to share their experiences and understanding of a particular course creation and delivery. A critical incident is ‘‘any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act’’ and ‘‘to be critical, an incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer and where its consequences are sufficiently definite to leave little doubt concerning its effects’’ (Flanagan, 1954, p. 327). In this study, the critical incident methodology was effective in helping to develop a more robust understanding of the work of the participants in this study and how the work is described as a component of a socio-technical system. A retrospective critical incident approach aligns well with the STS theoretical framing of this research. In an STS framing, the identification of stages in workflow as well as variances within an ideal workflow relies on the perspective of participants who have participated in the system under study (Bostrom & Heinen, 1977a, p. 18).

An arts-based approach to the retrospective critical incident method of descriptive qualitative inquiry provides participants with a way of going beyond written or spoken words.

Siegel suggests that a multimodal approach to research, asking participants to use both words and images, provides a deeper understanding: “Transmediation, the act of translating meanings from one sign system to another, increases [the participant’s] opportunities to engage in generative and reflective thinking because [they] must invent a connection between the two sign systems, as the connection does not exist a priori” (1995, p. 455). For the participants in this study, I did not want them to provide me with documentation of departmental processes, flowcharts, and institutional hierarchies. This may have limited their ability to accurately describe the events of the course build because they would have been continually describing it in the context of a standard process. Instead, I wanted participants to identify key events and interactions based on their own experiences and perspective and to do so by creating a visual representation of course teams and of their work on a particular course. The arts-based approach also aligns well with the STS framing of this research.

> A goal of the STS approach is to create a flexible “learning system”—a work system which is able to adapt and adjust within a constantly changing environment. In order to create a learning system, members of the work system must have usable and understandable “maps,” or clear pictures, of both the social and technical systems (Bostrom & Heinen, 1977a, p. 14).

The interview protocols incorporate both a retrospective focus on a particular event as well as an opportunity for participants to map representations of their work and their work teams.

Site Selection

I have used purposeful, reputation-case sampling to identify sites at which to recruit participants (Savin-Baden & Major, 2012, pp. 314–315). I also wanted to select universities with a large enough staff that working with two staff members for a total of five staff hours would not place an undue burden on the staff or on the department. Each of the three universities in this study are in the top ten universities in their respective countries, according to the Times Higher

Education World University Rankings. Each of the universities offers learning at scale courses in English on the edX platform, and each university has an administrative unit devoted to online learning. Two of the three universities have administrative units that support the creation of both open learning at scale and traditional small, private, online, closed courses. The third university has devoted an administrative unit to the production of open and at scale learning. Finally, each university has had multiple courses nominated for the annual edX Prize for Exceptional Contributions in Online Teaching and Learning.

Participant Selection and Rationale

Socio-Technical Systems theory posits that in the two distinct but interacting subsystems, a change in one requires a change in the other. There are two significant differences between a learning at scale course and a traditional online course. One is the presence of unlimited numbers of learners, which is made possible by the platform on which these courses are offered. The other is the central role that video plays in these courses. Hollands and Tirthali describe the increased work of MOOC making:

> All interviewees who had been involved in the development of a MOOC reported the effort being two to three times greater than creating a traditional course. . . . Development of MOOCs was deemed to be more time-consuming compared to traditional online courses due to MOOC-specific components such as high-quality video, quizzes to substitute instructor-graded assignments, and peer-to-peer learning technologies. Several interviewees noted that the level of "polish" required for content and delivery was far greater than for traditional on-campus or online courses because of the more public nature of the MOOC (2014, pp. 118–119).

The presence of the learning at scale platform and high-quality video in the technical subsystem of MOOC creation requires an adjustment in the social subsystem of this Socio-Technical System. One of the major cost drivers in Hollands and Tirthali's study of resource requirements of MOOCs was "the number of faculty members, administrators, and instructional support personnel participating in the process" (2014, p. 118). The interviews in this study were with two of the course personnel associated with the adjustments in the technical subsystem—instructional designers or educational technologists who facilitate access to the platform on which the learning at scale course is developed and delivered, and videographers, who create the high-quality video required in learning at scale courses. Both roles are considered as educational technologists and instructional designers for the purposes of this study.

I used the site selection parameters to select institutions. I then searched their websites to determine whether they had an administrative unit responsible for learning at scale and then contacted the directors of those administrative units. In two of the three sites in this study, I had prior professional relationships with IDs and contacted them directly to gauge interest in participation. Each of those participants agreed and identified a videographer, whom I contacted and enrolled. To identify participants at the third institution, I asked the director of that learning at scale creation unit whether she would be amenable to forwarding my invitation to participate to a pair of course personnel. I then enrolled all three pairs using the process described below. I have identified and interviewed an additional pair of course personnel at a fourth university. Unfortunately, this pair, due to workload constraints, were unable to complete the second, follow-up interview with me in time for participation in this study. I plan to complete the follow-up interview with this pair later in the spring and use that data in future studies.

Participants and Confidentiality

Confidentiality was a high priority of the study. The number of universities offering learning at scale courses on the edX platform is relatively small, as is the population of university staff who work on learning at scale courses at those universities. For this study, I have assigned pseudonyms to each participant, and I have generalized their job titles to match their role rather than the job title used by their institution.

Table 15.
Table of participant pseudonyms

Institution	University 1 (U1)	University 2 (U2)	University 3 (U3)
ID Pseudonyms	Abby	Ben	Charles
Vid. Pseudonyms	Andrew	Bjorn	Connor

Data Collection Procedures

In total, I conducted nine interviews for this study, three at each of three universities. The participants were pairs of course personnel who worked together on at least one completed learning at scale course at their universities. Each pair was comprised of one instructional designer or educational technologist and one videographer. The first interview was with each participant individually, the follow-up interview included both participants within a university.

Table 16.
Data collection table

	Abby	Andrew	Ben	Bjorn	Charles	Connor
Interview 1 90 minutes	X	X	X	X	X	X
Interview 2 60 minutes	Both participants		Both participants		Both participants	

Before the first interviews, the two course personnel were asked to identify a completed course that they would use as the focus of the interviews. To aid their selection, I suggested that the course might be one that they felt told a particularly “universityX” story. (The naming convention for universities that offer courses on the edX platform is to add an “X” to the end of their name, e.g., RITx, HarvardX, MichiganX, etc.) Whether the story represented a negative or positive outcome, I left to the participants to decide.

The questions in the interview protocols were designed to elicit information about the roles, tasks, tools, and personnel associated with the work of building learning at scale courses. The interview protocols for the initial interview and the follow-up interview are in Appendix C.

In addition, the protocols are designed to provide information about the institutional context in which these course personnel do their work and a sense of the factors that affect their work. Interviews were conducted and recorded in Zoom. The visualization-creation portion of the interview was conducted in Miro, a web-based digital collaboration platform.

Participant recruitment and enrolment were conducted via email. I asked participants to use Calendly to find a time for the interview that worked for us both. Calendly is a digital tool that allows participants outside of my organization to identify and select open meeting times on my institutional Exchange calendar. I paid for a premium Calendly account so that I could create two meeting types—the 90-minute initial interview and the 60-minute follow-up interview. When a time slot was claimed by a participant, Calendly automatically generated a Zoom meeting and placed the URL in the meeting location on the event on my calendar and on the participants' calendars. When I received a notification that an initial interview time had been scheduled and the Zoom meeting auto-generated, I confirmed the day and time with the participant and sent a link to a Miro board that I had created for use in the first interview. Miro is a web-based digital collaboration tool that provides a whiteboard-like space, pen tools, and other markup options for digital sketching and ideation. Prior to the first interview, I asked participants to complete the following task, which I made available within a text box on the Miro board:

> Hello! This task is meant to give you practice using the Miro tools before our interview. It should take you no more than 7-10 minutes to complete. Using shapes, lines, text, and the sticky note tools, please create a high-level representation of the primary work team for the MOOC we will be talking about during the interviews. Who did you work with on that MOOC?

This brief task provided participants with an opportunity to practice using the collaboration tools in Miro, and it provided background information and additional content for the first interview.

During the first interview, I asked participants to think about the course that they had selected as the focus for our interviews, and I asked them to use Miro to create a representation of their work on that learning at scale course. This representation was a focus of much of the first interview. During the initial interview, I asked participants to look at a list of roles and select those that they performed on the course that we were using as a focus of the interviews. This document is an edited version of the "Assemble Your Course Team" document available on the edX partner portal website (edX, n.d., 2019). I edited the document to remove text that suggested which roles commonly work together, preserving only the description of the roles. Participants were asked to think about other learning at scale courses they had worked on and how the roles they performed on the learning at scale course under investigation differed on those other courses.

The follow-up interview with both course personnel featured another Miro board I had created for that interview. On that board, I copied the representations of work that each of the course personnel had created in the first interview. I asked each person to describe their representation to their coworker. Then, I asked both participants to create a representation of work that synthesized both representations. We then discussed that synthesized representation and spoke about MOOC making more broadly.

Interview Artifacts

All interviews were conducted in Zoom. I used a headset and microphone to increase the quality of audio, and used the recording function within Zoom to capture the interview. Recordings were saved to Zoom cloud storage in order to activate the Zoom auto-transcription function. When auto-transcription was complete, I downloaded the audio file and the web-video text track (VTT) file, and copied and pasted the text from the VTT file into Word. I corrected the transcript as I listened to the recordings. In order to facilitate verification and correction of the transcript against the audio recording. I uploaded the audio recordings to Camtasia, which provided an interface that was conducive to the frequent stopping and scrubbing backward and forward that is part of verifying a transcript. I then saved the transcripts of the videos to my UA Box account. Once all transcripts were edited, I uploaded them into NVivo for coding and analysis.

Naming Convention

I created a naming convention that allowed me to anonymize participants and institutions while maintaining their institutional role and affiliation. I did not use the names of institutions or of courses in my work, substituting generic terms to protect the identity of the participants. U1, U2, and U3 are the universities in this study. Participants in this study were given the following pseudonyms: Abby and Andrew, Ben and Bjorn, and Charles and Connor. Participants at U1 have pseudonyms that begin with "A," participants at U2 have pseudonyms that begin with "B," and participants at U3 have pseudonyms that begin with "C." I have not used institutional job titles in reporting the data because the distinctive phrasing of some of the titles may compromise my attempts to anonymize participation. Other roles, such as project manager and student assistant, when they appear in the study, were coded by role—project managers are PM, student assistants are SA, accessibility experts are Access.

In this study, I use "faculty" as a plural noun and to refer broadly to the in-house subject matter experts employed by universities to teach, conduct research, and perform service. I use "faculty member" when I refer to specific faculty members or to their individual work with staff. "Subject-matter experts (SMEs)" refers to those who have disciplinary expertise but are not employed by universities in a teaching role.

A subject-matter expert (SME) provides the knowledge and expertise in a specific subject and is responsible for the accuracy and sometimes the production of the specialized content that is the subject of instruction. In a higher education context, the SME role often falls to those experts who are employed by universities—instructors and tenure-track faculty members. In this study, I used the term “faculty member,” rather than SME, to refer generally to the role associated with the responsibility for subject-matter accuracy. I used the term “faculty member” specifically for the SMEs for U1 Course and U3 Course, as the SME role was performed by tenure-track faculty members for both courses. The U2 Course SME role was performed by true subject-matter experts. Some were employed by the university but not in an instructional role. Others were employed by a global non-profit.

U1 Course, U2 Course, and U3 Course are the courses that the participants selected for this study, though they are not the only courses that I discussed with participants. I have made those distinctions clear. U1 Division, U2 Division, and U3 Division represent the administrative units responsible for creating learning at scale. These administrative units employ the participants in this study.

I did not divulge the names of learning at scale courses, nor did I divulge the type of content or the areas of expertise held by the faculty members or SMEs associated with the courses. Some of the disciplines represented in the learning at scale courses under discussion are specialized enough that describing the field would compromise my attempts to anonymize participation. I included information about the course or about the faculty members that was important to understand the work of the course team only when I was able to communicate it in a manner that did not compromise attempts to anonymize the participants.

Data Analysis Techniques

Saldaña describes the use of codes in qualitative data analysis:

> A code is a researcher-generated construct that symbolizes or "translates" data . . . and thus attributes interpreted meaning to each individual datum for later purposes of pattern detection, categorization, assertion or proposition development, theory building, and other analytic processes. Just as a title represents and captures a book, film, or poem's primary content and essence, so does a code represent and capture a datum's primary content and essence. (2016, p. 4)

In this study, I use data gathering techniques and analysis to make meaning within and across interview transcripts. I do so to understand and describe individual experience and how context may affect interpretation and performance of a role.

I conducted multiple coding passes through the transcripts. Saldaña's *Coding Manual for Qualitative Researchers* (2016) guided my approach. My first pass of the manuscripts was for coding attributes: university and role. In the second pass I used descriptive codes consistent with the STS framework: "role," "task," and "tool." "Personnel," the remaining category in STS, was not used as a code. Rather, the idea of personnel was used to understand how an individual performed their role in context. Therefore, the "role" code served for both "role" and "personnel" categories. I employed standard descriptive codes and categories across individuals and institutions (Savin-Baden & Major, 2012, p. 437), using a constant comparative analysis process.

Simultaneous to employing descriptive STS codes in the second pass, I employed pattern coding for those occurrences or phenomenon that appeared repeatedly within and across transcripts. For Saldaña, a pattern is

> repetitive, regular, or consistent occurrences of action/data that appear more than twice. . . . [Patterns] become more trustworthy evidence for our findings since patterns demonstrate habits, salience, and importance in people's daily lives. They help confirm our descriptions of people's "five Rs": routines, rituals, rules, roles, and relationships. Discerning these trends is a way to solidify our observations into concrete instances of meaning. (2016, pp. 5–6)

Coding for patterns helped me to describe roles and relationships within and across social and technical subsystems and across universities. These STS systems are comprised of technical and social subsystems, each of which are affected by a particular institutional context, traditional systems of hierarchy within higher education, interactions among particular personnel and the tools that they oversee, and individual performance of a role based on background and inclination. Interpreting and reinterpreting the transcripts helped provide layers of analysis, each of which provided a different perspective on the systems at each institution. For the analysis section of this report, I analyzed patterns in successive layers, with each layer representing an approach with greater granular focus or to interpret patterns within or across institutions. The visualizations that each participant created, individually and in collaboration, were used to provide support for the first layer of analysis, which maps out the teams that worked on the courses at the center of this study and the work done by study participants. The visualizations provide an entry point and a reference for understanding how personnel work within their systems.

Ethical Considerations

Aligned with university expectations regarding research with human-subjects, I applied for and have received approval to conduct this study from my institution's Internal Review Board for human subject research. I have anonymized all participants, disciplines, courses, institutions, and administrative units within institutions. I did not record conversations without consent. I scrubbed all artifacts used in this report of identifiable information. Before interviews I talked with participants and was transparent in my research aims. Because this work is descriptive and not evaluative, the risk for participants may be not as great as it could be if I were evaluating their work products.

Quality Assurance

In the pre-interview task and in the two interviews, I collected visual and verbal information that helps me to understand the work of making learning at scale courses. By using a sequence of initial individual interview and follow-up joint interview, and by having two types of data—the text of the interview and the visual depiction of work—I was able to ensure a more valid understanding of their experiences by triangulating among people and data sources (Merriam & Tisdell, 2016, pp. 244–245; Savin-Baden & Major, 2012, p. 477; Yin, 2009, pp. 114–116).

I employed methodological coherence in the alignment of my research questions, methods, data, and analysis with the socio-technical systems framework (Savin-Baden & Major, 2012, p. 477). I also relied on the concept of trustworthiness to assure the quality of the research and its dependability, specifically employing an audit trail and peer review. All interview assets, raw and edited transcripts, notes, revisions, and documents related to this study have been retained as part of an audit trail and record of the research process (2012, p. 477). I employed peer review for my interview protocol, testing it with colleagues who work on learning at scale courses and using their feedback to refine my approach and more thoroughly align the protocol with my methodological framework. I have also used peer review throughout the analytic process to prevent researcher bias. I have not included my home institution in this study, which helped me to avoid many of the potential insider blind spots.

4. RESULTS

The purpose of this research project was to learn more about the primary work systems associated with designing, developing, and delivering learning at scale. Specifically, I wanted to learn how course personnel represent their work on MOOCs, and how they describe their experiences of working on MOOCs. During interviews and visualizations, six themes emerged: the interacting effects of team structure, scale, and tasks; storyboarding and the zero-sum work of instructional design support; adjusting to the unexpected; faculty motivation, student learning, and course video; the ethos of faculty support; and the most-valued KSAs of learning at scale instructional designers and videographers. The results section begins with a description of the institutions and research participants in this study.

Description of the Institutions and Research Participants in This Study

An accounting of the results of this study of the socio-technical system of learning at scale creation begins with a description of the institutions and participants in this study. U1 is a large, private technical research university in United States. U2 is a large, public research university in Western Europe. U3 is a large, public research university in Australia. In 2020, each of these institutions placed in the top ten universities in their respective countries according to global rankings from Times Higher Education (*World University Rankings*, 2020). Given the global access to learning created by open, online learning platforms, it is sensible to speak with course personnel at universities across the world.

U1 course personnel and course under discussion

Abby and Andrew have both worked for the U1 division responsible for creating learning at scale for more than five years. They work on creating both MOOCs and learning at scale courses. Abby holds a STEM doctorate and elected to have a career outside of academic research. She has experience in scientific communication and education outreach, web design, data visualization, and coding. Andrew has a graduate degree in art and visual art and has worked as an artist in various digital and non-digital media, as well as running a videography business. Both Abby and Andrew came to U1 because they were intrigued by the possibilities of MOOCs and learning at scale, and they felt that education work held greater meaning than the work that they had been doing.

At U1, faculty must submit a grant proposal for the funds to develop a learning at scale course, though some learning at scale courses are developed outside of the grants process. When an award is made, the funds are used by the faculty to hire suitable personnel to assist them in designing, building, and teaching their learning at scale course. Because of the faculty-driven nature of learning at scale course building at U1, the teams that design and build these courses are referred to in this study as “faculty teams.” If a faculty team is awarded funds to create an entire course, they are often provided with a media budget to hire media staff such as videographers and animators. Faculty are also expected to build their course on the edX platform using Studio, the edX course authoring tool. Faculty teams can decide whether to spend part of their award money on hiring someone to build their course on the platform. The course under discussion, U1 Course, had a faculty course team of five subject-matter experts (SMEs) who were employed as faculty in the same academic department at U1, in addition to a number of staff from that same department. One faculty member was designated as the lead faculty member on the team.

U2 course personnel and course under discussion

Ben and Bjorn have both worked at U2 Division for at least three years. Their division is responsible for all online learning at their university, from massive open courses to traditional online. We largely confined our conversations to massive open learning. Ben has a life-long interest in learning, particularly in connectivism and the social elements of learning at scale. He completed graduate-level coursework, but found that he preferred teaching to research, and so stepped away from his doctoral program. After working in a variety of higher education staff positions, he came to U2 and his current ID role. Bjorn is a self-described autodidact who has taken courses in film at the college level and has continually sought out additional formal and informal learning opportunities in film and other fields. He has experience in commercial film and videography and teaches courses in elements of film and videography creation.

U2 has a request-for-proposal process for all faculty and SMEs who wish to develop learning at scale courses. Part of the U2 Division RFP evaluation process asks IDs to provide feedback on what form the proposed course should take—massive and open or small and closed. The U2 Course had four primary SMEs and additional secondary or "guest" SMEs, some of whom are employed by a nongovernmental nonprofit, others by a research center within U2. None of the U2 Course SMEs serve in a faculty or instructor role within U2, though some of them are "trainers" within their organization. The SMEs for this course are referred to as SMEs. Course teams at U2 are made up of two subteams. The content subteam is made up of the SMEs who are responsible for providing the content for the course. The production subteam is made up of the staff from U2 Division.

U3 course personnel and course under discussion

Charles and Connor have both worked for U3 Division for more than five years. U3 Division is responsible for all online learning at U3, from massive and open to traditional. Charles began working at U3 in his current role, while Connor worked at U3 for more than five years in a variety of technical staff roles before moving five years ago to his current role as videographer. Both Charles and Connor pursued vocational credentials specific to their current roles—visual communication, multimedia, and film and videography. Charles has experience in multimedia, web design, and online learning, while Connor has experience in commercial film and videography. The U3 Course had three SMEs who were faculty employed by the same department within U3. The SMEs in this course are referred to as faculty members, with one of those designated at lead faculty. The U3 Course was one of the first courses developed for scale at U3 Division. Both Charles and Connor were assigned to work with the U3 Course faculty to help them design and develop their course. Their work with faculty was as part of a course team.

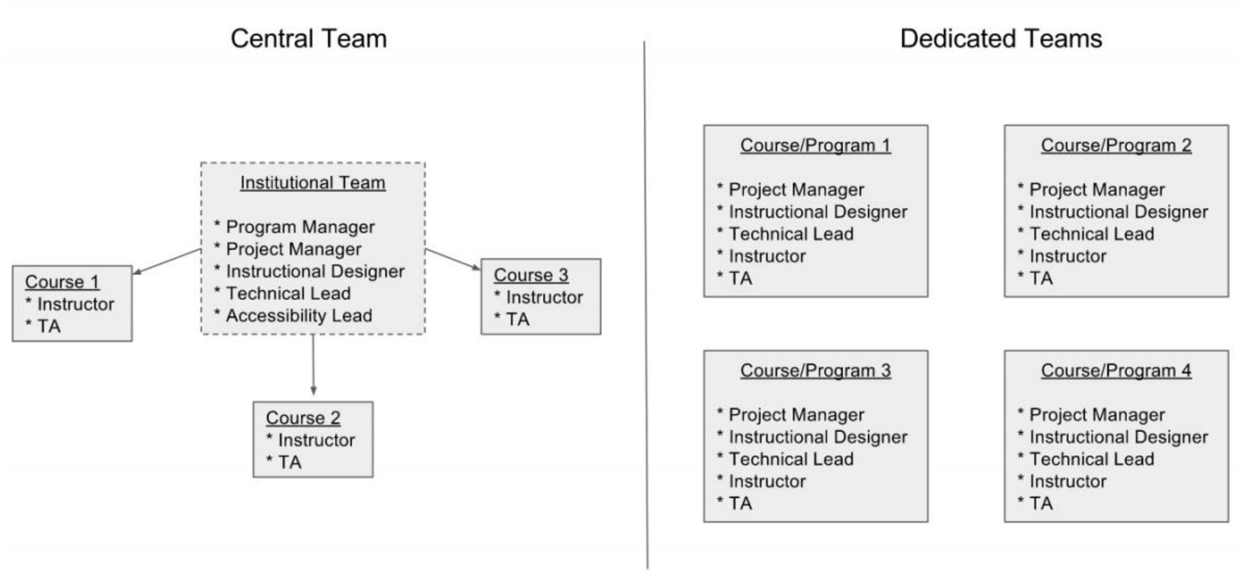
Team Structure and Roles

To compare the work done by personnel across institutions, I used a document created by edX called "Assemble Your Course Team" in my interviews. This document provided me with a standard set of roles and tasks to use with participants, regardless of how roles were defined and tasks assigned within each institution. The document also identifies two main team structures used in MOOC making. I was able to compare the work-team visualizations created by participants to the document to determine the type of team structure used at each university.

Team structure

The edX document, "Assemble Your Course Team," describes two ways of structuring teams, shown in Figure 2 (edX, 2019). edX suggests that institutions choose a structure based on “available resources and the scale of . . . MOOC development efforts” (edX, 2019), with the central team staffing requirements presumably appropriate for larger efforts—learning at scale, at scale, one might say. The central team, usually comprised of a program manager, project manager, instructional designer/technologist, accessibility lead, and a media producer/manager, supports multiple instructors or subject matter experts who each focus on creating a single course. The dedicated team structure has course specific teams that come together for each course. The edX document suggested that the central team model is prevalent, though in our study, only U1 employs a strict central team model. U2 and U3 both employ a team approach that is more like the dedicated team structure.

Figure 2.
Team structures from “Assemble Your Course Team”



It is notable that videographers are missing from these team structures. The edX document suggests that “a media team will be an important contributor to the content development of your courses. Very small teams may hire one media producer and/or outsource the creation of videos, animation, and graphics” (edX, 2019). Whether universities hire media specialists or contract out, there is no guidance for how one might work with videographers in either diagram, which is an odd omission given the prominence of video in learning at scale. Table 17 describes team structure at U1, U2, and U3, and also includes a description of approximate individual workload.

Table 17.
Team structure and approximate participant workload

	Abby	Andrew	Ben	Bjorn	Charles	Connor
Central Team	X	X				
Dedicated Team			X	X	X	X
Workload	80-130 courses, both new and re-runs	Approx. 20; works on what interests him, hires out the rest	No more than 6 new courses in a year in the division	Approx. 10	2 MOOCs at any one time	Not mentioned

Roles performed by participants

Roles are associated with particular areas of expertise so that any tasks commonly assigned to that role are likely to be successfully completed. Participants were asked to review a list of course team roles commonly associated with edX learning at scale course creation. Each participant was asked to identify which role or roles they performed on the course under study. The list of course team roles that appears below is adapted from the edX document, “Assemble Your Course Team” (edX, 2019). This document appears on the edX partner portal, a website that is accessible to staff at institutions that create courses on the edX platform. In this adapted version, I removed suggestions for which roles often work together.

Table 18.
Assemble your course team

Project manager	Manages the course development life-cycle for one or more courses, including project timelines, deliverables, and team members.
Instructional designer	Helps the course team adapt existing courses to the online medium and to create a pedagogically powerful and universally accessible course and build that course in Studio.
Technical lead, trainer	Train and support the course teams in using edX Studio, as well as provide guidance on accessibility
Marketing lead	Supports course teams in copy editing, graphics development, and promotion of courses through your institution's media channels.
Legal/copyright	Supports course teams in matters of copyright, intellectual property (IP), and licensing (e.g., textbook agreements).
Data czar	Responsible for receiving and managing edX data packages, as well as supporting institutional educational research teams and initiatives
Research lead	Defines research strategy and runs experiments through your institution's MOOCs and/or SPOCs.
Accessibility lead	Supports course teams in the creation (or review) of content so that it meets applicable law and regulations regarding accessibility.
Faculty/instructor	Responsible for creating course learning objectives and syllabus, assembling course content and assessments, and guiding the overall pedagogical vision and strategy for a course.
Teaching assistant	Works closely with members of the course team to build and run a course. During a course run, TAs are invaluable for communicating with learners and maintaining discussion boards, among other tasks.
Media producer	Project manages video and media production for courses, including production, post-production, editing, and asset management. This role works with instructors to identify the appropriate visuals that will be included in a video. The producer will collaborate and provide direction to editorial staff [presumably this refers to video editors].
Videographer/audio engineer	A videographer and/or audio engineer is knowledgeable in video capture techniques as well as ensuring the quality of audio in your videos.
Editor	Creates the final video content by making creative editing decisions in the post-production process. This may include the creation of original graphics and animations.
Media coordinator	Video person who manages the ingestion and tracking of media who often interacts with the video and course staff. This role may also schedule shoots and maintain production calendars for a media team.
Post-production assistant	Entry-level position that assists in all aspects of video with a focus on media coordination and support of the producers.

In Table 19, I identify which roles participants said they performed in the courses under discussion, along with individual performance variations of the tasks associated with each role.

Table 19.
Roles that participants said they performed

	Abby	Andrew	Ben	Bjorn	Charles	Connor
Project manager			Advisory role		X	
Instructional designer			X		X	
Technical lead, trainer	X (and edX liaison)					
Marketing lead						
Legal/copyright			X		X	
Data czar						
Research lead						
Accessibility lead			Advisory role			
Faculty/instructor			Advisory role			
Teaching assistant			Supervisory role		Staffed the forums to answer technical questions	
Media producer		X	Review the PPTs that will be used in videos	X		X
Videographer/audio engineer		X		X	Assistant role	X
Editor		X		X		X
Media coordinator		X		X		X
Post-production assistant		X		X	Assistant role	X

In the next section, I describe with more granularity the labor involved in creating learning at scale courses, as well as how the videographer and instructional designer roles are intertwined.

The Interacting Effects of Team Structure, Scale, and Tasks

The edX document “Assemble Your Course Team” describes the choice between the central and dedicated team structures as based on available resource requirements and the scale of the effort. The scale of U1’s program, which has more than 100 courses in development at any one time, dictates the need for a central team structure. It would be difficult for U1 to employ enough instructional designers to distribute Abby’s course load in such a way that it aligns with that of Ben’s and Charles’s work. Does that mean that Ben and Charles do not work as hard as Abby? Not at all--the substance of the work and the patterns of engagement with faculty are different. The technical task of building a course on the edX platform is handled by different roles at the three institutions. What enables the scale of the socio-technical system at U1 is that faculty build their own courses. This requires an adjustment in the tasks associated with the other roles at U1. Abby must spend time not only discussing the instructional implications of learning at scale and the importance of setting learning goals and aligning instruction with assessment, she must also train faculty team members in the edX Studio course-authoring tool. At U2 and U3, staff or student employees build the courses in edX Studio. This means that Ben and Charles do not need to spend time training SMEs to use and build on the platform. They can spend their time with faculty focused on the work of designing and developing instruction at scale.

Scale and team structure affect the substance of Abby’s, Ben’s, and Charles’s work with faculty. It also affects the form of the interaction. Because of the large number of faculty teams that Abby must support, she confines her active support of these teams to a series of kick-off meetings soon after the faculty teams are awarded their grant money. In these meetings she works with them on their learning strategy, persuading them that time spent in designing and developing a detailed learning strategy with goals and outcomes is time well spent. She then trains them on building courses in the edX Studio course-authoring tool. After that initial burst of interaction, Abby transitions to an on-call model of support with faculty teams, responding to their requests for assistance with the tool or with questions about building learning at scale. Ben and Charles spend much of their time working directly and intensively with the SMEs, using a storyboarding process to tease out the learning goals and strategies, sequence, and structure of the course. In the courses under discussion in this study, Ben's work focuses on the completion of the storyboarding process to map out course design. He then continues faculty support but in an advisory capacity, providing feedback on scripts and on the presentations used in videos. In U2 Division, instructional designers do not build the courses. Ben provides feedback to the SMEs on content, assessments, scripts, and presentations. In the U3 Division at the time that U3 Course was being developed, instructional designers provided feedback on the content created by faculty—content, assessments, scripts, and presentations—and they built the course using the edX Studio course-authoring tool.

The work of videographers is also shaped by team structure and scale of efforts at their home institutions. Beginning with Bjorn and Connor, both work at institutions with dedicated teams. In both U2 and U3 divisions, instructional designers work intensively with faculty to help them design their courses. When faculty go to create course media, both U2 and U3 videographers have designed a process that is focused on efficiency—creating course media quickly and with as little post-production work as possible. Bjorn described how he and another videographer worked to set up their studio to emphasize efficiency and minimize post-production work. He described it as when someone enters the studio, it's "just a couple of button presses and once you're done, it's done. There's no post-production involved." Connor also describes his approach to media as working to make the process effortless for faculty. By the time that faculty begin to shoot video at U3, “all the hard work’s done and they come down there and I'll just make sure they're comfortable and we get it done really quickly and they’re happy with it.” In contrast, Andrew describes the work that he does with faculty teams to storyboard videos and ensure that the media content they create is aligned with their learning goals. I “talk to someone about, okay, well, like how does your content break down? Like do you know how many weeks you are you doing, and you know, we need to think about how we're going to kind of chunk things into videos.” For Andrew, the “hard work” described by Connor has *not* already been done. It is happening as an element of Andrew’s pre-production interactions with faculty members.

Storyboarding and the Zero-Sum Work of Instructional Design Support

Divisions 2 and 3 both have personnel who work as instructional designers and who claimed the ID role in Table 19. Ben and Charles both use storyboarding as the central strategy for their work with faculty and SMEs. Ben explains why he employs this strategy:

> Part of it is coming to the product of a storyboard where it becomes visually clear for the instructors. How do the different components of the course, how are they going to fit together? . . . [I]t helps to translate a lot of the instructional design principles for online learning, to make it you know visually clear. Well, why do you, you know, introduce a video? And why do you have activating assignments? And when do you put them in the course? And how big they should be? So that's part of it. And then that storyboard becomes a reference which later translates into the production board [the central content and asset tracking tool at U2].

Charles, too, employs a storyboarding approach. He begins working with faculty in face-to-face meetings to determine the broad sequence and goals of the course. On Course 3, once the structure had been determined, Charles and the faculty members worked asynchronously to iterate and refine the work until the storyboard itself represented the entire contents of the course. Charles described the tools that they used to work on the storyboards synchronously and asynchronously:

> So things like Word documents, Excel spreadsheets, and at that stage, they weren't even Google Docs or anything that like in terms of collaborative documents. They were just documents that were sitting in a shared space, maybe were exchanged via email to actually map things out, so from learning outcomes to assessment plans to high-level course design, to detailed storyboards of sections of the course. . . . [W]e may have had some workshops where we sat in a room. We had a document up on the screen, and we were just talking through things and I was documenting those in the documents, in terms of the workshop level. And most of it was done independently, so it was very much once the plan had been set--once the high-level design had been locked down, all those things which were more sort of face-to-face, "workshoppy," talking to people in a room--it was very much like yeah, let's just work on those bits via prompting the course team via emails, to get documents completed.

Storyboarding a learning at scale course at U2 and U3 provides team members with a concrete method of understanding how the course will be structured and represented on the edX platform. It is a process that facilitates the design of instruction, even as it produces a key instructional design product.

U1 has created a learning specialist role that combines discipline-based and learning science expertise. This is a role that is not universally represented within all disciplines at U1. This role did not participate in the design and development of the U1 Course under discussion. At U1, neither participant identified themselves as working as an instructional designer. Though Abby works with faculty teams in the learning strategy meeting that occurs before they begin the work of course design and development, she said that she could not claim to help faculty create a "pedagogically powerful" course. Andrew, like the other two videographer participants in the study, said that the five videographer roles reflected his work with the faculty team. However, his description of the storyboarding work that he does with faculty maps directly to the goals and products of the U2 and U3 instructional design storyboarding process. Here, Andrew describes the typical tasks associated with his work with faculty teams.

> The media team meets with the [faculty] team after they've had a chance to have what we call the strategy meeting. And that's often Abby or another instructional designer . . . where the [faculty] team gets to really talk to them about learning goals and assessment

> strategies and all these sorts of things. And then we try to talk to them about how media would then fit into that and support that. And then within those early conversations, trying to understand what it is they're hoping to do, their audience they're hoping to reach, the kind of content their course surrounds or is comprised of, and to sort of make them aware of options and approaches and some general recommendations. And then from there, we would really ideally like to see them flesh out on paper like a version of the course, like here's week one, . . . this is the content . . . there would be a reading and then there'd be this, you know, question and then there'd be like a short video that kind of reinforces that, or you know that they would actually kind of write this all out and then share that with us and that we would have kind of a map to go by.

Andrew is working with faculty teams to articulate goals, define their audience, and chunk and sequence their content. While Abby is available to faculty teams to answer their questions about learning strategy and instructional design, this is a service that faculty must initiate. Due to the time-intensive nature of video creation, Andrew has recurring interactions with the team over time as the team is designing and developing their course. In the pre-production work of identifying goals, audience, and outcomes for course media, and in creating storyboards with faculty, Andrew performs the instructional design role for the entire course, as well as performing the roles associated with course media. He suspects that he performs this ID role but does not feel comfortable claiming it. He describes this discomfort:

> I still feel pretty self-conscious about my lack of knowledge around instructional design, despite reading, like, I don't know, the Richard Mayer book [presumably *Multimedia Learning*, or similar], like I am certainly not as well-versed in theory and thinking about how theory can be applied and used, and it's something that I feel, you know, I feel like I spend so much time working with the faculty and the course teams that like I feel like I should know more.

For courses without a learning specialist in the ID role at U1, in theory, faculty must take on the tasks associated with both the faculty and the instructional designer roles. In the absence of a traditional instructional designer role, in practice, Andrew fills that gap.

Adjusting to the Unexpected

Participants in this study used a range of words and phrases to describe the experience of working on learning at scale—“chaos,” “organic,” “messy.” Some described their processes in terms of how development is supposed to work, and then with a description of how the course under discussion was actually developed. In this section, I describe how staff and teams respond to unexpected workload crises. I also describe how building learning at scale has shifted in the COVID-19 pandemic.

Disruption to personnel workload

At all three universities, faculty who are selected to build learning at scale courses must do so as an overload—in other words, they do so on top of their usual teaching, research, and service obligations. Consequently, when work builds and faculty members feel workload pressures, they may set the MOOC development aside. One challenge with learning at scale courses on the edX platform is that they do not follow the same academic work cycle as colleges and universities. Connor describes the effects of the misalignment between edX course schedules and academic calendars:

> And they don’t ever really ever seem to allow. . . for different stuff like, this MOOC is meant to release the same week as you know the start of semester, or you know they might be doing a bulk of the work and that just happens to be Christmas when they should be relaxing. We just sort of seem to be putting deadlines just randomly throughout the year. And then whenever it gets to crunch time and we need them to give us stuff, it happens to be the worst time ever, and then mega stress and then [Charles] and other people have to go and, you know, talk them off a cliff.

Charles has developed some strategies to help faculty manage what he calls the “roller coaster” of learning at scale course development. He said that in status update meetings with the course teams, they will discuss the tasks that need to be completed. If someone is overwhelmed, they will find someone else who can take on the task. Depending on the nature of the task, they may ask another faculty member on the team or in the department to take it on. Sometimes the task will fall to staff in U3 division. One strategy that Charles finds particularly effective is to find a graduate student or upper-level undergraduate student with disciplinary knowledge who can take on tasks that require both discipline-based expertise and some experience with online learning. Charles describes how they try to build in flexibility into their course teams:

> We sort of think about all of these things that could happen and we often try and involve often, sort of post-grad students, or students who are in their, sort of final year who are doing some work in the faculty area anyway, and have been suggested by the academic team to help out. . . . And I feel like those students really crossed the line between academics and our team, in terms of the hands-on experience in actually working and thinking about design and hands-on development of courses, rather than just subject matter. So they sort of come with, they probably have a better idea about the market group because they're a little bit closely aligned in terms of age and they can still remember what it's like being someone who's studying [the subject].

U3 division has hired these students to build content on the edX platform, and ensure that the specialized content is clear for a mass audience.

Neither Ben nor Bjorn mentioned any significant workload issues with the group of SMEs who comprised the content team for the U2 Course. Bjorn did need to adjust his production schedule to meet the requirements of the SMEs who were flying in from many international locations and who would only be available to shoot course video for a brief time. Bjorn described the change to his studio set-up as a “bullpen,” in which a group of SMEs would sit together and work on their scripts and shoot all of the videos from the course. Doing this, they were able to shoot all video for the course in just over a week.

At U1, the faculty team that drives course design and development maintained the same five faculty members. In the U1 system, all team personnel decisions are made by the faculty team, which hires its members. There were multiple staff who cycled onto and off of the U1 faculty team during the time that the U1 Course was being designed and developed. Neither

Abby nor Andrew knew why the staff were cycled on or off of a team, and sometimes they would not be aware that someone was no longer on the team. Abby said that she had to run three different platform training meetings for this team due to turnover. Ideally, there is only one platform training meeting. While the turnover required additional training meetings, the greater effect on Abby's work was that the individuals tapped by the faculty team to build the course on the edX platform had no subject-matter expertise, teaching expertise, or technical expertise. Abby describes the implications of a course builder not being "technical":

> It's really hard when the person is not technical. I mean, it takes so much longer to go over the basic stuff. . . . So, for this team, the initial person they hired I had to, I mean, actually for both people that they hired, I had to go over the same things like multiple times, so it's really, really frustrating, and takes extra time. So, he'd be like, "I got this slide with a question on it from the faculty, um, how do I put it in the platform?" And I would be like, "Well, that question, like, is that the actual question that they're going to want to put in there? There's no answer to the question. So, like, is this a question that's going to be open ended? Or is this going to be reworked into a multiple choice?"

For Abby her example of working with someone who has a lack of "technical" knowledge required her to train this staff person how to use the edX Studio course-authoring tool. It also required her to explain the necessary elements of a question. Abby says that this lack of technical expertise is an issue she has experienced with faculty members on multiple faculty teams. Faculty, who are experts in their disciplines, are not necessarily comfortable with complex learning management systems.

COVID-19

While learner enrollment in MOOCs greatly increased during 2020 as governments worldwide instituted COVID-19 shutdowns, the effect of these shutdowns and physical distancing requirements on staff who create learning at scale was more of a displacement than a significant disruption. The effect of COVID-19 physical distancing requirements and campus shutdowns has not affected the day-to-day productivity of the personnel involved in this work, or the quantity of work overall, but it has shifted where this work occurs and it has affected the quality of their work life. Ben mentioned that U2 Division is transitioning their processes to an Agile methodology. He said that while some elements of Agile are currently in place, the division hasn't "had the time properly yet to understand the principles and values behind Agile." A frequent theme, mentioned by Andrew, Abby, Bjorn, and Connor, addresses the loss of spontaneous conversation and support from colleagues when they began working remotely. In Abby's discussion of campus shutdowns and restrictions, she mentioned the loss of conversation and her concern about a new employee in U1 Division who was hired during the campus shutdown.

> If questions come in, we, when we were in the office, we would turn around and we would ask questions of each other, opinions, advice. . . Now it's all on Slack. But, you know, we have a really good team of people and we just brought somebody new on right before the pandemic. So, he's been doing all of his work from home. But I feel like he still has, you know, he's, I think he feels that he still has a team around him, helping him.

Bjorn also describes the COVID-19 disruption of casual work conversations over coffee across departments within U2 Division.

> The instructional designer most of the time is the second person we encounter [when a new MOOC design and development begins] and we get to talk with, and this is normally, so when there's no COVID-19 situation right? and we encounter each other during coffee or whatever.

Finally, Connor describes the COVID-19 disruptions as accelerating a tendency to work in a factory-line approach to learning at scale course creation,

> Especially with remote stuff, it's really just, you know, drop downs, and Excel things, when something's ready you download it, you edit it, you put it back. You put . . . a drop down in that Excel document saying it's ready for review, you get feedback as, you know, as text in there, and you action that, and then it disappears and it's in, you know, so that sort of thing. . . . It was like that before COVID, but it's even more so now.

The work gets done, but the community of workers is dispersed, and distance collaboration facilitated by digital tools helps, but it does not replace a face-to-face environment.

Some staff have been temporarily loaned to other departments to aid with a transition for faculty members who teach on-campus courses to an online or blended modality. Bjorn mentioned work that he had done for a department outside of U2 Division to facilitate a transition from face-to-face to remote for a laboratory class. Bjorn worked closely with science faculty members on a series of videos that taught laboratory skills for a course that could not meet due to COVID-19 restrictions. Abby mentioned a learning specialist who might normally have attended their learning strategy meeting at the beginning of the learning at scale process, being pulled into other work to help the campus transition to fully online.

The videographers mention that COVID-19 has interrupted studio time with faculty, due to the restrictions on numbers of people in a room based on the room’s capacity. Filming moved either to a third-party provider or to faculty shooting video at home. Supporting faculty to create video at home has become a more intensive tech support role for Andrew.

> I'm thinking about since we've been remote there have been some times where we've had to get into more like technical training stuff because people are recording from home. And so, it's like trying to get somebody to get an acceptable audio quality, and so describing like microphone pickup patterns and just making sure they've got sort of things set correctly. It's really frustrating, it takes a lot of time. You're like answering similar questions over and over again, there's a lot of back and forth to answer a simple question.

Bjorn and Connor described finding alternative places to shoot video, but were not prevented from shooting video altogether.

Ultimately, the COVID-19 shifts to remote work affected those staff who have greater training burdens with faculty. Both Abby and Andrew described the difficulty of training faculty to operate complex tools. Andrew said that training faculty to use video production tools, which was not something that faculty needed to do before the COVID-19 disruptions, presented significant difficulty and took significant time. Connor described the acceleration of a kind of factory-line approach to course media creation, but also said that their location had only been on lockdown for three weeks, and then had social distancing restrictions in place after that. The work at U3 was not disrupted so much as displaced to a larger studio or to people completing work from a home computer rather than the computer in their office. Because instructional designers and videographers are comfortable with the technology associated with learning at scale course creation, shifting work from the office to home, or to indoor spaces that accommodate social distancing rules, was less an impediment to completing the work than a disruption of normal processes.

Faculty Motivation, Student Learning, and Course Video

In the previous section I described how rising and falling workloads and personnel turnover can complicate work on learning at scale courses. In this section, I discuss the most time-intensive element of learning at scale course creation—course video—and how attitudes toward course video affect broader course development.

Interview participants at all three universities described the challenge of planning for and making good course video. A running “joke” among staff at all institutions was that some faculty members just want them to take their on-campus course and turn it into a MOOC. This was always mentioned in terms of working with the least-motivated faculty. Charles and Connor discussed their experiences working with faculty who have low motivation:

> Charles: Yeah I’ve experienced that a lot . . . and they’re sometimes less motivated because they have been pulled into the project and they don't, they haven't got the buy-in, they’ve just been told that they have to do it and they have an idea of what online learning is and so . . . I think they're the participants that are harder to work with because they're not up for any sort of professional development. They're not interested in that. They’re just like, “What do you want me to do? When do you want it done? I just want to get out of here.”
> Connor: “Make my current course into a MOOC.”
> Charles: That's right. Yeah, exactly.

> Connor: And “I've already done this online teaching for on campus, now just make that into a MOOC and leave me alone.”

Given that most faculty at the three institutions are creating these learning at scale courses as an overload, staff understand that sometimes work on a learning at scale course may come last on a harried faculty member’s to-do list. Yet there are contractual obligations to be met with the edX platform, and so staff are left to try to motivate faculty to meet course deadlines. Charles describes how he has tried to work with unmotivated faculty:

> It just becomes difficult because every small thing that we're looking to do becomes a, you've got to think about it strategically. You’ve got to do strategic communication with them. You’ve got to try and work out what's the best way to motivate them to be involved and that can sometimes be more aggressive in terms of going to their superiors to get them to have talks with them. It can just be accepting what they've got, what they give you, and doing more work on the content that they've given you and giving it back to them [for feedback].

Connor urges faculty to forget about chunking 50-minute lecture videos into digestible clips for use in a MOOC. A strong course video requires that faculty should plan for not only the subject-matter to be covered in the video, but also how images will support what is being said, and then they should write the script so that it incorporates the images. When faculty plan that intensively, says Connor, they can then more confidently sequence the content of their modules and their course, because they have a deep understanding of which content is where. Their design is intentional.

> It's the academics who’ve got the buy-in, want to do actual online learning, who have fully storyboarded their script, they’ve worked out what graphics are gonna be on screen, they're gonna work out how it's going to look, and then they can deliver to that, rather than just kind of trying to compress 50 minutes into 6, and then hoping that we can make it shiny afterwards with graphics and stuff. . . . You know, if you've planned out your whole course and you know you can be referring to stuff in the previous video, you knew there was an interview in between your two videos so you can talk to that interview and expand on it, . . . that's like when you've got like, you're on a winner.

While that amount of work will likely produce a more cohesive course, instructional designers describe the challenge of persuading faculty to spend time creating a learning strategy for videos. Ben said that even though the storyboarding process that he uses can help faculty to understand the importance of a learning strategy for guiding video creation, some resist this idea. In talking with Ben about a course that he felt was not successful (not the U2 Course but another learning at scale course developed by U2 Division), he described what happens when course media becomes the sole focus of a course.

> That was a headache for me. . . . There was no chemistry [between him and the faculty member]. There was a huge focus on video location shoots. It took a lot of energy and time of the staff. [The faculty member] had huge ambitions, but was so focused on the video material, making good videos. . . . We had wonderful ingredients for this course . . . and no time to write good assignments. So, it's missing the storyline from the student experience. It's, it's really a sending, knowledge sending, like I'm not really a great fan of like xMOOCs. . . . I really have serious questions about whether it contributes to longer term learning.

Abby also describes the challenge of setting a learning strategy for a course that can guide the creation of course media. A common frustration with some faculty teams is wanting to get right to video creation, skipping over the important work of defining a learning strategy. Abby explains,

> [Early on at U1] all anybody wanted to do was video, right? That's the shiny stuff. It's like, that's what I do in class, right? I lecture. And so that's what I as a course team, as an instructor, that's what I want to go to. I just want to either film myself giving my lecture, [which] the media team try to avoid doing, or I am going to think about changing the way I provide information, but I still just want to be providing information. You know, it's like adding knowledge in, instead of like getting knowledge out of the learners.

Both Abby and Ben try to push faculty to go beyond transmitting information to a sea of learners, to instead build a course focused on what the learners can achieve and take away from the course. Some consequences of not focusing on learners from the outset are wasted time and irrelevant course media. Abby explains,

> There was a lot of extra material that wasn't needed . . . this was a course team that was sort of just like "we just want to put the information out there." And I kept saying, well, what does that mean, you know? But it was just a bunch of videos on you know [the course topic], without really thinking about what the learner was doing and how they were measuring their learning.

For faculty members working on learning at scale, they are told that focusing on learning outcomes and assessment is prudent, but that message is not always received. For any time-intensive development process, it is important to try to spend time wisely, on high-value activities. And yet, faculty enthusiasm for a project is also important. As Connor describes above, faculty need energy and enthusiasm for the work of creating course video—it is the faculty members who have enthusiasm and "buy-in" who will develop a good course.

Ironically, a surplus of faculty motivation can also be a challenge to course development, and to staff who try to help faculty members channel their enthusiasm in productive ways. Videographers at all sites encourage faculty to go beyond narrated presentations, or in-studio videos with presentation slides projected behind the presenter. Andrew describes the early days working with the U1 Course faculty team:

> I think what led me to think it was going to be a good course from the media end was there was a high degree of openness in the beginning to hearing about just different categories or approaches for video. . . . [W]e see less of this now, but at the time, especially, like there were a lot of courses that were still sort of following the expectation, coming in with a strong expectation that they would just take some on-campus lecture video and chop it up, and we were really trying to get teams to think more openly and more ambitiously about, you know, different genres of video and how different modes of production or different types of videos could suit different, you know, aspects of the course content in different ways. . . . Abbott and Anna [two of the U1 Course faculty] were two of the professors who were both sort of engaged and interested in it, but Abbott was so disorganized. Abbott was sort of, like this ball of energy and ideas and [he] did do . . . a lot of cool stuff on the video end, but it was also very hard to wrangle him into like a coherent plan and be able to execute the plan . . . even though, there was a lot of enthusiasm.

Both Andrew and Bjorn acknowledge that working with faculty members who are enthusiastic about video can be a positive for their purposes, even as it can be a challenge for the creation of a course as a whole. Andrew explains, "You know, sometimes it's like the courses that are a great experience for the media team, I think, are like a nightmare for [the ID] because like they focus all their energy on the video and then they like don't do anything on the platform until the last minute." Bjorn echoed this sentiment in his discussion of another U2 Division course that he and Ben worked on together. Here Bjorn describes how faculty enthusiasm for video in an early MOOC in U2 Division ate up all of their course development time:

> So there were some things that were absolutely great . . . from a multimedia perspective, right? So this was a MOOC, the people doing this, they had a very clear idea on what they wanted, they knew how they wanted it to look, and we really wanted to facilitate them in that. . . . And then I think in our production process, . . . honestly, we were not ready enough to handle this request . . . with a client like this. So if you have a very well-organized person who can really be very decisive on yes or no, then perhaps we would have . . . used the time better and it wouldn't come down to the wire so much. But in this case, I think our approach to . . . producing these videos wasn't as mature as it is now, and combined with a teacher who is very creative and very, uh, he likes pretty much everything? Right? If you throw him an idea, he wants to do it, and our process wasn't mature enough to facilitate that.

Staff who work with faculty on these courses must have advanced collaboration skills to help motivated faculty maintain enthusiasm even as they meet production deadlines, and prod sometimes unmotivated faculty to meet obligations even as they are doing so as a work overload. In the next section, Andrew and Bjorn describe how they use prototyping to help faculty members stay motivated and on track.

Prototyping to set expectations

Interwoven throughout the conversations about learning at scale course creation with all interview participants is the idea that faculty are always surprised by how much work it takes to create a learning at scale course. It is common for faculty to underestimate the amount of time and help they will need, said Andrew.

> It can be hard to get buy-in, in terms of like especially that early pre-production of, okay, flesh it out and get a kind of a paper version of the course. I think it's hard for people to,

> especially when they've taught a course a bunch of times, to think about how they're, you know, it's not really just like turning on a camera and delivering the course to the camera. It's really like a whole different process.

One strategy to help faculty understand the amount and the substance of work that is required to create course video is to prototype. Andrew and Bjorn ask faculty members to work with them to create a video prototype as a way of creating a standard toward which the faculty members can work. The act of creating a protype also makes concrete for faculty the work associated with creating course videos of a particular type, and how one aligns videos with course content. For Andrew, prototyping course video is an important step in determining the portfolio of course media approaches that faculty will use in their course. By creating one of each type of video intended for the course, faculty develop a sense of the intensity of work required for that type. They can use that experience to create a budget of their time, energy, and grant funds. Similarly, Ben and Bjorn describe the importance of the first "tryout" video for helping faculty improve rapidly.

> Ben: [T[hey have the [media] training and then they do a tryout script and I'm not quite sure how that went for [U2 Course SMEs] in this MOOC, but usually that's kind of an A-ha! moment when they have their first tryout video and then they start to understand the role of video in the MOOC. Once they have their training . . . It's also a bit the presenters getting over their stage fright, you know, and you see the phase that they really start enjoying the video recordings in studio. . . .
> Bjorn: And they always do after their first, right after that first recording. They always find, "Oh, I'm gonna have to put in a whole new level of work to get to my second recording and because we're not going to do this again."

That first video allows SMEs and faculty at U2 to get practice, relax, and refocus on their approach to upcoming course videos.

From our conversations, U3 does not appear to use video prototypes as a way of refining faculty approach to video. It seems that the intensive work of designing and scripting the course is completed as part of the creation of a comprehensive storyboard. Connor's goal of making videography painless and effortless for faculty members, suggests that by the time they enter the studio, their approach to video has been determined and scripts have been edited and revised. Connor believes that success in the studio means “that you can capture what you need to capture without having to do things more than once.” In the most recent version of the U3 Division MOOC development process that Charles shared with me, video creation doesn’t begin until storyboards are 75 percent completed. Charles explained that particular strategies for video (narrated presentations vs. location shots vs. interviews) are discussed and solidified during storyboarding sessions with faculty, with Connor providing feedback and advice on the intended video strategies at regular U3 Division meetings.

The Ethos of Faculty Support

The interview protocol for this study was designed to provide the participants with the freedom to describe their work on MOOCs in terms of their own approach, not necessarily those processes, roles, and tasks defined by their division. The arts-based approach to the critical incident technique in the second interview allowed both participants to collaborate on a depiction of their shared work on developing the course under discussion. In this section, I’ll show these collaborative depictions of work on learning at scale courses as I describe the thematic tone that emerged from the interviews. Participants used distinctive language for describing learning at scale course creation at their universities in both individual and group interviews. In this section I describe the language used by pairs of course personnel to describe their work.

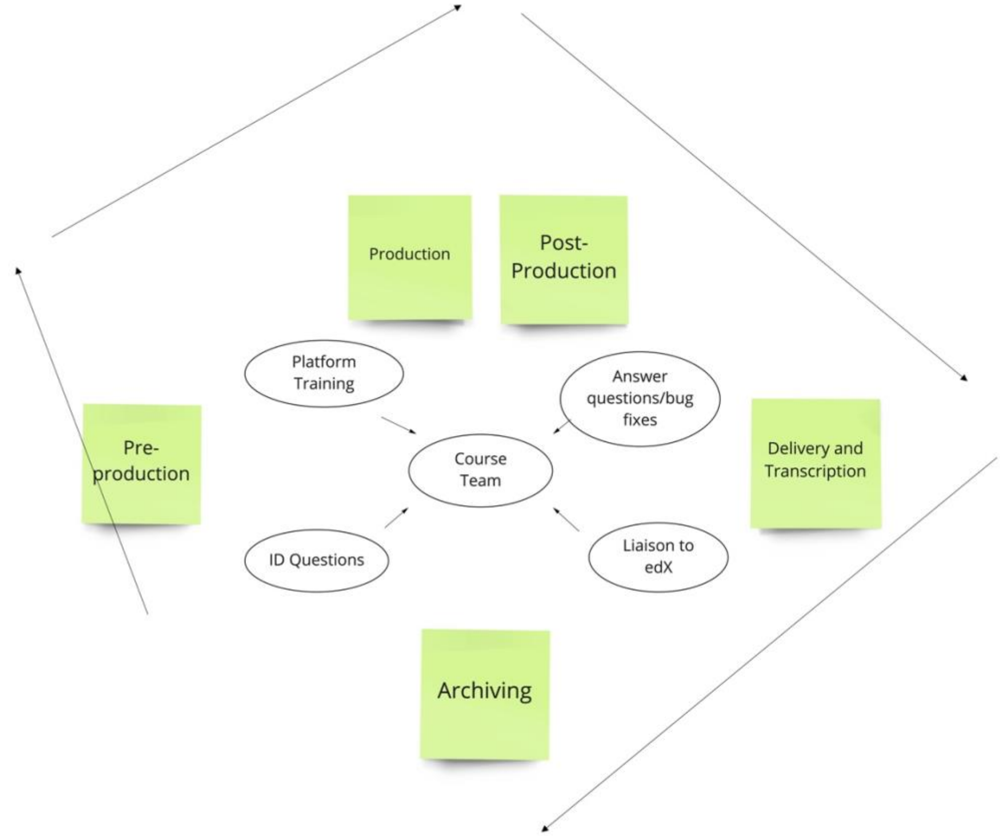
University 1

U1 Division employs a central team model of course development. Faculty at U1 apply for grants to build learning at scale courses. The funds that the faculty receive can be used to pay for personnel to join their faculty team to assist them with building courses and creating course media. Abby describes her work with faculty teams as an initial burst of structured training in learning strategy and platform orientation meetings. After that time, she transitions to on-call support, responding to faculty team questions and concerns. For the faculty teams that Andrew elects to work with, he meets with them formally and informally as they create a plan for their course media.

Abby and Andrew worked together to create a representation that would encompass both of their work visualizations for the U1 Course. They began with Abby's simple diagram (shown at the center of Figure 3) and superimposed Andrew's videography workflow. The arrows surrounding the image and pointing to the right indicate not only the videography workflow from pre-production to post-production, but also show the sorts of concerns that course teams would bring to Abby during particular points of the course and media development process. In the pre-production phase, the course team was trained on the platform. Then, during production and post-production, Abby is primarily answering questions and fixing bugs.

Andrew described being frustrated with the Miro tool, wanting something that would make this look much messier, and thus a more accurate representation of the course. They described the actual process as looking not like neat lines, but tangled yarn, and the simple circles that say things like "Answer questions/bug" actually represent many, many instances of questions from individual SMEs on as many as 100 different courses in different stages of development.

Figure 3.
Synthesized representation of work at U1



The simplicity of this map does not reflect the true nature of U1 work, which operates under a service model that sets the tone for all staff interaction with faculty team members. In their initial individual interviews, Abby and Andrew both described their work with faculty as characterized by an uneven power dynamic. The teams of faculty who apply for grants lead their own course development and are responsible for building the course on the edX platform. The grant-award money that they receive enables them to hire additional staff to perform whichever tasks are required to get their course built and running, such as someone to put the content on the edX platform or a freelance animator to create course assets. As part of the grant request, they anticipate how much money may be required for media creation. Faculty teams can ask for advice from the U1 Division staff on the amount of money that they may likely need, based on their instructional goals, but there is often little understanding of the complexities of course media when these grants are submitted. In addition, this faculty-driven service model manifests in another way in the process--the learning at scale course staff, primarily the instructional designer and videographer, both operate under the principle that they cannot "say no" to faculty team member requests.

Abby explained the challenge of helping faculty teams stay on track, "We can say you need to get something done in a particular time, but it's their time, you know, and if they can't get it done, it's not like we're going to say like, 'Oh, sorry, you're not going to run your course.' We can just give suggested times." Andrew describes the dynamic more broadly,

> In terms of how the process is like in our department--and my understanding is, this is at least somewhat unique compared to some universities--is that . . . we're not really able to say like "no" to things or we're not really able to dictate schedules or deliverables. [U1 Division] is, I think . . . conceived of as this service that's available to faculty to help them realize their visions of an online course, which is different than, you know, a faculty coming to us, and us saying, like "We have a process, you have to sort of conform to the process so that we can get this great outcome." And, so, I think that makes it hard when things start to go off the rails.

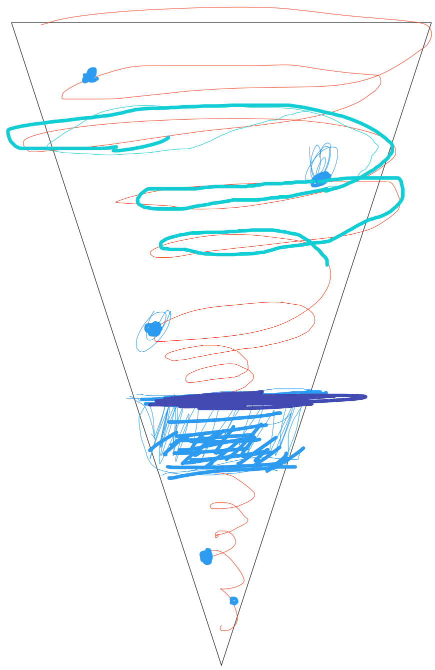
Andrew describes what can happen when faculty ignore advice, "After failing to convince them of our recommendations, . . . and then that leading to real problems down the road . . . like making aesthetic decisions that then have impacts on what's legible or clear, and then sort of having to undo it, like having to learn the hard way." Abby having to train a series of non-technical people in how to use the edX Studio tool reads as another consequence of faculty dictating the terms of course development. While the tone of powerlessness and frustration in their descriptions of work is notable, the workload at U1 Division would be unsustainable with the U1 Division staffing numbers and a dedicated team approach to course development.

University 2

U2 Division employs a dedicated team structure with instructional designers working intensively alongside SMEs and faculty on designing the learning at scale course. Ben and Bjorn had the most fun with these interviews. They enjoyed using the digital collaborative whiteboard, Miro.com, and in their joint interview they kept up a running commentary of how much they were learning from this experience. They also discussed what realizations they could bring back to their colleagues. I mention this here because my experience of conducting these interviews is aligned with the dominant theme for their work on learning at scale course creation: mutual learning.

In their individual interviews, both Ben and Bjorn described learning as the goal for the work that they do with faculty members and SMEs. Ben described the storyboarding process that he uses as “facilitating a learning process within this team” about learning at scale, which resulted in a deeper understanding, for the SMEs and for Ben, of the course content and goals for learners. In his individual representation of work, Ben depicted this mutual learning storyboarding process as a spiral that represented iteration, feedback, and refinement. Bjorn used a timeline to represent significant interactions with the SMEs. In the joint depiction of work, they used Ben’s spiral as the foundation of their representation, and indicated with blue dots those moments that the media, production, and content teams interacted. The dark blue line two-thirds of the way down the spiral represents the push to record media, with the lighter blue squiggles below representing iteration and improvement of the videos.

Figure 4.
Synthesized representation of work at U2



The joint depiction of work here achieved the messiness that Andrew wanted to depict in his tangled ball of yarn representation. Yet, the spiral here represents an intentional iterative learning process perhaps more accurately described as "organic."

In our first interview, Bjorn described himself as an autodidact. When I talked with him about the best course he had worked on, he described it in terms of how much the faculty member he had been working with had learned. Here Bjorn describes this faculty member marking up raw interview footage:

> We gave him all the rough footage, and he started to make paper edits, listen to all the interviews again, making selections on what parts are good for episodes, and since he's done this now for a couple of times, he has become way better in giving us the information we need to make his videos the way he has them in his mind. So, the collaboration between the two of us is way more efficient than a first-time MOOC presenter, which really helps him as well because it's way easier for him to articulate his ideas into video right now. And he's using this in his on-campus courses as well. So yeah, . . . these are some of the things with some of the courses that I'm, you know, I'm happy.

Bjorn also describes a new position in their division, an instructional designer who now works exclusively in the media team. He said that while she did not have a background in media, "she is learning more and more," and he described some of the ways he was helping her to learn more about video production in ways that would help her grow into her job.

Ben also described the division's transition to an Agile development methodology in terms of learning. The division had made the transition in line with larger institutional shifts, but he admitted that "we haven't had the time properly yet to understand the principles and values behind Agile because of Corona." This tendency to focus on improvement, on learning, on digging a little deeper to better understand seems broadly represented in the work of SMEs and staff colleagues in the U2 division.

University 3

U3 Division employs a dedicated team model. The dominant theme to emerge from the U3 Division descriptions of work was care for and support of faculty members and of colleagues. Charles and Connor described their work using language that focuses on faculty care and concern for their wellbeing. Charles, who served as the point person on the U3 Course design and development, suggested that the amount of work done by their small group of faculty and staff on that course "when we were still using some of our fairly primitive processes, . . . workloads were distributed in ways which would not probably be considered okay now." He described a focus of his work as supporting faculty members on "the roller coaster ride" of MOOC development, particularly in the hard times. Connor also describes his work in terms of its effect on faculty:

> I'm just like, generally people say that once they get to the video, they've had a good time. Because it's, yeah, everything, all the hard work's done and they come down there and I'll just make sure they're comfortable and we get it done really quickly and they're happy with it.

For Connor, he approaches his work as “work comes in, work goes out. I get done as fast as I can and make sure the academic has the best experience they can once they get to me.” In fact, Connor tries to minimize his role in course development, describing himself as a “bookable meeting room” and as “the video guy.” I had received advanced notice of this tendency from Charles, who described Connor’s role in course development:

> Connor is sort of a really amazing person in the way that, you know, he's such a practical guy, he’s got a lot of experience in filming and, you know, his insights are great . . . and he provides so much more than I think that he's aware of, anyway, to the whole process.

Connor’s carefully cultivated invisibility is a position that I recognize. After a career in commercial videography, Connor was hired by U3 to work in their classroom services team, installing audio-visual equipment and troubleshooting the equipment when it was not working. He worked in this capacity for six years until U3 Division hired him for his videography expertise. Having worked in a division that included a classroom services unit at two universities, I recognize Connor’s approach to working with faculty—get in, quickly solve the problem, make sure that faculty members understand the problem is not their fault (even when it might be), and get out--keep your head down, do your work, stay clear of drama. While Connor’s approach is understandable, it is to Charles’s credit that he is concerned that his colleague does not view his performance of the videographer role as important to the team.

While Charles and Connor created their individual representations of work, they declined to collaborate on a joint representation. While the interview itself was energetic and productive, it seemed that they could not figure out how to move forward on a joint representation. Charles’s individual representation of his work depicted his “not okay” workload on the U3 Course, with overlapping circles of responsibility, like soap bubbles. Connor represented his work on the U3 Course by drawing two arrows between himself and Charles on a course team map that he created as a warm-up activity. He said that his work was to do the videos that Charles told him to do. Connor was not interested in pursuing the question of how his work might be represented as a part of the whole, or in envisioning his contributions as integral to the work of the team. Their disinclination to pursue a joint representation seemed informed by Connor's desire to remain invisible in the larger process and Charles's interest in not pushing Connor to do something he did not want to do.

The visualizations jointly created (or not created) by the participants of this study provided an insight into roles and relationships, certainly. Even more, I learned as much from watching participants engage in the process as I did from the content of their visualizations. The personnel from U1 created a straightforward depiction of their shared work, but were frustrated that the Miro tool didn't seem able to accurately represent the chaos of repeating that single visualization for every interaction with individual members of a faculty team. *Chaos* is a significant word to use to describe one's work, indicating a system that is out of control, that has no discernable patterns, that is unmanageable. Compare this description to that of U2's spiral. While Ben's spiral captures the complexity of a tangled set of interactions, their "chaos" is managed, it is contained within a process that continually refines the product, and further, in which both the content and production teams are equal partners in refining this product. This is a symmetrical and evenly balanced spiral. Charles and Connor declined to participate in the Miro exercise even though they participated enthusiastically in the interview. The tone of each second interview with both participants from each university was telling—U1's rueful description of chaos and overload, U2's excitement and enthusiasm for learning, and U3's measured and tentative description of their work, primarily in terms of how they support overloaded faculty members. The tone of each interview helped me to understand the effects and implications of team structures and service models in place at the three institutions.

Each of the courses under discussion in this study, U1 Course, U2 Course, and U3 Course, were all developed at least three years prior to the time of the interviews. Not only was the critical incident method helpful in learning about the complexity of course design by investigating a single course and a single set of course personnel, but each pair of course personnel also described the ways that processes have changed since these courses were developed. Sometimes the need for the changes in policy or process, particularly at U1 and U3, are described in events that occurred during the course developments described in this study.

For staff at the three universities in this study, building learning at scale courses on the edX platform involves performing the same basic tasks: developing a learning strategy and designing and developing outcomes, course content, videos, and assessments. The same basic roles are in place at all three sites: instructional designers, videographers, and faculty or SMEs. The tools are largely the same: the edX Studio course-authoring tool, audio-visual equipment and software, tracking and productivity tools. The differences described in this section are due to the ways that personnel have interpreted their roles, whether these interpretations are based on a divisional service model or individual inclination.

Most Valued KSAs and Competencies

I closed the initial interview by asking each participant to tell me which experiences and expertise have proven particularly valuable in their roles. In this section I describe their most-valued experiences and expertise and compare it to the top KSA domains from the Ritzhaupt, et al, educational technologist study “Development and Validation of the Educational Technologist Competencies Survey (ETCS): Knowledge, Skills, and Abilities.”

In line with research on education technology KSAs, technical skills may be useful and frequently needed, but they are not described as being particularly valuable by all of the instructional designers or videographers—even those whose roles are more “technical.” This holds true with Ritzhaupt’s findings in the KSA study of educational technology work. Like that study, value is ascribed by educational technologists to skills that are related to communication and collaborative work as well as learning and instructional design skills. Abby says that learning to code has helped in her role as edX liaison, but even more important is “negotiation, interacting with people. . . . Building relationships is probably the most important. Building like a trusting relationship so that they can come to me for questions and feel comfortable coming to me with questions.” Because of the ever-increasing number of courses that Andrew is working on, his role has transitioned from one that requires significant technical skills to one that is more administrative. For Andrew

> I feel like increasingly, what I’m using more and more is really like kind of soft skills of talking to people and trying to build trust with the course teams and understand their motivations and understand their, their goals and metrics for success, and then figuring out kind of how to meet those and working with contractors to make contractors feel like they're valued and appreciated and understand what we're looking for when we contract work out to them.

Building trust for both Abby and Andrew is important in their work with faculty teams and with third-party contractors.

Ben describes his understanding of what is important in his role in terms of an evolution in his thinking that has occurred over the years.

> I think when I started, I was really fixated on the like the didactic knowledge and . . . I thought, okay, understanding how technology works and how people work with technology; how learning occurs using technology, so ed tech kind of thing, and it's still important, but I think I value just as much now people skills, you know, understanding how team dynamic works.

Bjorn describes the importance of anticipating problems and being proactive about addressing them. He describes the significant effects of missing small details.

> If you forget to ask one small question. I can tell you that at the end when things should have been done . . . and everybody's always been busy with the content and the scripts and the PowerPoint and kind of forget to think about the graphical design. . . . [T]hese are things that most of the times need to be fixed after the fact. And the fixing of videos after the fact, takes up some time.

Both Ben and Bjorn mention technology as they describe skills that they value, but the technology is not the focus of their remarks. Instead, Bjorn describes the important of organizational skills and an eye for detail, while Ben describes the importance of supporting a healthy team dynamic.

Finally, Charles describes the importance of working with a learner-centered perspective—always keeping the learner's experience in mind in order to make it "valuable, rewarding, enjoyable, challenging . . . making sure you're doing all those things that make a learning experience the best it can be." Connor promotes the importance of "having a work ethic and sort of working to deadlines and being able to work quickly." In addition, Connor describes knowing how to work with academics, and how to speak with them, always considering their workload and those things that they might be experiencing as instructors taking on the additional burden of developing a learning at scale course.

In validating their long list of KSA statements, Ritzhaupt, et al, also pulled out those KSAs that practicing educational technologists found particularly important in their work. The table below shows the top KSA factors identified by participants in Ritzhaupt's study on the left, with those factors described as most valuable by the participants of this study on the right. When the two columns overlap, personnel are identified in the column to the right of the KSA item.

Where study participants indicated a KSA not in Ritzhaupt's most valued list, this is indicated on the right with the item description followed by the personnel who value that KSA.

Table 20.
Top KSA domains and most valued KSAs

Top KSA Domain Factors of Educational Technologists (Ritzhaupt, et al, 2018)	Most Valued KSAs of Learning at Scale IDs and Videographers
	K2: Development methodology, software, and programming—Abby
K4: Learning theory and human performance technology	Charles
K5: Assessment, evaluation, and teaching techniques	
K6: Curriculum standards and frameworks	
K8: Instructional design, development, and online facilitation	Ben, Charles
K15: Copyright laws, policies, and procedures in training programs	
S1: Communication, problem-solving, and interpersonal skills	Andrew, Bjorn
	S6: Project and quality management skills—Andrew, Bjorn
A1: Project management and providing feedback	Abby, Andrew, Ben, Connor
	A2: Teaching and delivery of instruction—Ben
A3: Application of instructional design, development, and evaluation	Ben, Charles
	A4: Analysis and strategic management—Andrew
A5: Adaptability to technology and process	
A6: Work and communication with diverse constituencies	Abby, Andrew, Ben, Connor
	A8: Initiative and focus—Connor
A9: Leadership and ethical judgment	

While the aim of this study was to fully describe the work of making learning at scale courses, the next step is to determine whether there is something distinctive or different about the work of building learning at scale. Five of Ritzhaupt's top KSA domains are not mentioned within the most valued KSAs among this study's participants. Furthermore, five KSAs that are highly valued by this study's participants are not in Ritzhaupt's list of top domains. This mismatch suggests that there is room for further investigation of the work of creating learning at scale courses.

5. DISCUSSION

The roles, tasks, personnel, and tools involved in the creation of learning at scale courses on the edX platform were the focus of this study. In this chapter, I discuss the findings of the study. The research question addressed was what are the primary work systems associated with designing, developing, and delivering learning at scale? Out of this main question arise two sub-questions:

Sub Q1: How do course personnel visually and verbally represent their work on MOOCs?

Sub Q2: How do course personnel describe their experiences of working on MOOCs?

I pursued this study through a socio-technical systems approach. STS describes complex systems as being comprised of two interacting, independent technical and social subsystems. In turn, the technical subsystem is comprised of tools and tasks, the social subsystem of roles and personnel. The STS framework is practical and adaptable to various contexts. In addition, it ascribes to a Theory Y view of the workplace, in which workers are viewed as wanting to contribute to organizational goals and able to provide feedback on how the systems might be optimized. Finally, a goal of the STS framework is to create a "learning system," which is adaptable and "agile"—adjusting to rapidly changing environments. To ensure that a learning system is in place, workers should have a clear understanding of the social and technical systems (Bostrom & Heinen, 1977a).

Using an arts-based approach to the critical incident methodology allowed me to learn more about the work done on a specific learning at scale course. I could then use those descriptions of a particular course to understand broader patterns of work and behavior that may not have been visible with a strictly text-based data set. The arts-based approach also helped me to understand when personnel had a clear visual understanding of their social and technical environments. The cycle of individual initial interview and follow-up joint interview allowed me to verify information from the first interview, and also to observe and understand more about how IDs and videographers work together at the three universities in this study.

Discussion of the Results

The main research question for this study was "What are the primary work systems associated with designing, developing, and delivering learning at scale?" The socio-technical systems approach to this question was valuable in helping me to understand how the roles, tool, and tasks at all sited may be performed or interpreted differently at each site. All instructional designers and videographers have the same basic task—support faculty members who are creating learning at scale courses. At all sites, staff work to help faculty understand the conditions for learning associated with the tools—what is learning at scale and what does it mean for your content and your learners? This primary function of the tools, to help students learn, can sometimes become a secondary concern for faculty members who just want to "get the information out there." At all sites, participants discussed issues around expertise, flexibility, motivation, and agency. These are addressed in greater detail below.

Instructional Design and Expertise

In 1990, Boyer described teaching in higher education as "often viewed as a routine function, tacked on, something almost anyone can do" (p. 23). He goes on to argue strenuously against that notion, but this is still a common view. While some universities may have programs in place to train graduate students to teach, few offer any rigorous or systematic training for faculty beyond voluntary attendance at workshops or seminars. The system of higher education conflates expertise and the ability to teach others what one knows.

Increasing numbers of instructional designers and educational technologists hired to work on campuses suggest that this conflation can be disrupted by the presence of educational technology, and particularly of learning management systems. The perception in higher education is that teaching in a classroom may be something that experts can do without much training, but experts do need assistance when it comes to integrating technology into teaching. Yet, if we look at the actual work being done by instructional designers (and videographers) who provide ID support in the form of storyboarding for faculty developing learning at scale courses, the technology is secondary. Of primary importance are identification of the learning strategy and goals, sequencing the topics, designing and developing instruction and assessments—this work happens between IDs and faculty and SMEs at U2 and U3 and between the videographer and faculty at U1.

Hollands and Tirthali have described the ways in which resource requirements and staffing in designing, developing, and building learning at scale courses differs from traditional online course development (2014). This study provides a description of how this work is performed. Ritzhaupt, et al’s, work in validating educational technologist knowledge, skills, and ability statements provided a language for describing the work. In this study, the following KSAs were described as particularly valuable by participants in this study.

The participants in this study and the Ritzhaupt most-favored KSA statements aligned on the following KSAs:

- learning theory and human performance technology
- instructional design, development, and online facilitation

- communication, problem-solving, and interpersonal skills
- project management and providing feedback
- application of instructional design, development, and evaluation
- work and communication with diverse constituencies.

These are all squarely within the design and communication skills most favored by Ritzhaupt's educational technologists. However, in the KSAs that this study's participants highly favored, and Ritzhaupt's educational technologists did not, one finds echoes of Hollands and Tirthali's technology resource intensiveness:

- development methodology, software, and programming
- project and quality management skills
- teaching and delivery of instruction
- analysis and strategic management
- initiative and focus

These KSAs, associated with learning at scale work, suggest a fast-paced, technical environment with many moving pieces. It also suggests an environment with blurry role distinction--teaching and delivery of instruction is a task for instructors. Ben, however, uses his knowledge of and experience with teaching to advise the SMEs on the U2 Course in good instructional practice. These may not be radically different than the KSAs favored by Ritzhaupt's educational technologists. Even so, learning at scale work seems to skew toward technical proficiency in a most-valued KSA realm otherwise dominated by "people skills," such as communication, collaboration, and leadership.

The two team structures at the three universities in this study account differently for the expertise associated with the faculty role and the expertise associated with the ID role. For the

U2 and U3 Courses, built by dedicated teams, designated instructional designers provided direct support to faculty. For the U1 Course, Abby provided support in early meetings, but more extensive ID support was provided by Andrew during pre-production meetings with the faculty team. It is not known whether within the faculty team for U1 Course, faculty or those whom they hired to build in the edX Studio course-authoring tool engaged in storyboarding or other instructional design work within faculty team meetings. It is also not known how the presence of a learning specialist may affect the work of the other staff members who support faculty teams in the central team model.

Developing Flexible Systems

At all sites in this study, there is a defined development process and then there is what "really" happens. At all sites in this study, there are defined roles and the ways that individual personnel perform those roles. Understanding the real work of course design and development can provide a foundation for understanding how tasks may shift among roles, how to strategically employ the particular strengths of individual personnel, and how to create new roles to meet gaps in task performance.

The descriptions of work from Andrew, Ben, and Connor all suggest how we might understand the implications of personnel role adaptations in a larger context. Andrew works intensively with faculty on pre-production tasks that echo instructional design storyboarding. He describes being uncomfortable with this invisible responsibility and wishes to receive more training in instructional design. Even so, he is using his expertise in pre-production videography to address an unmet need. Ben describes the work he does with faculty and SMEs in storyboarding as a little different than his colleagues, and that this is a distinction that he has cultivated. He asks faculty to dig deep into their disciplinary expertise and talk with him about how learners at scale can emerge changed from the course. Connor has developed an approach to his role that he feels comfortable with—his work is effective and faculty benefit from his approach—even if his attempts to remove himself from the process concern his colleagues. In each of these situations, individual choices and preferences affect the work of the larger team.

Abby, Bjorn, and Charles describe ways that their divisions have responded to a need for flexibility with the creation of new processes and roles. Abby described how their faculty on-boarding process has changed to emphasize the importance of defining a learning strategy and learning goals before the work of course asset creation begins. Bjorn adapted his video production process to account for the compressed schedule of the SMEs for U2 Course. He also described the creation of a new instructional designer position in his administrative unit that will help them address those aspects of instructional design that may arise in media creation work. Charles described how they approached the set of tasks associated with learning at scale course design and development for U3 Course—by considering individual workload and seeking others on the team who can take on particular tasks. He also described a new role in their division that was designed to aid faculty in their work on course design and development. Student/staff assistants—whether post-docs or high-achieving graduate and undergraduate students--use their disciplinary expertise and their experiences taking online courses to provide back-up support in technical and content matters.

In addition to individual performance of a role, and larger administrative responses that address task performance gaps, current knowledge of team members must be considered as a factor in course design and development. Participants in this study mentioned that faculty often underestimate the time and amount of work involved in creating learning at scale. (This misunderstanding is present in designing and developing traditional online courses, as well.) This challenge has two main implications. First, more direct instructional design support is needed for faculty who are new to learning at scale course design and development. In a central team system that is driven by faculty and in which faculty build their course on the edX platform, this is a challenge. Faculty inexperience with learning at scale has a significant impact because faculty are responsible for doing more in that system—designing their course for learning at scale and developing it in the edX Studio course-authoring tool. Abby described her approach to working with new faculty as increasing the number of learning strategy and platform orientation meetings that she might otherwise run. Abby also described having to train personnel selected by the faculty teams to build the course in Studio even though they had no subject matter, teaching, or technical experience. Poor hiring decisions may be an unfortunate by-product of asking faculty to manage a process that they do not fully understand. The collaborative relationship between IDs and faculty that one finds in a dedicated team model may be more flexible in accounting for faculty inexperience. In addition, at U2 and U3, faculty did not build their courses on the edX platform. Their inexperience is limited to a lack of knowledge about how disciplinary expertise can be conveyed and how instructional practice must shift in a learning at scale environment. Therefore, course personnel at U2 and U3 can focus their efforts on helping faculty and SMEs develop expertise in performing an accustomed role in a new context.

MOOC design and delivery do not align with the academic calendar. Both Abby, Andrew, Charles, and Connor described significant workload issues with the faculty members working on the U1 Course and the U3 Course, largely because all of them were carrying on with the rest of their teaching, research, and service obligations. The U2 Course employed SMEs rather than faculty members. Neither Ben nor Bjorn described workload pressures experienced by the SMEs. Indeed, the SMEs seemed able to adjust their schedules to respond to the development needs of the course. For example, instructors from all over the world were able to fly in to create course videos over a week and a half. The edX platform, which does not align work to the academic calendar, presents particular challenges for faculty to integrate this additional obligation into the rise and fall of their academic year workflow.

Buy-in, Motivation, and Agency

Instructional designers in higher education describe “faculty buy-in” as their greatest obstacle. The Intentional Futures study that reports this finding describes the nature of “buy-in” as stemming from “part lack of knowledge, part lack of understanding. Faculty may be having a difficult time integrating new methods and practices when they are comfortable teaching what they know” (2016, p. 15). While participants did use the phrase “buy-in,” a more robust term in the context of this study was “motivation”—how important it is to have, how carefully staff work to help faculty maintain it, and how frustrating a highly motivated faculty member can be if they do not pair enthusiasm with the ability to take advice from staff colleagues. An excess of faculty enthusiasm for “shiny” things, such as course video or animations, can make working with faculty challenging. All participants described the importance of defining and developing a learning strategy before creating course videos to avoid wasting time and resources. U3 Division has made this a formal part of their course design and development process--faculty may not develop course video until at least 75 percent of their course has been storyboarded.

Staff described potential “root causes” of a lack of faculty motivation. The arts-based approach to the critical-incident methodology was employed to reveal whether participants had an understanding of the “map” of their organization. None of the participants were privy to the final decisions about which courses would be developed, even if they gave feedback on proposals as part of the review process. Their understanding of these decisions made one or two levels of hierarchy above them was murky. Participants at U1 and U3 described the challenge of working with faculty members who have been pressed into service, but uncovering the mechanism by which faculty members or SMEs were chosen to develop learning at scale courses was not a focus of this study. As much as staff discussed faculty motivation, they also described situations related to their own agency and authority.

The tone of the interviews was consistent across the pairs. This could have to do with how the staff identified themselves to me as participants. Both Abby and Ben recruited the videographer at their institution to be a participant. This may have lead Abby and Ben to select like-minded colleagues. However, Charles and Connor were recommended by the director of their division, likely because in the early days of learning at scale at their institutions, they were the two primary staff designing and building these courses. I think it more likely that the consistent theme across the pairs was intentional and had to do with the stories they wanted to tell about their work. In the discussion participants had with one another about which course to choose, I advised them to select a course that they believed told a "particularly universityX story." (I did not participate in these discussions.) The descriptions they gave of their work on their chosen course represented their understanding of broader themes in play in their divisions.

What struck me most about the arts-based approach on Miro was how it revealed whether participants felt a sense of agency in their working relationships with faculty and SMEs and within their divisions. Abby and Andrew are two highly qualified and skilled practitioners, yet they do not feel that their expertise is valued or respected. Their advice must be delivered to faculty teams as a suggestion. They watch courses "go off the rails" and feel that they can do nothing. It is not clear, however, that being positioned as collaborators within a course team lends more weight to ID or videographer advice. Ben and Charles both described situations in which faculty members who were motivated to create video without first thinking about learning strategy could not be dissuaded from their paths. Yet, neither Ben nor Charles defined their work by their lack of power or agency. For Abby and Andrew, not being able to "say no" was a consistent thread running through their descriptions. Is it a problem of scale? If we posit that an inclination to ignore advice is a by-product of working with subject-matter experts, and that it is present in, say, half of the population of subject-matter experts, working with 50 course teams who ignore your advice may feel more overwhelming than working with one course team who ignores your advice. Recent work by Patrice Prusko and Whitney Kilgore highlights the problem of instructional designer burnout and compassion fatigue. They describe one of the most emotion-boosting aspects of a workday as "making progress in meaningful work" and described the experiences instructional designers had with long hours, lack of respect, and not having their voices heard (2016, p. 15). While all participants described these frustrations, only Abby and Andrew selected a course that seemed to be defined by having their advice ignored.

Recommendations for Research

This examination of the socio-technical systems involved in the creation of learning at scale provides some compelling directions for future research. Most broadly, there are opportunities to track the ongoing evolution of learning at scale. Learning at scale began as an exploration of connectedness made possible by the Internet, digital resources, and digital tools. These connectivist ideals are now largely secondary for institutions seeking to increase student enrollment. However, there are practitioners within learning at scale who seek to integrate elements of those original explorations within a learning at scale degree-seeking context. A socio-technical systems approach to connectedness in learning at scale would help us learn more about the experiences of instructors, designers, videographers, and learners and the tools they use that make personal connection possible.

Massive learning has existed for almost two decades now, and while there are opportunities to learn from past successes and failures, the technology available to practitioners has rapidly evolved, making the challenges associated with a massive student enrollment easier to manage. As artificial intelligence and other bleeding edge tools are made available to practitioners at scale, a socio-technical systems examination of the social effects of these tools is warranted. Researchers and institutions that offer learning at scale would do well to engage in ongoing reflection on the social effects of new tools for learning at scale—examining the effects on learning, practice, and livelihood for practitioners and learners.

It would seem that team structure has a significant influence on the tasks associated with the roles in teams that build learning at scale, but more research is needed beyond the three universities in this study. More research is needed to determine how dedicated and central teams are effective in learning at scale course building, whether there are predictable benefits and challenges for each model, and how institutional identity and culture affect implementations. In this same vein, an assessment of team member satisfaction within central and dedicated teams will help to inform administrator implementation decisions.

Beyond the effects of team structure on the work of course teams, further investigation of instructional design practice is warranted. Learning more about instructional design support and who may provide it will also help us to understand how and when this work may be most beneficial to a course development team. Learning specialists, who hold both expertise in an academic discipline and instructional design training, were mentioned in this study, but more research is needed to learn how these roles are performed in practice. In particular, understanding how the disciplinary expertise of learning specialists affects the performance of instructional design support will aid practitioners. The following research questions on disciplinary expertise will help promote the effective functioning of teams and inform hiring or professional development efforts:

- How does disciplinary expertise affect the support instructional designers and learning specialists are able to provide course teams?
- How does disciplinary expertise affect the perceived quality of the advice that they give to colleagues and instructors?
- How does the context of instructional design advice--whether in a pre-development training meeting, a pre-production conversation with a videographer, a meeting with a learning specialist, or a storyboarding meeting with an ID—affect how that advice is received by SMEs and acted upon?

Finally, and more broadly, research into the work of teams--whether faculty or cross-functional teams--in learning at scale course creation will help clarify how teams can operate more effectively and efficiently in a higher education context.

Divisions within institutions of higher education that create learning at scale courses are betwixt and between two worlds—a traditional academic context with a workflow based on an agrarian calendar, and a free-market platform that provides learners with content whenever and wherever they might want it. Research focusing on organizational behavior and development will aid in making these workplaces more effective, efficient, and enjoyable. The next stage of an STS investigation into learning at scale in higher education would provide important information about common challenges and potential responses. The differing approaches in this study to the work of creating learning at scale courses suggests that a Theory X and Theory Y examination of workplace culture would be beneficial. More research is needed to determine how flexibility is performed at different operational levels within an organization—at the university, division, department, team, and personnel levels. Researchers should seek to learn what systems are currently in place to allow organizations to respond flexibly to unexpected events, and what benefits proactive and reactive measures may provide.

Finally, institutions of higher education were reckoning with a mental health crisis even before we all started living and working in a global pandemic. The workplace context of higher education is key. More research is needed to understand the particular challenges and stresses of the work of creating learning at scale courses and how these stresses are felt differently among team members. In addition, more research is needed on the formation and support of cross-functional teams in a higher education context. Finally, research is needed to determine how to promote collaboration among cross-functional team members in the creation of learning at scale, and the effects of a collaborative work environment on productivity and feelings of self-efficacy.

Implications for Practice

This study of three sites begins an important area of research into the work of instructional design in cross-functional course development teams within higher education. This study also provides implications for practice.

Teamwork and Role Clarity

Higher education is an industry that is fueled by and produces expertise. Faculty support within higher education has within it a power imbalance—staff employ their own expertise to aid faculty in the performance of their work. A challenge for staff in higher education can be that their spheres of expertise are seen as less valuable or prestigious than expertise held by faculty. Another challenge for staff is that some faculty are unaware of the limits of their spheres of expertise. The higher education context for the work of building learning at scale courses requires that the terms of engagement between faculty SMEs and the staff who support them are made clear. In addition, spheres of expertise must be articulated and respected. Faculty member SMEs hold expertise in their disciplines. This expertise may extend into the pedagogies associated with their disciplines, but this is not assured. It is very likely that faculty SME expertise does *not* extend into designing, developing, and teaching learning at scale courses. Research into cross-functional teams suggests that the onboarding phase of team creation in which trust and common mental models are established is critical for effective performance (De Jong & Elfring, 2010; Dechurch & Mesmer-Magnus, 2010; Salas & Fiore, 2004; Wildman et al., 2012). Teams should set clear ground rules for members regarding participation, collaboration, and communication. Teams should clarify the skills needed in each role, to ensure that critical skills are held by personnel. A task inventory may be useful for practitioners to determine who is performing tasks outside of their designated roles and whether a redefinition of roles may be required.

Building in Flexibility

In the three universities in this study, faculty members take on the work of designing, developing, and teaching learning at scale courses in addition to the rest of their professional and personal obligations. It would be prudent to develop approaches that will help faculty members manage their workload as they also perform work on designing and developing learning at scale courses. In addition, faculty reward structures must account for and recognize faculty time and effort spent on these courses. The challenge of helping faculty manage their workload will continue until administrative units stop piling overload work on already overloaded faculty.

Clarifying expectations regarding roles and tasks for all team members, and clarifying the amount of work associated with each task, may allow a more concrete set of discussions among project managers and SMEs regarding their availability. These conversations will help managers proactively identify additional personnel who can lend a hand when other team members are overloaded. At U1, Andrew described a stable of videographers, both within U1 and external freelance media professionals, who can be hired by faculty teams to help them produce their media. A reasonable adjustment in a central team implementation would be to use the same model for instructional design staff—develop a stable of instructional design professionals who could be "hired" by faculty teams to help them design, develop, and build their courses.

In addition, it may be beneficial to develop roles that ease the burden on faculty and provide technical expertise and some disciplinary expertise. At U3, Charles described employing graduate students and third- and fourth-year undergraduates to provide subject-matter expertise and technical ability in the performance of some tasks. Unlike a learning specialist, these roles do not direct the conversations about design and instructional strategy, rather they serve in a dual role—providing feedback on the readability of the discipline-specific content, and creating and checking the accuracy of discipline-specific questions on the edX platform. To go a step further in avoiding faculty overload, it may be prudent to imagine a different content-creation model—in which divisions hire graduate students, post-docs, or alumni as SMEs who can devote the required time to developing course materials. This new SME role might act in partnership with faculty members who have an oversight role rather than a content generating role.

Supporting Staff Who Support Faculty

While it can be a challenge to work with faculty members who are at the far ends of the motivation spectrum, the conversations in this study helped to clarify that a key aspect of “faculty buy-in” is a willingness to take and act on advice from staff colleagues. While the recommendations for practice earlier in this chapter may help to establish a collaborative and equitable approach to course design, managers must take seriously the mental health consequences for staff of working with faculty and SMEs who are inexorable.

Participants in this study described needing to go to a department chair or to an administrator within their own division to speak with a faculty member who was not fulfilling their obligations. While these reactive measures are appropriate when needed, it may be that proactive measures may create a better workplace environment for everyone from the outset. Participants in this study spoke of not understanding why some faculty who seemed uninterested in, or even resistant to, learning at scale were appointed to develop a course. While some disciplines are sufficiently specialized that the range of potential SMEs is small, looking beyond the faculty members for someone to perform the SME role, as suggested in the previous section, may mean that willing participants with the required disciplinary expertise can be identified. In addition, it may be useful to identify a team of faculty with a range of skills beyond disciplinary expertise. We tell students that they must learn to work in teams if they want to be successful. It seems odd that we do not similarly value collaboration and teamwork skills among faculty.

Managers of divisions tasked with creating learning at scale may also wish to incorporate language promoting collaboration and collegiality into department policy as an expectation for how staff and faculty members work together. As described earlier, time spent setting the tone of collaboration during onboarding may provide a more productive and healthier work environment for all team members.

Conclusion

The purpose of this qualitative study was to describe the primary work systems associated with designing, developing, and delivering learning at scale. To accomplish this I asked course personnel, instructional designers and videographers, to describe their work on learning at scale courses in words and by creating visualizations on Miro.com, a digital interactive whiteboard tool. I spoke with one pair of course personnel—one instructional designer and one videographer—at each of three universities. One university is in the United States, one is in Western Europe, and one is in Australia. Each participant talked with me about their work with faculty and with colleagues in their divisions of online learning. All of them described when they felt that they were doing good work and when they were frustrated. They described the challenges and pleasures of working on these complex courses with faculty members and subject-matter experts.

Many themes emerged from this study—some describing the interacting effects of roles and tasks as they were defined at the different institutions. Other themes focused on the challenges of working on these technologically intensive and time-consuming courses in the context of the rest of the work associated with an academic year. Administrators of divisions that produce these courses should reflect on the effects of team structure on staff morale and on the quality of the end product. While the number of learning at scale courses in development at any one time may dictate a particular operational approach, this study showed that faculty and SMEs require ongoing instructional design support to create these technically complex courses. This study also provides recommendations for practice. Finally, the findings in this study suggest that new developmental models may be required for a sustainable approach to learning at scale design, development, and delivery in contemporary research-intensive universities.

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APPENDIX A

INVITATION TO PARTICIPATE IN A RESEARCH STUDY

Rebecca L. Johnson, The University of Alabama

Student, Educational Leadership, Policy, and Technology Studies

201 Carmichael Hall, Box 870231

The University of Alabama

Tuscaloosa, Alabama 35487

Greetings [participant],

My name is Rebecca Johnson. I am a doctoral student in the Instructional Leadership with a concentration in Instructional Technology program at The University of Alabama. As part of the fulfillment of my dissertation requirements, I am conducting a research study into the personnel, roles, tasks, and tools associated with designing and developing massive open online courses. I would like to learn more about the work of MOOC making at your institution by interviewing two people who have worked together on at least one MOOC—ideally one person in the instructional designer or technologist role and one person who has served as a videographer. There will be a brief activity before the first interview that will last no longer than 15 minutes. In the initial interview, which would last no more than 120 minutes, I will interview each participant separately to learn about their broader experiences with MOOC making teams and then their experiences on the common MOOC. In a follow-up interview lasting approximately 60 minutes, I will bring the two participants together to discuss their common course. Participation in the study is voluntary. The interviews will be confidential.

If you are interested in participating, or have any questions, please do not hesitate to contact me at rljohnson@crimson.ua.edu. If you agree to participate, I will follow up with you to schedule the interview. Thank you kindly for your time.

Best regards,

Rebecca Johnson

APPENDIX B

INFORMED CONSENT

Please read this informed consent carefully before you decide to participate in the study.

Consent Form Key Information: You are being asked to participate in a research study. This study is called Making MOOCs: Identifying Primary Work Systems in the Creation and Delivery of Learning at Scale. This study is being conducted by Rebecca L. Johnson, a student at the University of Alabama in partial fulfillment of the degree of Doctor of Philosophy in Instructional Leadership with a concentration in Instructional Technology. Key information for your participation in this study:

- You will be asked to complete an initial task on Miro that will take no longer than 15 minutes
- You will be asked to participate in an initial interview via Zoom of no longer than two hours
- You will be asked to participate in a follow-up interview via Zoom of no longer than 60 minutes
- No information will be collected that will connect your identity with your responses.

Purpose of the research study: In this study, the principal investigator will explore the roles, tasks, personnel, and tools associated with making and delivering massive open online courses. The P.I. will focus in particular on the work of instructional designers/technologists and videographers. The P.I. hopes to learn more about making MOOCs by studying how participants describe and visually represent their work.

What will you be asked to do?

Before the first interview, you and a colleague will be asked to select a MOOC or learning at scale course that will be the focus of the interviews. You will then be asked to participate in a brief warm-up activity in Miro, the digital collaboration platform that will be used in the interviews. This brief warm-up activity will be done on your own time and take no longer than 15 minutes.

In the initial and follow-up interviews, you and a colleague who have both worked on the same MOOC will be asked to do the following:

1. Initial Individual Interview: You will participate in a recorded Zoom interview lasting no longer than two hours in length. During the interview you will be asked to describe the work that you have done on learning at scale courses. You will be asked about your work on learning at scale courses generally and about the MOOC that you worked on with the other participant. You will be asked about the roles, personnel, tasks, and tools associated with course creation and delivery. You will be asked to create a visual representation of learning at scale course creation on Miro, a digital collaboration platform.
2. Group Follow-Up Interview: In an interview lasting no longer than 60 minutes, you and your colleague will discuss your work on MOOCs generally, and on the common MOOC. You will be asked to produce a joint visual representation of MOOC work in Miro. The interview will be recorded in Zoom. We will talk about the work of making the course and how it was similar to and different from other courses.

Time required: The study will require about 3.25 hours of your time—the warm-up activity on Miro lasting no longer than 15 minutes, the initial interview lasting no more than two hours; the follow-up interview lasting no more than 60 minutes.

Risks: There is no more than minimal social or psychological risk associated with discussing one's work in MOOC making. While the content of each initial, individual interview is confidential, the follow-up interview will include your MOOC-making colleague. As an employee of your university, you may criticize your place of employment or the performance of your colleague. If confidentiality is compromised, you may be subject to embarrassment should your confidentiality become compromised and these criticisms revealed.

Beyond participation in the two interviews, risk will be minimized by anonymizing participants, courses, and institutions in the report. You will not be recorded without your consent.

Benefits: There are no direct benefits to you from participation in the study. You will not be paid. The only cost is the cost of your time in participating. This study has the potential to save time and resources for universities and personnel engaged in this work.

Confidentiality: The researcher will maintain confidentiality of study participants as far as possible. Interviews will be conducted on Zoom and within a private space (likely in the researcher's and participants' homes due to various coronavirus work-from-home arrangements). All interview transcripts, saved JPGs and PDFs of Miro artifacts, notes, and back-up audio recordings will be stored in box.ua.edu, which provides a secure, cloud-based system for file and data storage. All Zoom interview recordings will be stored in Zoom, which provides a secure, cloud-based system for file storage. Zoom recordings and back-up audio recordings will be deleted immediately after transcription and verification of the recordings. Data will be de-identified so that your name will not be associated with your responses. Your institution and the courses that you have mentioned in interviews will also be de-identified. Access to data will be restricted to the principal investigator (P.I.) and the investigator's dissertation chair. Reports of the research will not name or otherwise identify participants.

Because of the nature of the data, and that you will be discussing your MOOC work with a colleague, there cannot be a definitive guarantee that your data will be confidential and it may be possible that others will know what you have reported. See the Risk section for more information.

Voluntary participation: Your participation in the study is completely voluntary. You may choose to not take part at all. You may refuse to answer any of the questions. If you start the study, you can stop at any time. Not participating or choosing to leave the study will not result in any penalty or loss of any benefits you would otherwise receive. You need only notify the researcher of your intent to withdraw by asking the researcher to stop the interview.

Right to withdraw from the study: You have the right to withdraw from the study at any time without penalty. The recording of your interview and any artifacts created during the interview will be destroyed if you decide to withdraw

How to withdraw from the study: There is no penalty for withdrawing from this study at any time. You may withdraw by contacting the P.I. by phone or email using the contact information provided below, or you may tell the P.I. during one of the interviews that you wish to withdraw. If you would like to withdraw after the interviews have been completed, please contact the P.I., who will destroy the artifacts associated with your participation.

If you have questions about the study or need to report a study related issue please contact, contact:

Rebecca Johnson
Principal Investigator and student at the University of Alabama
Department of Educational Leadership, Policy, and Technology Studies
(205) 233-1201
RLJohnson@crimson.ua.edu

Dr. Claire Howell Major
Dissertation chair
Department of Educational Leadership, Policy, and Technology Studies
205-348-8461
cmajor@bamaed.ua.edu

If you have questions about your rights as a participant in a research study, would like to make suggestions or file complaints and concerns about the research study, please contact: Ms. Tanta Myles, the University of Alabama Research Compliance Officer at (205)-348-8461 or toll-free at 1-877-820-3066. You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach Website at http://ovpred.ua.edu/research-compliance/prco/. You may email the Office for Research Compliance at rscompliance@research.ua.edu.

Verbal Agreement to Participate—Do you agree to following? (P.I. will check these as permission is or is not granted)

- ☐ I agree to participate in the research study described above.
- ☐ I do not agree to participate in the research study described above.
- ☐ I agree to video and audio in the research study described above.
- ☐ I do not agree to video and audio in the research study described above.

____

Print Name of Research Participant

____

Signature of Investigator or other Person Obtaining Consent Date

____

Print Name of Investigator or other Person Obtaining Consent

APPENDIX C

INTERVIEW PROTOCOL

The P.I. will seek out at least two key personnel who have participated in MOOC work at each institution within the scope of the project—videographer/video editor and instructional designer/technologist/course builder.

Once the two participants are recruited, the P.I. will schedule a Zoom interview with each participant separately, to take place at a time convenient to the participant, ideally during the participant's business hours (8:00-5:00 in their local time zone). The P.I. has allotted two hours to conduct the interview.

Pre-Interview Task

Approximately 72 hours prior to the initial interview, the P.I. will email both participants a copy of the consent form and a link to a Miro board generated from the P.I.'s account. Miro is a digital collaboration tool, that provides a digital space to practice real-time, collaborative ideation. The Miro interface is a web-based digital whiteboard with tools such as digital notes, commenting, text boxes, diagramming tools, different pen colors and thicknesses, and the ability to import and edit image files. The boards can be saved and exported as a PDF or an image file. The P.I. will ask them to do two things before the first interview

With your colleague, agree which shared MOOC or learning at scale course will be the focus of your interviews. You might consider something that is illustrative of MOOC-making at your university.

On your own time, but before the first interview, open the Miro link that I have included in this email and accomplish the task described in the board. The task should take you no longer than 15 minutes.

[The following appears on the Miro board.] This task is meant to give you practice using the Miro tools before our interview. It should take you no more than 7-10 minutes to complete. Using shapes, lines, text, and the sticky note tools, please create a representation of the primary work team for the MOOC we will be talking about during the interview. Who did you work with on that MOOC?

I will let them know that I have attached a copy of the informed consent form to this email, and that we will go over this form verbally at the beginning of the first interview.

In the initial interview the P.I. will subject each study participant to the following study procedures:

Individual Semi-structured Interview (two hours)

At the date and time of the first interview, the P.I. will meet the participant in the Zoom meeting and conduct the interview. The P.I. will begin by pressing "record" in Zoom and asking the participant for permission to record the Zoom session. If consent is not obtained, the P.I. will terminate the interview. Once consent is obtained, the P.I. will initiate the interview protocol. The P.I. will first review the Informed Consent form with the subject. The P.I. will ask for verbal consent to participate in this interview.

The P.I. will ask the subject questions from the interview protocol and collect data on the subject's answers. For those questions having to do with how a MOOC is developed at the university in question, the P.I. will ask participants to quickly represent what their work in MOOC design and development looks like using the tools within Miro. The representation is *meant to be a quick sketch, not an accurate representation. Participants will be given five minutes to create their sketch. The sketch will then serve as the focus of questions and probes to learn more about the participant's work on the MOOC and about roles, tasks, tools, and personnel. A semi-structured interview allows the P.I. to alter the order of questions or omit some questions based on the participant's previous answers or the applicability of the question to the respondent.*

Once the P.I. has completed the interview, the P.I. will stop the Zoom recording and shut off the digital audio recording device. The P.I. will export PDF images of the work in Miro to a secure cloud storage space. The P.I. will send the respondent a follow-up email thanking the participant for their participation.

Interview Questions--Interview 1

Videographer or Instructional Designer and P.I.

1. What is your title and where do you work within the university?
2. Can you provide me a brief overview of your academic and professional background?
3. Where do MOOC ideas come from at your institution? How does your institution determine which MOOCs will be created/offered?
4. What is your university hoping to achieve with MOOCs?

The P.I. will ask the participant to open the Miro board on their computer. The P.I. will then screen share the Miro board within Zoom so that work on the Miro board will be recorded.

5. Think about the MOOC that you and your colleague selected to be the focus of these interviews. Please take five minutes to give me a high-level representation of your work on that MOOC, using circles, the squares, and the text tool, or any of the tools within Miro.

After the participant spends 5-7 minutes on the description, ask follow-up questions as the participant edits and revises the depiction.

6. For those team members you included in your Miro warm-up activity, where do they appear in your map?
7. Are there other important personnel/roles that you did not show in your course team and have not mentioned yet? Where did they appear?
8. Tell me about the resources you had to do your work on that course. (What tools? What personnel? What space?)
9. Does your work follow a particular process?
10. How did you know, in your work on that MOOC, when it was time for your work to move to the next stage?

I've just shared a document with you in Zoom. It is an edX document that describes course team roles.

11. Can you take a look at the document and tell me which role or roles you had in the course you described for me?
12. Tell me the story of a good course. What made it "good"?
13. Tell me the story of a bad course. What made it "bad"?
14. Think about the depiction of MOOC making you made here on Miro. How would that change to depict either the good or bad course you described?
15. Think about that list of roles from edX. How does your role change depending on the course you work on? What about in the good and bad courses? How did your role(s) change? Remain the same?
16. What about your resources? Do they change from course to course?
17. What experiences and expertise have been particularly helpful in your role?
18. As you think back on what we've discussed today, what haven't I asked you? What is important that you haven't shown on your course map?

General prompts for the first interview:

- What happened next?
- Can you give me an example?
- When did the instructor [or the videographer, ID, or other course personnel] get involved?
- When did the videographer [or the instructional technologist/course builder] get involved?
- Where did you appear in this process?
- If you don't know much about a part of the process or a role, just put a question mark there.

The Miro board will be saved and used as a focus in the next interview with both participants from the university MOOC making team.

Follow-up Joint Semi-Structured Interview (60 minutes)

After initial examination of the individual interview transcripts, the P.I. will contact the two course development personnel to schedule a joint interview. The P.I. will use the questions shown below to ask them to fill in missing details and provide clarification where needed. This interview is also an opportunity to clarify understanding of the MOOC making at that institution, and probe particular themes. To request a joint follow-up interview, the P.I. will do the following:

The P.I. will contact the two participants by e-mail to schedule a follow-up Zoom interview at a time convenient to both participants. The interview will occur in Zoom, during the business hours of the participants' time zone. The P.I. has allotted 60 minutes for the follow-up interview.

At the date and time of the follow-up interview, the P.I. will meet the participants in a Zoom meeting room generated from the P.I.'s account. The P.I. will begin by pressing the "Record" button and asking the participant for permission to record the Zoom session. Once consent is obtained the P.I. will initiate the interview. If consent is not obtained, the P.I. will terminate the interview. The P.I. will remind participants that they may withdraw at any time and the P.I. will stop the interview.

At the beginning of the interview, the P.I. will send a link to a new Miro board through the chat in Zoom. This Miro board will have been created prior to the second interview and contain the representations of work created by each interview participant. During the follow-up interview, the P.I. will ask the participants questions from the protocol below in order to clarify points from the initial interview or to elicit elaboration on previous interview questions from the Interview 1 Protocol. The P.I. may also ask questions from the Interview 1 Protocol that may *have been omitted during the first interview. Once the P.I. has finished collecting data, the P.I. will end the interview by ending the Zoom recording.*

Interview Questions for Interview 2

Videographer AND the instructional designer or technologist or course builder AND the P.I.

The P.I. will discuss the goal of this interview, which is to jointly create a representation of MOOC work, using their individual representations of their common course as the subject. The P.I. will have copied both individual representations to this shared Miro board. The P.I. will bring up the individual representations and ask each participant to provide an overview of their depiction to the other participant. Participants can then decide whether they will synthesize their two maps into one representation, or whether they will start fresh with a new map. After they have created a common representation, the P.I. will use the following, or similar, questions to elicit shared understanding of the learning at scale course design and development experience.

1. [ID] Can you tell us a bit about your representation?
2. [Vid] Can you tell us a bit about your representation?
3. Now, I'd like you to work together to create a representation that encompasses both workflows. You might consider whether to combine these workflows, elaborate on one of them, or create an entirely new representation.
4. Can you tell me what stages are missing from this new representation?
5. Can you tell me about how you coordinate your efforts on this MOOC?
6. Tell me about a time where efforts weren't coordinated. What happened and how did you fix this?
7. Are there any roles missing from this joint representation?
8. Are there any tasks missing?
9. How similar was this MOOC to others that you have worked on?
10. How is this MOOC different?
11. Is there anything else you think I should know about MOOC work or how you've represented this MOOC?

The jointly created representation of MOOC making will be exported as a PDF file.

APPENDIX D

IRB APPROVAL

THE UNIVERSITY OF ALABAMA | Office of the Vice President for Research & Economic Development
Office for Research Compliance

August 11, 2020

Rebecca Johnson
Department of ELPTS
College of Education
Box 870302

Re: IRB # 20-07-3715: "Making MOOCs: Identifying Primary Work Systems in the Creation and Delivery of Learning at Scale"

Dear Ms. Johnson,

The University of Alabama Institutional Review Board has granted approval for your proposed research. Your application has been given exempt approval according to 45 CFR part 46. Approval has been given under exempt review category 2(iii) as outlined below:

(2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if: (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

The approval for your application will lapse on August 10, 2021. If your research will continue beyond this date, please submit the annual report to the IRB as required by University policy before the lapse. Please note, any modifications made in research design, methodology, or procedures must be submitted to and approved by the IRB before implementation. Please submit a final report form when the study is complete.

Please use reproductions of the IRB-approved informed consent form to obtain consent from your participants.

Sincerely,

[redacted]

Carpantato T. Myles, MSM, CIM, CIP
Director & Research Compliance Officer

cc: Dr. Claire Major

Jessup Building | Box 870127 | Tuscaloosa, AL 35487-0127
205-348-8461 | Fax 205-348-7189 | Toll Free 1-877-820-3066