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Editors and Editorial Board

Editor's Preface

Kathleen J. Tate, Ph.D.

Before I present the 2020/2021 issue of the *Journal of Online Learning Research and Practice*, I would like to introduce the new Associate Editor Dr. Todd Cherner.

Dr. Cherner's Biography

Todd Cherner, Ph.D., is the Director of the Master of Arts in Educational Innovation, Technology, and Entrepreneurship program at The University of North Carolina (UNC) at Chapel Hill and has nearly 20 years of experience as a teacher, teacher educator, and researcher. After graduating from the University of Central Florida with bachelor's degree in English language arts education, Dr. Cherner began his career as a 10th grade English teacher. He later earned a Master of Education in Secondary Education from Clemson University and a doctorate in Teacher Education from The University of Tennessee, Knoxville. Todd then taught at Coastal Carolina University and Portland State University. At Portland State University, he transitioned from English education to instructional technology and was appointed to the Teacher Standards and Practices Commission by Governor Brown.

Dr. Cherner is an innovator within the educational technology space, as he launched App Ed Review (www.appedreview.com), a startup that combines research-based practices to evaluate educational products and provide instructional ideas for using those products in the classroom. His passion is to use research for improving the quality of education provided to students at all levels, and his research addresses equity issues in the use of technology for teaching and learning along with developing strategies to support students' digital literacy skills. Dr. Cherner will become more active with journal processes and promotion during his two-year appointment.

This Issue

Within this issue, you will find book and media reviews, perspectives from the field, and a long-awaited historical piece about distance and online education. There is a theme of evolving applications in online education with a thread of approaches, tools, and frameworks for teaching, assessing, selecting digital tools, and migrating learning management systems.

Drs. Betts, Delaney, Galoyan, and Lynch present a historical review of the literature, focusing on the 1700s to 2021. They address the evolution of instructional design and events such as COVID-19 that led to noteworthy pivots in teach-

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ing. Due to the extensive length, it is taking the place of the two to three pieces typically included in the Articles section of the journal.

In the From the Field section, Dr. Jill Drake, Associate Vice President for Academic Affairs and Professor in the College of Education at the University of West Georgia is featured in *3 Questions for an Online Learning Leader*. Dr. Drake makes recommendations for ensuring that course assessments meet the various needs of online, diverse undergraduate and graduate students; shares perspectives about digital tools and strategies that may help college students who struggle with math instruction primarily offered online; and discusses technology considerations for teacher education programs.

Dr. Norman Rose's book review of CommLab India's (2019) *eLearning Design and the Right Brain* of provides an overview of the book's premise, structure, and content. Dr. Rose emphasizes the book's focus on the shift to holistic left/right brain integration with the right-brain receiving more attention when designing coursework. He describes the multiple approaches to engage learners through the author's six right-brain aptitudes.

In this issue's media review, Dr. Michael Cottam explains how Principles of the Agile Manifesto may serve as a lens through which universities plan and execute difficult and complex migration of a learning management system. He explains the importance of stakeholder input, collaboration, flexibility, and more.

This issue provides a range of practices and tools for university constituents to consider. Articles capture examples, theory, and experience from the field. As always, I hope you extract discussion points that you may share with your own students, colleagues, or supervisors to prompt new directions in discourse, research, and practice.

Enjoy!

Dr. Kathleen J. Tate,

Editor-in-Chief of *Journal of Online Learning Research and Practice*

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CommLab India. (2019). *eLearning design and the right brain*. https://elearningindustry.com/free-ebooks/elearning-design-and-the-right-brain

Historical Review of Distance and Online Education from 1700s to 2021 in the United States: Instructional Design and Pivotal Pedagogy in Higher Education

Kristen Betts, Brian Delaney, Tamara Galoyan, and William Lynch
Drexel University, USA

Abstract

In March 2020, the coronavirus disease 2019 (COVID-19) pandemic disrupted education worldwide. In the United States, the pandemic forced colleges and universities across the nation to adopt quickly emergency remote teaching and learning. The ability to pivot instruction seamlessly and effectively across learning formats (e.g., face-to-face, hybrid, online) while supporting student engagement, learning, and completion in an authentic and high-quality manner challenged higher education leaders. This historical review of the literature examines distance and online education from the 1700s to 2021 to identify how external and internal pressures and opportunities have impacted and influenced the evolution of educational formats pre-COVID-19, and how they will continue to evolve post pandemic. This historical review also explores how instructional design and pedagogy have been and continue to be influenced by technological advancements, emerging research from the Learning Sciences and Mind (psychology), Brain (neuroscience), and Education (pedagogy) science.

Keywords: online education; distance education; instructional design; pivotal pedagogy; Learning Sciences; Mind, Brain, and Education Science; historical literature review

Revisión histórica de la educación a distancia y en línea desde 1700 hasta 2021 en el Estados Unidos: diseño instruccional y pedagogía fundamental en la educación superior

Resumen

En marzo de 2020, la pandemia de la enfermedad por coronavirus 2019 (COVID-19) interrumpió la educación en todo el mundo.

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En los Estados Unidos, la pandemia obligó a los colegios y universidades de todo el país a adoptar rápidamente la enseñanza y el aprendizaje remotos de emergencia. La capacidad de hacer pivotar la instrucción de manera fluida y efectiva a través de múltiples modalidades (por ejemplo, cara a cara, formatos híbridos, en línea) mientras se apoya la participación, el aprendizaje y la finalización de los estudiantes de una manera auténtica y de alta calidad se convirtió en un tema central para los líderes de la educación superior. Esta revisión histórica de la literatura examina la educación a distancia y en línea desde el siglo XVIII hasta el 2021 para identificar cómo las presiones y oportunidades externas e internas impactaron e influyeron en la evolución de los formatos educativos anteriores al COVID-19, y cómo continuarán evolucionando después de la pandemia. Esta revisión histórica también explora cómo el diseño instruccional y la pedagogía han sido y continúan siendo influenciados por los avances tecnológicos, la investigación emergente de las ciencias del aprendizaje y la ciencia de la mente (psicología), el cerebro (neurociencia) y la educación (pedagogía).

Palabras clave: educación en línea; educación a distancia; diseño instruccional; pedagogía fundamental; ciencias del aprendizaje; ciencia de la mente, el cerebro y la educación; revisión de literatura histórica

关于1700-2021年间美国远程及线上教育的历史述评：高等教育中的教学设计和枢轴型教学

摘要

2020年3月，2019冠状病毒病（COVID-19）大流行打乱了全球教育。在美国，所有大学被迫迅速采纳紧急远程教育和学习。在多种教育模式（例如面对面、网络、或混合型）之间无缝并有效地转换教学，同时以真实和高质量的方式支持学生参与、学习和完成课业，这种能力是高等教育领导者面对的一个关键问题。文献历史述评分析了1700-2021年间的远程及线上教育，以期识别内外部压力和机遇如何影响了COVID-19来临前教育形式的演变，以及这些教育形式在大流行后期将如何发展。该历史述评还将探究教学设计及教学法曾如何以及还将继续受到下列因素的影响：技术进步、学习科学（learning sciences）得出的新型研究、以及心智（心理学）、大脑（神经科学）、和教育（教学法）科学。

关键词：线上教育，远程教育，教学设计，枢轴型教学（pivotal pedagogy），学习科学，心智、大脑和教育科学，历史文献述评

The higher education landscape in the United States is constantly evolving. Demographic shifts in enrollments over the last decade have made the increasing non-traditional student population today's traditional population (Anderson, 2016; National Center for Education Statistics, 2015; Westervelt, 2016). The iconic image of 18-22-year-old undergraduate students walking across campus from their dormitory or the library to attend a class in an ivy-covered red-brick building is no longer the norm. The most recent data reported by the National Center for Education Statistics (NCES) (2015) revealed that 74% of undergraduate students had at least one or more non-traditional student characteristics (e.g., delayed postsecondary enrollment, part-time enrollment, financial independence, employed full-time while enrolled, have one or more dependents, is a single parent, did not receive a traditional high school diploma).

Projections indicate this national shift to an increasingly non-traditional student population in higher education is not slowing down. According to the Projections of Education Statistics to 2027, enrollments of students 25 to 34 years old increased 43% between 2000 and 2016, and are projected remain approximately the same through 2027 (NCES, 2019, p. 25). The number of students 35 years and older increased 8% between 2000 and 2016, and are expected to increase by 3% between 2016 and 2027 (NCES, 2019, p. 25). To meet and support the financial, temporal, family, and geographical access needs of this increasingly diverse student population, institutions of higher education (IHE) continue to expand their courses and program offerings to include online education.

Distance education has its roots in correspondence education, which dates back to the 18th century, and continued to expand enrollment in the 19th century. Pedagogical approaches for correspondence education engaged teachers and students in communication through the postal service (Kentor, 2015). Distance education then expanded to radio delivery, televised broadcasts, and telephone in the 20th century. While radio provided one-way communication (Yüzer & Kurubacak, 2004), two-way interactive television (Fulford & Sakaguchi, 2001) and the use of telephone connections (O'Leary & Quinlan, 2007) enabled live synchronous interaction. Distance education programs used synchronous interactive methods of delivery statewide, regionally, and nationally as they continued to evolve.

The pedagogical dynamics of teaching and learning changed in the latter part of the 20th century with the advent of the Internet and through supplemental forms of interaction, including the "use of electronic mail (email), bulletin board systems (BBS), computer mediated conferencing (CMC), audiographics or video teleconferencing, remote database access, and most recently, the World Wide Web (WWW)" (Kearsley et al., 1995, p. 37). In the late 1990s and 2000s, the Internet accommodated additional methods of two-way communication. With the progressive and strategic use of the Internet in the late 1990s, educational institutions increasingly offered more courses and programs online. The 21st century brought forth even further transformational change. Between 2001 and 2019, institutions used the Internet and advancements in educational technology to expand pedagogical approaches: new opportunities to present content, engage students synchronously and asynchronously, integrate dynamic forms of assessment, and provide feedback through different modalities.

In March 2020, the coronavirus disease 2019 (COVID-19) pandemic disrupted education worldwide. By April 1, 2020, the United Nations Educational, Scientific and Cultural Organization (UNESCO) reported that COVID-19 had affected approximately 1.6 billion students through 195 countrywide closures (UNESCO, 2020). In the United States, the pandemic forced colleges and universities across the nation to pivot quickly to online environments. Educational scholars differentiated this type of learning as emergency remote teaching and learning to distinguish it from online learning (Hodges et al., 2020; Milman, 2020). Online learning includes preparation time for developing course materials and design in adherence to best pedagogical practices within the online teaching and learning literature (Milman, 2020). Conversely, emergency remote teaching (ERT) is:

> ... a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances. It involves the use of fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated. (Hodges et al., 2020, para. 13)

The challenge for IHEs during this time was how to pivot quickly in the midst of a pandemic. Post-COVID-19, educational leaders must be prepared to navigate strategically an increasingly complex educational landscape and to meet the expanding instructional needs of a diverse student population across all learning formats (e.g., on-campus, blended/hybrid, online).

We conducted a historical review of the literature on distance and online education from the 1700s to 2021. The review also addresses how technological advancements, emerging research from the Learning Sciences and Mind (psychology), Brain (neuroscience), and Education (pedagogy) (MBE) Science,

and a worldwide pandemic influence instructional design and pedagogy.

Methodology

We employed a historical literature review methodology. The purpose of a historical literature review is to examine "research throughout a period of time, often starting with the first time an issue, concept, theory, phenomena emerged in the literature, then tracing its evolution within the scholarship of a discipline" (Baumeister & Leary, 1997, as cited by Banomyong et al., 2017, p. 3). Historical reviews may follow a chronological method, such as this historical review, to show how research has been added to the literature and to identify directions for future research.

Historical literature reviews are valuable contributions to the literature because they provide both a comprehensive perspective of a phenomenon of interest as well as illumination of that phenomenon's contextual relevance within modern constructs. Primary data sources include original and verified documents or artifacts. Secondary sources are credible artifacts, such as peer reviewed research articles, books, book chapters, observations, or interviews that document the existence and impact of the phenomenon. Booth et al. (2012) identified three components for historical reviews: they must be (a) clear; (b) valid; and (c) auditable. Historical reviews are auditable when they follow the same four steps as systematic reviews: search, appraisal, synthesis, and analysis (Booth et al., 2012; Grant & Booth, 2009). Furthermore, historical reviews may reflect searches that are more exhaustive because they are not limited to predetermined constraints such as a specific number of databases.

The purposes of a historical review are to provide historical context that shows developments across phenomena and identify directions for future research. We used the term "distance education" for the research questions since the term "online education" developed as part of the evolution of distance education. The following research questions guided this historical literature review:

1. How has distance education evolved from the 1700s to 2021 in the United States?
2. How has instructional design and pedagogy evolved in distance education?
3. How has research from the Learning Sciences and Mind, Brain, and Education Science influenced instructional design and pedagogy?
4. How has the COVID-19 pandemic affected pedagogical practices within higher education?

We began this historical literature review by searching multiple education databases for publications related to the following word search combinations: correspondence education, correspondence courses, correspondence study; distance education, distance learning; online education, online learning, online instruction;

eLearning; hybrid education, hybrid learning, hybrid instruction; blended education, blended learning, blended instruction; andragogy; pedagogy; instructional design; Learning Sciences; and Mind, Brain, and Education Science. We reviewed titles and abstracts to identify relevant publications. Of those publications, reference lists were reviewed to identify additional relevant publications and artifacts. Additionally, we searched publications from the U.S. Department of Education, accrediting agencies, and education databases for publications related to COVID-19 national emergency, emergency remote instruction, emergency remote teaching, emergency remote learning, Coronavirus Aid, Relief, and Economic Security (CARES) Act, and waiver.

This historical literature review explores four key periods: 1700-1899; 1900-1969; 1970-1989; and 1990-2021. The historical literature review focuses on (a) distance and online education in the United States; (b) instruction and instructional design; and (c) pedagogy.

Knowles (1980) defined the term pedagogy as "the art and science of teaching children" (p. 40), while andragogy is defined as "the art and science of helping adults learn" (p. 43). According to Knowles (1973), pedagogy comes from the Greek word "paid" meaning child and "agogus" meaning leader of which together—pedagogy—means the art and science of teaching children (p. 53), while andragogy comes from the Greek word "aner," meaning man (p. 54). However, after hearing from teachers in K-12 education and in colleges that the application of andragogical practices in certain situations were producing superior learning, Knowles (1980) shifted from "andragogy vs pedagogy" to "from pedagogy to andragogy:"

> I am at the point now of seeing that andragogy is simply another model of assumptions about learners to be used alongside the pedagogical model of assumptions, thereby providing two alternative models for testing out the assumptions as to their 'fit' with particular situations. (p. 43)

Picciano (2016) shared, "Since online and blended learning have become so commonplace in higher education, andragogical as well as pedagogical principles are assumed to come under the umbrella of pedagogy" (p. 5). In this historical review, the term pedagogy refers to the science and art of teaching.

This review follows a chronological method to explore distance education using seminal publications from 1920 to 2021 to provide an overview of distance education in the United States, the emergence of the Learning Sciences and MBE Science, and emergency remote teaching during the COVID-19 pandemic. Therefore, this historical review begins with distance education in the 1700s and concludes with looking at online education in 2021 and beyond.

From Correspondence Education to Online Education in the United States

We begin the first part of the historical review with correspondence education and then explore the evolution of distance education through advancements in technology including radio, television, telephone, computer assisted instruction, satellite, personal computers, the World Wide Web, and the Internet. We conclude with the emergence of learning management systems, mobile devices, social media, and applications.

Correspondence Education

Distance education dates back to correspondence study, which allowed learners to engage in education through postal mail (Bower & Hardy, 2004). The earliest record of correspondence education in the United States is March 20, 1728, when Caleb Phillips placed an ad in the *Boston Gazette* in Massachusetts to send weekly lessons to students who wanted to learn shorthand (Bower & Hardy, 2004). Communication between the instructor and the student included written assignments that supported teaching and learning.

During the 19th century, correspondence study expanded both in the United States and worldwide. In 1840, Sir Isaac Pitman offered correspondence courses for shorthand in the United Kingdom; students mailed in transcribed Bible selections on postcards and received feedback from him (Bower & Hardy, 2004). Pitman's work continued, and Sir Isaac Pitman's Correspondence Colleges later formed to continue his work (Schlosser et al., 2009; Bower & Hardy, 2004). The University of London became the "first University to offer truly distance teaching from 1858, when the residential requirements previously in place for Universities were abandoned" (Gaskell, 2018, p. 85).

In the United States in 1873, Anna Eliot Ticknor founded the Society to Encourage Studies at Home in Boston, Massachusetts (Kentor, 2015). Over a 24-year period, the Society to Encourage Studies at Home, based on the correspondence school model, provided instruction to thousands of members, primarily women (Casey, 2008, p. 46). Toward the mid-1870s, correspondence education for adults emerged during the Chautauqua Movement (Kentor, 2015, p. 23). In 1874, Lewis Miller and John Heyl Vincent started a summer training program that evolved, by 1878, into the Chautauqua Literary and Scientific Circle (CLSC) in Chautauqua, New York. CLSC was the first adult education program and also the first major correspondence school in the United States (Casey, 2008; Kentor, 2015, p. 23; Scott, 2005). CLSC became Chautauqua University in 1883, offering extension courses, correspondence courses, and summer terms (Kentor, 2015).

In 1891, the International Correspondence Schools (ICS) founded in Scranton, Pennsylvania, enrolled over 190,000 students in coal mining correspondence courses within the first eight years (Watkinson, 1996). In 1892, the

University of Chicago Extension division was created, the "first US school to organize correspondence courses at the college level, offering full credit for successful completion and using the same rigorous standards as in UChicago classrooms" (University of Chicago, n.d., para. 3). In 1892, the term "distance education" appeared for the first time in the United States in a pamphlet by the University of Wisconsin-Madison (Wei & Yan, 2014). Similarly to the University of Wisconsin-Madison, other land grant institutions such as Penn State University in 1892 (Dawson, 2017) and University of Nebraska in 1909 (Frolik & Graham, 1987) offered correspondence education to increase educational outreach to students, including farmers in rural areas.

Radio, Television, and Telephone

Mass media advancements transformed distance education in the United States. The radio expanded the footprint of distance education in the 1920s. According to Ferenga and Ness (2015), "The first educational radio licenses were granted in 1922 to the University of Salt Lake City, the University of Wisconsin, and the University of Minnesota" (p. 637). Penn State College offered the nation's first broadcast courses through the radio in 1922 (Ferenga & Ness, 2015). A total of 202 colleges, universities, and school boards received educational radio licenses for educational broadcasting between 1922 and 1946 (Ferenga & Ness, 2015).

In the 1930s, television stations joined the evolution of distance education. The University of Iowa began using television for education in 1934 (Syed, 2010). In the 1950s, Western Reserve University was the first IHE in the United States to offer a regular series of television courses (Bower & Hardy, 2004; Rickman & Wiedmaier, 2011; Simonson et al., 2000). In 1953, the University of Houston started offering educational programming to its students and the community through its non-commercial television station KUHT-TV (Fischer, 2013; Purdy, 1980).

Educational programming through radio and television continued to grow through the 1960s. By the mid-1960s, the University of Wisconsin expanded its educational outreach through the telephone. In 1965, the University of Wisconsin Extension developed the Educational Telephone Network (ETN) and Subsidiary Communications Association (SCA) as communication media to support instruction (Parker, 1974). Using a private four-wire telephone network, ETN provided "an instant and personalized educational channel for more than 100 Wisconsin communities with 173 listening locations" (Parker, 1974, p. 34). Toward the end of decade, Stanford University launched the Stanford Instructional Television Network in 1968 and was "broadcasting 12 graduate engineering courses on two television microwave channels to companies within a 50-mile radius of Hoover Tower" (Levy, 2005, para. 3).

Computer Assisted Instruction

While the 1960s represented a time of educational expansion in higher edu-

cation through radio, television, and telephone, researchers pioneered and conducted work on computer-based education, later known as the "Internet." The University of Illinois launched the first generalized computer assisted instruction program, Programmed Logic for Automatic Teaching Operations (PLATO), in 1960 (Bari et al., 2018). PLATO was a pioneering platform for computer-based learning. Features such as PLATO Notes included one of the first online messaging boards, which supported online community (Mitrakos, 2020). During this same time, research led by J.C.R. Lickliderof at the Massachusetts Institute of Technology (MIT) on his "Galatic Network" concept provided the foundation for what would later become the Internet (Leiner et al., 2009). Lickliderof worked with researchers and teams at MIT, the Defense Advanced Research Projects Agency (DARPA), and RAND Corporation to develop a computer network. According to Leiner et al. (2009), "By the end of 1969, four host computers were connected together into the initial ARPANET, and the budding Internet was off the ground" (p. 24).

Satellite Technology and Personal Computers

During the 1970s and 1980s, satellite technology and personal computers transcended boundaries within and across education, supporting both asynchronous and synchronous instruction. This decade included experimentation with transmitting educational programs via satellite by colleges and universities. Coastline Community College was the first college to license and offer fully televised college courses in 1970 without a physical campus (Casey, 2008). The University of Alaska and the University of Hawaii were among the first educational institutions to use satellite technology for delivering educational programs with a focus on rural areas and underserved populations (Gedney et al., 2000). Statewide satellite-based education, exemplified by those in Maine, Virginia, and Alaska, paralleled university- driven efforts. These initiatives were supplemented in 1981 by Public Broadcasting Service (PBS) Adult Learning Services, which brokered courses offered by local colleges and universities (Walther, 1991). Students increasingly received instructional materials disseminated through audio and video cassette players (VCRs) through the 1970s and 1980s due to convenience and affordability (Moore & Kearsley, 2012). In 1985, the National Technological University (NTU) began offering online degree courses via satellite, with all of the instruction distributed through real-time broadcasting or video (Casey, 2008).

In 1987, Glenn R. Jones launched the cable television network Mind Extension University (ME/U, later Knowledge TV), which enabled 30,000 students to take courses from more than 30 colleges and universities via satellite and pre-recorded video, plus pre-internet communications networks (Colorado Business Hall of Fame, 2013). Glenn R. Jones' efforts evolved into Knowledge TV, and then Jones International University (JIU), which in 1995 claimed to be the first university anywhere to func-

tion completely online. By 1999, JIU became the first fully online university member of the North Central Association in the U.S. accredited by the Higher Learning Commission (Chaung, 2015; Colorado Business Hall of Fame, 2013).

As satellite technology continued to expand educational opportunities nationally, personal computers came onto the market. In 1974, Dr. Henry Edward Roberts developed the MITS Altair 8800, which was the first personal computer using an Intel 8800 microprocessor (Ceruzzi, 1998; Miller, 2014). In January 1975, the Altair 8800 microcomputer appeared on the cover of *Popular Electronics* with the heading, "World's First Microcomputer Kit to Rival Commercial Models" (National Museum of American History, n.d., para. 1). This publication inspired many developers who went on to be pioneers in the personal computing revolution, including Bill Gates and Paul Allen, who "[wrote] a version of the new BASIC programming language for the Altair," which MITS agreed to distribute and market under the name Altair BASIC (Bellis, 2020). This deal inspired the founding of Micro-Soft, now known as Microsoft, in 1975 (Bellis, 2020). Inspired by Altair 8800, Steve Wozniak and Steven Jobs founded Apple in 1976. They began by "building Apple I in Job's garage and sold them without a monitor, keyboard, or casing (which they decided to add on in 1997)" (Terrell, 2008, para. 1). The contributions of Roberts, Gates, Allen, Jobs, and Wozniak greatly influenced and expanded distance education in ways that are present worldwide today.

American Center for the Study of Distance Education and Terminology

Distance education in the United States received increased national attention in the mid-1980s. In 1987, the *American Journal of Distance Education*, the first scholarly journal in distance education, debuted. In 1988, Dr. Michael Moore established the American Center for the Study of Distance Education (ACSDE) at The Pennsylvania State University (Diehl, 2019). That same year, ACSDE hosted the first Distance Education Symposium focused on research in distance education (Diehl, 2019). In 1991, ASCDE launched the Distance Education Online Symposium listserv (DEOS-L), "one of the first online databases of information, ideas, and discussions" (Black, 2013, p. 15), reaching 4,000 participants in 60 countries by 1996.

During the mid-1980s, the term "online education" became more prominent within academic literature. In 1986, Dr. Stuart Umpleby published *On-line Educational Techniques*. Between 1987 and 1990, Dr. Linda Harasim published one article and two chapters about online learning, which brought increased attention to this term. Harasim's publications included the article, "Teaching and Learning Online: Issues in Designing Computer-Mediated Graduate Courses" (1987) and a book chapter titled "Online Education: A New Domain" (1989). Harasim then published "Online Education: An Environment for Collaboration and Intellectual Amplification" (1990) as a chapter in *Online*

Education: Perspectives on a New Environment, which she edited.

World Wide Web and Internet

In 1989, Sir Tim Berners-Lee invented the World Wide Web, an Internet-based hypermedia initiative designed for global information sharing, while working at CERN, the European Organization for Nuclear Research (PEW Research Center, 2014; World Wide Web Foundation, n.d.). In 1990, Berners-Lee wrote the first web browser and server. "By the end of 1990, the first web page was served on the open internet, and in 1991, people outside of CERN were invited to join this new web community" (World Wide Web Foundation, n.d., para. 9). In 1993, the graphical browser Mosaic accelerated the widespread use of the World Wide Web and by January 1998, "almost 30 million host computers were connected to the Internet (Zakon, 1998), and more than 58 million users in the United States and Canada were estimated to be online (Neilsen Media Research, 1997)" (as cited in National Research Council 1999b, p. 181). The 1990s to 2000 represented an era of expansive growth within higher education and online education as the World Wide Web and the Internet became publicly accessible.

Online education continued to expand in the mid-1990s. During this time period, the University of Phoenix extended its online course offerings reaching enrollments as high as 470,000 in 2010, but dropping to 103,975 in Fall 2017 (NCES, 2019). In 1995, New Hampshire College, now known as Southern New Hampshire University, launched its Internet-based distance learning programs, now "SNHU Online" (SNHU, 2021a). Two decades later, SNHU (2021b) reported online enrollments of over 135,000 students. Nineteen U.S. governors founded Western Governors University (WGU) in 1997 to expand access to higher education through the Internet (WGU, 2017). WGU reported that in 2017, the institution enrolled "more than 82,000 students and 87,000 graduates in all 50 states, the District of Columbia, and military bases overseas" (WGU, 2017, para. 2). University of Maryland University College (UMUC), now University of Maryland University Global Campus (UMGC), began offering its "web-based" courses in 1997 (UMGC, n.d.) and in 2016 reported "more than 80,000 students at 140+ classroom and service locations worldwide and online" (para. 8).

Institutions such as The George Washington University, which had been offering distance education degree programs since the mid-1980s, expanded offerings to include fully online formats (Gibbs, 1998; Kearsley et al., 1995). Drexel University (Fry, 2020), New York University (James, 2005), and other traditional universities began developing and offering degree programs fully online. The flurry of interest in online education spawned extensive development efforts among several universities that subsequently failed.

Learning Management Systems

During the latter part of the 1990s, learning management system (LMS) platforms became increasingly present

within higher education (Zapalska & Patel, 2002) and greatly expanded the ability of many organizations to provide multimedia-based programming without having to build their own internet-based delivery systems. WebCT, developed by the University of British Columbia, launched in 1996. Blackboard, founded in 1997, acquired WebCT in 2005 (Empson, 2012). Since the early 2000s, LMS platforms have provided a foundational component of online education for IHEs and K-12 education, with extended LMS platform choices including, but not limited to, Canvas, Desire2Learn, Moodle, and Schoology.

Emerging Terminology and U.S. Department of Education Definitions

During the late 1990s to 2010, new terminology accompanied the growth of distance education. Dr. Badrul Khan first coined and popularized the phrase "web-based instruction" in his 1997 book *Web-Based Instruction* (Corbeil & Corbeil, 2015). Elliot Masie, founder of The MASIE Center, first professionally referenced "e-learning" in the 1999 special report *The 'e' in e-learning Stands for 'E'xperience* (Masie, n.d.; Masie, 1999).

On October 27, 2009, the U.S. Department of Education provided definitions for distance education and correspondence education as part of the Institutional Eligibility Under the Higher Education Act of 1965, as Amended, and the Secretary's Recognition of Accrediting Agencies; Final Rule (U.S. Department of Education, 2009). These definitions remained essentially the same between 2009 and 2020 (see Tables 1 and 2).

According to the Federal Student Aid Handbook AY 2019-20 (2019), "If a school offers more than 50% of its courses by correspondence or if 50% or more of its students are enrolled in its correspondence courses, the school loses its eligibility to participate in the FSA programs" (p. 37). It is important to understand the differences between the definitions for distance education and correspondence education, since classifications affect Title IV eligibility and funding.

In 2020, the Office of Postsecondary Education put forth a proposal "to amend the general, establishing eligibility, maintaining eligibility, and losing eligibility sections of the Institutional Eligibility regulations issued under the Higher Education Act of 1965, as amended (HEA), related to distance education and innovation" (U.S. Department of Education, 2020, para. 3). The proposal intended to "reduce barriers to innovation in ways in which institutions deliver educational materials and opportunities to students" and to revise "outdated technologies" (U.S. Department of Education, 2020, para. 9). Furthermore, the proposal provided greater clarity on the requirements of "regular and substantive interaction between instructors for a course to be considered distance education and not a correspondence course" (U.S. Department of Education, 2020, para. 11). WCET (2020) provided detailed posts regarding the 2019 Negotiated Rulemaking process and proposed regulations in April 2020, with a detailed update in

Table 1. *Distance Education Definitions 2009 and 2020*

Distance Education October 27, 2009	Distance Education December 23, 2020
Distance education means education that uses one or more of the technologies listed in paragraphs (1) through (4) of this definition to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor, either synchronously or asynchronously. The technologies may include: (1) The Internet; (2) One-way and two-way transmissions through open broadcast, closed circuit, cable, microwave, broadband lines, fiber optics, satellite, or wireless communications devices; (3) Audio conferencing; or (4) Video cassettes, DVDs, and CD-ROMs, if the cassettes, DVDs, or CD-ROMs are used in a course in conjunction with any of the technologies listed in paragraphs (1) through (3) of this definition. (U.S. Department of Education, 2009, p. 55426)	Distance education means education that uses one or more of the technologies listed in paragraphs (1) through (4) to deliver instruction to students who are separated from the instructor and to support regular and substantive interaction between the students and the instructor, either synchronously or asynchronously. The technologies may include: (1) The Internet; (2) One-way and two-way transmissions through open broadcast, closed circuit, cable, microwave, broadband lines, fiber optics, satellite, or wireless communications devices; (3) Audio conferencing; or (4) Video cassettes, DVDs, and CD-ROMs, if the cassettes, DVDs, or CD-ROMs are used in a course in conjunction with any of the technologies listed in paragraphs (1) through (3). (U.S. Department of Education, 2020, para. 3)

Table 2. *Correspondence Education Definitions 2009 and 2020*

Correspondence Course October 27, 2009	Correspondence Education December 23, 2020
Correspondence course: (1) A course provided by an institution under which the institution provides instructional materials, by mail or electronic transmission, including examinations on the materials, to students who are separated from the instructor. (2) Interaction between the instructor and student is limited, is not regular and substantive, and is primarily initiated by the student. Correspondence courses are typically self-paced. (3) If a course is part correspondence and part residential training, the Secretary considers the course to be a correspondence course. (4) A correspondence course is not distance education. (U.S. Department of Education, 2009, p. 55426)	Correspondence education means: (1) Education provided through one or more courses by an institution under which the institution provides instructional materials, by mail or electronic transmission, including examinations on the materials, to students who are separated from the instructor. (2) Interaction between the instructor and the student is limited, is not regular and substantive, and is primarily initiated by the student. (3) Correspondence courses are typically self-paced. (4) Correspondence education is not distance education. (U.S. Department of Education, 2020, para. 3)

August 2020 on the "re-definitions" of distance and correspondence education (Downs, 2020). On September 2, 2020, the U.S. Department of Education published the *Federal Register* with the Distance Education and Innovations final regulations, which included revisions and provisions related to distance and correspondence education (Council for Higher Education Accreditation, 2020). The *Federal Register* defined distance education as:

(1) Education that uses one or more of the technologies listed in paragraphs (2)(i) through (iv) of this definition to deliver instruction to students who are separated from the instructor or instructors and to support regular and substantive interaction between the students and the instructor or instructors, either synchronously or asynchronously.

(2) The technologies that may be used to offer distance education include—

(i) The Internet;

(ii) One-way and two-way transmissions through open broadcast, closed circuit, cable, microwave, broadband lines, fiber optics, satellite, or wireless communications devices;

(iii) Audio conference; or

(iv) Other media used in a course in conjunction with any of the technologies listed in paragraphs (2)(i) through (iii) of this definition.

(v) For purposes of this definition, an instructor is an individual responsible for delivering course content and who meets the qualifications for instruction established by an institution's accrediting agency.

(3) For purposes of this definition, substantive interaction is engaging students in teaching, learning, and assessment, consistent with the content under discussion, and also includes at least two of the following—

(i) Providing direct instruction;

(ii) Assessing or providing feedback on a student's coursework;

(iii) Providing information or responding to questions about the content of a course or competency;

(iv) Facilitating a group discussion regarding the content of a course or competency; or

(v) Other instructional activities approved by the institution's or program's accrediting agency.

(4) An institution ensures regular interaction between a student and an instructor or instructors by, prior to the student's completion of a course or competency—

(i) Providing the opportunity for substantive interactions with the student on a predictable and scheduled

basis commensurate with the length of time and the amount of content in the course or competency; and

(ii) Monitoring the student's academic engagement and success and ensuring that an instructor is responsible for promptly and proactively engaging in substantive interaction with the student when needed on the basis of such monitoring, or upon request by the student. (U.S. Department of Education, 2020, p. 54809)

The *Federal Register* defines a correspondence course as:

(1) A course provided by an institution under which the institution provides instructional materials, by mail or electronic transmission, including examinations on the materials, to students who are separated from the instructors. Interaction between instructors and students in a correspondence course is limited, is not regular and substantive, and is primarily initiated by the student.

(2) If a course is part correspondence and part residential training, the Secretary considers the course to be a correspondence course.

(3) A correspondence course is not distance education (U.S. Department of Education, 2020, p. 54809)

The effective date for the Distance Education and Innovations final regulations is July 1, 2021 (U.S. Department of Education, 2020, p. 54742).

Mobile Devices, Social Media, and Applications

Between 2010 and 2020, advancements in technology greatly supported the increase of online education offerings in the United States. The ubiquity of computers, mobile devices (e.g., laptops, smartphones, tablets, eReaders, smart watches), and applications, coupled with wireless internet, allowed IHEs to expand online and offer blended course and program formats. This expansion also led to international collaborations and domestic consortia among most universities.

The emergence of new educational platforms continued to evolve during 2010-2020. In 2014, Google launched Google Classroom as an alternative to the LMS platform. Within just one year, Google estimated that approximately 10 million students and teachers were using it (Siu, 2016). Voice-over Internet Protocol (VoIP) services and software became more prevalent in online education, supporting student-to-instructor and student-to-student engagement. Video conferencing pioneers, such as Skype, increased competition with the emergence of Google Hangouts, Zoom, WebEx, JoinMe, GoToMeeting, WhatsApp, and more. Social media applications such as Twitter, Instagram, Mastodon, Reddit, and others provided dynamic ways for students to stay connected within and outside of the online classroom. Learning

Tools Interoperability (LTI) integration within the LMS platform supported increased student engagement and active learning through free or low-cost subscriptions for creating presentations (e.g., Haiku Deck), infographics (e.g., Piktochart, Venngage), mindmaps (e.g., Mindup), concept maps (e.g., Bubl), bulletin boards (e.g., Padlet), and more. Across higher education, technology continued to transform education and provided increasing enrollment and engagement opportunities across onsite, blended, and online settings.

Distance and online education formats have continuously evolved since their inception in the late 1700s. From correspondence courses using U.S. mail to email, IHEs have found innovative ways to engage students in learning. At no time in history has online education garnered more national attention than in 2020 and 2021, with the COVID-19 pandemic. The differentiation between emergency remote teaching and online education is critically important for IHEs and educators. Emergency remote teaching, which is offered online, is a temporary shift in instructional delivery in response to a crisis, while "effective online learning results from careful instructional design and planning, using a systematic model for design and development" (Hodges et al., 2020, para. 7). As higher education institutions prepare for post-pandemic education, it is essential for all educators to know how to pivot and effectively teach across learning formats, including online. Student success must remain central as educators navigate a shifting higher education landscape.

Distance and Online Education: Instructional Design and Pivotal Pedagogy

This second part of this historical review begins by examining distance and online education focusing on instructional design, then explores three generations of distance education pedagogy. The final part focuses on accessibility, Universal Design for Learning, and the emergence of the Learning Sciences, Mind, Brain, and Education Science, and pivotal pedagogy.

Distance Education and Instructional Design

Distance education began with correspondence education, which was a pioneering approach to instructional design within higher education. Using the postal system, educators were able to instruct students locally, regionally, and nationally through written, personalized correspondence as early as the 1700s. The goal of correspondence education was to "provide a quality education and enable any and all to expand their intellect and knowledge" according to Kentor (2015, p. 24). The instructional design of correspondence education involved two-way asynchronous interaction between the instructor and students. Arthur J. Klein, Secretary of National University Extension Association in 1920, described correspondence course design as follows:

> As ordinarily applied in correspondence study the method consists of the assignment of the instructor of carefully planned

> work, the writing out by the student of the results of his work, the correction and criticism of the instructor of the written lessons, and the suggestion and assistance upon points where the student needs special help. (Hermann, 1921, p. 7)

Hermann (1921) noted that with correspondence study "the student and the instructor reduce everything to writing" (p. 7). However, from a pedagogical perspective within this framework, Hermann noted, "Correspondence instruction adapts itself to the student—his time, his background, his conditions, his desires" (1921, p. 5). When students enrolled in a correspondence study course, they received a textbook, blank paper to use as directed, a syllabus with assignments, instructions with explanations, and problems to solve (Hermann, 1921).

The origins of instructional design are rooted in World War II, when psychologists and educators conducted research and developed training materials for the military (Dick, 1987; Reiser, 2001). Researchers including Gagné, Briggs, and Flanagan had a tremendous influence on the development of the training materials, and following the war, continued their work related to instructional design (Dick, 1987; Reiser, 2001).

B. F. Skinner and Robert Gagné conducted seminal research that is foundational to instructional design and the field of the Learning Sciences. In 1954, Skinner published "The Science of Learning and the Art of Teaching," and in 1968, he published *The Technology of Teaching* providing insights on instruction, teaching machines, and programmed materials. According to Skinner (1968), "The first step in designing instruction is to define the terminal behavior" (p. 190). While Skinner took a behaviorist approach to education, Gagné took a cognitive approach.

In 1965, Gagné published *The Conditions of Learning and Theory of Instruction,* which had an immense influence on instructional design and online learning. Gagné's conditions of learning included internal and external factors. According to Gagné and Briggs (1974), internal factors "originate from the original source of the individual's memory" (e.g., factual information from prior learning, intellectual skills from prior learning, strategies from prior practice), while external factors included guided stimulation (e.g., continuity of arranged conditions, repetition, and reinforcement) (pp. 10-11) (see Figure 1). Gagné's work built upon four basic assumptions about instructional design:

- Instructional design must be for the individual.
- Instructional design has phases that are both immediate and long-range.
- Systemically designed instruction may greatly affect individual human development.
- Knowledge of how humans learn must provide the basis for designing instruction. (Gagné & Briggs, 1974, pp. 4-5)

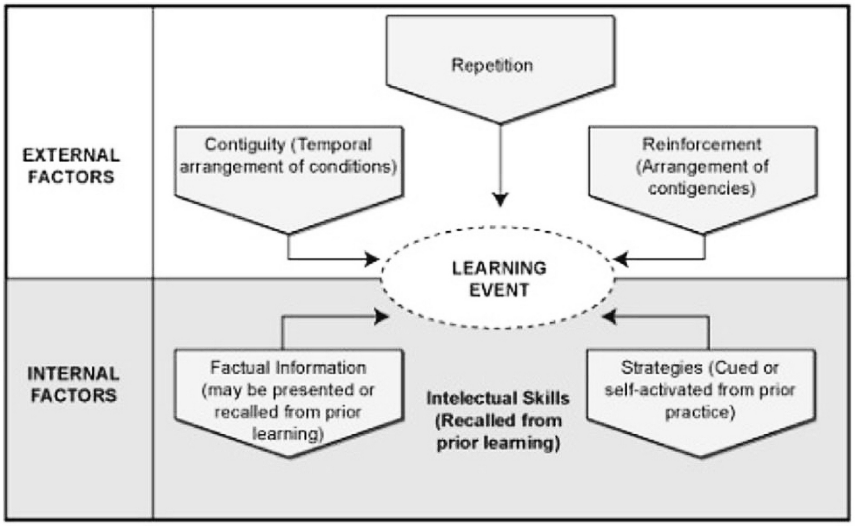

Figure 1. *External and Internal Factors Affecting the Learning Event (Open University Malaysia, 2006, p. 15;* Gagné & Briggs, 1974, p. 11).

These four assumptions are foundational in research related to Universal Design for Learning, the Learning Sciences, and MBE Science.

Significant instructional design contributions by Gagné include a set of categories of learning outcomes and Nine Events of Instruction. The five types of learning outcomes are: (a) intellectual skills; (b) verbal information; (c) cognitive strategies; (d) motor skills; and (e) attitudes (Gagné, 1972; Gagné, 1984; Gagné & Briggs, 1974). The Nine Events of Instruction are:

1. Gaining attention (reception).
2. Informing learners of the objective (expectancy).
3. Stimulating recall of prior learning (retrieval).
4. Presenting the stimulus (selective perception).
5. Providing learning guidance (semantic encoding).
6. Eliciting performance (responding).
7. Providing feedback (reinforcement).
8. Assessing performance (retrieval).
9. Enhancing retention and transfer (generalization). (Gagné, 1965; Gagné & Briggs, 1974; Gagné, 1985; Gagné, Briggs, & Wagner, 1992)

Gagné's processes of learning and instruction and principles of instructional design continue to inform course and program development across all modalities of educational delivery, including onsite and distance education.

Gagné's processes inspired the development of additional instructional design models now prominent in dis-

tance education, including the Dick & Carey Systems Model of Instructional Design, designed by Walter Dick and Lou Carey, published in *The Systematic Design of Instruction* in 1978. The Dick and Carey model, influenced by Gagné's processes of learning, included 10 instructional design elements:

1. Determine instructional goal.
2. Analyze instructional goal.
3. Analyze learners and contexts.
4. Write performance objectives.
5. Develop assessment instruments.
6. Develop instructional strategy.
7. Develop and select instruction.
8. Design and conduct formative evaluation.
9. Revise instruction.
10. Perform summative evaluation. (Chen, 2011, p. 85)

Additionally, M. David Merrill, greatly influenced by Gagné, developed the First Principles of Instruction. Learning is promoted when:

1. Learners are engaged in solving real-world problems.
2. Existing knowledge [and skill] is activated as a foundation for new knowledge.
3. New knowledge is demonstrated to the learner.
4. New knowledge is applied by the learner.
5. New knowledge is integrated into the learner's world. (Merrill, 2002, pp. 44-45)

Additional instructional design frameworks and approaches that build upon and expand prior models include the Analysis, Design, Development, Implement, and Evaluate (ADDIE) model, Successive Approximation Model (SAM), Four-Component Instructional Design (4C/ID) model, and Learning Experience design (LX). Florida State University developed the ADDIE Model (Budoya et al., 2019; IGI Global, n.d.), which includes a five-stage design process (e.g., analysis, design, development, implementation, and evaluation). SAM, developed by Michael Allen, includes three phases: preparation, iterative design, and iterative development (Allen & Sites, 2012; Jung, 2019). SAM is a contemporary alternative to ADDIE, applicable to a variety of learning environments. The Four-Component Instructional Design (4C/ID) model, developed by van Merriënboer, includes four components: (a) learning tasks, (b) supportive information, (c) procedural information, and (d) part-task practice (van Merriënboer, 2012, 2019). LX design takes a human-centered approach to achieving desired learning outcomes by creating learning experiences for more diverse contexts from course environments to real-world settings (Ahn, 2019; LXD.org, n.d.).

Instructional design models continue to evolve and emerge. Need, technology, crisis, learning theory, learners, educators, and research influence instructional design trends. Table 3 includes an overview of prescriptive in-

structional design models that "provide guidelines or frameworks to organize and structure the process of creating instructional activities" (Culatta & Kearsley, n.d., para. 1).

Table 3. *Instructional Design Models, Culatta and Kearsley, InstructionalDesign.org*

4C-ID Model (Jeroen van Merriënboer)	Gerlach-Ely Model, Hannafin-Peck Model
ADDIE Model	Goal-based scenarios
Algo-Heuristic Theory (Lev Landa)	Instructional Systems Design ISD
ARCS (John Keller)	Integrative Learning Design Framework for Online Learning (Debbaugh)
ASSURE (Heinich, Molenda, Russel & Smaldino)	Iterative Design
Backward Design (Wiggins & McTighe)	Spiral Model (Boehm)
Cognitive Apprenticeship (Edmondson)	Rapid Prototyping (Tripp & Bichelmeyer)
Component Display Theory (David Merrill)	Kemp Design Model (Morrison, Ross, and Kemp)
Conditions of Learning (Robert Gagne)	Kirk and Gustafson Model
Criterion Referenced Instruction (Robert Mager)	Organizational Elements Model (OEM) (Roger Kaufman)
Dick and Carey Elaboration Theory	Successive Approximation Model (SAM)
Discovery Learning Empathic instructional design	Transactional Distance (Michael Moore)

These instructional design models continue to inform course and program design within distance and online education.

Three Generations of Distance Education Pedagogy

Anderson and Dron (2011), authors of *Three Generations of Distance Education Pedagogy*, developed a historical overview of distance education pedagogy. The three generations of distance education pedagogy included:

- First generation, cognitive-behaviourist pedagogy;
- Second generation, social constructivist pedagogy; and
- Third generation, connectivist pedagogy. (Anderson & Dron, 2011, p. 80)

Anderson and Dron (2011) examined the three pedagogical models of distance education "using the community of inquiry (COI) model (Arbaugh,

2008; Garrison, 2009; Garrison, Archer, & Anderson, 2003) with its focus on teaching, cognitive, and social presence" (p. 80). From a historical perspective, Anderson and Dron (2011) described the predominate technologies employed for delivery with each generation: the first generation of distance education technology was postal correspondence; the second generation was mass media of television, radio, and film production; and the third generation introduced interactive technologies with "first audio, then text, video, and then web and immersive conferencing" (p. 81).

The cognitive-behaviorist pedagogical model focused on the teacher or the instructional designer, whereas response to the stimuli supported the acquisition of new behaviors or changes in behaviors (Anderson & Dron, 2011). While this first generation highly supported individualized learning, there was "an almost total absence of social presence" (p. 83). The social constructivist pedagogical model shifted, with the teacher viewed more as a guide and less as a "sage on the stage." During this second generation, social interaction became a critical component of distance education. Learners and teachers using educational content they had collaboratively created and recreated provided the basis for the connectivist pedagogical model (Anderson & Dron, 2011). During this third generation, social presence and social capital became a central part of distance education. These three generations provide a historical foundation for distance education pedagogy (see Table 4).

Table 4. *Three Generations of Distance Education Pedagogy, (Anderson & Dron, 2011, p. 92)*

Generation of distance education pedagogy	**Technology**	**Learning activities**	**Learner granularity**	**Content granularity**	**Evaluation**	**Teacher role**	**Scalability**
Cognitive – behaviourism	Mass media: Print, TV, radio, one-to-one communication	Read and watch	Individual	Fine: scripted and designed from the ground up	Recall	Content creator, sage on the stage	High
Constructivism	Conferencing (audio, video, and Web), many-to-many communication	Discuss, create, construct	Group	Medium: Scaffolded and arranged, teacher–guided	Synthesize: essays	Discussion leader, guide on the side	Low
Connectivism	Web 2.0: Social networks, aggregation & recommender systems	Explore, connect, create and evaluate	Network	Coarse: Mainly at object and person level, self–created	Artifact creation	Critical friend, co-traveler	Medium

In the chapter "Theoretical Underpinnings of Learning Design" in *Learning Design: Conceptualizing a Framework for Teaching and Learning Online*, Canole (2015) further examines learning theories and pedagogy. Building upon the work of Mayes and de Freitas (2004), Canole (2015) introduced four perspectives to learning design and suggested adding four elements:

1. Associative: where the focus is on the individual, learning as activity through structured tasks and learning through association and reinforcement.

2. Cognitive/Constructivist: where the focus is on learning through understanding and learning building upon prior knowledge; the learning is task oriented.

3. Situative: where the learning is through social interaction and dialogue, in context and as social practice.

4. Connectivist: based on learning in a networked context. (Canole, 2015, p. 69)

These pedagogical typologies apply across online and blended education and are highly relevant to the work of instructional designers, instructors, and professional development administrators.

Accessibility and Universal Design for Learning

As telecommunications and technology continued to advance, educational delivery, instructional design, pedagogy, and andragogy also advanced. To support student success across learning formats throughout the evaluation of distance education, accessibility and engagement must continue to remain central.

The Americans with Disabilities Act (ADA) was signed into law in 1990 and prohibits "discrimination and provides guarantees so that people with disabilities can fully participate in American life" in places such as schools, businesses, and stores (ADA National Network, n.d., para. 1). The ADA passed just one year before the public received access to the Internet (World Wide Web). In 1998, Congress amended the Rehabilitation Act of 1973 to require "Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities" (U.S. General Services Administration, 2020, para.1). Under Section 508 of the Rehabilitation Act of 1973, "Federal agencies must give disabled employees and members of the public access to information comparable to the access available to others (U.S. General Services Administration, 2020, para.1). A final rule updating accessibility requirements covered by Section 508 took effect in 2018 (U.S. General Services Administration, 2020, para.1).

As technology and the Internet continued to transform education and business, seminal guidelines to support accessibility and learning accompanied these advances. In 1999, the World Wide Web Consortium (W3C) published the Web Content Accessibility Guidelines, also known as "WCAG," which provided 14 guidelines for web developers who wanted to ensure accessibility for users with disabilities (Bartlo, 2015; W3C, n.d.). W3C was founded in 1994 and led by Tim Berners-Lee, inventor of the World Wide Web.

The Center for Applied Special Technology (CAST), founded in 1984, joined the Web Access Initiative of W3C in 1998 to assist in defining web

accessibility. In this same year, CAST introduced principles for Universal Design for Learning to the Council for Exceptional Children (CAST, n.d.a). In 2011, UDL principles 2.0 were released with new language and checkpoints (CAST, n.d.a). UDL principles build upon the "fields of neuroscience, the Learning Sciences, and cognitive psychology" (CAST, n.d.b, para. 2) and provide a "framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (CAST, n.d.c, para. 1). UDL principles focus on engaging the affective, recognition, and strategic brain networks through multiple means of engagement (why), recognition (what), and action and expression (how). According to Tobin and Behling (2019):

> Universal Design for Learning is a mind-set that is grounded in evidence-based practice. UDL has been tested for decades, in physical classrooms and online learning environments, at two-year colleges and research universities, across all kinds of subjects, curricula, and teaching methods. (pp. 285-286)

UDL principles may be integrated into instructional design for online course development (Shi, 2018). UDL principles may also be integrated into professional development since they support teaching and learning across all environments from face-to-face to blended and online.

Learning Sciences

The Learning Sciences is a relatively new interdisciplinary field, dating back to 1991 (Sawyer, 2008). The Learning Sciences encompass teaching and learning within formal learning settings, such as school classrooms, as well as informal learning settings, such as work, distance and online learning, clubs, and centers. According to Sawyer (2008):

> The goal of the Learning Sciences is to better understand the cognitive and social processes that result in the most effective learning, and to use this knowledge to redesign classrooms and other learning environments so that people learn more deeply and more effectively. The sciences of learning include cognitive science, educational psychology, computer science, anthropology, sociology, information sciences, neurosciences, education, design studies, instructional design, and other fields. (p. 2)

Learning scientists often employ a variety of approaches and methods to understand and enhance learning and teaching (Luckin & Cukurova, 2019; Nathan & Sawyer, 2014). Hence, the Learning Sciences provide valuable information on various interdisciplinary factors affecting learning and how learners interact with technologies across different instructional formats.

Specifically, for technology-rich online learning environments, Learning Sciences principles have valuable applications. A study conducted by

Sommerhoff et al. (2018) of 75 Learning Sciences programs across the U.S. revealed core concepts of the Learning Sciences, which included: "designing learning environments and scaffolding, using technology to support learning, cognition and metacognition" (p. 342). The aforementioned concepts also constitute an integral part of online learning (Mayer, 2019), and therefore should be leveraged to maximize the online learning and teaching process.

The Learning Sciences and instructional design are both critical components of online education. Foshay and Roschelle (2017) describe the Learning Sciences and instructional design as "cousins, not twins" (p. 65). According to Foshay and Roschelle (2017), these two applied fields share several defining characteristics:

- Both draw on cognitive learning theory.
- Both are evidence-based and design-oriented.
- To varying degrees, both fields draw from computer science and information science, design theory, systems theory, measurement theory, economics, project management, and engineering. (p. 65)

Key practices and approaches within the Learning Sciences, including Computer-Supported Collaborative Learning (CSCL), Problem-Based Learning (PBL), Project-Based Learning, Situated Learning, Design-Based Research (DBR), among others, have been applied to instructional design and instruction to better understand learning environments and their effect on individual and group learning. For instance, CSCL examines collaborative learning mediated by computers and network devices (Stahl et al., 2014). CSCL can take both synchronous and asynchronous forms and facilitate communication among learners from different physical locations around the world.

Learning Sciences has the potential of transforming online education to make teaching and learning experiences more meaningful and relevant as the higher education landscape continues to evolve. The use of the approaches and theories within the Learning Sciences as broader conceptual frameworks, combined with a variety of learning technologies, allows for customizable and personalized experiences for online instruction and instructional design.

Mind, Brain, and Education Science

MBE Science is a field within the Learning Sciences (see Figure 2) focused on the teaching-learning dynamic that intersects neuroscience, psychology, and education (Tokuhama-Espinosa, 2010; 2019). MBE Science emerged from research conducted by the Organisation for Economic Co-operation and Development (OECD). Since 1999, the OECD's Centre for Educational Research and Innovation (CERI) has been conducting research on the brain and learning (OECD, 1999). CERI's first publication in 2002, *Understanding the Brain: Toward a New Learning Science*, was followed by a second publication in 2007, *Understanding the Brain: The*

Birth of a Learning Science (OECD, para. 2). Other publications during this time also contributed to understanding how learning occurs and changes the brain. The National Research Council (1999a) published *How People Learn,* which focused on the brain, mind, experience, and school. Dr. James Zull (2002) published *The Art of Changing the Brain*, in which he focused on how educators can use knowledge about the brain to inform pedagogical practice.

Harvard University's School of Education offered the first MBE master's program in 2002, designed by Dr. Kurt Fischer (Hough, 2020). The International Mind, Brain and Education Society (IMBES) was founded in 2004 (Ferrari & McBride, 2011; Harvard University, 2007). In 2007, IMBES launched the *Mind, Brain and Education* journal (Harvard University, 2007). According to Fischer and colleagues (2007), the journal intended "to promote the integration of the diverse disciplines that investigate human learning and development" and to investigate questions such as "What are the principles for designing schools and other educational settings to optimize effective learning and healthy development?" (p. 1). In 2017, IMBES celebrated 10 years of research and publications.

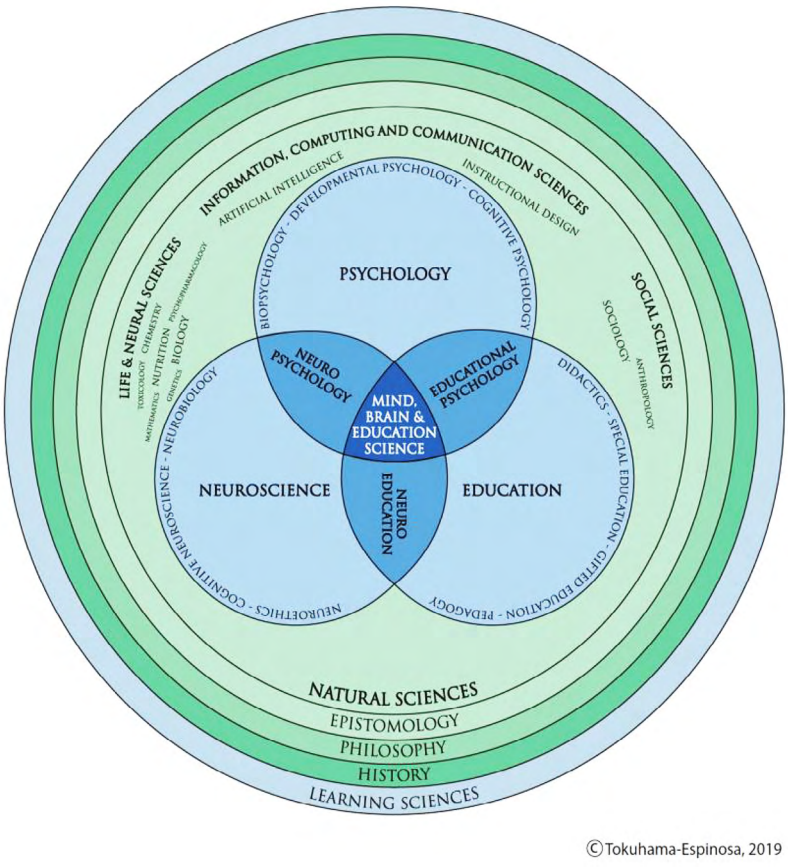

Figure 2. *Mind, Brain, and Education Science, Dr. Tracey Tokuhama-Espinosa (2019)*

MBE Science created a strong research foundation for educators requiring a "new approach to connecting research and education, with a two-way collaboration in which practitioners and researchers work together to formulate research questions and methods so that they can be connected to practice and policy" (Fischer, 2009, p. 3). The field of MBE Science continues to build upon current and emerging research to support teaching, learning, and student success across all educational formats.

MBE is a transdisciplinary field that builds upon neuroscience, psychology, and education. According to Tokuhama-Espinosa (2011), "MBE Science is concerned with studying how humans learn best in order to develop more effective teaching methods" (p. 14). Advancements in neuroscience research offer new insight about the brain and how individuals learn. For example, functional magnetic resonance imaging (fMRI) enables researchers to examine neuroplasticity and how the brain changes across lifespan (Oberman & Pascual-Leone, 2015). Functional near infrared spectroscopy (fNIR) measurements can "monitor cognitive tasks such as attention, working memory and problem solving" (Ayaz et al., 2011, p. 1). fNIR measurements may also provide new insight into the skill acquisition process relating to the quality and extent of practice of specific tasks providing biological evidence associated with learning (Shewokis et al., 2011). While cognitive and educational research inform MBE Science, current and emerging research within neuroscience provide educators with new evidenced-based strategies to support skill acquisition and transfer of learning (Galoyan & Betts, 2021).

In 2006, Tokuhama-Espinosa (2011) conducted an MBE international Delphi study. The study brought together a panel of 21 experts from seven countries across disciplines to determine what evidenced-based research from MBE should be integrated into classrooms. A decade later, Tokuhama-Espinosa (2017) conducted a second Delphi study with a panel of 41 experts from 11 countries across the Learning Sciences. Building upon Tokuhama-Espinosa's original 2006 study, the results of the 2016 Delphi study included six principles, 21 tenets, and 10 instructional guidelines (Tokuhama-Espinosa, 2017). MBE principles are considered universal. The six MBE principles included in Table 5 are foundational for teaching and learning across all learning formats.

The literature indicates that educators spend a limited amount of time learning about the human brain (Tokuhama-Espinosa, 2011). However, knowledge about the human brain is foundational to teaching and learning. MBE Science provides a transformative shift in teaching techniques since it emphasizes "how humans learn (which is the focus of brain-based learning, educational neuroscience, educational psychology, cognitive neuropsychology, and neuroscience) as well as how we teach (pedagogy)" (Tokuhama-Espinosa, 2011, p. 17). A 2019 international study conducted by the Online

Learning Consortium, which included responses from 45 countries and 48 of 50 states in the United States, revealed very high interest by faculty, instructional designers, and professional development administrators in learning about the brain and opportunities to increase awareness about neuromyths and evidence-based practices related to the brain (Betts et al., 2019).

Table 5. *Principles of Mind, Brain, and Education Science (Tokuhama-Espinosa, 2017, n.p.)*

Principles of Mind, Brain, and Education Science (2017)	
Principle 1	Human brains are as unique as human faces. While the basic structure of most human brains is the same (similar parts in similar regions), no two brains are identical. The genetic makeup unique to each person combines with life experiences (and free will) to shape neural pathways.
Principle 2	Each individual's brain is differently prepared to learn different tasks. Learning capacities are shaped by the context of the learning, prior learning experiences, personal choice, an individual's biology and genetic makeup, pre- and perinatal events, and environmental exposures.
Principle 3	New learning is influenced by prior experiences. The efficiency of the brain economizes effort and energy by ensuring that external stimuli are first decoded and compared, both passively and actively, with existing memories.
Principle 4	The brain changes constantly with experience. The brain is a complex, dynamic, and integrated system that is constantly changed by individual experiences. These changes occur at a molecular level, whether simultaneously, in parallel, or even before they are visible in behavior.
Principle 5	The brain is plastic. Neuroplasticity exists throughout the life span, though there are notable developmental differences by age.
Principle 6	There is no new learning without some form of memory and some form of attention. Most school learning requires well-functioning short, working, and long-term memory systems and conscious attention. However, procedural learning, habituation, sensitization, and even episodic memory can occur without conscious attention.

As technology continues to shape education, there are factors regarding technology, teaching, and learning for IHEs to consider. According to Battro and Fischer (2012) in *Mind, Brain, and Education in the Digital Era*:

> Thousands of people now take courses online, making use of the tools of computers and the Internet, using communication technologies that were not available only a decade ago. What happens to brain and behavior with this rapidly evolving dynamic system of teaching and learning skills? (p. 49)

Research will help educators better understand teaching and learning in a new paradigm shaped by digital technology. While the digital era may provide new challenges to traditional pedagogy, Battro and Fischer (2012) also reflected on the possibility of new technologies leading to a new kind of neurocognitive support for teaching and learning.

Advancements in technology and research provide critical insight into the human learning process. According to CAST (2018), "In the past decade, there have been unprecedented ways to examine the living brain and to better understand what happens during learning" (p. 1). The concept of neuro-variability is critical for educators, just as understanding that the brain, which is made up of billions of interconnected neurons, continues to change over one's lifetime based on experiences and interactions with the environment (CAST, 2018).

Current and emerging research from neuroscience and psychology offers new insights to our understanding of human cognitive architecture and working memory, which can inform instructional design through strategies that enhance cognitive processes such as attention, problem solving, planning, and transfer of learning (Galoyan et al., 2021). Publications related to the Learning Sciences and MBE Science continue to inform teaching and learning. Research by Immordino-Yang et al. (2018) provides critical insight on how emotions and social relationships drive learning. Darby and Lang (2019) explored how to apply Learning Science in online classrooms. McThigh and Willis (2019) encouraged educators to leverage neuroscience research about how the human brain learns to improve curriculum, instruction, and assessment. Kirschner and Neelen (2020) examined evidence-informed learning design and how to improve performance. Dehaene (2021) explores learning, neuroplasticity, and education as the main accelerator of the brain. Through transdisciplinary research, educators will continue to expand and enhance their practices to meet the diverse needs of students in higher education.

It is important to recognize the extent to which technology has transformed education. "Learning online" is now prevalent, even in face-to-face classrooms. Within on-campus courses, instructors may use technology to share sections of a TED Talk as part of lecture or bring in a guest lecturer synchronously via Zoom, Skype, or other video-conferencing applications. Students may be engaged while in class conducting research online using a laptop or mobile device. Students may be engaged in online polling or using a Learning Management System to access course content, post assignments, or complete assessments. Students working in groups, whether in or outside of class, may be communicating via text, WhatsApp, or other social media platforms as part of course assignments, as well as engaging in online discussion boards. Additionally, students may access Open Education Resources (OERs) as part of their course assignments or utilize online content from textbook providers made accessible via the cloud.

The realities of "learning online" overlap in many ways with "online learning." Therefore, it is critical for educators to understand the historical evolution of distance and online education, as well as how the pedagogical approaches have continued to evolve as technology has developed, to support student success across all learning formats.

Pivotal Pedagogy

In spring 2020, the COVID-19 pandemic highlighted the importance of pedagogical practices in online learning and the ability of faculty to pivot quickly from one learning format to another. We define pivotal pedagogy for this historical review as:

> Pedagogical practices that engage learners in educational experiences through instruction, active learning, assessment (e.g., formative, summative, etc.), and feedback building upon theory, research, and authentic contexts supporting comprehension, application, and transfer of learning seamlessly across learning formats (e.g., in-class/onsite, blended, online) in alignment with learner needs and learning outcomes.

As IHEs contemplate how to move forward beyond the pandemic, professional development opportunities may help faculty gain critical pedagogical skills that build upon the Learning Sciences and MBE Science to teach across multiple formats. Faculty must be able to pivot formats seamlessly and effectively while continuing to engage students using theory and practice to meet learning outcomes.

While many challenges exist, there are opportunities for educators to reflect on their own course designs and pedagogical practices. Knowing that engagement is a critical component to learning, educators may reconsider how they engage their students in Instructor-Student, Student-Content, and Student-Student interaction. Educators may also contemplate alternative equivalencies for Instructor-Student, Student-Content, and Student-Student interaction if they have to pivot from one instructional modality to another. Moore's (1989) research contributions on three types of interaction in distance education (Learner-Content, Learner-Instructor, and Learner-Learner) are as important today as they were 30 years ago. According to Moore (1989), "…it is vitally important that distance educators in all media do more to plan for all three kinds of interaction and use the expertise of educators and communication specialists in both traditional media-printed, broadcast, or recorded-and newer teleconference media" (p. 3). As educators move forward in historic and unprecedented times, student interaction will be critical to teaching and learning.

As IHEs plan educational delivery, it is important to differentiate emergency remote teaching and learning from online education, particularly considering the historical roots of distance education in the United States. There is also an incredible opportunity to move beyond "the new normal"

and provide educators with knowledge, skills, and experience to be able to pivot seamlessly and successfully across learning formats, and to transform the future of education in alignment with a dynamic workforce that will evolve in the wake of the pandemic.

Analysis

This historical review reveals a paradigm shift in higher education, whose student population is increasingly diverse, amidst a global pandemic. The chronological historical review shows that delivery formats, beyond in-class/onsite courses and programs, date back to the 1700s. The postal service, radio, broadcast television, satellite technology, and personal computer each played a role in distance education delivery in the pre-Internet era. Paralleling the development of online delivery formats, instructional design approaches and pedagogical models, supported through cognitive and educational research, have evolved to meet the needs of students and institutions. Accreditation agencies have adopted self-regulatory and peer-reviewed processes for developing and delivering online and blended learning experiences.

A national movement to support accessibility in the 1990s through the ADA, Section 508, and work by organizations such as W3C and CAST continue to guide educators across higher education and K-12 education. The development of the Learning Sciences and MBE Science in the early 1990s and 2000s provided new insight regarding teaching and learning from a transdisciplinary perspective. MBE principles provide an evidence-based framework that supports teaching and learning across all modalities including in-class/onsite, blended, and online. COVID-19 and the ensuing medical and social issues that unfolded during the national and global crises appear to be clear predictors of a paradigm shift evolving within education. It is essential that all educators, including instructors, instructional designers, and professional development administrators, be a part of this evolving paradigm shift. Developers of learning design systems must pivot and recognize the value of creating blended experiences and content knowledge to achieve outcomes for individual learners (see Figure 3).

It is essential to revisit the evolutionary process of distance education: born of necessity and opportunity, addressing populations with special needs, extending enrollment beyond a campus and physical classroom, and building on emerging technologies. This evolutionary development will likely continue in the future with more intentionality. It is important to understand that some technological possibilities spring from need. However, some technological possibilities drive the development of new applications to meet increasing needs. The technologies used for online education have capitalized on the communications and networking technologies of the Internet, audio and video development, computers, mobile communications, distributed data storage and management, and learning management systems. Simultaneously, these technologies and the online education

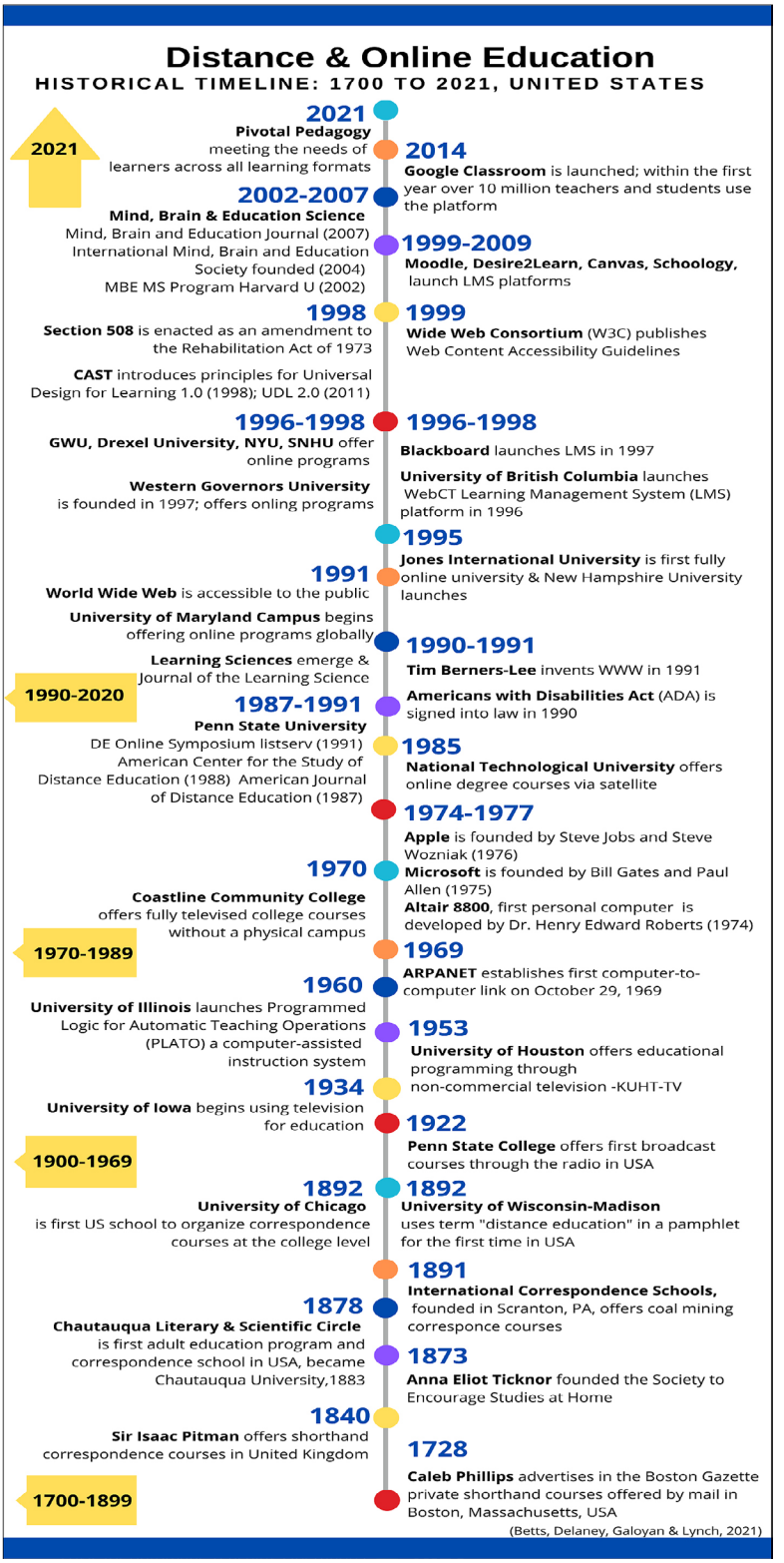

Figure 3. *Historical Timeline: Online Education 1700s to 2021*

applications have created solutions for problems that have only recently emerged. Consequently, instructional design, whose conceptual framework is based on psychology (Rabinowitz & Shaw, 2005), is now also informed through new interdisciplinary research on the human brain and the human learning process, national policies regarding universal accessibility and accreditation, and the requirements of the COVID-19 pandemic.

Relatively new, the field of Learning Sciences draws from multiple disciplines to examine how people learn and how to best support learning. Newer, Mind, Brain, and Education Science examines how neuroscience, psychology, and education impact teaching and learning by debunking myths related to learning and the brain, while focusing on evidence-based practices. Although their orientations differ, the efforts of these initiatives together provide valuable resources for designers of learning environments and the facilitators of learning.

The COVID-19 crisis affected higher education in many ways. This historical global event created a new need to provide a safe environment in which learners may continue their intellectual growth. Over the past 20 years, many IHEs across the United States garnered experience and skill piloting different modes of instruction, particularly online learning, as they expanded their course and program offerings. However, not all faculty members have this experience or skill, since their primary roles have focused solely on in-class instruction up to this point. When confronted with closed campuses in March 2020, many were challenged by a sudden pivot to "remote teaching," in some cases with limited support. While this approach allowed continuity in instruction, many faculty members simply presented their classroom lectures to remote students via video-conferencing technology and supplemented teaching with additional video, readings, and online discussions, assuming that instruction would go back to in-class settings in the summer or at least by fall. For some, this pivot to emergency remote teaching was unsatisfying and discouraged them from the possibilities of online education formats. For others, it provoked questions and requests for better short and long-term solutions.

The bottom line is that IHEs must be able to pivot beyond the pandemic. IHE leaders must consider ways to support faculty and provide training to teach across learning formats. Given the strengths of emerging technologies, the growing understanding of learning and the brain, and the power of instructional design, pivotal pedagogy will be increasingly important to the future of both higher education and K-12 education, as well as meeting the needs of students worldwide.

Conclusions

Distance education has adapted in form, substance, and design to the circumstances of the times, driving and being driven by implementing and modifying technology to achieve the primary mission of dis-

tance education, universal access, and inclusion to effective learning.

Research Question 1 asked, "How has distance education evolved from the 1700s to 2021 in the United States?" Distance education in the United States began with correspondence education in 1728. The evolution of distance education in the 19th and 20th centuries expanded through radio, television, telephone, and computer assisted instruction. In the latter part of the 20th century, satellite television, personal computers, and the advent of the Internet further enhanced distance education. In the 21st century, the increased use of the Internet for online and blended learning further contributed to today's advanced, cloud-based online learning modalities.

Rapid advancements in learning technologies, coupled with the public's demand for just-in-time learning, has catalyzed an entire e-learning economy. The e-learning market was projected to exceed $300 billion by 2025 (Sanyal, 2019), prior to the pandemic. These pre-pandemic projections corresponded with increasing enrollments in exclusively online courses (Seaman et al., 2018). Approximately 35% of all U.S. college students in Fall 2018 enrolled in some distance education courses (U.S. Department of Education, 2019), marking 16 consecutive years of increased online enrollment. Jaschik and Lederman (2019) found that 46% of faculty taught an online course for credit, "up from 39% in 2016 and 30% in 2013" (p. 6).

Research Question 2 asked, "How has instructional design and pedagogy evolved in distance education?" The Internet era transformed distance education in the 1990s, introducing digital methods of two-way communication. The reliability, efficiency, power, and reach of such technologies improved rapidly during the ensuing three decades, offering institutions of higher education tools like synchronous video conferencing, cloud-based storage, and advanced multimedia presentation software. These tools eased the facilitation of online learning, but also introduced new complications to the teaching and learning processes. Englund and colleagues (2017) wrote about the disconnect between the aspirational rhetoric of education technologies versus their actual mixed performance in relation to higher education learning outcomes. Research consistently indicates that with education technologies, pedagogical and content knowledge must unite with technological knowledge to optimize learning potential (Mishra & Koehler, 2007). This remains true as innovative immersive technologies (e.g., augmented reality, virtual reality, and 360 video) emerge as educational tools across learning modalities.

Augmented Reality (AR) technology as an educational application continues to attract increased interest from higher education. AR overlays virtual objects in the real world and may be applied to all senses, not just sight (Akçayir & Akçayir, 2017; Garzón & Acevedo, 2019). A meta-analysis of 64 studies found that augmented reality had a medium effect on student learning gains (Garzón & Acevedo, 2019). While immersive technologies are often asso-

ciated with expensive equipment, many augmented reality applications now function on smartphones and tablets. In contrast, virtual learning environments (VLEs) may be fully immersive when using a headset, or semi-immersive when viewing a 3D environment on a monitor (Fowler, 2015). Educators utilize VLEs across disciplines, grade levels, and modalities. Health profession educators use VLEs to simulate tasks difficult to replicate, such as surgery, in non-clinical settings. 360 video is one type of non-immersive VLE. Rupp and colleagues (2019) found that 360 video experiences that were more immersive led to positive student outcomes. Augmented reality, virtual reality, and 360 video technologies are common in online programs at institutions of higher education.

Adaptive learning, driven by algorithms and artificial intelligence, is a nascent technology awaiting widespread adoption (Johanes & Lagerstrom, 2017). Benjamin Bloom's famous study "The 2-Sigma Problem" concluded that one-to-one tutoring stimulated a learning effect size two times greater than typical classroom learning (Bloom, 1984). Adaptive learning replicates the one-to-one tutoring experience at scale for each student in a course, based on complex algorithms that factor subject domain knowledge and student learning behaviors (Johanes & Lagerstrom, 2017). For students, the optimal net effect is a personalized learning experience—even in large online lecture courses (Arizona State, 2019). "Based on the proliferation of adaptive learning in the corporate and academic worlds, it is certain that they are here to stay" (Johanes & Lagerstrom, 2017, p. 11). Uncertainties and potential drawbacks to adaptive learning include data privacy and security, the potential for human-created algorithms that discriminate, and the need to account for identity and affect (Avella et al., 2016; Johanes & Lagerstrom, 2017).

Research Question 3 asked, "How has research from the Learning Sciences and Mind, Brain, and Education Science influenced instructional design and pedagogy?" Technological innovation has expanded instructional options and modalities for institutions of higher education, while simultaneously causing challenges to access, equity, functionality, and cost. Education technology researchers publish continuously about the importance of emphasizing pedagogical content strategies facilitated by technology. Learning Sciences, MBE principles, and pivotal pedagogy offer direction in this area. The Learning Sciences provide seminal research to support distance education instructional design and learning environments. MBE principles provide a framework to support distance education instruction by expanding current instructional design models and pedagogy through advancements in neuroscience research. Instructor knowledge of important learning factors such as working memory, cognitive load, scaffolding, modeling, retrieval practice, and so forth may help facilitate learning with advanced technologies in web-based environments. MBE principles are foundational to pedagogy even as instructional technologies evolve. IHEs

would do well to follow the advice put forward by Crawford-Ferre and Weist (2012, p. 12): "Successful online instruction requires new methods of course design, interaction among course participants, and instructor preparation and support."

Research Question 4 asked, "How has the COVID-19 pandemic affected pedagogical practices within higher education?" The COVID-19 pandemic disrupted the once siloed concept of teaching either face-to-face or online. The reality is that learning online is evident in all educational formats, ranging from electronic communications to online content to research and collaboration. Amidst the many challenges, there are new opportunities for faculty, instructional designers, and professional development administrators to work collaboratively and to be a significant part of the evolving higher education landscape. Since the 1700s, IHEs have continued to meet the needs of learners through technology and innovative practices. Together, IHEs have the opportunity to optimize advancements in technology, research from the Learning Sciences and MBE Science, and pedagogical practices and instructional design to meet the needs of students across all learning formats.

Overall, distance education has responded to the dynamic demands for learning opportunities that are geographically, socially, economically, and intellectually diverse. Learning at a distance has shifted the locus of control and participation to learners/consumers rather than solely to providers. Changes in understanding how people learn and creating more authentic and interactive learning experiences have altered the strategies used to help students learn. Finally, the challenges of the COVID19 pandemic have awakened the need for all university instructors, designers, and administrators to understand better the benefits of distance education methodologies in the teaching and learning process regardless of the physical limitations.

Limitations of the Study

There are three limitations to this historical literature review. First, we utilized a historical literature review approach so there were no qualitative or quantitative methods employed. Second, we only had access to IPEDS distance education enrollment data and distance education reports that may not capture all blended, hybrid, or online enrollment models across IHEs due to variation in definitions by each institution. Third, findings from historical literature reviews may not be systematically replicated, though they may be audited (Bhatt & Bhatt, 1994). This is because search parameters extend over several hundred years and record-keeping practices are inconsistent throughout history.

Recommendations

To meet the needs of an increasingly diverse student population and to pivot in response to crises, IHEs will need to provide training and support for faculty who have historically taught face-to-face so they may deploy online techniques more seamlessly and effectively as needed. As with all course and pro-

gram offerings, quality must be central, and that means instructional practice, the development of instructional personnel, as well as pursuing and applying new insights from the Learning Sciences and MBE will continue to evolve and garner attention. Research to compare student engagement, retention, academic performance, and faculty evaluations prior to and after the faculty development and instructional delivery should be institutionalized.

Insights from the Learning Sciences and MBE Science may also be integrated into faculty development for distance education instruction in online and blended formats on a national level. These principles may serve as cornerstones in professional development workshops. Surveys and interviews could be distributed to workshop attendees 6 to 12 months after they complete the workshops to explore any changes noticed regarding student engagement, retention, academic performance, and course evaluations prior to and after workshops.

Finally, collaboration is key to moving forward. Moore stated in 1993, "In distance education teaching is hardly ever an individual act, but a collaborative process joining together the expertise of a number of specialists in design teams and delivery networks" (p. 28). This is reflected by Ko and Rossen (2017) as well: "When it comes to development of online courses, a growing number of institutions committed to online education have increasingly turned to a team approach for course development" (p. 92), which may include "an instructor paired with an instructional designer, instructional technologist, or other technically oriented person providing assistance or it may be a larger group of individuals" (p. 92). Through collaboration, innovation, and these recommendations, IHEs are positioned to meet the instructional needs of an increasingly diverse population in a complex global environment through multiple modalities (e.g., online, blended, and on-campus formats) to support student engagement, learning, and completion in an authentic and high-quality manner.

Summary

Projections by NCES, prior to the COVID-19 pandemic, indicated that higher education enrollments in the United States would increase by "15% between 2014 to 2025, with larger proportional increases among adults than traditional-age students" (Lederman, 2017, para. 1). Learning Sciences and MBE Science support teaching and learning across modalities, and support pivotal pedagogy creating a new frontier in teaching and learning for students, instructors, instructional designers, faculty, and professional development administrators. It is the responsibility of IHEs, independent scholars, and practitioners to maintain currency and document high-quality practices and outcomes of a changing population of learners in higher education. In the article "Three Generations of Distance Education Pedagogy," the authors state at the end: "It is tempting to speculate what the next generation will bring" in

terms of distance education pedagogical models (Anderson & Dron, 2011, p. 90). Collaboration and the continued investment in research and practice of online education will certainly move us in the right direction.

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Three Questions for an Online Learning Leader

Featuring Jill Drake, PhD

Associate Vice President for Academic Affairs
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Dr. Jill Drake is both Professor in the College of Education and Associate Vice President for Academic Affairs at the University of West Georgia. In the latter role, she currently oversees academic programming and assessment, transfer agreements, and internal curriculum approval processes. Jill has experience teaching face-to-face and online courses at the graduate and undergraduate levels in educational foundations, early childhood, and elementary education. Her research focuses on assessment in K-5 mathematics education, problem posing, and teaching mathematics to diverse populations. Internationally recognized for her research on problem posing, Dr. Drake has published two mathematics activity books for high school and middle school students. Prior to her appointment at the University of West Georgia, Jill was an educator at the early childhood, elementary, and middle school levels. She completed a Bachelor of Science in Elementary Education, a Master of Education in K-12 School Counseling, and a Specialist in Health and Rehabilitative Services at Florida State University. She holds a Doctorate of Education in Curriculum and Supervision from the University of Georgia and completed a postdoctoral program in math education at the University of West Georgia.

Tres preguntas para un líder de aprendizaje en línea

Presentando a Jill Drake, PhD

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La Dra. Jill Drake es profesora de la Facultad de Educación y vicepresidenta adjunta de Asuntos Académicos de la Universidad de West Georgia. En este último rol, actualmente supervisa la programación y evaluación académica, los acuerdos de transferencia y los procesos internos de aprobación del currículo. Jill tiene experiencia en la enseñanza de cursos presenciales y en línea a nivel de posgrado y pregrado en fundamentos educativos, primera infancia y educación primaria. Su investigación se centra en la evaluación en la educa-

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ción matemática K-5, la presentación de problemas y la enseñanza de las matemáticas a poblaciones diversas. Reconocida internacionalmente por su investigación sobre la presentación de problemas, la Dra. Drake ha publicado dos libros de actividades de matemáticas para estudiantes de secundaria y preparatoria. Antes de su nombramiento en la Universidad de West Georgia, Jill fue educadora en los niveles de educación infantil, primaria y secundaria. Completó una Licenciatura en Ciencias en Educación Primaria, una Maestría en Educación en Consejería Escolar K-12 y una Especialista en Salud y Servicios de Rehabilitación en Florida State University. Tiene un Doctorado en Educación en Currículo y Supervisión de la Universidad de Georgia y completó un programa postdoctoral en educación matemática en la Universidad de West Georgia.

为网络学习领导者准备的三个问题

采访Jill Drake博士，美国西乔治亚大学学术事务助理副校长

Jill Drake博士是西乔治亚大学教育学院教授兼学术事务助理副校长。作为学术事务助理副校长，她目前负责学术规划和评估、转学协议（transfer agreements）、以及内部课程批准过程。Jill的教学经历包括教育基础、学前教育和初等教育的本科及研究生课程（面对面和网授）。她的研究聚焦K-5 数学教育评估、提问（problem posing）、以及面向多样化群体的数学教学。Drake博士在关于提问上的研究受到国际认可，她已出版两部针对中学生的数学活动课本。就职西乔治亚大学之前，Jill曾教授学前教育、小学和中学教育课程。她在佛罗里达州立大学取得了初等教育学士学位、教育学硕士（K-12 学校咨询）学位、以及健康与康复服务专业人员资格。她在乔治亚大学取得教育学博士（课程与管理）学位，并在西乔治亚大学完成了数学教育博士后项目。

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1 With an increase in online university course offerings due to COVID-19, what are your recommendations for ensuring that course assessments meet the various needs of online, diverse undergraduate and graduate students?

Ensuring that online course assessments meet the various needs of diverse student populations requires being mindful of the potential inequities students may face, such as lack of access to reliable, high-speed Internet, a functional device, or even a quiet place to take

course assessments. Instructors must understand that the students enrolled in their courses will have a wide range of experiences with online learning. The fast-paced, massive shift from face-to-face to online courses for more traditional institutions has resulted in many first-time students at both the graduate and undergraduate levels never having taken an online course. Though a student may be technologically savvy, online learning does not operate like social media or online search engines. Faculty members have to acknowledge that the learning curve for many new-to-online learners will be steep.

To avoid further disadvantaging learners who lack adequate access to appropriate hardware and Internet service, faculty members should utilize quality tutorials and short videos to ensure they understand the content covered on assessments and the related procedures to follow when taking them online. In any online learning environment, it is critical to communicate course-related procedures to learners in a clear manner: this is especially important when the learners are unfamiliar with the learning context or are under duress, as many are, due to COVID-19.

Leaders and faculty members need to research and then employ strategies to reduce incidences of academic dishonesty to best measure student outcomes in an online course. Today, many websites that students can access enable them to cheat on online assessments. Many perceive that it is easier to engage in academic dishonesty in an online environment than in a face-to-face course.

Faculty members wanting to ensure they are effectively measuring their students' knowledge of course objectives will need to create assessments that are more open-ended and provide opportunities for unique answers. This includes developing alternatives to proctored exams. While requiring proctored exams may be an effective method to decrease the occurrence of academic dishonesty, the use of proctored exams may put some learners with poor Internet access at a disadvantage. The cost of some emerging types of online exams may be a financial burden for some students, especially if they are unaware of the fees prior to the initial time of test registration.

Ingenuity and empathy are essential in developing course assessments that both meet the needs of a wide range of learners and accurately measure learning outcomes. For these reasons, the recommendation is that academic departments form teams of faculty members whose charge is to develop common assessment procedures that reflect best practices in online learning and then repeat those throughout the program of study.

2 College students may struggle with math instruction that is primarily offered online. Which digital tools and strategies do you recommend for online math courses in higher education?

Textbook companies have become highly effective in developing online course supplements. Selecting textbooks with high quality, user-friendly

supplemental websites is a first choice if the cost is not prohibitive. Often, individualized tutorials are available to students on these supplemental sites. In making a textbook selection, professors should choose a company that can interface with the institution's learner management system if possible. This will streamline the grading process and other instructional duties, which can be especially valuable to instructors new to online teaching.

If faculty members are looking for low-cost resources, open-access resources may be the best option. Resources such as those found on the Open Stax website can certainly support students' mastery of math content. Professors should evaluate the resources aligned to their course, program, institutional, and national objectives and provide students with a guide for accessing and using these resources.

There are also no-cost or low-cost teaching resources available on the websites of professional organizations, such as the National Council of Teachers of Mathematics or the American Mathematical Society. Students are typically familiar with stand-alone resources, such as Khan Academy, School Yourself, Math Planet, and Chegg.

3 What are important technology aspects that teacher education programs should attend to when better preparing future teachers for today's K-12 classrooms?

The two major technology aspects that are critical to preparing future teachers for today's K-12 classrooms are repeated and varied exposure to digital learning platforms, such as Google Classrooms, Moodle, Microsoft Teams, and Brightspace, and online learning tools, such as Nearpod, Quizz, MobyMax, and others. Personalized online learning is at the heart of education in the 21st century. Educators will need to be well-informed consumers of technology and online learning resources and this can only happen through exposure and critical analysis. Teacher preparation institutions must incorporate those experiences into their programs of study to foster digital literacy, information literacy, and discernment of teacher candidates when selecting appropriate digital tools to meet the various needs of diverse K-12 learners in face-to-face and online classrooms.

A Review of *eLearning Design and the Right Brain*

CommLab India. (2019). *eLearning design and the right brain.* https://elearningindustry.com/free-ebooks/elearning-design-and-the-right-brain

By Norman Rose
American Public University System, USA

Abstract

This article reviews an e-book that outlines ways to improve student engagement online and in-person. Planning instructional elements that elicit positive emotional response is the emphasis.

Keywords: eLearning, right brain

Una reseña de *Diseño de eLearning Design y la parte derecha del cerebro*

Resumen

Este artículo reseña un libro electrónico que describe maneras para mejorar la participación de los estudiantes en línea y presencialmente. La planeación de elementos instructivos que fomenten una respuesta emocional es el énfasis.

Palabras clave: eLearning, parte derecha del cerebro

关于《电子学习设计与右脑》的书评

摘要

本文评论了一本电子书，后者概述了提升学生线上及线下参与的不同方式。重点是对能激发积极情感响应的教学要素进行规划。

关键词：电子学习，右脑

doi: 10.18278/jolrap.8.1.4

eLearning Design and the Right Brain is a relatively short (and free) e-book that examines familiar instructional matters with a renewed focus on stimulating emotional response in learners. Using the work of consultant and writer Daniel Pink, it outlines best practices for getting students motivated, enthused, and connected.

Premise

The premise of the book, which is Pink's main message, is that the *old world* of left-brain, linear thinking in education and business is fading away and a *new world* of holistic left/right brain integration is emerging. This means that right-brain needs should receive attention when instructors design and implement coursework.

To engage students' emotional sides, the book offers multiple approaches based on Pink's six right-brain aptitudes:

1. **Design**: increasing student accessibility by incorporating visual elements in an intuitive, learner-friendly GUI or in classroom presentations.

2. **Symphony**: helping students see the big picture of content by providing mind maps, videos, and stimulating assessments.

3. **Story**: adding realism by providing scenarios, comic strips, and case studies that incorporate narrative into learning.

4. **Empathy**: humanizing the classroom or platform by providing open navigation, diagnostic feedback, and personalized learning.

5. **Play**: increasing engagement and enthusiasm by providing interactive activities such as game-based learning, gamification, and simulations.

6. **Meaning**: putting course content in context by providing performance-based learning objectives, ice breakers, and ponder activities.

Considerations

This is a useful book. However, there are some considerations. First, according to left/right brain hemisphere theory, the left-brain is responsible for logical thinking and response and the right- brain is responsible for emotional thinking and response. There is a tenuous veracity associated with the theory, but it does not matter regarding this book, because best practices prevail regardless of any theory. Therefore, it would be to every educator's advantage to choose items from each of the six aptitudes, whether planning for in-person, online, or hybrid instruction.

Next, the author and Mr. Pink might not be classically trained in pedagogy or andragogy. An experienced and well-trained educator might prioritize the six aptitudes. For instance, it might be wise to start with *Meaning* [e.g., learning objectives] before deciding on what *Symphony*, *Story,* or *Play* activities to provide for students. Those familiar with backward design will appreciate the logic of that.

Finally, some educators might want to expand on Pink's concept of *Empathy* to include deeper connection with learners using concepts and strategies of emotional intelligence.

Conclusion

This book is a concise compilation of ideas that can save educators the expense of buying heftier books or attending workshops. To keep it brief, it leaves to the reader's imagination and talent *how* to fit those six aptitudes into lesson plans and online platforms. However, most experienced educators should be able to apply the *how to* aspect easily. A copy of the graphic from the book showing the six aptitudes might be all an instructor needs as a reminder when planning in the future.

Dr. Norman Rose is a former assistant professor of education and current instructor in the Teaching program of the School of Arts, Humanities, and Education at American Public University System. Dr. Rose received a BA and MEd (Elementary Generalist) from Washington University in St. Louis and a PhD in Elementary Education from the University of North Texas. Norman is the author of *The Design of Life: Human Development from a Natural Perspective.*

An Agile Approach to LMS Migration

By Michael E. Cottam
American Public University System (USA)

Abstract

Principles of the Agile Manifesto may guide academic and technology teams to lead learning management system (LMS) migration projects with inclusiveness, flexibility, and speed. Agile teams follow an iterative, rapid-cycle path to design, develop, evaluate, revise, and improve the LMS from project inception to completion. An agile approach values individuals and interaction, delivering working courses, collaboration, and responsiveness to changing environments. With attention to each of these values in LMS migration, the project runs with full stakeholder engagement, responsiveness, and speed.

Keywords: learning management system, LMS, LMS migration, agile project management, Agile Manifesto

Un método ágil para la migración de SGA

Resumen

Los principios del Manifiesto Ágil pueden guiar a los equipos académicos y tecnológicos para liderar proyectos de migración del sistema de gestión del aprendizaje (SGA) con inclusión, flexibilidad y velocidad. Los equipos ágiles siguen una ruta iterativa y de ciclo rápido para diseñar, desarrollar, evaluar, revisar y mejorar el LMS desde el inicio del proyecto hasta su finalización. Un enfoque ágil valora a las personas y la interacción, brindando cursos de trabajo, colaboración y capacidad de respuesta a los entornos cambiantes. Prestando atención a cada uno de estos valores en la migración de LMS, el proyecto se ejecuta con total participación de las partes interesadas, capacidad de respuesta y velocidad.

Palabras clave: sistema de gestión del aprendizaje, SGA, migración SGA, gestión ágil de proyectos, Manifiesto ágil

doi: 10.18278/jolrap.8.1.5

一项用于学习管理系统迁移的敏捷方法

摘要

敏捷宣言（Agile Manifesto）原则能指导学术团队和技术团队以包容、灵活、快速的方式引领学习管理系统（LMS）迁移项目。敏捷团队遵循迭代的快速循环路径，从项目接收到完成的过程中对LMS进行设计、开发、评价、修改和提升。敏捷方法的四个价值分别是个体和互动、工作过程交付、客户合作、响应变化。对LMS迁移中的每个价值加以关注，项目则能实现利益攸关方完全参与、充分响应、全速运行。

关键词：学习管理系统，LMS，LMS迁移，敏捷项目管理，敏捷宣言

Learning management system (LMS) migration is one of the most complex and labor-intensive initiatives that a university might undertake. For universities with a significant hybrid or online presence, the number of courses that they must migrate from a legacy to a new system may number in the thousands. The designated team must execute the project in a manner that permits students and faculty members to transition smoothly from one system to another without loss of critical data, records, or materials. Meanwhile, faculty members and students interact with difficulty in two different systems until the project is complete.

It is impossible to predict challenges accurately in a one- to two-year migration project, given the diversity of courses, instructional formats, and faculty and student preferences. Inevitably, as soon as courses transition and users make contact within the new system, teams must adapt their best-laid plans to a new reality. Teams must adapt their processes and designs to emerging requirements and use cases that the new system provides, which are different from the legacy system procedures and habits that develop over many years.

Aligning LMS Migration with the Agile Manifesto

A framework that may be informative in LMS migration is agile project management. The values and principles of the Manifesto for Agile Software Development (https://agilemanifesto.org/) provide an agile mindset to projects in software development. With some adaptation, the manifesto applies to other fields, such as instructional technology.

Early Considerations

Agile teams follow an iterative, rapid-cycle path from conception and early

analysis to quick design, development, testing, and implementation with actual users. Then, the users' (e.g., faculty and students) feedback flows back into the process quickly to help design, develop, and test the next version of the interface and model courses. Getting the product in the hands of the users early in the development cycle results in many small pivots along the migration project path, and it also surfaces issues while the project and impacts are small and more easily corrected before scaling up implementation.

Stakeholder Input

Agile teams value individuals and interactions over processes and tools. In the case of LMS migration at a large university, this means putting the technology team in contact early and often with instructional design, faculty, and student groups. They meet not to produce extensive process and tool documentation, but instead to build and test the product and migration process in rapid, iterative steps, with significant input from those who will use the LMS the most. Early and consistent interaction among stakeholders is key to successful migration.

Experiential over Theoretical

Agile teams value working software over comprehensive documentation. The technology and instructional design team builds sample courses and models in close collaboration with the faculty. Those models may be quickly applied to migrating courses in numerous disciplines from the legacy system into the new LMS. Teams iteratively establish course models, along with documentation of best practices, as learned from experience, rather than a theory of how the migration might work. Hands-on experience in the LMS, with candid feedback and design pivots, is paramount to success.

Collaboration

Agile teams value customer collaboration over contract negotiation. In a university team, collaboration with a diverse group of faculty members, staff, and students is a part of shared governance and is essential for instructional technology success. The team of faculty, staff, and students regularly collaborates on all stages of the LMS migration in a flexible, changeable arrangement. The team needs a basic set of working agreements, rather than a comprehensive migration contract. Throughout the project, teams may need to adjust course migration sequences, quality checks, and publication dates based on data from the stakeholders who are most affected by the system's change.

Flexibility

Agile teams value responding to change over following a plan. An effective LMS migration team makes a plan while recognizing that requirements and feature requests will emerge as the faculty and staff interact with the new LMS. Rather than adhering rigidly to a predetermined project schedule, based on the initial theoretical analysis of users' needs, the team engages with change requests to design, develop, and test new features during migration.

Workflow

In the spirit of agile, an LMS team might follow a workflow, such as the following:

- Establish an initial plan with all stakeholders, publishing clear assumptions of roles, processes, timelines, and workflows.
- Build early prototypes of a few courses with a small group of stakeholders.
- Test prototypes with faculty and students.
- Revise prototypes based on faculty and student feedback.
- Repeat the build-test-revise process with incremental releases on an accelerating schedule of 5, 20, 50, 100, or more courses at a time.
- Document feedback, learning, and adjustments in each increment.
- Recognize errors, adjust processes, update the user experience, and improve courses iteratively until all courses are successfully migrated.

American Public University System used such a process in 2020 to migrate over 1,700 courses in less than 12 months. While there were inevitable challenges and setbacks along the way, each was faced with respect and collaboration among technology teams and academic leadership teams. The agile mindset and iterative process contributed to the successful LMS migration, just as much as the expertise of the people involved in the project did.

Conclusion

By adopting an agile mindset during LMS migration, a lengthy and painful process for students, faculty members, and staff may be less punishing, and completion may be quicker and smoother than legacy project management models provide. While there are many frameworks of agile project management available, the Agile Manifesto provides a set of foundational principles to guide whichever process a university may choose. Such principles guide the team in creating a project plan and assembling a cross-functional team to complete one of the largest instructional technology projects that a university undertakes.

Dr. Michael E. Cottam is Associate Provost of Academic & Faculty Services at American Public University System (APUS). He has been leading, designing, and teaching in the online learning space for more than two decades, focusing his work on using online technologies and interactive multimedia to enhance student engagement, student learning, and student success in the virtual university classroom.

Prior to joining APUS, Michael was Dean of Military Campuses and Online Education at Webster University. While there, he led the expansion of online undergraduate and graduate programs, serving several thousand students worldwide. He established and scaled up live online classes using video conferencing technologies, serving students enrolled at more than 50 extended campus locations across the United States and internationally.

Previously, Dr. Cottam served as the founding Dean of Instruction for MyCollege Foundation and Portmont College at Mount St. Mary's, Los Angeles (now MSMU Online). The MyCollege Foundation was a Bill and Melinda Gates-funded initiative to extend access to high-quality learning experiences to students who previously did not have access or success in college. He led the design, development, and delivery of new programs of study in a customized LMS built to support at-risk students.

Michael previously served as Associate Dean of Instruction, leading curriculum and program development, as Director of Instructional Design, and as Spanish Faculty at Rio Salado College, the largest public online two-year community college in the United States.

Dr. Cottam earned a BA in Spanish, an MA in Spanish Applied Linguistics, and a PhD in Educational Technology, all from Arizona State University.

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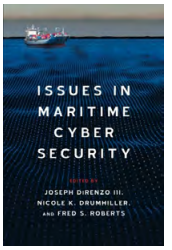
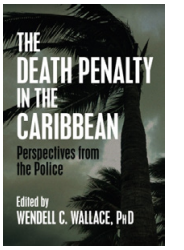


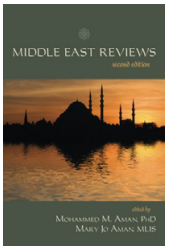
Issues in Maritime Cyber Security Edited by Nicole K. Drumhiller, Fred S. Roberts, Joseph DiRenzo III and Fred S. Roberts

While there is literature about the maritime transportation system, and about cyber security, to date there is very little literature on this converging area. This pioneering book is beneficial to a variety of audiences looking at risk analysis, national security, cyber threats, or maritime policy.

The Death Penalty in the Caribbean: Perspectives from the Police Edited by Wendell C. Wallace PhD



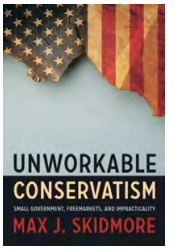
Two controversial topics, policing and the death penalty, are skillfully interwoven into one book in order to respond to this lacuna in the region. The book carries you through a disparate range of emotions, thoughts, frustrations, successes and views as espoused by police leaders throughout the Caribbean



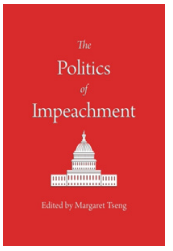
Middle East Reviews: Second Edition
Edited by Mohammed M. Aman PhD and Mary Jo Aman MLIS

The book brings together reviews of books published on the Middle East and North Africa. It is a valuable addition to Middle East literature, and will provide an informative read for experts and non-experts on the MENA countries.

Unworkable Conservatism: Small Government, Freemarkets, and Impracticality by Max J. Skidmore



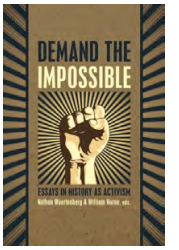
Unworkable Conservatism looks at what passes these days for "conservative" principles—small government, low taxes, minimal regulation—and demonstrates that they are not feasible under modern conditions.



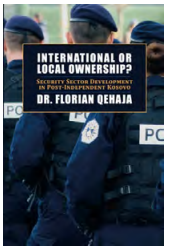
The Politics of Impeachment
Edited by Margaret Tseng

This edited volume addresses the increased political nature of impeachment. It is meant to be a wide overview of impeachment on the federal and state level, including: the politics of bringing impeachment articles forward, the politicized impeachment proceedings, the political nature of how one conducts oneself during the proceedings and the political fallout afterwards.

Demand the Impossible: Essays in History as Activism
Edited by Nathan Wuertenberg and William Horne



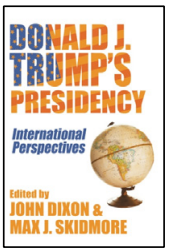
Demand the Impossible asks scholars what they can do to help solve present-day crises. The twelve essays in this volume draw inspiration from present-day activists. They examine the role of history in shaping ongoing debates over monuments, racism, clean energy, health care, poverty, and the Democratic Party.



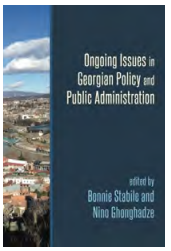
International or Local Ownership?: Security Sector Development in Post-Independent Kosovo by Dr. Florian Qehaja

International or Local Ownership? contributes to the debate on the concept of local ownership in post-conflict settings, and discussions on international relations, peacebuilding, security and development studies.

Donald J. Trump's Presidency: International Perspectives
Edited by John Dixon and Max J. Skidmore



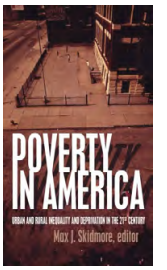
President Donald J. Trump's foreign policy rhetoric and actions become more understandable by reference to his personality traits, his worldview, and his view of the world. As such, his foreign policy emphasis was on American isolationism and economic nationalism.



Ongoing Issues in Georgian Policy and Public Administration
Edited by Bonnie Stabile and Nino Ghonghadze

Thriving democracy and representative government depend upon a well functioning civil service, rich civic life and economic success. Georgia has been considered a top performer among countries in South Eastern Europe seeking to establish themselves in the post-Soviet era.

Poverty in America: Urban and Rural Inequality and Deprivation in the 21st Century
Edited by Max J. Skidmore



Poverty in America too often goes unnoticed, and disregarded. This perhaps results from America's general level of prosperity along with a fairly widespread notion that conditions inevitably are better in the USA than elsewhere. Political rhetoric frequently enforces such an erroneous notion.

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Thanks to the generosity of the American Public University System