PART I

FOUNDATIONS
The growing need for an educated workforce, changing student demographics, opportunities presented by new technologies, and increases in the cost of accessing higher education have led many educators, researchers, policymakers, and business people to engage with a variety of emerging approaches to education, including competency-based assessment, open educational resources, flipped classrooms, micro credentials, and private-public partnerships in degree offerings. Concomitantly, many scholars have been engaging in an ever-expanding array of emerging practices, including blogging, networking on social media, and sharing their scholarship in different forms (such as via videos and open courses).

Many of these approaches to education and scholarship can be categorized as either emerging technologies (such as automated grading applications within MOOCs) or emerging practices (such as sharing instructional materials online under licences that allow recipients to reuse them freely). The terms “emerging technologies” and “emerging practices,” however, are catch-all phrases that are often misused and haphazardly defined. As Siemens (2008, para.1) argues, “terms like ‘emergence,’ ‘adaptive systems,’ ‘self-organizing systems,’ and others are often tossed about with such casualness and authority as to suggest...
the speaker(s) fully understand what they mean.” A clearer and more uniform understanding of emergence and of the characteristics of emerging technologies and practices will enable researchers to examine these topics under a common framework and allow practitioners to better anticipate potential challenges and impacts that may arise from their integration into learning environments.

In *Emerging Technologies in Distance Education*, I described emerging technologies as “tools, concepts, innovations, and advancements,” intentionally defining “technologies” broadly to include not just tools and software but also concepts, such as pedagogies (Veletsianos, 2010). A number of researchers and students have found this definition helpful in framing the contested and complex nature of technologies and online learning environments. Returning to this work six years later, however, it is clear to me that the term “emerging technologies” does not fully capture what is emerging in digital education. At the time, I argued that contextual factors determine whether a technology is emerging or not; I now also believe that the notion of emerging phenomena in education can be better captured by differentiating between “emerging technologies” and “emerging practices.” This differentiation, I believe, will help practitioners and researchers make better sense of the innovations and advances currently occurring in educational technology worldwide. This change emphasizes the social, political, cultural, and economic contexts that surround emerging technologies and provides a timeliness that transcends particular advances and innovations.

Both in 2009 and 2015, my review of the literature did not provide adequate definitions or descriptions of what individuals mean when they refer to emerging technologies and emerging practices. The literature is littered with casual uses of the term and spans content areas and disciplines. The view espoused in this chapter and in this book is that the terms “emerging technologies” and “emerging practices” transcend academic disciplines. New technologies and practices have emerged in diverse disciplines, even if some technologies might be more appropriate for specific content areas (e.g., Geometer’s Sketchpad for mathematics-related disciplines), some practices may be more pronounced in some disciplines that others (e.g., open scholarship in the sciences), and some technological affordances may render some tools more appropriate for certain purposes than others (e.g., wikis and blogs for community-focused and writing-intensive approaches). An October 2014 search on the PsychInfo database, for example, revealed that emerging technologies were being examined in a number of disciplines across the social sciences, humanities, formal sciences, and professional fields. Within education, emerging technologies were being
used in teacher training, instructional design, language learning, distance education, higher education, adult education, and medical education. The term “emerging practices” was used less often, but again in numerous disciplines. The lack of a clear framework with which to consider emerging technologies and emerging practices calls for an education-specific definition that can guide our thinking, research, and practice. Establishing a common understanding of these widely used terms will provide a significant step toward meaningful conversations and inquiry.

HOW HAVE EMERGING TECHNOLOGIES BEEN DEFINED IN THE PAST?

When composing the introduction to Emerging Technologies in Distance Education in 2010, I began with what seemed a logical starting point, attempting to define the term “emerging technologies.” To this end, I scanned my personal bibliography, typed the term in my favorite search engine, searched the academic literature, and to my amazement (and increasing angst), discovered that a definition for the omnipresent term was nowhere to be found. Searching magazines, periodicals, and industry reports, I discovered a few descriptions but no formal, commonly accepted definition.

Could it be that a definition existed and I had simply been unable to locate it? I emailed colleagues, posted requests on social media, and contacted all the authors whose papers were going to appear in the book, asking for possible definitions. The answers I received were informative and helped shape my thinking, but a clear definition was still elusive. It appeared that the term central to the book I was editing had never been defined, or, if it had been defined, neither my colleagues nor I had been able to locate that definition. This experience provided the impetus for converting what I had envisioned as a short introduction into a chapter.

In my searches, I was able to locate four significant publications that focused on the terms “emerging technology” and “emerging practice.” These are described and summarized below.

In a report for the Australian Capital Territory Department of Education and Training, Green and Putland (2005) stated that a technology is still emerging if it is not yet a “must-have.” Email, for instance, moved from what was once an optional communication technology to a must-have, must-use technology for most people in most organizations. This definition helped me understand that “new” may not be a necessary descriptor for emerging technologies and practices, and that all technologies not currently used in educational institutions
can be considered emerging. Educators explore and adopt technologies even before they become “must-haves,” and some technologies that may become must-haves for other industries and venues will not necessarily become must-haves for educational providers.

The second publication is a series entitled The Horizon Reports, which the New Media Consortium (NMC) has released every year since 2004 to lay out adoption horizons for key technologies. The descriptions of emerging technologies given in these reports suggest that emerging technologies are those that (a) have not yet been widely adopted, and (b) are expected to influence a variety of educational organizations. The descriptions of emerging technologies in each report vary slightly, indicating that uncertainty exists with respect to the definition of the term “emerging technology” and the expected magnitude of its impact.

The third publication is a series of reports entitled Emerging Technologies for Learning, published by the British Educational Communications and Technology Agency (Bryant et al., 2007; Oblinger et al., 2008; Stead et al., 2006). As with the Horizon Reports, these emphasized the possibility of a near-future impact.

The fourth publication is Emerging Practice in a Digital Age, published by the Joint Information Systems Committee or JISC (Knight, 2011). In this report emerging practice was described as involving “experimentation and openness—the ability to respond to changing circumstances and to embrace unforeseen benefits” as institutions move “to changes of approach, and to more collaborative ways of working” (p. 5)

THE CHARACTERISTICS OF EMERGING TECHNOLOGIES AND EMERGING PRACTICES

As noted earlier, this chapter argues that what makes technologies and practices emerging are not specific technologies or practices, but the environments in which particular technologies or practices operate. This definition recognizes that learning, teaching, and scholarship are sociocultural phenomena situated in specific contexts and influenced by the cultures in which they take place (Brown, Collins, & Duguid, 1989; Vygotsky, 1978). This perspective is particularly appropriate for digital learning situated on the contemporary Web which has social and co-producing capabilities and practices. According to this view, technology is itself socially shaped. It embeds its developers’ worldviews, values, beliefs, and assumptions into its design and the activities it encourages (Oliver, 2013). Learners and instructors can accept or reject particular technologies or
practices. They are also capable of finding alternative uses for them that will better meet their needs and values. Thus, sociocultural factors make technologies and practices emergent.

To provide an example of why it makes sense to consider technologies and practices as emerging, consider online journals and social media such as Facebook, Twitter, and YouTube. These technologies have become an integral part of open scholarship, which is often seen as a major breakthrough in radically rethinking the ways in which knowledge is created and shared (Nielsen, 2012; Weller, 2011). Much of the existing literature argues that scholars can amplify and transform their scholarly endeavors by adopting open practices supported by technology, and a multitude of ways to do so have been developed (Veletsianos, 2013). For instance, a cultural anthropologist might share draft versions of her research on her blog, a geographer might post his syllabus on a document-sharing website, a World War II historian might enlist the help of online crowds to obtain digital copies of letters to examine personal communication during the era, and a political scientist might use social media data to investigate political campaigns during elections. These are examples of the emerging practice of Networked Participatory Scholarship (Veletsianos & Kimmons, 2012; Veletsianos, 2016), which refers to the use of participatory technologies, online social networks, and other emerging technologies to share, reflect upon, improve, validate, and further scholarship. Scholarly blogging, for instance, is an emerging practice within an increasingly digital scholarly life (Kirkup, 2010; Martindale & Wiley, 2005; Nardi, Schiano, & Gumbrecht, 2004; Walker, 2006).

Emerging technologies and emerging practices, therefore, may be adopted in a variety of educational settings to serve various purposes (such as instructional, social, and organizational goals). After an extensive examination of these emerging educational phenomena and the literature about them, all appear to share these four characteristics: not defined by newness; coming into being; not-yetness; and, unfulfilled but promising potential.

Emerging technologies and emerging practices are not defined by newness

Although the words emerging and new are often treated as being synonymous, emerging technologies and practices may or may not be new. Emerging technologies and practices may be recent developments (such as using 3D printers, publishing open data) or older ones (using open-source learning management systems). Even though it may be true that most emerging technologies are newer
technologies, the mere fact that they are new does not necessarily categorize them as emerging. For example, synthetic (or virtual) worlds were described as an emerging technology in the mid-1990s (Dede, 1996), and research on Multi-User Dungeons dates back to the 1980s (Mazar & Nolan, 2008). Yet virtual worlds are still widely referred to as emerging technologies (Warburton, 2009; Dawley & Dede, 2014), particularly in some fields, such as healthcare (Boulos, Hetherington & Wheeler, 2009; Rogers, 2011) and hospitality (Huang, Backman, Chang, Backman, & McGuire, 2013), where their appropriateness shines. Newness by itself, then, is a problematic indicator of emergence.

Emerging technologies and emerging practices are evolving organisms that exist in a state of “coming into being”

The word “evolving” refers to a dynamic state of change in which technologies and practices are continuously refined and developed. To illustrate this, consider the chalkboard and dry-erase board, the use of which is generally established within the educational community and thus, while still in use, is no longer evolving. Contrast this to Twitter, the currently popular social networking and micro-blogging platform. Although various practices and activities on the Twitter platform can be said to be established (e.g., the ReTweet (RT) activity (boyd, Golder, & Lotan, 2010)), numerous aspects of the technology, as well as practices associated with it, are emerging as platform refinements change the way the technology is used and users engage in practices that may depart from those originally anticipated.

For example, Twitter’s early success and popularity caused frequent outages, which were most noticeable during popular technology events such as the 2008 MacWorld keynote address. Early attempts to satisfy sudden surges in demand included using more servers and on/off switches on various Twitter features, while later efforts included re-designing the application’s architecture and withdrawing services such as free SMS and instant-messaging support. Existing in an evolutionary state, Twitter is continuously being developed and refined. At the time of writing, for example, Twitter engineers are considering introducing filtering algorithms aimed at refining and curating user timelines. Twitter practices are also in a continuing state of evolution. For instance, it has been used for scholarly purposes (Veletsianos, 2012) and as a tool to engage learners (Dabbagh & Kitsantas, 2012; Junco, 2012), establish instructors’ social presence (So & Brush, 2008; Pollard, Minor, & Swanson, 2014), and conduct research (Chong, 2010; Darling, Shiffman, Côté, & Drew, 2013). Researchers have argued
that tweeting has emerged as a new literacy practice, a practice that consists of both traditional and new literacies (Greenhow & Gleason, 2012).

As emerging technologies and practices evolve, some will be integrated into the day-to-day operations of educational organizations, while others will fade into the background. The context surrounding emerging technologies and practices also shifts and changes over time, creating a negotiated relationship between the maturation of a technology/practice and the environment that surrounds it.

**Not-yetness: Emerging technologies and emerging practices are not yet fully understood or researched**

One distinguishing characteristic of emerging technologies and practices is that we are not yet able to understand their implications for education, teaching, and learning or for learners, instructors, and institutions. We also lack an understanding of the contextual, negotiated, and symbiotic relationship between practices and technologies. For example, what effect might the opportunity to socialize with classmates via social networking sites have for online learners? How do automated grading practices reconfigure the role of instructors? Could social networking sites or MOOCs break down digital divides between haves and have-nots? Or are social networking sites simply another medium through which societal inequalities are perpetuated? What are the pedagogical affordances of social networking sites? How may learning analytics support online instructors? How may we design supportive and engaging self-paced learning environments? Can location-aware devices enhance communal learning experiences?

Emerging technologies and practices are not fully understood largely because they have not yet been thoroughly researched. Initial investigations of emerging technologies are often evangelical, overly optimistic, or dystopian in their conclusions and describe benefits and drawbacks without empirically examining the role, impact, and implications for online education. Because of the evolutionary nature of emerging technologies and practices, most of the research conducted about them takes a case study or formative evaluation approach (Dede, 1996), reflecting the early stage of our attempts to understand them. Because emerging technologies/practices have not yet been fully studied, initial deployments of emerging technology applications tend to replicate familiar processes. For example, linear PowerPoint slides replace slideshow projectors and blogs replace personal reflection diaries, despite the opportunities they offer
for rethinking practice. Ross and Collier (chapter 2) delve into a more detailed examination of not-yetness and its implications.

Emerging technologies and emerging practices have promising but as yet unfulfilled potential

The final characteristic of an emerging technology or practice is its promise of significant impact, which is as yet mostly unfulfilled. Individuals and organizations may recognize that particular technologies and practices offer significant potential for enacting change (e.g., improving learner-learner interaction, reducing student cost, supporting classroom equity), but such potential has not yet been realized. The fields most associated with the use of technology in education, including online and distance learning, often exhibit techno-utopian and techno-deterministic thinking. In particular, technology and certain practices associated with it are often expected to revolutionize the way individuals learn and teach. Yet scholars and practitioners alike are wise to maintain some skepticism about promises of transformation that ignore the environmental factors that surround innovations. Even though technology has had a significant impact on how education is delivered, managed, negotiated, and practiced, this book, and past research, remind us that the environment in which such impacts occur is influenced by a variety of factors, including politics and economics.

The reasons can be found in the characteristics already discussed. For instance, educational institutions are relatively slow to change for a variety of organizational, cultural, and historical reasons (Cuban, 1993; Lortie, 1975); emerging technologies and practices exist in the context of sociocultural systems; and mature research on their impacts and uses has not yet been conducted. Additionally, the potential to transform practices, processes, and institutions is often simultaneously welcomed and opposed by various stakeholders. The openness movement is an illustration of this fact. Supporters of openness have claimed that free and open access has the potential to transform the ways research and knowledge are disseminated and evaluated, but for a number of reasons, open practices and scholarly uptake of social media for professional purposes are still at a nascent stage (Jordan, 2014; Veletsianos, 2013).

THE COMPLEXITIES OF INCORPORATING TECHNOLOGIES INTO EDUCATION

The four defining characteristics identified and discussed in this chapter provide a glimpse into the complexities that arise when emerging technologies and
practices are integrated into educational contexts. Although practitioners and researchers anticipate and hope that emerging technologies and practices will prove to be powerful instruments in our quest to enhance teaching, learning, research, and educational institutions, we are still exploring the possibilities and implications of these technologies. The absence of a large empirical or practitioner knowledge base to guide the use of emerging technologies and practices should be seen as an opportunity to conduct research into educational practice. We should remain open to the idea that the existing ways of teaching, learning, and designing learning environments may not adequately serve contemporary or future educational purposes. Expanding and applying what we know about learning, teaching, and education from such diverse fields as educational psychology, instructional design, sociology, and the learning sciences will be important to understanding and applying emerging approaches in education.

At the same time, technology is changing the way we live and act in the world (for instance, digital overlays allow us to experience the world differently); therefore employing emerging approaches to education may necessitate the development of new theories, pedagogies, and roles. If we employ emerging technologies in our work, we should also be prepared to be open to new ways of viewing the world and ways of exploring knowledge, scholarship, collaboration, and even education itself. While doing so, we should remain cognizant that resistance and failure are possible, but also, if documented in the literature, helpful. Numerous advances on this front are described in this book, including net-aware theories of learning (chapter 3), open and social learning (chapter 9), personal learning environments (chapter 8), and data mining and learning analytics (chapter 6).

The proposed characteristics of emerging technologies and practices also imply that technologies and practices cannot be seen as being “emerging” out of context (chapter 7). More specifically, technologies may be emerging in one area while already established in another area. For example, the sharing of open data may be an acceptable and established practice in some fields (say, bioinformatics), but not in others (education). A practice or technology may also be established and emerging at the same time. For example, competency-based assessment and credentialing is an established practice among a number of online education providers in the United States (Klein-Collins, 2012; Alssid, 2014), but it has just begun to emerge in the broader higher education landscape (Feldstein, 2014; Haynie, 2014; Fain, 2014). In the context of alternative credentialing models, therefore, competency-based assessment is both emerging and
established at the same time. Another example is the practice of online and distance education, which, while an established model of education in several institutions worldwide (such as The Open University in the UK), has more recently become an emerging activity in numerous campus-focused colleges and universities that once considered themselves residential and wanted little to do with online learning. The contextual nature of emerging technologies also holds true for differences across nations, regions, and even organizations. Examples include countries that have bypassed landline infrastructure and leapfrogged to mobile phones when others, such as Canada, are finding it difficult to support innovations in mobile technologies due to heavy regulation and geography—within a single province or state some cities have fibre-optic Internet access while others do not. Technology may be used to support problem-based teaching techniques in one classroom in a K–12 school, and for drill-and-practice exercises in a different classroom within the same school.

The sociological theory of emergence also suggests implications that emerging technologies and practices may have for education (Clayton, 2006). Emergence theory posits that events and phenomena do not happen in a formal or predetermined way, but rather occur spontaneously and unexpectedly in dynamic environments that both influence activities and are influenced by those activities (Cole & Engestrom, 1993; Moje & Lewis, 2007). The implications are two-fold: technologies and practices developed for purposes other than education find their way into educational institutions and processes (e.g., wikis, openness); and once such technologies and practices are integrated into education, they both mould and are moulded by micro-educational practices, such as teaching and learning activities and communities (chapter 7).

DEFINING CHARACTERISTICS MATTER

In 2007, the Association of Educational Communications and Technology returned to the use of the term “educational technology” to define a field that, over the years, has been referred to by numerous names, including “instructional design,” “instructional systems,” and “instructional systems technology” (Reiser, 2006). In response to the name change, Lowenthal and Wilson (2009) argued that definitions and labels are critical because they establish a common ground upon which we can have conversations. An agreed-upon definition can enable practitioners and researchers to examine concepts with a shared understanding, enabling the field to move forward. Without an agreed-upon definition, the very foundations of our work are precarious. In the same way, the
characteristics of emerging technologies and emerging practices for educational purposes provided in this chapter are intended to provide a foundation upon which to position our work. In addition to highlighting important issues for future research and practice, this chapter also refines the meaning of the terms *emerging technologies* and *emerging practices* and provides further scaffolding upon which our work can be conceptualized, refined, and evaluated.

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