A DEFINITION OF
EMERGING TECHNOLOGIES
FOR EDUCATION

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Acknowledgements
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Abstract
The term “emerging technologies” is often used without a clear meaning or definition. My aim in this chapter is to understand the meaning of the term while at the same time exploring what a clear understanding of emerging technologies means for technology-enhanced learning. Combining previous conceptualizations of the term, I propose that emerging technologies are tools, concepts, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes. Additionally, I propose that (“new” and “old”) emerging technologies are evolving organisms that experience hype
cycles, while at the same time being potentially disruptive, not yet fully understood, and not yet fully researched. These ideas bring to the surface important issues relating to the use of technology in education.

**Introduction**

Technological innovation and advancements have brought about massive societal change. In comparison, technology’s impact on education, teaching, and learning has been rather limited (Bull, Knezek, Roblyer, Schrum, & Thompson, 2005). While expectations have run high about instructional radio, television, personal computers, computer-based instruction, the Internet, Web 2.0, e-learning, m-learning, the latest technological innovation of our times, and the impact of these tools and technologies, results have often been disappointing (see Cuban, 2001): “showcase” learning environments, disengaged students, and technology-enhanced instruction that merely replicates face-to-face teaching seem to be the norm and the standard to which we have become accustomed, rather than the exception.

As a field that seems to find joy in the development of acronyms, terms, and catchy descriptors (think i-learning, student 2.0, education 3.0) we seem to quickly traverse innovations in the hope that the next technological advancement will be our holy grail. The focus of this book, however, is not on all previously used educational acronyms. The focus is on the often-misused, haphazardly defined, ill-applied, and all-encompassing term of “emerging technologies” as used in educational contexts in general, and distance education in particular. Siemens (2008, ¶ 1) makes a similar argument when he states that “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.”

If you think that I am being unfair in my description of emerging technologies for education, ask your colleagues at your next conference gathering to describe (or dare I say, define) emerging technologies. The majority of your colleagues will agree that emerging technologies describe new tools with promising potential. If you feel brave, you might ask what new means, but let me warn you that you may find yourself
faced with rolling eyes and questioning looks. In my questioning, I was not able to find an adequate definition of the term, or at least a description that differentiates between technologies as emerging or non-emerging (e.g., developed or established). Searching prior literature for a definition is the logical next step. Yet again, you will be quickly disappointed. Not only is the literature plagued with casual mentions of the term, it also spans multiple and divergent fields: educators from multiple academic disciplines employ the services of emerging technologies to pursue academic endeavours. Does one search the literature from all academic disciplines? Or does one focus on his/her own discipline? Do emerging technologies transcend academic foci? Do we just search the distance education and instructional design literature? Or do we examine individual content areas, such as nursing, art, and social science education?

In the sections that follow, I argue that the utilization of emerging technologies for education transcends academic disciplines. After discussing my attempts to locate a clear discussion/understanding of “emerging technologies,” I put forth my own definition of the term and conclude with thoughts on the implications of this definition.

Emerging Technologies: An Interdisciplinary Notion

The view espoused in this chapter (and in this collection) is that the term “emerging technologies” transcends academic disciplines and activities, and can be defined independently of its specific application to educational endeavours. While some innovations might be more appropriate for specific content areas than others (e.g., Geometer’s Sketchpad for mathematics-related disciplines), and technological affordances may render some tools more appropriate for certain purposes than others (e.g., wikis and blogs for community-focused and writing-intensive modules), on the whole, emerging technologies can be applied to diverse disciplines. A November 2008 search on the PsychInfo database, for example (for papers published from 2000 to 2008 that include the keywords “emerging technologies” and “education”), yielded 255 results. The diversity in these results is clear: emerging technologies are used in nearly every field imaginable, with teacher training, instructional
design, language learning, distance education, e-learning, adult education, and medical education prominently appearing on the list. The accepted chapters and submissions to this edited volume also attest to this fact. For example, eleven proposals on virtual worlds, from authors spanning five different countries, were submitted for consideration for publication in this book. Of those, two focused on formal learning outcomes, seven focused on informal learning outcomes, and two investigated the use and meaning of avatars. These proposals were submitted by individuals working both in industry and academia, and the submissions from academics came from fields as diverse as instructional design, teacher education, distance education, nursing, art education, and mathematics. This diversity is not limited to virtual worlds: a similar phenomenon was observed for proposals investigating wiki-related topics and Web 2.0 technologies.

Following from the thesis that emerging technologies transcend academic disciplines, it seems worthwhile to put forth an education-specific definition to guide our thinking, research, and practice. Establishing a common understanding of a widely used term represents the first step towards meaningful conversations and inquiry.

What Are Emerging Technologies?

First, a personal story. In the summer of 2008, I received an e-mail that announced the release of an open-access e-book while also noting that the editor was “editing a new series of which this book is the first. The series is entitled Issues in Distance Education and we welcome submissions or letters of interest from authors wishing to publish with an Open Access, peer-reviewed license.” A few weeks later (and after contacting the series editor, press director, and lead editor), I was given permission to proceed with the edited volume that you are now reading. In the midst of completing my dissertation and moving to a different country for my first tenure-track appointment, I quickly found myself putting together a call for proposals (CFP) for an edited volume on the use of emerging technologies in distance education. In the next two months, I received more than sixty-five proposals. Emerging technologies in distance education seemed to be a “hot topic,” and it seemed
that we had managed to solicit chapter proposals at an opportune time. After acceptance/rejection decisions were made, I began writing the introduction to this book and decided to begin by quickly defining the term “emerging technologies.” I scanned my personal bibliography. I typed the term in my favourite search engine. I searched the academic literature. To my amazement, a definition for the omnipresent term was elusive. I searched magazines, periodicals, and industry reports. I discovered a few descriptions, but no such thing as a formal, commonly accepted definition. I took it upon myself to define “emerging technologies” but quickly began doubting the absence of a definition. Could it be that a definition actually existed and I simply could not locate it?

I decided to ask my colleagues for assistance (Figure 1.1): I asked my Facebook friends; posted a working definition on my blog; e-mailed colleagues asking for the definition that they use, who in turn, posted the question on the online networks they frequent; and contacted all the authors whose papers appear in this volume. The answers I received were informative and shared some commonalities, but I could not find one single statement that uniformly explained the meaning of the term “emerging technologies.” The term that was central to the book I was editing had never been defined, or, if it had been defined, neither I nor my expert colleagues were able to locate that definition.

Figure 1.1 Asking colleagues to offer their definition of the term emerging technologies
This experience provided the impetus for converting the book’s short introduction into a chapter. How could a book on emerging technologies (in distance education or otherwise) exist without a shared understanding of what emerging technologies are?

At the same time, and since my initial search to discover a definition in the academic literature had proved futile, I focused on high-profile publications that specifically discussed emerging technologies for teaching and learning. The only explicit definition of emerging technologies I could locate in such publications came from a report commissioned for the Australian Capital Territory Department of Education and Training in which Miller, Green, and Putland (2005) state that

A technology is still emerging if it is not yet a “must-have.” For example, a few years ago email was an optional technology. In fact, it was limited in its effectiveness as a communication tool when only some people in an organization had regular access to it. Today, it is a must-have, must-use technology for most people in most organizations. In this sense a technology can be a standard expectation in the commercial or business world, while still being considered as “emerging” in the education sector. (p. 6)

Essentially, these authors note that any technology (defined as “infrastructures of various kinds, delivery devices, and classroom and teaching tools” on pp. 2 and 6) that is elective and not yet a requirement for educational organizations is considered to be an emerging technology. I find this definition to be an inadequate conceptualization of emerging technologies because it treats all technologies not currently used in educational institutions as emerging. While a number of technologies not currently in use in the education sector may be emerging, it is not necessarily true that all are emerging. Specifically, (a) organizations explore and adopt technologies even before they become “must-haves,” (b) the notion of following others that popularize technologies as “must-haves” is problematic in that it implies that learning-focused organizations constantly follow on the footsteps of
others, and (c) it disregards the potential of the technology for educational purposes — while some technologies may be “must-haves” for industries outside the educational realm, it does not necessarily mean that these same technologies are must-haves for educational providers. Finally, the notion of the specific situation one is facing (e.g., in terms of students, learner characteristics, institution, local realities, etc) in influencing what can and cannot be classified as an emerging technology is an important factor in considering whether technologies are emerging or otherwise — I explore this issue in the Implications section of the chapter.

Another set of publications investigated were the Horizon Reports (http://www.nmc.org/horizon). Since 2004, the New Media Consortium (NMC) and the EDUCAUSE Learning Initiative (ELI) have released their yearly Horizon Reports, which, in short, lay out adoption horizons for key emerging technologies likely to have an influence on education. The sections of these reports describing the concept of “emerging technologies” to date (2004–2008) are presented in Table 1.1. We can make three observations from these descriptions. First, the reports have consistently described emerging technologies as “likely to have a large impact … on teaching, learning, or creative expression … within three adoption horizons over the next one to five years” (2004–2008). Second, while the reports have focused on “higher education” for the period 2004–2007, the focus was broadened to “learning-focused organizations” in 2008. Third, the reports fluctuate as to the impact and expected magnitude of the impact that emerging technologies will/may have: emerging technologies are expected to become “very important” (2004), are expected to become “increasingly significant” (2005), will have “significant impact” (2006), will “impact” (2007), and will “enter mainstream use” (2008). While the descriptions of emerging technologies given in these reports are relatively stable across the project’s lifespan, the differences in the descriptions from year to year provide additional insight into emerging technologies. From these descriptions and their differences, it can be inferred that emerging technologies are technologies that have not yet been widely adopted and that are expected to influence a variety
Table 1.1 “Emerging technologies” definitions as given in yearly Horizon Reports 2004–2008 (emphasis added)

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<th>Year</th>
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<td>2008</td>
<td>“The annual Horizon Report describes the continuing work of the New Media Consortium (NMC)’s Horizon Project, a five-year qualitative research effort that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, or creative expression within learning-focused organizations... The main sections of the report describe six emerging technologies or practices that will likely enter mainstream use in learning-focused organizations within three adoption horizons over the next one to five years. Also highlighted are a set of challenges and trends that will influence our choices in the same time frames.” (2008, p. 3)</td>
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<td>2007</td>
<td>“The annual Horizon Report describes the continuing work of the NMC’s Horizon Project, a research-oriented effort that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, or creative expression within higher education... The core of the report describes six areas of emerging technology that will impact higher education within three adoption horizons over the next one to five years.” (2007, p. 3)</td>
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<td>2006</td>
<td>“The annual Horizon Report describes the continuing work of the NMC’s Horizon Project, a research-oriented effort that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, or creative expression within higher education... Each year, the report describes six areas of emerging technology that will have significant impact in higher education within three adoption horizons over the next one to five years.” (2006, p. 3)</td>
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<td>2005</td>
<td>“The second edition of the NMC’s annual Horizon Report describes the continued work of the NMC’s Horizon Project, a research-oriented effort that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, or creative expression within higher education... The report highlights six areas of emerging technology that the research suggests will become increasingly significant to higher education within three adoption horizons over the next one to five years.” (2005, p. 3)</td>
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<td>2004</td>
<td>“This first edition of the NMC’s annual Horizon Report details the recent findings of the NMC’s Horizon Project, a research-oriented effort that seeks to identify and describe emerging technologies likely to have a large impact on teaching, learning, or creative expression within higher education... The 2004 Horizon Report ... highlights six technologies that the research suggests will become very important to higher education within three adoption horizons over the next one to five years.” (2004, p. 2)</td>
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of educational organizations within a time span of one to five years. The differences between the descriptions of expected impact across 2004–2008 point to the uncertainty that exists with regards to (a) whether these technologies will actually have an impact, and (b) the magnitude and importance of the expected impact. These differences are important because as the next section describes, uncertainty is an important aspect of emerging technologies.

The Horizon Reports’ definitions of the term *emerging technologies* seem to encompass the main ideas of what we traditionally consider to be “emerging technologies,” but the fluctuations in terms of expected impact are problematic. Additionally, the reports focus on “teaching, learning, or creative expression” even though emerging technologies may potentially alter organizational structures, and influence leadership and scholarship.

The third report studied is entitled “Emerging technologies for learning.” This is a publication of the British Educational Communications and Technology Agency (BECTA) that has also sought to understand the implications of emerging technologies. The introduction to the three editions of the “Emerging technologies for learning” reports (retrieved 28 October 2009, from http://bit.ly/147D9C) states that the publication

> aims to help readers consider how emerging technologies may impact on education in the medium term. The publications are not intended to be a comprehensive review of educational technologies, but offer some highlights across the broad spectrum of developments and trends. It should open readers up to some of the possibilities that are developing and the potential for technology to transform our ways of working, learning and interacting over the next three to five years.

As is the case with the Horizon Reports, BECTA emphasizes the *possibility* of a near-future impact. Broader than the Horizon Reports, BECTA also sees emerging technologies influencing the way we work and interact.
A Comprehensive Definition of Emerging Technologies

To define the term *emerging technologies for education*, I explored how researchers and practitioners perceive these technologies, what their functions, characteristics, and affordances are perceived to be, and what is known and not known about them. Further, I attempted to define emerging technologies in terms of their properties and not in terms of the actual technologies that are categorized as emerging (e.g., Web 2.0 technologies are often considered to be emerging technologies, and while the two terms are often used synonymously, I treated them as being distinct; more accurately, I attempted to define emerging technologies without focusing on features of Web 2.0). This process led to an initial definition that was then questioned through the ideas and definitions offered by others (presented as a mind map in Figure 1.2). These contributions acted as a peer-review system for my initial thoughts and research while lending further credibility to the definition I offer below.

Figure 1.2 A mind map of ideas offered by other researchers and practitioners when the question was asked on Twitter, Facebook, in e-mails, and on various blogs.

I define emerging technologies as tools, concepts, innovations, and advancements utilized in diverse educational settings (including distance, face-to-face, and hybrid forms of education) to serve varied
education-related purposes (e.g., instructional, social, and organizational goals). Emerging technologies (ET) can be defined and understood in the context of the following five characteristics:

1. **Emerging technologies may or may not be new technologies.**
   It is important to note that the words *emerging* and *new* are usually treated as synonymous, but they may not necessarily be so. While a definition of *new* might be perilous and contentious, ET may represent *newer* developments (e.g., utilizing the motion-sensing capabilities of a video-game controller to practice surgical techniques) as well as older ones (e.g., employing open-source learning management systems at higher-education institutions). 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. If we were to treat new technologies as emerging technologies, the following two questions would arise:

   When do technologies cease to be *new*?
   When technologies cease to be *new*, do they also cease to be emerging?

   For example, synthetic (or virtual) worlds were described as an emerging technology in the mid-1990s (Dede, 1996), with research on Multi-User Dungeons dating back to the 1980s (Mazar & Nolan, 2008). Yet, virtual worlds are still described as emerging technologies (e.g., see chapter 15 and de Freitas, 2008). Newness, by itself, is a problematic indicator of what emerging technologies are; older technologies can also be emerging, and the reasons for this will become clearer after we examine the characteristics that follow.

2. **Emerging technologies are evolving organisms that exist in a state of “coming into being.”**
   The word *evolving* describes a dynamic state of change where technologies and practices are in a continuous state of refinement and development. To illustrate this, consider the chalkboard. We no longer have discussions about how to use the chalkboard, and even though dry-erase
boards may be less dusty and easier to use, the way the board is used is generally established; to a large extent, the community has agreed and settled on the use of the chalk/dry-erase board. On the other hand, Twitter, the currently popular social networking and micro-blogging platform, represents an illustrative example of an ET that is “coming into being.” For example, Twitter’s early success and popularity caused frequent outages, and such issues were most noticeable during popular technology events (e.g., during the 2008 MacWorld keynote address). Early attempts to satisfy sudden surges in demand included using more servers and implementing on/off switches on various Twitter features (e.g., during the 2008 Worldwide Developers Conference), while later efforts included re-designing the application’s architecture and withdrawing services (e.g., free SMS and instant-messaging support). Existing in a state of evolution, Twitter has engineers who continuously develop and refine the service, while maintaining its core purpose. On the whole, Twitter exists in an evolutionary state where new features change the way the technology is used, and new users engage in practices that may depart from what was originally anticipated. Nevertheless, and it is important to note this, while Twitter may be an emerging technology, various practices and activities on the Twitter platform may already be established. An example of this is the ReTweet (RT) activity (boyd, Golder, & Lotan, 2010).

3. Emerging technologies go through hype cycles.

Today’s emerging technology might be tomorrow’s fad, and today’s simple idea might be tomorrow’s key to boosting learner engagement or university outreach. While it is easy to fall into the trap of believing that today’s innovations will restructure and revolutionize the way we learn and teach, it is important to maintain skepticism towards promises of sudden transformation. Even though technology has had a major impact on how distance education is delivered, managed, negotiated, and practiced, it is also important to recognize that due to organizational, cultural, and historical factors, education, as a field of study and practice, has been relatively resistant to change (see Cuban, 1993; Lortie, 1975).
Technologies and ideas go through cycles of euphoria, adoption, activity and use, maturity, impact, enthusiasm, and even infatuation. In the end, some of today’s emerging technologies (and ideas) will become staples, while others will fade into the background. One way to describe the hype that surrounds emerging technologies and ideas for education is to observe the Hype Cycle model (Fenn & Raskino, 2008) developed by Gartner Inc. This model evaluates the relative maturity and impact of technologies and ideas, and follows five hype stages: Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment, and Plateau of Productivity (Fenn & Raskino, 2008). Most specific to the topic of this book are the hype cycle models developed for higher education (Gartner, 2008b), e-learning (Gartner, 2006), and emerging technologies (Gartner, 2008a).

4. Emerging technologies satisfy two “not yet” criteria:
   (a) Emerging technologies are not yet fully understood.
   One factor distinguishing emerging technologies from other forms of technology is the fact that we are not yet able to understand the implications of these technologies. What do they offer to education, teaching, and learning? What do they mean for learners, instructors, and institutions? For example, what exactly does socialization via social networking sites mean for distance learners? What does it mean to have “access” to others via an “add as friend” button? Could social networking sites break down digital divides? Or are social networking sites another medium through which societal inequalities are perpetuated? What are the pedagogical affordances of social networking sites? How can we sustain learner engagement in online learning communities? Can location-aware devices enhance communal learning experiences? As a result of emerging technologies not being fully understood, a second issue arises:

   (b) Emerging technologies are not yet fully researched or researched in a mature way.
   Initial investigations of emerging technologies are often evangelical and describe superficial issues of the technology (e.g., benefits and
drawbacks) without focusing on understanding the affordances of the technology and how those affordances can provide different (and hopefully better) ways to learn and teach at a distance. Additionally, due to the evolutionary nature of these technologies, the research that characterizes them falls under the case study and formative evaluation approaches (Dede, 1996), which is not necessarily a drawback, but it does point to our initial attempts to understand the technology and its possibilities. Because emerging technologies are not yet fully researched, initial deployments of emerging technology applications replicate familiar processes, leading critics to argue that technologies are new iterations of the media debate (e.g., Choi & Clark, 2006; Clark, 1994; Kozma, 1994; Tracey & Hasting, 2005), without an understanding of the negotiated and symbiotic relationship between pedagogy and technology. Yet such criticisms are not entirely misplaced: newer technologies are often used in old and familiar ways. For example, linear PowerPoint slides replace slideshow projectors; blogs—despite the opportunities they offer for collaboration—replace personal reflection diaries; and pedagogical agent lectures replace non-agent lectures.

5. Emerging technologies are potentially disruptive but their potential is mostly unfulfilled.

Individuals and organizations may recognize that a potential exists within a technology, but such potential has not yet been realized. The reasons may be found in the features of emerging technologies already discussed. For instance, education is relatively resistant to change and mature research has not yet been conducted on the numerous emerging technologies used. Lack of research impedes dissemination and diffusion. Additionally, the potential to transform practices, processes, and institutions, is both enthusiastically welcomed and ardently opposed. A well-known example with regards to the open education movement concerns open-access journals. Supporters claim that free and open access has the potential to transform the ways research and knowledge are disseminated and evaluated. While this advancement has the potential to disrupt scholarship, to date—for a number of reasons—the
majority of research is still published in fee- and subscription-based journals and periodicals, even though institutions are slowly moving towards open-access repositories (see http://dash.harvard.edu/ and https://www.escholar.manchester.ac.uk/).

To summarize, emerging technologies are tools, concepts, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes. Emerging technologies

(1) may or may not be new technologies,
(2) can be described as evolving organisms that exist in a state of “coming into being,”
(3) experience hype cycles,
(4) satisfy the “not yet” criteria of (a) not yet being fully understood, and (b) not yet being fully research or research in a mature way, and
(5) are potentially disruptive, but their potential is mostly unfulfilled.

Implications

The proposed definition provides a glimpse into the complexities that arise when emerging technologies are utilized in educational contexts. Although educational practitioners and researchers may consider emerging technologies powerful instruments in our quest to enhance teaching, learning, student engagement, and educational systems worldwide, we are still learners, still learning what is possible to achieve with these technologies. The absence of a large empirical or practitioner knowledge base to guide our work is evident. Rather than viewing this issue as a drawback, however, I would like to see it as an opportunity to explore how we can enhance educational practice. We should remain open to the idea that existing ways of teaching and designing learning environments may not serve the twenty-first century purposes of education. Note that I am not arguing that students are “wired” differently due to technological exposure or that we should abandon sound pedagogical principles. On the contrary, what we do know about learning, teaching, and education from such diverse fields as psychology, instructional design, sociology, and neuroscience, is
important in our quest to understand and utilize emerging technologies. At the same time, technology is changing the way we live and act in the world (e.g., browsing physical books is a completely different experience when we can evaluate the quality of a book as a result of viewing online reviews received through augmented-reality software). Employing emerging technologies to further educational goals may necessitate the development of different theories, pedagogies, and approaches to teaching, learning, assessment, and organization. If we employ emerging technologies in our work, we should also be prepared to experiment with different lenses through which to view the world and with different ways to explore such ideas and practices as knowledge, scholarship, collaboration, and even education. While doing so, we should also remain cognizant of the fact that resistance and failures are possible, and, if documented in the literature, helpful. A few advances on this front have already been undertaken, and they include connectivism as an example of a learning theory to capitalize on networked knowledge (Siemens, 2005) and social network knowledge construction as an example of a pedagogical approach that enables instructors to integrate social network technologies into learning environments (Dawley, 2009).

The proposed definition of emerging technologies also implies that technologies cannot be seen as being “emerging” out of context. More specifically, technologies may be emerging in one area, while already being established in another area. For example, geographic information systems may already be established tools in the real estate and agriculture industries, but they are still considered to be emerging in the teaching of K–12 geography (Doering & Veletsianos, 2007). Perhaps more importantly, a technology may be established and emerging within the same field, at the same time. For example, interactive whiteboards are already established and pervasive in the United Kingdom’s primary and secondary school sectors (BECTA, 2006; Hall & Higgins, 2005; Kennewell & Higgins, 2007). The scene is different at higher-education institutions: interactive whiteboards, while mostly available in teacher-training departments, are still in a state of emergence with instructors struggling to devise ways to use
them (Brown, 2003). Within the field of education, therefore, interactive whiteboards are, at the same time, both emerging and established. Finally, in an e-mail message concerning the proposed definition, Alec Couros (author of chapter 6) pointed out that the contextual nature of emerging technologies might also hold true for differences across nations, regions, and even organizations. Examples include countries bypassing landline infrastructure and “leapfrogging” to mobile technologies when others, such as Canada, cannot support mobile technologies due to heavy regulation and geography; citywide wireless Internet for some cities (e.g., Minneapolis, MN) while not for others (e.g., Brainerd, MN); and the use of technology to support problem-based teaching techniques in one classroom in a K–12 school as compared to using technology for drill-and-practice exercises in a different classroom within the same school.

The link between emerging technologies as “evolving organisms that exist in a state of ‘coming into being’” and the sociological theory of emergence (see Clayton, 2006) was highlighted by Hagit Meishar-Tal (author of chapter 11) in a private e-mail, and is also discussed in Whitworth and Benson’s chapter (chapter 10). Emergent 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 the activity (Cole & Engestrom, 1993; Moje & Lewis, 2007). The implications of emergent theory for emerging technologies in education are twofold: on the one hand, technologies developed for purposes other than education find their way into educational institutions and processes (e.g., wikis), while on the other, once such technologies are integrated into educational practice, they both mould and are moulded by micro-educational practices, such as teaching and learning activities and communities of practice (chapter 10).

Finally, it is important to highlight that, in addition to categorizing various tools as emerging technologies, the definition of the term allows it to also describe ideas, theories, and approaches. This is only natural. In the same way that the word technology arises from the Greek word technē (τεχνη), meaning “craft” or “art,” emerging technologies
encompass both the tools and the ideas that are emerging and emergent. Examples of approaches that can be described as emerging technologies are: adventure learning, an approach to the design of authentic, experiential, and collaborative adventure-based learning environments (chapter 5); the utilization of the personal learning network within an open teaching framework (chapter 6); and the use of artistic pedagogical technologies (chapter 7).

Concluding Thoughts

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 critically vital because they establish a common ground upon which we can have conversations. An agreed-upon definition can enable colleagues to discuss ideas and research upon a shared understanding, enabling the field to move forward. Without an agreed-upon definition, the very foundations of our work are precarious.

The definition of emerging technologies for education provided in this chapter lays the foundations upon which to position our work. In addition to highlighting important issues for future research and practice, this definition also provides a starting point from which our work (and the rest of the chapters in this volume) can be conceptualized, extended, and evaluated.

REFERENCES


