Chapter 6
An Emergent Pedagogical Framework for Integrating Emergent Technologies into Curriculum Design

Norine Wark and Mohamed Ally

Abstract The current educational climate is in a state of flux. Emergent technologies is ushering in a new era, facilitating a dramatic shift from information scarcity to information abundance, while rendering the historically-dominant knowledge transmission model increasingly irrelevant as learners transform from passive knowledge recipients to active knowledge innovators, curators, and disseminators. The dilemma that educational stakeholders, *especially learners*, face is determining what educational paradigm most empowers them to thoughtfully and perpetually integrate emergent technologies for learning on demand during this tumultuous period and in the nebulous future beyond. Two disparate educational paradigms and three approaches to learning are considered herein. Next, a critical review of technology integration frameworks, models, and taxonomies indicate that none are sufficient for guiding stakeholders in helping learners develop the mindset that is required to learn within such dynamically-changing contexts. Thus, a Paradigm Framework is introduced. The framework encapsulates the traditional behavioural and emerging perceptual paradigms, as well as the shift between them. It also includes pedagogical and andragogical approaches to learning, as well as the emerging heutagogical approach. This framework helps stakeholders to identify existing learning contexts, as well as intentionally select or design contexts that cohesively bind theory with practice. The Omni-tech taxonomy included in the framework ensures that emergent technologies are also coherently integrated according to the theoretical and practical elements that define specific learning contexts. A practical example of how the framework can be used within an online graduate student context concludes the chapter.

Keywords Emergent technologies · Pedagogical framework · Curriculum design · Heutagogy · Pedagogy · Andragogy

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6.1 Introduction

The proposed chapter provides a theoretical framework for integrating emergent technology into any K-12 or higher education curriculum design within the context of learners' dynamic real and virtual worlds. The chapter begins with a broad overview of the current educational landscape. It outlines the global race by educational stakeholders to keep abreast of the dizzying array of exponentially-emerging, unpredictable technologies in their effort to harness the potential of these technologies for enhanced learning. The chapter then moves on to consider how best to prepare learners for lifelong and life-wide learning within the fluxing milieu of this educational landscape.

Two disparate educational paradigms, their related systems, contexts, and approaches to learning are described and a Paradigm Shift Model is presented. Next, an analytical summary of various technology integration frameworks, models, and taxonomies is provided before the Paradigm Shift Framework (Wark 2018) is introduced. The Paradigm Shift Framework (consisting of the Paradigm Shift Model and Omni-tech taxonomy) assist educational stakeholders in assessing current learning contexts by determining what educational paradigm and learning approach to emergent technology integration are being used in delivering curricula, and how this affects what is being learned about the identified technology. Perhaps more importantly, the framework is also designed to create and implement curricula that foster the mindset learners need to move beyond formal schooling competency measures to the lifelong, life-wide capacities characteristic of self-determined learning (Hase and Kenyon 2001, 2013).

Lastly, highlights from an exploratory transformative mixed methods dissertation (Wark 2018) offers readers with a practical illustration that employs the Paradigm Shift Framework to (1) assess one group of voluntary online graduate students' current learning environments and mindsets, and (2) determine how these factors affected their ability to integrate 16 emergent technologies included in the study.

6.2 Emerging Technologies and Learning Contexts

Any educational context may employ a myriad of emerging technologies, such as new device hard- and software, communication technologies (for example, the Internet and wireless connectivity), and old technologies that are used in innovative manners. Yet, emergent technologies are not just tools. They are much more than that, encompassing "concepts, innovations, and advancements utilized in diverse educational settings to serve varied education-related purposes" (Veletsianos 2010, p. 33). This more inclusive definition of emergent technologies may assist educational stakeholders in realizing that *who* is involved in a learning context, as well as *where, when, how,* and *why* learners use these technologies to learn matters significantly more than *what* technologies are chosen. In other words, emergent technologies can be used

equally well to replicate and advance traditional educational contexts or to create and cultivate new ways of perceiving and interacting in the world (Wark 2018).

6.2.1 From Formal to Personal Learning Contexts

Major epochs in the evolution of humanity are typically precipitated by the widespread adoption of general-purpose technologies (GPTs; Brynjolfsson and McAfee 2014). One need only consider the Stone, Bronze, and Iron Ages, the stirrup, gun powder, and electricity to recognize the profound influence that technology has on our world. Oral and written language, Guttenberg's press, and the pencil, for instance, have had indisputable impacts on learning. Emergent technologies like the Internet, social media, and wireless communication are once again transforming the world of education. These innovative technologies are not only blurring the lines between traditional face-to-face (f-2-f) and distance education (DE), but also between formal and informal learning contexts, prompting growing recognition that learning extends beyond formal schooling and is, indeed, a lifelong and life-wide process (Collins and Halverson 2010; Palalas and Wark 2017a, b; Wark 2018).

An increasing number of post-secondary institutions are changing admission policies and using prior learning assessment recognition (PLAR) evaluation processes to award formal academic credit, based upon non-formal and informal knowledge and skills learners have earned through workplace learning, self-study, and informal DE (Collins and Halverson 2010; Conrad 2008). Certificates, digital badges, open badges, and micro-certificates are also awarded for industry-specific training achievements by technical organizations and companies and in online educational contexts, such as MOOCs (massive open online courses; Collins and Halverson 2010; Friedman 2014). Certificates and badges could be perceived as a threat to the traditional educational system that currently holds the monopoly on formal credentialing (Jacobs 2012). Nevertheless, the existence of these certificates and badges does highlight how views on learning are changing, as well as the role that emerging technologies play in enabling on-demand access to the specific knowledge, skills, and education that learners seek.

While translating the conception of education into a holistic system that merges formal and informal learning contexts into practical reality is a complex and multifaceted process, demanding rational and innovative thinking to circumvent unfortunate consequences for learners and society, there are substantive benefits to such an endeavour (Collins and Halverson 2010; Wark 2018). Research demonstrates that learners become more actively engaged, intrinsically-motivated, self-regulated, and therefore self-determined learners who demonstrate increased learning capacity when focused on personally-meaningful and relevant topics (Deci and Ryan 2002; Hase and Kenyon 2001, 2013; Jeno et al. 2017; Palalas and Wark 2017a, b; Pink 2009; Ryan and Deci 2000a, b; Sha et al. 2012).

Transformation to a holistic learning system can be facilitated by the use of individual educational plans (IEPs) with the support of other emergent technologies.

Such technologies enhance learners' abilities to connect and interact with human and non-human resources, and to form personal learning networks (PLNs), while dynamically and seamlessly merging their unique real and virtual worlds. Thus, by merging technology-enabled formal and informal contexts, learners are empowered "to customize, contextualize, and control their learning experiences according to increasingly individualized needs, time/space parameters, interests, and goals" (Wark 2018, p. 80), creating a personal learning environment (PLN) .

6.2.2 Omni-Learning

Over half of the world's population (51.8%) is now using the Internet and nearly 60% of households have Internet access (as opposed to 20% in 2005; ITU 2018). Less than half of households have a computer, though, which indicates that the Internet is also being accessed through mobile devices at home. Mobile access to telecommunication systems is also burgeoning. Mobile cellular subscriptions currently exceed the global population, although the spread is not as pervasive in developing countries as it is in the rest of the world. Furthermore, almost everyone lives within range of a mobile cellular network signal. Most of the population has access to networks of 3G or higher quality. Mobile networks are expanding faster than the percentage of people using the Internet. Finally, Internet traffic and international bandwidth are growing more rapidly than access to information communication technologies (ICTs) and the percentage of people using the Internet, indicating that people stay online longer and are engaged in activities that consume greater amounts of data (e.g., streaming videos, engaging in online gaming).

As the rapid spread of wireless ICTs across the globe continues, nearly limitless access to information and learning networks may soon be available to learners across the globe (Harsh and Sohail 2002; Idiegbeyan-ose et al. 2015). For instance, on-demand, even urgent, learning opportunities in the most isolated places imaginable are currently being made possible through advances in remote augmented reality (RAR; Ally and Wark 2017; ScopeAR 2019). Emergent technologies are indeed transforming the world of learning by "offering access, communication, inclusion, and sharing on a hitherto unknown scale. In short, these technologies are rapidly creating a global context for "omni-learning" (Wark 2018, p. 81).

Omni-learning is defined as "the ability to learn anywhere, anytime, with anyone, on-demand, typically with the support of emerging technology" (Wark 2018, p. 81). Such technologies assist learners in choosing what, how, where, when, why, and with whom they learn while fostering intrinsic motivation, promoting learner empowerment, and enhancing learner-determination. The adoption of an omni-learning mindset is becoming increasingly crucial during this turbulent era wherein nation-governed formal education contexts and knowledge transmission technologies are being supplanted by global learning contexts and exponentially-emerging multimedia knowledge capturing, innovating, curating, investigating, and communicating technologies (Bates 2005; Moore 1965/1998; Wark 2018). The task set

before educators is to determine what educational paradigm most enhances learners' omni-learning capacity during this global knowledge shift and the unforeseeable future beyond. The Paradigm Shift Framework presented herein provides stakeholders with a theoretically-grounded foundation to foster the development of a learner-determined omni-learning mindset.

6.3 Shifting Paradigms

The previous section establishes the role that emergent technologies are playing in precipitating the shift of knowledge creation and ownership from formal learning contexts orchestrated by national political and educational leaders to self-determined learners within their PLEs. This section moves on to the theoretical foundations, systems, and approaches to learning that generate and sustain these contexts. A review of two educational paradigms and three approaches to learning are presented first. A Paradigm Shift Framework is then introduced.

6.3.1 Behavioural Versus Perceptual Learning Paradigms

The term, *paradigm*, was originally defined by Kuhn (1962) to identify camps, schools of thought, or "worldviews" among specific scientific groups, although the term is now applied to other disciplines as well. Paradigms are founded upon unique epistemologies, values, assumptions, theories, methodologies, and instruments. A *paradigm shift* involves the movement or change from one worldview or paradigm to another (Kuhn 1962). Brynjolfsson and McAfee (2014) point out that the invention of a GPT (like the stirrup, gunpowder, or the written word) typically catalyzes a paradigm shift which, in turn, dynamically transforms existing social, economic, political, cultural, educational, and other institutions in a given society. When the term, paradigm, is used in this discussion, it relates to specific worldviews on learning.

Two disparate paradigms are explored herein. Written accounts of the epistemologies underlying each one trace back to the Greek philosophers, Plato (427–347 BC) and Aristotle (384–322 BC). Plato, the rationalist, surmised that truth and knowledge were found within the individual. The empiricist, Aristotle, countered that truth and knowledge were only obtainable through sensory interaction with the external world (Hammond et al. 2001). Aristotle's epistemology was eventually adopted as the foundation for the behavioural paradigm, while Plato's became the foundation for the perceptual paradigm.

These opposing epistemic stances and resultant paradigms are manifested to varying degrees in the learning theories and approaches that have evolved from these notions over millennia. In practice, though, the most prevalent differences are who has ownership over knowledge, how that knowledge is distributed and ultimately, who controls learning (Emery 1981; Wark 2018).

The most prevalent paradigm of our day is behaviourism; it is also the first major paradigm to be adopted by twentieth-century educational institutions. Based on the Industrial Age model, the role of these "traditional" educational institutions is to disseminate government-controlled and funded mass public education. The educational system operationalizing the behavioural paradigm reflects a top-down hierarchal dictatorship. The curriculum is abstract, fractured, linear, one-size-fits-all, ageist, and determined by ranking power. The institution and instructor control instructional time, pace, place, content, resources, delivery, and evaluation. Transmission of sanctified, objective knowledge and facts is verified through measurable behavioural competencies and tangible product evidence. Learners are prompted to passively regurgitate accepted knowledge through a system of external rewards and punishments (e.g., letter grades) meted out by those in power. Learning officially occurs in the formal schooling context (e.g., face-to-face, laboratory-like classroom settings), typically during the learners' youth (Atkisson 2010; Gregory 2016; Hammond et al. 2001; Hauser n.d.; Kazamias 2009; Laliberte 2009; Tomic 1993; Wark 2018; Wark and Ally 2018).

The perceptual paradigm (also referred to as the "learner-determined paradigm") is based upon the belief that innate perceptions are the key to learning (Emery 1981). Thus, only learners can control their learning. Moreover, learning occurs naturally in any setting throughout life (Benson et al. 2007; Dewey 1897, 1903, 1916/2007, 2011; Emery, 1981; Hase and Kenyon 2001, 2013; Wark 2018). Through a continual process of synthesizing and generalizing individual perceptions (or "pattern-making"), people conceptualize and perceive in variances that help them to dynamically interpret the fluctuating world as they interact with it (Emery 1981; Wark 2018).

In a perceptual learning system, the institution is a networked democracy emulating principles of autonomy, diversity, openness, interactivity (Downes 2010), and responsibility (Freire 1970/1993). The curriculum is holistic, individualistic, and based upon a learner-determined IEP. The learner controls their learning throughout life within their unique PLEs with the support of their PLNs. Through this learning process, the learner hones their capacity for transformative learning and leading (Wark 2018). (Transformative learning is a dynamic blend of rational thought, involving logic and affective thinking, and creative intuition, leading to change in perception; Kant 1781/2013; Mezirow 1981; Peat 2000; Vygotsky 1986; Wark 2018.)

6.3.2 Three Approaches to Learning

The beliefs, values, and theories underlying these opposing paradigms are translated into praxis through varying methods and practices, or "approaches" to learning. This chapter considers three approaches to learning: pedagogy, andragogy (Knowles 1970, 1984), and heutagogy (Hase and Kenyon 2001).

6.3.2.1 Pedagogy

Pedagogy is derived from *paidogogos*, a Greek word meaning "leader of a male child." Thus, *pedagogy* may be understood as the art and science of teaching children (Palaiologos 2011). While the term, pedagogy, is often used as a general term encapsulating all approaches to teaching and learning (see, for instance, Freire 1970/1993; Murphy 1996), within this context pedagogy is considered as one specific approach.

Pedagogy emerged in monastic schools during the seventh century. Reinforced by the behavioural paradigm of the twentieth century, pedagogy became, and has remained, the dominant approach to teaching in all areas and levels of formal schooling (Emery 1981; Holmes and Abington-Cooper 2000; Keller 2008; Murphy 1996). The aim of this patriarchal approach is to transmit sanctified truths, facts, and logic from the politically, socially, and culturally dominant to the masses; learners' informal or incident knowledge and experience are rejected (Bourne 1917; Emery 1981; Freire 1970/1993). The government-standardized curriculum guides the transmission of age- or level-appropriate snippets of knowledge and skills (Murphy 1996), which may hold sparse relevance to the learners' real-world needs, interests, abilities, or contexts. Concentration is on the development of instrumental reasoning: rote memorization, description, classification, and tangible, measurable application of new learning to demonstrate understanding, solve problems, or operate as trained to (Murphy 1996). Teachers need to maintain strict control over sources and timing of environmental stimuli to ensure that learners absorb the "correct" associations and generalizations. With the incentive of externally-delivered rewards and punishments, students are expected to passively and compliantly regurgitate what may be beyond their capacity to understand. In such settings, student discipline and literacy precede knowledge acquisition (Emery 1981; Hase and Kenyon 2001, 2013; Murphy 1996; Wark 2018).

6.3.2.2 Andragogy

In 1833 Kapp coined the term, andragogy, to describe Plato's educational theory (Nottingham Andragogy Group 1983). Knowles later defined *andragogy* as the "art and science of helping adults learn" (Holmes and Abington-Cooper 2000).

Knowles (1973) asserted that pedagogy was teacher-driven content-transmission model concentrating upon what skills and information must be taught, whereas andragogy was a teacher-facilitated process-driven enterprise that helped learners to acquire skills and information with decreasing teacher support. Thus, the purpose of adult educators was to facilitate and support the development of self-directed adult learners (Holmes and Abington-Cooper 2000; Knowles 1984).

As envisioned by Knowles (1973), the andragogical classroom environment is less formal than the pedagogical one. The teacher is no longer the ultimate authority figure and source of knowledge; instead, mutual respect and collaboration are modelled. Learning becomes a shared teacher-learner process involving diagnosis of learning needs, development of plans, and engagement in experiential learning

and problem-solving. Negotiated meaning and shared understanding are derived from discourse and interaction with the teacher, students, and possibly other experts. However, while the learner may control some aspects of the learning environment, the teacher retains final authority over the learning process, tasks, and assessment (Knowles 1970; Palalas and Wark 2017b). Given that andragogy represents a transitional process wherein control of learning oscillates between teacher and learner, it appears to represent a shift between the behavioural and perceptual paradigms.

6.3.2.3 Heutagogy

Heutagogy is defined as "the study of self-determined learning" (Hase and Kenyon 2001). It is a humanistic learning (not teaching) approach embodying "constructivism, neuroscience, cognition, affect, motivation (Pink 2009), active learning and reflection (Argyris and Schön 1978; 1996), Complexity Theory (Lissack 1999; Stacey et al. 2000; Waldrop 1992) and systems thinking (Blaschke and Hase 2016; Emery and Trist 1965; Emery 1993; Hase and Kenyon 2001, 2013)" (Wark 2018, p. 42).

While pedagogy focuses upon what to learn (the product) and andragogy centers on how to learn (the process), heutagogy encompasses the what, how, when (timing), where (context) , why (the meaning), and who (who is involved and who controls the power) of learning (Hase and Kenyon 2013; Wark 2018).

In a heutagogical learning environment, learners must relearn how to accept their "own perceptions as a direct form of knowledge and [learn] to suspect forms of knowledge that advance themselves by systematically discounting direct knowledge that people have in their life-sized range of things, events and processes" (Emery 1981, p. 41). Learner needs, goals, and PLEs dictate the learning process, timing, and outcomes. The educator (or "learning leader"; Hase 2014, 2015) is a transient facilitator who creatively and dynamically assists the learner in assuming control and responsibility for their own learning. The acquisition of transmitted knowledge and skills demonstrated through competency measures in formal schooling contexts is replaced by active, relevant, and meaningful engagement in the learner's PLE that fosters learning capabilities (defined as "deeper cognitive processes… using competencies in new contexts and challenging situations"; Hase and Kenyon 2013, p. 25). The aim of heutagogy is to: enhance higher levels of cognition, deeper levels of reflection, positive emotional development, creativity, and the intrinsic motivation to be lifelong self-determined learners (Blaschke 2012; Blaschke and Hase 2016; Hase and Kenyon 2001, 2013).

The following Paradigm Shift Model encapsulates both paradigms and all three learning approaches.

6.3.3 Paradigm Shift Model

Expressed graphically as a Venn diagram (Fig. 6.1), the Paradigm Shift Model assists

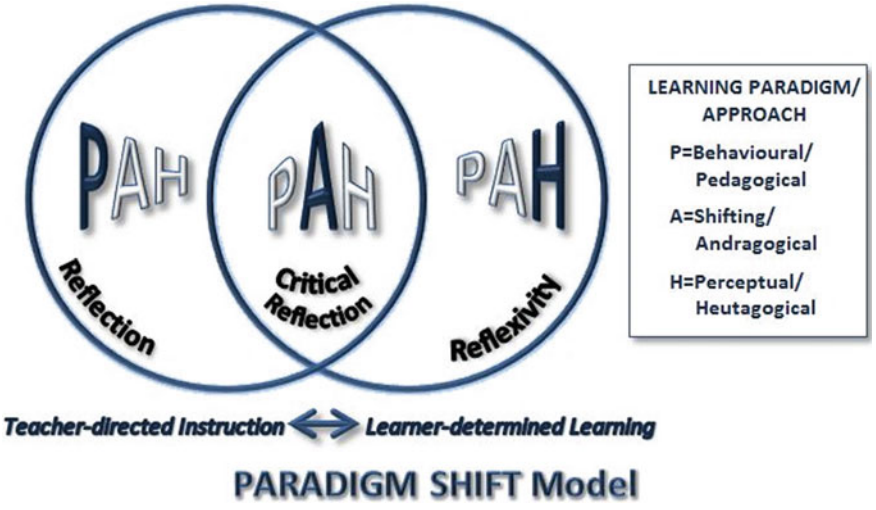

Fig. 6.1 Paradigm shift model illustrating movement between a teacher-directed and student-determined approach to learning. *P* indicates a pedagogical, *A* an andragogical, and *H* a heutagogical approach to learning

educational stakeholders in identifying existing paradigms, approaches, and contexts, and in the intentional generation of future theoretically- and practically-cohesive learning contexts.

The acronym, PAH, is used in the diagram to represent the relationships between various learning paradigms and approaches. To illustrate, the large *P*, mid-sized *A*, and small *H* in the left circle indicate that the behavioural paradigm and pedagogical teaching approach are most prevalent in this learning context. The mid-sized *A* indicates that some shift between paradigms and an andragogical approach to learning may be present in this context as well. Finally, the small H suggests that little, if any representation of the perceptual paradigm and heutagogical approach would be found in this context. The center oval suggests a shift between paradigms and an andragogical approach to learning would be most prevalent in this learning context, while P and H would likely be less obvious and nearly equally represented. Lastly, the large H in the right circle indicates that the perceptual paradigm and heutagogical approach to learning would be dominant in this learning context, *A* would be less prevalent, and *P* would be virtually non-existent.

Each of these three contexts primarily manifests the prevalent paradigm and approach in terms of who controls the curriculum as well as the instructional time, pace, place, content, resources, delivery, and evaluation of learning.

The model is not expressed as a continuum for numerous reasons. First, it does not reflect the individual learner's paradigm or approach to learning. For instance, a self-determined student who adopts a heutagogical approach to learning can be found in a predominately *P* environment. That student may have even made the choice to be in that environment *because it meets their self-determined needs and goals.*

Second, an A environment can quickly become either a *P* or *H* environment simply by changing the balance of power between teacher and learner. Third, a continuum would suggest that learners would necessarily begin in a *P* environment, move to an *A* environment, and eventually graduate to an *H* environment. Yet literature on how preschool children learn suggests that they are naturally self-determined learners (Dewey 1897, 1903, 1916/2007; Hase and Kenyon 2013), suggesting that they would learn best in an *H* environment. Moreover, the current diagram strives to convey the notion that learning is not linear or hierarchal in nature, but is rather a messy, dynamic, and complex process (Garnett and O'Beirne 2013; Hase and Kenyon 2013; Wark 2018).

6.3.3.1 Reflection as Agency

The model includes consideration of three forms of reflective thought. In a *P*-dominate environment, the educational focus is primarily upon reflection; how to improve the efficiency and effectiveness of performance (Finlay 2008; Schön 1983, 1987; Smyth 1992). An *A* environment fosters critical reflection or the individual analysis of existing conceptions in light of new knowledge or experience (Fook et al. 2006; Rose 2013). Finally, an *H* environment encourages reflexivity; the introspection of self, praxis, and human nature (Freire 1970/1993; Ryan n.d.; Smyth 1992). To clarify, these are the prime forms of reflective thought encouraged within each of these contexts. However, while an educator may be facilitating critical reflection in an *A* environment, for example, it is quite possible that a student in this environment may be engaging in reflective or reflexive thinking instead.

6.4 Technology Integration Frameworks, Models, and Taxonomies

A number of technology integration frameworks, models, and taxonomies are reviewed in this section for their ability to help learners integrate emergent technologies within *P*, *A*, and *H* contexts. These include: the Framework for the Rational Analysis of Mobile Education (FRAME; Koole 2009) model, the Bring Your Own Device (BYOD; Stead 2012) framework, the Padagagy Wheel (Carrington 2015), the Substitution, Amplification, Modification, and Redefinition (SAMR; Puenterdura 2006, 2013) taxonomy, the Replacement, Amplification, and Transformation (RAT; Hughes et al. 2006) framework, and the Replacement, Amplification, Transformation and Leadership (RATL; Hesselbein 2014) model.

The FRAME, BYOD, and Padagogy Wheel blend theory with practice providing an umbrella approach to merging various individual, technological, and social aspects of mobile learning. All three reflect a shifting paradigm that focuses predominately on cognitive development, with the Padagogy Wheel offering the greatest opportunity for enhancing self-directed learning.

While the FRAME, BYOD and Padagogy Wheel focus specifically on mobile learning and are theoretically dense in nature, the SAMR, RAT, and RAT(L) taxonomies are less theoretical and intended to facilitate the integration of generic technologies for specific activities or situations. All three taxonomies adhere to a behavioural paradigm and pedagogical approach, although the RAT(L) does contain one level aimed at developing teacher leadership.

Wark's (2018) review of the aforementioned frameworks and taxonomies led to the following conclusions: (1) no literature clearly defined or operationalized all features, aspects, concepts, or terms, (2) all had little to no academic scrutiny or field research conducted on them, (3) the relationship between theory and practice was incomplete, confusing, or inconsistently applied in the reviewed frameworks, (4) all were intended to be used within a *P* or an *A* environment, (5) all focused exclusively or primarily upon the development of cognitive skills, especially instrumental reasoning (e.g., efficiency and effectiveness of technology integration). Ultimately, none were adequate for integrating emergent technologies within an *H* environment, or flexible enough to be used within the contexts of *P*, *A*, and *H* environments.

6.4.1 Omni-Tech

The omni-tech taxonomy defines the teaching and learning emergent technology integration goals within the *P*, *A*, and *H* environments (Fig. 6.2). Students acquire and practice developing efficient and effective use of emergent technologies within the P environment. In the *A* environment, instruction shifts from how to use particular technologies to more fully and seamlessly integrating technology as the learner connects to and interacts with human and non-human resources. The H environment addresses emergent technology integration in a holistic manner, responding to the

Fig. 6.2 Omni-tech taxonomy. Illustrates various levels of technology integration anticipated in relation to a behavioural/pedagogical (left column), shifting/andragogical (middle column), and learner-determined/heutagogical (right column) educational paradigms

learner's self-determined needs, drives, and goals within their PLEs, and with the support of their PLNs.

The arrows in Fig. 6.2 conveys the notion that learning is not linear. Nevertheless, the linear nature of government-imposed curricula in *P* and *A* environments is based upon the behavioural assumption that skill development starts with acquisition, moves to practice, and culminates in competency (Ertmer and Newby 2013; Garnett and O'Beirne 2013). The arrows reflect this mandated curricular approach, while simultaneously expressing the reality that learners can, for instance, demonstrate competency with a particular technology in one context, while still practicing how to use that technology in other contexts. The endlessly-looping circle in the *H* environment portrays the messy learner-determined curricula and double-loop learning. The learner accesses information from their PLEs and PLNs, practices, masters, and innovatively uses emergent technologies on an omni-learning basis, while employing instrumental reasoning, rational thought, and creative intuition as needed. The learner models leadership "by actively engaging in their learning, learning from and with others, and sharing what they have learned" (Wark 2018, p. 92).

Figure 6.3 provides a closer look at the transformative learning and leading segment of the omni-tech model. As explained in Wark (2018):

> A learner's emergent technology integration perceptions and experiences dynamically influence each other through reflexivity and by innate drives to find purpose, achieve mastery, gain autonomy, and innovate within the learner's natural, holistic omni-learning context. The learning process engages instrumental reasoning, rational thought, and creative intuition on [the learner's] demand. These mental processes not only help the learner to interpret experiences, but when used reflexively, may transform perceptions, alter experiences, and change reality, while enhancing intrinsic motivation to achieve higher levels of purpose, mastery, autonomy, and innovation (p. 93).

A learner's intrinsic drives are unique and dynamic. To illustrate, one learner may be driven to master the integration of a new technology simply for the challenge, another may be driven to master technology integration for social reasons, and a third may be driven by both desires. Furthermore, the motivational drive to achieve mastery may change for a learner depending upon, for instance, evolving perceptions, purposes, and contexts. Learning leaders must understand a learner's emergent technology integration perceptions and experiences in order to help the learner clarify: (1) why the learner views the integration as being important, (2) what learning is needed, (3) how the technology can be used (including possible consideration of novel solutions and opportunities), (4) where and when to learn, and (5) who should be involved in the learning process (Wark 2018).

The development of reflexive thinking gives learners the ability to challenge personal and collective moral reasons for integrating (or not integrating) a particular technology, as well as the opportunity to possess the imagination, means, and courage to transform reality. The learning leader's foremost goal, therefore, is to help the learner foster the mindset needed to challenge the purpose and value for integrating the emergent technology. Part of this process includes aiding the learner in identifying extrinsic and intrinsic motivations for integrating the technology, and learning how to enhance intrinsic motivators while reducing dependency upon extrinsic ones. In

Fig. 6.3 Integrating emergent technology naturally. A learner's emergent technology integration perceptions and experiences dynamically influence each other through reflexivity and by innate drives to find purpose, achieve mastery, gain autonomy, and innovate within in the learner's natural, holistic omni-learning context. The learning process engages instrumental reasoning, rational thought, and creative intuition to help the learner interpret experiences and reflexively transform perceptions, while enhancing intrinsic drives

doing so, the learning leader helps the learner hone instrumental reasoning, rational thinking, and creative intuition, thereby promoting reflection, transforming perceptions, and changing reality for the learner and perhaps others, including the learning leader (Wark 2018).

6.4.2 The Paradigm Shift Framework

The Paradigm Shift Framework (Fig. 6.4) merges the Omni-tech taxonomy with the Paradigm Shift Model. The paradigmatic shift is complete when the *P* or *A* learner realizes that they alone control their learning path. At this point, they move permanently into the H realm, fully reclaiming their natural, holistic ability to learn.

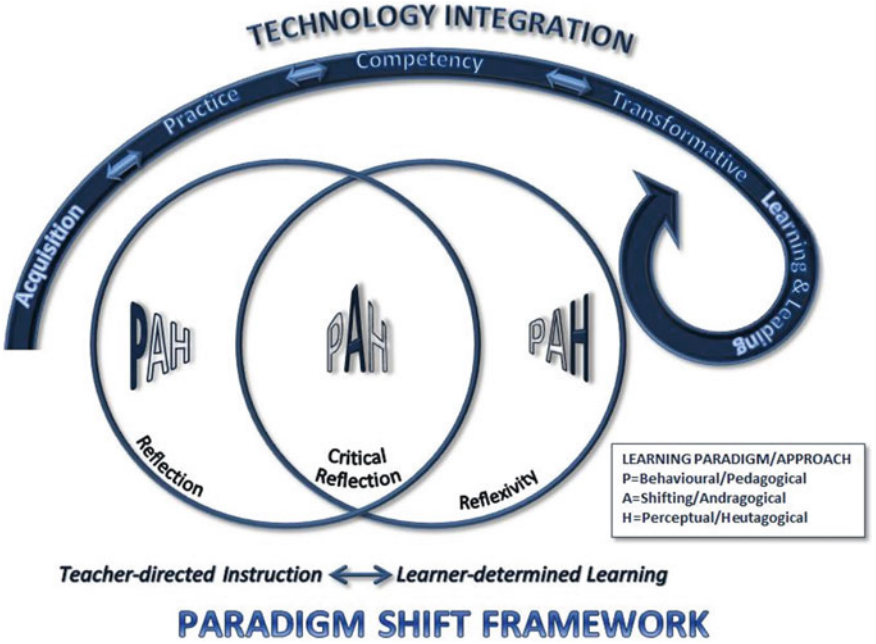

Fig. 6.4 Paradigm Shift Framework, illustrating the merger of the omni-tech taxonomy (dark blue technology integration arrow at the top of this image) with the paradigm shift model

6.4.3 Illustrating the Paradigm Shift Framework in Action

The Paradigm Shift Framework was employed to determine what key factors and, ultimately, what paradigm most empowered online graduate students to integrate emergent technologies for learning on demand. During the Spring 2017 term, volunteer students completed pre- and post-term questionnaires and participated in mid- and post-term interviews. This information was combined with course instructor interviews, public University website information, and researcher observations. The Paradigm Shift Framework was used to determine that the participating class contexts were very similar in nature, offering *A* and *H* opportunities within the larger *P* setting of the University (Wark 2018).

Results indicated that at the beginning of the term there was a nearly even split between the preference for a *P*, *A*, or *H* learning environment among the respondents. When asked to rate their level of integration with the 16 emergent technologies included in the study, participants indicated that, on average, they were beginning to practice integration with these technologies.

During the term, three-quarters of the participants indicated a change in their paradigmatic preferences; some increasing their preferences for *P*, others for *A*, and the remainder for *H* environments. Even those who expressed a consistent preference for one paradigm indicated fluctuations in motivational drives. These findings

support the claim that learning is a dynamic, complex, and messy process (Garnett & O'Beirne 2013; Hase and Kenyon 2013).

By the end of the term, there was a moderate preference for an *H* environment among participants. Those who preferred a *P* environment indicated a slight drop from their pre-term practice level with the 16 emergent technologies. They did not set any emergent technology integration goals for the term. Participants who showed a preference for the *A* environment reported a slight to moderate increase, although they remained at the practice level when the term was over. The *A* participants who set goals experienced a slight increase in their practice level, while those who set and changed their goals during the term reported a moderate increase. Lastly, those aligning with an *H* environment reported a significant increase, achieving early competency in their technology mastery level. All *H* respondents reported setting goals.

Interestingly, *P* and *H* respondents felt that they required less scaffolding and experienced less of a learning curve in relation to emergent technology integration during the term than their classmates did. It seems logical that the *P* respondents did not require emergent technology integration scaffolding or experience much of a learning curve, because they did not set emergent technology integration goals or report an increase in mastery with emergent technologies during the term. The reason why *H* respondents did not require much scaffolding either, despite setting goals and achieving the highest level of technology integration mastery during the term was because these learners were self-determined learning leaders who relied upon trial-and-error experimentation, as well as their expansive PLEs and PLNs to help them integrate technologies. The respondents who felt that they required the most scaffolding and experienced the greatest learning curve were the *A* respondents who set and changed their goals during the term. This was explained by their shifting dependence for learning from the instructor to themselves throughout the term. Ultimately, most respondents felt that, in the future, an *AH* or *H* environment would most empower them to integrate emergent technologies for learning on demand throughout life.

6.5 Conclusion

Exponential growth in emergent technologies is rapidly and dynamically changing the world. Some of these technologies have precipitated a shift in the knowledge economy from millennia of information scarcity to information explosion. These technologies offer humanity with the potential to transform learning by replacing the prevalent knowledge transmission model with a knowledge capture, curation, investigation, communication, and innovation model. Educational stakeholders are tasked with determining what paradigm and approaches to learning best facilitate the mindset learners need to purposively and perpetually integrate emergent technologies for learning on demand.

A review of existing emergent technology integration frameworks, models, and taxonomies indicates that none are capable of assisting stakeholders in identifying, selecting, and designing educational contexts that cohesively and coherently bind theory with practice from more than one paradigmatic stance. Most of the reviewed frameworks, models, and taxonomies subscribe to a behavioural paradigm, a few reflect a shift between paradigms, and none exemplify the emerging perceptual paradigm.

The Paradigm Shift Framework assists educational stakeholders, including learners, in identifying what prevalent paradigm, as well as what approaches to learning and emergent technology integration are being adopted in any learning context. The framework also enables stakeholders to intentionally design or participate in the learning context that best meets desired learning goals and objectives. Moreover, the framework can assist stakeholders in shifting from one paradigm and approach to learning to another.

The framework is not meant to be interpreted as a continuum; it based upon evidence that learning is messy, dynamic, and individualistic (Garnett and O'Beirne 2013: Hase and Kenyon 2013; Wark 2018).

Finally, the framework has been field-tested in one exploratory study (i.e., Wark 2018). It is anticipated that further testing will result in revision, refinement, and evolution of the framework.

Glossary of Terms

Andragogy An adult learning theory, most commonly associated with Knowles (1970) that includes the notion of the "self-directed" learner, who becomes increasingly less dependent upon the instructor for learning needs, while typically fostering greater participation in and reliance upon professional communities of practice.

Behaviourism An educational paradigm founded on the belief that the external, objective world is the only source of knowledge. Sensory interaction with this world evokes learning.

Context The collective sum of all environmental, social, and/or other circumstances and conditions found in a particular place or situation, or related to a particular notion or statement; the setting.

Emergent technology New or existing technologies, including "concepts, innovations, and advancements" (Veletsianos 2010, p. 33) that are being used in innovative manners and Contextfor educational purposes.

Emerging paradigm A previously obscure or unknown school of thought, based upon unique beliefs, and related practices, which is gaining popularity. Examples include twenty-first-century learning and "connectivism" (Siemens 2005a, b).

Formal learning Learning that occurs within structured educational systems and contexts, which is usually certified by official governing bodies. Examples include public schools, universities, and technical institutions.

General Purpose Technology (GPT) Widespread or pervasive use in a society of a particular technology, such as the steam or combustion engine, or electricity (Brynjolfsson & McAfee 2014).

Heutagogy A term coined by Hase and Kenyon (2001), to describe a learning approach derived from the perceptual learning paradigm. Heutagogy is based upon the belief that learning is learner-determined (that is, learners control their learning) and promotes the development of learner capacity for lifelong, and life-wide learning.

ICT Acronym for "information communication technologies"; technologies that transmit information (e.g., telephony or Internet connection technologies).

IEP Acronym for "individual educational plan." IEPs are typically generated during meetings that involve the learner and their learning team (e.g., educators, caregivers, other professional experts). IEP components include: short, mid-, and long-term educational goals; learner characteristics, preferences, strengths, weaknesses, barriers, and incentives; human and non-human resources; and timelines. The ideal IEP is learner-determined; other team members are considered to be transient resources. IEPs are typically reviewed, revised, and updated on a regular basis (e.g., every semester).

Informal learning Learning that occurs outside of formal, structured learning institutions or contexts; casual or incident learning.

Learner-determined learning Learning in which the learner controls the learning task, process, and context; also referred to as "self-determined learning" (Hase and Kenyon 2001, 2013). Learner-determined learning is not to be confused with "self-directed" learning (see also).

Omni-learning "Always learning"; the ability to learn anywhere, anytime, on the learner's demand (Wark 2018); mobile, augmented reality (AR), and wearable technologies enable the possibility of omni-learning.

Paradigm Or "worldview"; a term initially intended to identify particular scientific camps or schools of thought based upon specific theories, values, beliefs, assumptions, methodologies, and instruments (Kuhn 1962), but has since been extended to other disciplines as well.

Paradigm shift The change or movement from one paradigm (see also) or worldview to another (Kuhn 1962). The invention of a general-purpose technology (GPT; for instance, the printing press, electricity; Brynjolfsson and McAfee 2014) usually precipitates a paradigm shift which, in turn, significantly alters existing social, economic, political, cultural, educational, and other institutions of a particular society.

Pedagogy The original Latin term for a man leading a boy in learning; adheres to the behavioural paradigm, and teacher-directed approaches to learning most commonly used with children and novice learners.

Perception The identification, interpretation, and organization of sensory information in the brain used to represent, understand, and interact with the environment.

Perceptual learning The dynamic interplay between the environment and one's senses, cognitive thought, affective reasoning, emotions, and neurophysiological functioning; the foundational tenet of a learner-determined or perceptual paradigm (see also).

Perceptual paradigm A learning paradigm based upon the belief that the source of knowledge is innate and individually unique; also referred to as "learner-determined paradigm." See also "perceptual learning."

Rational thought A process in which the meaning attached to one's sensory perceptions of the world is challenged by some experience incongruent with this meaning (Kant 1781/2013; Adorno 1951/2005). This incongruence is critically (i.e., morally and cognitively) analyzed, and judgment is made by the mind before action is taken.

Reflective thinking Review of knowledge, value, or belief in relation to evidence that supports or refutes it, and the conclusions resulting from this review; originally defined by Dewey (1910, 1933).

Reflexivity Typically associated with research; the process of examining one's knowledge, beliefs, values, and actions in relation to the research process; involves reflection on how the researcher's axiology affects research decisions, and how the researcher/research respondent relationship affects the research project.

Self-directed The learner may control some aspects of the learning context, but the teacher usually controls the learning process and task; also referred to as "learner-directed learning" (Knowles 1970); not to be confused with "learner-determined learning" (see also).

Shifting paradigms A process of movement or change between one paradigmatic mindset or worldview and another. For instance, the behavioural and perceptual paradigms represent two disparate views on the source of learning. The behavioural epistemology rests upon the belief that the source of knowledge is external and sense-based, whereas the perceptual epistemology asserts that the source of knowledge is innate human perception. Theories, approaches, and practices that manifest elements of both paradigms, such as constructivism and andragogy, indicate a shifting state between these paradigms.

Teacher-directed A learning context in which any curricular, instructional design, instructional delivery, activities, assessment, learning resources, and environment are determined by the instructor.

Technology Merger of Greek roots, *techne*, meaning art, craft, skill, or the means to obtain something, and *logos*, the outward expression of an inner thought or feeling; "tools devices, systems, or procedures …[that] order and transform matter, energy, and information to realize certain valued ends" (Funk 1999).

Technology integration Seamless inclusion of technologies in learning contexts wherein the use of a given technology comes naturally to the learner in support of their learning, rather than being the focus of their learning; also defined as a process where the learner is becoming accustomed to using a technology for learning also defined as a process where the learner is becoming accustomed to using a technology for learning.

Traditional learning Formal learning theories, contexts, and practices typifying the Industrial Age educational system, and based upon the behavioural paradigm; characterized by patriarchal management, face-to-face teacher-directed interactions, knowledge transmission (e.g., rote learning), passive learning (e.g., independent seat work), and strict rules and routines, set within the context of brick-and-mortar buildings and laboratory-like classrooms.

Transformation Dramatic alteration in appearance, form, and/or function metamorphosis.

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