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Chapter 2

Making Personal and Professional Learning Mobile: Blending Mobile Devices, Social Media, Social Networks, and Mobile Apps to Support PLEs, PLNs, & ProLNs

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Abstract

Mobile technologies have become an integrated, or inseparable, part of individuals' daily lives for work, play, and learning. While social networking has been important and in practice in our society even before human civilization and certainly prior to the advent of computers, nowadays, the opportunities and venues of building a network are unprecedented. Currently, the opportunities and tools to build a network to support personal and professional learning are enabled by mobile technologies (e.g., mobile apps, devices, and services), web-based applications (e.g., Diigo and RSS readers), and social-networking applications and services (e.g., Facebook, Google+, and Twitter). The purpose of this chapter is to describe and propose how individuals use personal learning environments (PLEs), personal learning networks (PLNs), and professional learning networks (ProLNs) with mobile technologies and social networking tools to meet their daily learning needs. In our chapter, we consider categories of learning relevant to personal learning and professional learning, then we define and examine PLEs, PLNs, and ProLNs, suggesting how mobile devices and social software can be used within these. The specific strategies learners use within PLEs, PLNs, and ProLNs are then presented followed by cases that depict and exemplify these strategies within the categories of learning. Finally, implications for using mobile devices to support personal and professional learning are discussed.

Keywords: Mobile devices, social media, personal learning environments, personal learning networks, professional learning networks, smartphones, tablet computers

Introduction

Mobile devices are ubiquitous, and they are becoming inconspicuous to everyday life and learning. In 2013 the Horizon Report for K-12 (Johnson, Adams Becker, Cummins, et al., 2013a) and the Horizon Report for Higher Education (Johnson, Adams Becker, Cummins, et al., 2013b) listed mobile learning with smartphones and tablets and tablet computing, respectively, as significant impacts within one year or less. The EDUCAUSE Center for Analysis and Research (ECAR) Study of Undergraduate Students and Information Technology (Dahlstrom, Walker, & Dziuban, 2013) reported that it was equally common for undergraduate students in the U.S. to own two, three, four, or more Internet-capable devices, including laptop computers, smartphones, tablets, and e-readers.

The use of mobile devices, social software, social networks, and mobile applications (i.e., apps) offer promise as tools for learners to leverage more autonomy for what they learn, how they learn, and when they learn. This flexibility in learning “makes learning resources and methods increasingly distributed, varied, and personalised [sic] across temporal and spatial places” (Looi & Toh, 2014, p. 163). Wagner and Wilson (2005) and Attwell (2007) suggested the ubiquity of mobile devices by individuals and in the workplace and the increased access to networked technologies, such as social software and social networks, have given rise to individuals’ needs to learn in more differentiated and personalized ways.

Most recently, the 2014 Horizon Report for Higher Education Preview (New Media Consortium, 2014) identified social media for learning as an accelerating trend. In addition, “mobile apps are also tightly integrated with social networks” to allow learners to leverage personally developed networks of individuals and experts to support their learning (Johnson, Adams Becker, Cummins, et al., 2013b, p. 17). So, the integration of mobile devices and apps, social software, and social and professional networks engender the possibilities for learners to use personal learning environments (PLEs), personal learning networks (PLNs), and professional learning networks (ProLNs).

The purpose of this chapter is to describe and propose how individuals use PLEs, PLNs, and ProLNs with mobile technologies and social networking tools to meet their daily learning needs. In our chapter, we will consider categories of learning relevant to personal learning and professional learning, then we will define and examine PLEs, PLNs, and ProLNs, suggesting how mobile devices and social software can be used within these. The specific strategies learners use within PLEs, PLNs, and ProLNs are then presented followed by cases that depict and exemplify these strategies within the categories of learning. Finally, implications for using mobile devices to support personal and professional learning are discussed.

Categories of Learning

With an increased interest and emphasis on personalized learning and the roles that mobile devices may play, two categories of learning should be considered. First, formal and informal learning distinguishes between those learning activities that are structured or occur in a more ad hoc manner. The second category is personal and professional learning, which identifies the purposes of learning for the individual and to improve workplace skills. Each of these is described in more detail below.

Formal and Informal Learning

Formal learning is considered where learners are engaging with materials developed by a teacher to be used during a program of instruction in an educational environment (Colley, Hodkinson, & Malcom, 2003; Halliday-Wynes & Beddie, 2009). These are often led and evaluated by an instructor and associated with credentials (Jubas, 2010). For example, Ducate and Lomika (2013) used mobile devices with undergraduate foreign language students to complete specific tasks and assignments as part of their courses.

Informal learning is often defined as learning that results “from daily work-related, family or leisure activities” (Halliday-Wynes & Beddie, 2009, p. 3). Hrimech (2005) described informal learning as learning “which people do on their own” (p. 310). This type of learning is sometimes “unanticipated, unorganized, and often unacknowledged, even by the learner” (Jubas, 2010, p. 229). Activities, such as reading, using the Internet, visiting community resources, such as libraries, museums, and zoos, and on-the-job learning are usually considered informal learning activities. For example, Cui and Roto (2008) described how individuals used mobile devices for fact-finding to seek out a specific piece of information and information gathering, where they collected information from multiple sources to compare or aggregate the information in order to make a decision.

Personal and Professional Learning

Attwell (2007) was one of the first to depict the needs of personal learning and, subsequently, PLEs. Based in constructivist and sociocultural theories, he identified that (a) the individual identifies his or her learning needs that extend across informal learning, workplace learning, and formal learning; (b) learning takes place in various circumstances and conditions; and (c) all learning needs cannot be addressed through one program or environment. Attwell went on to suggest as did Cigognini (2011 as cited in Dabbagh & Kitsantas, 2011) that tools and technologies are needed to manage an individual’s personal needs. Mobile devices coupled with social software and

social networks enable these types of learning across contexts and reflect the individual. For example, Saadatmand and Kumpulainen (2013) described the uses of social media and Web 2.0 tools by students in open online courses to create, connect, share, annotate, bookmark, and aggregate their individual learning — even though no specific tools or technologies were required as part of the coursework.

Webster-Wright (2009) and Bitter Rijpkema and Verjans (2010) distinguished between professional learning and professional development. Professional learning is within the purview of the individual. Webster-Wright noted that professional learning is typically originated and executed by the individual. The learning needs are identified by the individual and occur during professional work activities (Bitter Rijpkema & Verjans). Professional learning is considered a continuous process of informal learning. The learning needs and learning strategies must be contextualized and relevant to the individual's work. Professional development in contrast is most often administered to professionals, such as inservice teachers, by identified experts in formalized programs (Webster-Wright, 2009). For example, Wasko and Faraj (2005) and Pimmer, Lixen, and Gröhbriel (2012) described online discussions and social media used by professionals for informal learning. In both cases, participants self-selected to participate in the online communities.

PLEs, PLNs, and ProLNs

Learners are using mobile devices for formal and informal learning, as well as personal and professional learning. In this section, we will define PLE, PLN, and ProLN. We will discuss the relationships among these three terms and relate these to the categories of learning above. This will help provide clear contexts for suggestions on the pedagogical strategies in the following sections.

PLEs

PLEs are a collection of subsystems in the form of devices (e.g., computers, tablets), software/applications (mobile applications), and web services/ learning resources/objects (e.g., video tutorials) that together serve an individual's learning needs (Martindale & Dowdy, 2010; Schaffert & Hilzensauer, 2008; van Harmelen, 2008; Wilson, Liber, Johnson, Beauvoir, Sharples, & Milligan, 2006). A PLE is usually interpreted and studied from a technology perspective and discussed in terms of how the collection of technologies forms an environment to support one's learning. Attwell's (2007) definition suggests that an individual self-organizes learning with autonomy over what needs to be learned, how it can be learned, and that the learning can occur across different locations or circumstances. Learning within a PLE is often informal, and the strength of the PLE is directly related to the fit to the individual (Bitter-Rijpkema & Verjans, 2010).

PLNs

A PLN, however, is established by integrating human social networks afforded through personal contacts and social web services into a PLE to address an individual's learning needs. Due to its network nature, a PLN can help individuals reach out, emulate, and finally integrate the similar practice observed in his/her networked connections' PLE practices to help enrich and improve his/her own PLE, and vice versa. Wheeler (2010) also suggested that PLNs could integrate digital networks and real-life networks. So, PLNs need not be completely asynchronous or geographically disparate; PLNs can include local colleagues or experts and virtual ones. For example, some students interested in building and programming robots can collect a series of learning resources such as tutorial in text, images, and video formats and bookmark those sites. With social web services (such as blogging, microblogging, Facebook), the students can connect with other individuals who share similar interests. Building a network of experts and collaborators, they exchange ideas and resources with like-minded individuals through sending e-mail, responding to blog postings, and tweets, and they may send requests to become "friends" with certain individuals. The resources can include personal blogs on building different types of robots, problem solving processes, and tips to avoid time-consuming trial-and-errors.

ProLNs

A ProLNs is grounded within a PLN. A PLN is built to serve an individual's learning needs from an individual's perspective. A ProLN also serves an individual's learning needs and at the same time serves the needs of a community of practice, where members in the ProLN have common professional interests and goals. In ProLNs, members collaborate and contribute to each other's knowledge construction and professional development (Ivanova, 2009). Wasko and Faraj (2005) suggested that an electronic network of practice is a "self-organizing, open activity

system focused on shared practice” (p. 37). Though the participants are often only connected to one another online, the participants are “willing to mutually engage with others to help solve problems common to the practice” (p.37). In addition, Wasko and Faraj discovered that an individual’s knowledge contribution to the network was predicted by his perception that participation in the network enhanced his professional reputation. So, there was perceived individual value to contributing. The reciprocal process discussed above, where an individual learns and emulates practices learned from a PLN, can help result in a self-sustaining ProLN for formal and informal learning (Couros, 2010; Martindale & Dowdy, 2010), and provide momentum to support individuals’ development as lifelong learners (Ivanova, 2009).

In the context of a ProLN, individual learning interests are still valued, but it is the shared learning interests for professional needs and purposes that bring the community members of a ProLN together. Using social networking sites (e.g., Facebook, Google+, Twitter, private or public discussion forums), for example, teachers currently teaching or interested in integrating technology in their curricula can form a group that exchanges resources (e.g., lesson plans) and ask for suggestions on dealing with technical issues. This is evident from the number Google+ communities, such as Appademics, Teachers and Technology, and iPad Ed, and Twitter chats, such as #PBLChat, #Edtechchat, and #Spedchat. ProLNs are usually formed through shared interests and are collaboratively organized.

Mobile Layer of PLN/ProLN

With advancing mobile technologies, mobile devices today are much more portable, packed with strong computing power and can be always connected to the Internet (Hsu & Ching, 2013). These affordances allow mobile devices to serve as the physical hubs of PLNs because the social media and networking services all have corresponding applications for the portable, powerful, Internet-connected mobile devices. *Social media* “implies that it exists in a social space” (Rodriguez, 2011, para. 3), which may be used for individual, professional, and/or entertainment purposes, and leverages social networks cultivated by individuals. The *media* portion of the term suggests that the social interactions are mediated through social networks, digital networks, and digital devices.

Broadly, social media encompasses (a) social networking sites, such as Facebook, Twitter, and LinkedIn; (b) media sharing sites, such as YouTube and Flickr; (c) creation and publishing tools, such as wikis and blogs; (d) aggregation and republishing through RSS feeds; and (e) remixing of content and republishing tools (Greenhow, 2011, p. 140). Dabbagh and Kitsantas (2012) discussed integrating PLE with social media, namely adding the networking component. In fact, what they proposed can be better conceptualized as a PLN with the social media providing the network component to an individual’s PLE. They also argued for the benefits of integrating a PLE with social media for bridging formal and informal learning. Through social media, learners can go beyond one’s PLE and for network of learning, which aligns with the spirit and realization of PLN. The networking component in PLN also differentiates PLE and PLN in Ivanova’s (2009) conceptualization of the relationships between PLE and PLN. Couros (2010) also emphasized the importance of social media in establishing a PLN.

Siemens’s (2005) theory of connectivism, and Sharples’ (Sharples, 2000; Sharples, Taylor, & Vavoula, 2010) notion of learning as conversation propose that learning events do not halt but may continue within other networks to which we are part. Organized, or structured, formal learning can purposively leverage these networks, such as through Facebook or Twitter. Likewise, informal learning can flow throughout a day or days, tolerating pauses and disruptions (Ng, Howard, Loke, & Torabi, 2010). This means it is possible to maintain, access, and contribute to one’s PLN and ProLN anytime and anywhere using the affordances of mobile devices, mobile services, and social media.

For example, Hsu and Ching (2012) integrated mobile microblogging in a graduate-level online graphic design course. The students used the on-device camera to take photos of design examples and shared with classmates the photos, as well as short critiques using Twitter mobile apps. The students felt more connected with their peers because the authentic design examples from their daily lives were shared and discussed via short and quick conversations that helped to maintain the momentum of interactions. In that example, both mobile technologies and social media help strengthen the PLN that extended from the in-class formal learning environment to the out-of-class informal settings. This also helps pave the way for students with this experience to further develop their ProLNs as they are still connected with each other via Twitter after the semester ends.

Strategies for Learning with Mobile Devices in PLEs, PLNs, and ProLNs

There are no conclusive or definitive categories of strategies used for learning with or from PLEs, PLNs, or ProLNs. However, there is some consensus about the activities learners employ while working within these environments. For example, Ivanova (2009) identified search, aggregation, communications, connections, customization, creation, sharing, and curation as strategies to learn with or from PLEs, PLNs, and ProLNs. Similarly, Martindale and Dowdy (2010) listed creation, organization, and sharing. Finally, Dabbagh and Kitsantas (2011) described the aggregation and sharing of resources, participation in shared knowledge, and managing meaning making as the strategies for learning from PLEs and PLNs. Across these lists, we identified the following as common learning activities: communications, searching, creation, sharing, curation, and aggregation. Each of these is described in more detail below.

Communication

Communications persist as the primary function of mobile devices (Cui & Roto, 2008; Karikoski & Soikkeli, 2013). Wheeler (2010) defined communication in terms of “sharing, discussion, and dialogue” with synchronous and asynchronous methods or technologies (para. 2). Cui and Roto (2008) agreed that communications for individuals involves sharing their experiences and knowledge with others. Kietzmann et al. (2011), however, considered conversations (i.e., interpersonal communications) and sharing (see below) as distinct functions. They argued that conversations are the extent to which individuals communicate with others (Kietzmann et al., 2011, p. 244). So here, we have separated communication and sharing in order to differentiate the purposes individuals have for using these strategies for learning. Admittedly though, we recognize these terms are not dissimilar and are not mutually exclusive to one another.

Karikoski and Soikkeli (2013) asserted that communications with mobile devices are used to create and sustain the social networks of individuals through interpersonal exchanges. Communications technologies help to build cultures, and in some ways, they make individuals communicate and respond (Caron & Caronia, 2007; Mazmanian, Orlikowski & Yates, 2013). Mazmanian et al. (2013) described the habitual use of email communications by individuals to support their work for staying informed and responding. Karikoski and Soikkeli bifurcated the communications technologies afforded on mobile devices into two categories: (a) operator provided services, which includes voice, short messaging service (SMS), and multimedia messaging service (MMS); and (b) Internet communications services, which includes email, instant messaging, voice over internet protocol (VOIP), and social media. Moreover and important to learning with and from others, Karikoski and Soikkeli reported that as the social ties among individuals become stronger, they are more likely to use multiple media and services to communicate within their networks.

Searching

Both formal learning and informal learning require individuals to search, or seek, information to solve their learning needs. Marchionini (1992) proposed five components to information seeking in order to depict how individuals conduct searches: (a) define the problem, (b) select the resources, (c) articulate the problem, (d) examine the results, and (e) extract desired information. Yang (1997) noted how Marchionini’s process acknowledges the recursive and adaptive nature of information seeking. Hill (1999) and Eisenberg’s (2003) processes are similar to Marchionini’s stages, recognizing the need to consider searches and information seeking as a problem-solving process that should include an evaluation of the search strategy in addition to the information retrieved. For example, Cui and Roto (2008) described three specific types of searching individuals conduct on a daily basis: Fact-finding included searching for a small distinct piece of information or declarative knowledge. Casual browsing included an individual’s searching with no clear goal or seeking entertainment. Finally, information gathering included collecting information from several sources or sites in order to achieve a specific goal, such as making a decision or to collect knowledge on a specific topic.

When searching, learners use keyword searches with a broad search engine like Google and search methods based on an organized taxonomy of terms or categories, such as the academic database ERIC. Moreover, learners also use less formal searches with social media through folksonomies, such as with tags in social bookmarking sites (e.g., Diigo, Delicious) and with hashtags in social networking sites (e.g., Twitter, Facebook, Google+). On mobile

devices, searches can occur inside web browsers for search engines like Google, Yahoo, and Bing, or they can occur within specific mobile apps, such the variety of apps that access all of Wikipedia.com's entries (e.g., Wikipedia Mobile, Wikipanion, Wikilinks, Articles for iPhone).

Creation

Apps on mobile devices, as well as access to social software on mobile devices, have made the creation of multimedia readily available to learners. With built-in functions, such as cameras for still photography or video capture, and applications for note taking, audio recording, blogging, screen recording, etc., downloaded to mobile devices, the ease with which learners can create representations of their knowledge, evidence of their learning, and document their thinking is available where and when a learner chooses to learn. For example, Gikas and Grant (2013) described an activity where students were asked to provide video examples for the concept of community on their campus. For media creation, many of the functions available on mobile devices do not require data services or access to a network, so these artifacts can be created anywhere and then uploaded or shared when the learner is later within a wireless network.

Sharing

Sharing focuses on how and to what extent learners "exchange, distribute, and receive" information (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011). Kietzmann et al. proposed that social media focuses on sharing media, such as text, URLs, videos, locations, etc., and the development of any relationships beyond the shared media is dependent on the social media platform. For example, FourSquare is dedicated to sharing mobile locations, but it does not emphasize building relationships. Similarly, YouTube's primary emphasis is creating, posting, and sharing videos, but it is not directly attuned to building a community among its users. In contrast, Facebook's aim is to build relationships by sharing textual updates, photos, location check-ins, etc., and it includes functionality for creating groups and pages that are specific for sharing learners' more specific interests. However, as learners leverage personal learning networks and professional learning networks, expectations of personal benefit (e.g., new knowledge, relevant resources), achieving status, altruism, and obligation to others in their field may encourage reciprocity and increase sharing (Wasko & Faraj, 2005) regardless of the specific platform. Moreover, Jarcho (2012) suggested that as we learn, we use our understanding of the different networks to which we belong, such as project teams, professional networks, and social networks, "to discern with whom and when to share" (para. 5).

Curation

Curation is the organization of a collection, such as artwork and books. Digital curation differs from real-life curation, though (Hogan, 2010). Curators of art and collections select from rare and fine pieces by experts, where the potential pieces for inclusion are often small. Digital information in contrast is abundant. So for digital curation, learners must filter, order, and search through data and information (Hogan & Quan-Haase, 2010). Individuals must filter and select digital content, then annotate with descriptions or additional keywords (i.e., tags, metadata) in order to make the digital content retrievable and useful in the future (Rusbridge, et al., 2005). When used within social software, such as social bookmarking sites and mobile apps, this additional metadata can be shared with others publicly or within a restricted group.

Digital curation can be supplemented through algorithms built into social media tools available on mobile devices. For example, personal digital magazines, such as Zite and Flipboard, present relevant information or resources based on a learner's previous preferences. Curation can also occur through expert selection. For example, experts within personal learning networks and professional learning networks can tweet or retweet relevant information, resources, and links to their followers. Even for an individual mobile learner as part of her personal learning environment, all of these data can be selectively saved into social bookmarking systems (e.g., Diigo, Pinterest) or personal note-taking applications (e.g., Evernote) with relevant metadata (i.e., tags with bookmarking sites, specific boards for Pinterest or Learn.ist) for later retrieval.

Aggregation

Aggregation as a strategy for learning automates previous actions of visiting multiple sources of information. Aggregation services using distribution technologies, such as RSS, gather information from myriad sources across the Internet and publishes it into a single location (Anderson, 2007). For example, RSS feed aggregators, such as the now-defunct Google Reader and Feedly, pull updates from blogs and news sites directly without the learner having to check each site individually. As a point of information, the aforementioned personal digital magazines Zite and Flipboard could also be considered aggregators because they also retrieve updates for a learner. So, some social media tools use multiple strategies, such as curation and aggregation, which can support formal and informal learning on mobile devices.

Cases of Mobile Learning

In the previous section, we have presented categories of learning connected with learning with mobile devices. In addition, we have suggested six strategies learners use with PLEs, PLNs, and ProLNs. In this section, we discuss three cases from literature that present uses of mobile devices for personal and professional learning. In these cases, not only are the contexts diverse, but the categories of learning, strategies of learning, and uses of mobile devices, social media, and apps are also varied.

“Medical Profession, wow I Love It” Facebook Page

Pimmer, Linxen, and Gröhbiel (2012) described the use of a social networking site with mobile phones in the context of health education for developing and emerging countries, such as Nepal and India. “Medical Profession, wow I Love it” was characterized as a Facebook page, where medical professionals and medical students read and contributed. An overwhelming number of the participants used Facebook on a daily basis, and most all used Facebook on their mobile phones. The authors described the site participants’ uses of Facebook as a learning tool to engage in discussion of medical and clinical topics. The page owner would post (a) open and closed questions, (b) presentations of cases, (c) links to medical resources, or (d) cartoons and jokes, and participants would respond through comments, sharing, and “likes.” This use of social networking within a professional network could be interpreted as the implementation of a ProLN. The participants deemed their interactions on the Facebook page as relevant to their learning and considered it as an informal way to augment their formal medical educations as a form of professional development (c.f., Ivanova, 2009).

Pimmer et al. (2012) suggested that through the discussions and responses to the moderators’ questions and posts, participants were part of a professional community. In addition, the participants—both practicing professionals and medical students— were expressing and negotiating their individual professional identities. Indicative of Wasko and Faraj’s (2005) network of practice, the participants of “Medical Profession, wow I Love it” were typically strangers, where interactions were primarily based on virtual relationships, and they were focused on a shared practice. The use of mobile device in this case allowed participants to access the Facebook page more, and the participants used “pull strategies” (Pimmer, Linxen & Gröhbiel, 2012, p. 735), where the individuals chose when and how to engage with the ProLN.

Mobile Learning at Sheffield Hallam University

Northcliffe and Middleton (2013) were interested in the autonomous use of personal digital devices, and they expanded their previous research on student uses of personal audio recording devices. Concurrent to this Northcliffe and Middleton study, other survey research identified that 87% of the students at Sheffield Hallam University owned smartphones. So, the authors wanted to explore how students were using their personal smartphones and tablets to support their learning. Five students from the computing and engineering departments described the ways in which they used their devices.

Northcliffe and Middleton reported that “students valued the flexible access” their mobile devices provided (p. 200). In addition, it became apparent that the students were “always on” with regard to multitasking and accomplishing personal and academic or professional tasks at the same time (p. 200). The student participants described uses of

collaborative applications, such as Google Docs and Dropbox, along with using social media, such as Facebook, for communications. Northcliffe and Middleton organized the student uses in four categories of productivity, communication, multitasking, and organization.

What was also evident from the case presented here is the students autonomously chose specific tools and applications to use. The uses of social media/social networking tools, such as Facebook and Skype, were selected as needed and used extemporaneously. In addition, some students chose to use audio recordings of formal instruction and collaborative productivity tools, such as Google Docs and Dropbox, at their discretions. So, while the applications, social media, and mobile strategies were used as part of their formal learning, the choices indicative of Ivanova's (2009) strategies for PLEs were made by the students to meet their personal learning needs.

Mobile Assisted Language Learning

It is important to recognize that not every use of mobile devices with social software and mobile apps reported in the literature was an implementation of PLEs, PLNs, or ProLNs. Moreover, in some cases the lines distinguishing among these were quite blurred. Ducate and Lomika (2013) reported how undergraduate foreign language students used mobile devices, specifically iPod Touches and smartphones. The mobile devices were used with specific tasks and assignments as part of formal learning in the course. The tasks included conducting searches, using specific apps, downloading videos in the target languages, posting to Twitter, creating videos, building photo collages, posting to a Facebook group, and uploading to a YouTube channel.

While all of these tasks and assignments reflect authentic tasks for language learning, they do not appear to reflect the tenets of PLEs, PLNs, or ProLNs. The assignments as part of these courses did not specifically integrate the professions or professionals for each of the individuals (c.f., Ivanova, 2009). In addition, the students did not share a common practice, other than completing similar assignments (c.f., Wasko & Faraj, 2005). Arguably, the use of social networking sites, such as Twitter and Facebook, social software, such as YouTube, and mobile devices, such as iPod Touches and smartphones, could constitute the foundation of a PLE and possibly a PLN. The tasks described in Ducate and Lomika's research suggest a formal structure crafted by the instructors and followed by the foreign language students. The autonomy, or personalization, of a PLE and PLN suggested by Attwell (2007), Ivanova (2009), and Martindale and Dowdy (2010) does not seem to be individualized by the students. Ducate and Lomika, however, reported that the participants did use the "devices in ways that corresponded with their needs and interests" (p. 457-458). So, we are left to conclude that some students may have benefitted from creating a learning environment akin to a PLE or PLN and additional research is needed as to whether formal learning with quite structured resources and scaffolding allow learners the flexibility to craft a more individualized learning process or network.

Implications for Using Mobile Devices to Support Personal and Professional Learning

While the cases we have presented for mobile learning are quite varied, there are some common implications across these and the strategies, categories of learning, and implementations of PLEs, PLNs, and ProLNs we have discussed. In this section, we explore three areas of implications when using mobile devices to support learning with personal and professional learning: (a) flexibility, (b) ubiquitous and situated learning, and (c) design considerations.

Flexibility

Comparing and differentiating PLEs, PLNs, and ProLNs can help inform the design of learning experiences, leveraging individual goals and professional- or discipline-specific goals. However, it is not necessary to set definite boundaries among PLE, PLN, and ProLN as the learning experiences can evolve as the learning needs of individuals or groups of individuals change. Personalized learning needs can involve formal, informal, personal, and/or professional contexts, which signify the flexibility of designing learning experiences with PLEs, PLNs, and ProLNs in mind. For example, Google offered its employees approximately 20% of their work time dedicated to a personal goal that aligns with the company's goals (Mediratta, 2007). In addition, Couros (2010) and Saadatmand and Kumpulainen (2013) described how learners self-selected social media and technologies within massive open online courses (MOOCs).

While PLNs and ProLNs can arguably maximize one's learning through social networking, some individuals may wish to isolate their personal learning from their professional learning. Email for business/professional communication and SMS text messaging for personal communication (e.g., Karikoski & Soikkeli, 2013) are two good examples of such practice. Also, even in my (first author Grant) own practice, I have recommended to teachers that initially they consider using Facebook for their personal social networking and Twitter for their professional networking and learning, which I have observed is a common path for novices (see e.g., Grant, 2011). Karikoski and Soikkeli (2013) noted that as personal connections, such as those within PLNs, become stronger, there is a greater tendency for individuals to use multiple media, such as social media, text messaging, and social networking, in order to communicate with their personal networks. Also, even with the all of the pervasive access and affordances, Caron and Caronia (2007) reported, it is still possible for individuals to retain solitude and social isolation.

Ubiquitous and Situated Learning

Another implication of using mobile devices with PLEs, PLNs, and ProLNs is the complexities of ubiquity and situated learning. Because mobile devices, social media, social networks, and pervasive access to the Internet, individuals are "always on" (Northcliffe & Middleton, 2013, p. 200). As Caron and Caronia (2007, p. 38) explained, mobile devices afford active learning during "non-times" and "non-places," such as waiting for the bus and walking from one place to another. These can include contributions, responses, and annotations to PLEs, PLNs, or ProLNs.

Mobility while learning affords learning at different times and varied places. This contextualizes learning and allows learners to situate knowledge in specific contexts (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991). However, a relationship between learning content and learning locations is not guaranteed (Sharples, Taylor, & Vavoula, 2007). Particularly appropriate to ProLNs, this highly contextualized learning aligns with Wenger's (1999) descriptions of communities of practice and Wasko and Faraj's (2005) descriptions of an electronic professional network, where experts cultivate novices practice within the work of a discipline. This was exemplified in the case by Pimmer, Linxen, and Gröhbiel (2012) presented previously.

Learning afforded by ubiquity, in what Caron and Caronia (2007, p. 38) called "stand-by moments", and in specific contexts has implications as well. Tella (2003) suggested that individuals might have difficulty integrating knowledge that has been learned in chunks or fragments. Fragmented information does not change into knowledge until it has been internalized (Tella, 2003). Highly contextualized knowledge can also become inert and ungeneralizable without explicit strategy to make it useful across places or disciplines (Bereiter & Scardimalia, 1985). Assimilating or accommodating information into existing schemata from informal learning, such as PLEs, PLNs, and ProLNs, may be more difficult than that with formal learning required in coursework or training. Because some informal learning may be unanticipated or even unrecognized by a learning (Jubas, 2010), encoding this knowledge may be more difficult. So, as learners move through different contexts when learning, they may need to have more cognitive flexibility (Tella, 2003), preventing isolation or fragmentation of knowledge.

Design Considerations

Finally, past research has provided some recommendations for building PLNs and ProLNs, which could be essential for teachers, K-12 professional development coordinators, university faculty, or trainers who are interesting in integrating more personalized and informal learning opportunities. Wasko and Faraj (2005) recommended focusing attention on a set of core, centralized individuals to create a critical mass of communication, sharing, etc. in order to sustain a ProLN. Interest in social network analysis (see e.g., Haythornthwaite, 1996) may become more important to leverage a ProLN for a more formalized informal learning within an organization.

Individuals can also consult their own PLNs, such as via Twitter or LinkedIn (Steer, 2012), to contribute to solving a current problem at an organization so they get immersed in the PLN. It is also a good idea to request to join a private group of interest and experience the actual running of a ProLN. It helps to observe and compare how open groups run their ProLN (i.e., activities, announcements, etc.) on Facebook, Twitter, or Google+, as benchmarking when considering organizing one. With the ubiquitous affordance of mobile technologies, individuals can more easily engage in PLN and ProLN activities through frequent access and interaction with others in their network, sustaining the momentum within the networks.

However, while building networks can be successful, it is worth noting that attempting to sustain networks is not always successful and would take extra effort and arrangement beyond the formal/required life cycle of the networks. For example, in an online course, Mackey and Evans (2011) reported there was little acknowledgement of the overlapping experiences of participants in communities of practice and other informal networks beyond the online course. This may be indicative of the institutional walls inherent in a course management system (Dabbagh & Kitsantas, 2012) or organizational cultures (Bartlett-Bragg, 2006) that may not value social media or informal learning. These types of barriers would not easily allow learners to integrate seamlessly their existing PLEs, PLNs, or ProLNs.

Conclusion

We have presented a broad depiction of how mobile devices, such as smartphones and tablet computers, can contribute to an individual's personal and professional learning. PLEs and PLNs are grounded in the needs of the individual with social media, local and internet-based networks, and mobile-specific apps to support communications, searches, original creations, annotations, sharing, curation, and aggregation. Similarly, ProLNs use these same technologies and strategies to support an individual's professional learning within an online discipline-specific community. Definitions, discussions, and examples have been presented to communicate what PLEs, PLNs, ProLNs each entail. This helps provide a more concrete picture for individuals to understand what they might engage in depending on their needs or interests. We do not intend to set finite boundaries because we recognize the boundaries among these three learning environments can often overlap and evolve from one to another due to the dynamic nature of one's needs.

While we have presented a number of exemplars from literature and examples from our own practices, we have had to interpret much of these as they relate to personal and professional learning. Given the hype that is currently surrounding personalized learning and the frameworks for accommodating informal learning opportunities (see e.g., Koole, 2009; Ruta, Scioscia, Colucci, Di Sciascio, Di Noia, & Pinto, 2010), there is surprisingly little empirical research with PLNs or ProLNs. Research with ProLNs is especially deficient. Moreover, the reports of mobile devices with PLEs, PLNs, and ProLNs are even more limited. Some papers (e.g., McElvaney & Berge, 2009; Mott, 2010; Rajagopal, Joosten-ten Brinke, Van Bruggen & Sloep, 2011), however, have provided suggestions on how to build PLNs and the pedagogical suggestions for using a PLN with teaching.

The research with regard to PLEs and PLNs has often been focused on reporting experiences with online courses and MOOCs especially. We have frequently observed reports of course design and activities in courses from an instructor's perspective with little description or interpretation on learners' experiences and outcomes. For example, Couros (2010) discussed his graduate course entitled, "Education, Curriculum, and Instruction: Open, Connected, Social," and what we have observed here surprisingly corresponds to what Couros (2010) noted in his chapter:

When I began conceptualizing this chapter, I envisioned a literature review focused on the differences between personal learning environments (PLEs) and personal learning networks. While there is a growing field of research and thinking behind the concept of the PLE ... the academic research on PLNs is much more anecdotal. A quick Google search will deliver hundreds of blog entries highlighting the importance of the PLN, dozens of strategies focused on how to build a PLN, and many K-12 conference presentations focused on the PLN as professional development. Yet, a definition of the PLN — one that differentiates itself from the PLE — does not readily exist. (Couros, 2010, p. 125)

Couros highlighted that literature on PLNs have continued to focus on advice to building a PLN and providing tips about it. This is perhaps due to its arguably indefinite boundary and potentially complicated nature, which makes defining the scope and boundary to study it difficult.

While there is research on personal and professional learning in higher education (e.g., Gikas & Grant, 2013; Moran, Seaman & Tinti-Kane, 2011) and informal or experiential learning for professionals (e.g., Bitter-Rijkema & Verjans, 2010; Pimmer, Linxen & Gröbhel, 2012; Wasko & Faraj, 2005), there is little if any implementation of PLEs and PLNs reported with K-12 education. These students could benefit greatly from developing life-long learning skills by communicating with peers and experts and developing self-regulation and metacognitive capacities as part of a curriculum. While there are examples of teachers integrating strategies for information

literacy, digital literacy, and media literacy (e.g., Clark, 2013; Lan & Sie, 2010; Lessig, 2008), there is scant research on how students are learning through more informal methods. Caron and Caronia (2007) and Garcia (2012) offered beginning insights into how youth are using mobile devices and what they might be learning through their social networks of peers. The emphasis of mobile learning research with children has been with formal learning (e.g., Kiger, 2012; Kim & Kim, 2012; Roschelle, Patton, & Tatar, 2007), and little has considered informal learning or the personal learning goals of children outside of schooling (c.f., Jones, Scanlon & Clough, 2013; Shuler, 2009). So, more research should consider how children and youth might use their mobile devices to craft PLEs, PLNs, and even ProLNs to help them accomplish their personal and professional goals.

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