Internet and Higher Education 15 (2012) 3–8

Contents lists available at ScienceDirect

Internet and Higher Education

Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning

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ARTICLE INFO

Available online 25 June 2011

Keywords:
Social media
Personal Learning Environment (PLE)
Self-regulated learning
Web 2.0

ABSTRACT

A Personal Learning Environment or PLE is a potentially promising pedagogical approach for both integrating formal and informal learning using social media and supporting student self-regulated learning in higher education contexts. The purpose of this paper is to (a) review research that support this claim, (b) conceptualize the connection between PLE, social media, and self-regulated learning, and (c) provide a three-level pedagogical framework for using social media to create PLEs that support student self-regulated learning. Implications for future research in this area are provided.

Learning on demand is becoming a type of lifestyle in modern society (McLoughlin & Lee, 2007). Learners constantly seek information to address a problem at work, school, or to just satisfy a curiosity. To do so, they take advantage of digital and networked technologies not only to seek information, but also to share information. Thus, learners should not be considered as passive information consumers; rather, they are active co-producers of content. Additionally, learning in the context of social media has become highly self-motivated, autonomous, and informal, as well as an integral part of the college experience (McGloughlin & Lee, 2010; Smith, Salaway, & Caruso, 2009; Solomon & Schrum, 2007). However, higher education institutions are still primarily relying on traditional platforms such as course and learning management systems (CMS/LMS) that do not capitalize on the pedagogical affordances of social media for example allowing learners to manage and maintain a learning space that facilitates their own learning activities and connections to peers and social networks across time and place (McGloughlin & Lee, 2010; Selwyn, 2007; Valjataga, Pata, & Tammets, 2011; van Harmelen, 2006). The aim of this paper is to discuss how Personal Learning Environments or PLEs can serve as platforms for both integrating formal and informal learning and fostering self-regulated learning in higher education contexts. There is strong evidence that social media can facilitate the creation of PLEs that help learners aggregate and share the results of learning achievements, participate in collective knowledge generation, and manage their own meaning making. We begin by providing research that supports this claim. We then describe a pedagogical framework that college instructors can use to demonstrate to students how to use social media to create PLEs that support a learner-centered pedagogy and foster self-regulated learning.

1. Social media use in higher education

Social media is a 21st century term used to broadly define a variety of networked tools or technologies that emphasize the social aspects of the Internet as a channel for communication, collaboration, and creative expression, and is often interchangeable with the terms Web 2.0 and social software (Dabbagh & Reo, 2011a). Examples of social media include experience- and resource-sharing tools such as Delicious, WordPress, and Twitter that enable online/social bookmarking, blogging, and microblogging; wiki software such as PBworks that enables the creation of collaborative workspaces; media sharing tools such as Flickr and YouTube that enable social tagging; social networking sites (SNS) such as Facebook and LinkedIn that enable social networking; and web-based (cloud-computing) office tools such as Google Apps that enable document and calendar sharing and editing among other things (Dabbagh & Reo, 2011b; Kitsantas & Dabbagh, 2010).

The 2010 ECAR (EDUCAUSE Center for Applied Research) study of undergraduate students and information technology revealed that students' use of social media has steadily increased from 2007 to 2010 and that the gap between older and younger student use of social media is shrinking (Smith & Caruso, 2010). More specifically, the 2010 ECAR study showed that 33.1% of the participant undergraduate student sample (N = 36,950) reported using wikis; 29.4% used SNS; 24.3% used video-sharing websites; 17.4 used web-based calendars; 11.6% used blogs; 4.3% used micro-blogs; and 2.8% used social bookmarking tools. Additionally, the percentages of those using social

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doi:10.1016/j.iheduc.2011.06.002

media for coursework related collaboration was particularly noteworthy (30.7% of wiki use, 49.4% of SNS use, 33.4% of video-sharing use, 37.6% of blog use, 40.2% of micro-blog use, and 30.5% of social bookmarking use). These data reveal that college students are integrating social media in their academic experience both formally and informally. Furthermore, college faculty is increasingly using social media to support teaching and learning activities (EDUCAUSE Learning Initiative, 2007, 2007). For example, some are encouraging students to use blogging platforms (e.g., WordPress) for the development of e-portfolios which have become an important authentic assessment tool in higher education (Rosen & Nelson, 2008). Others are using Twitter (a micro-blogging platform) to stimulate student engagement in the classroom (Rankin, 2009) and wiki software (e.g., PBworks) to engage students in collaborative projects that support the creation, editing, and management of content (Hazari, North, & Moreland, 2009).

These efforts by faculty and students are creating new ways of teaching and learning leading to the emergence of constructs such as e-learning 2.0, pedagogy 2.0, student 2.0, faculty 2.0, and classroom 2.0, with the suffix 2.0 characterizing themes such as openness, personalization, collaboration, social networking, social presence, user-generated content, the people's Web, and collective wisdom, and demarcating areas of higher education where a potentially significant transformation of practice is underway (Alexander, 2006; Dabbagh & Reo, 2011b; Jones, 2008; Lindstrom, 2007; Norton & Hathaway, 2008; O'Reilly, 2005; Sessums, 2006). For example, Hilton (2009) believes that higher education is being challenged by perceptions that Web 2.0 technologies (social media in particular) are empowering students to take charge of their own learning resulting in what some interpret to mean that there is no arbiter of their knowledge, work, publication, or thinking. Others (e.g., Anderson, 2008; Cormier, 2008; Dede, 2006; Katz, 2008; Siemens, 2005; Siemens & Tittenberger, 2009; Weigel, 2002) argue that Web 2.0 technologies are inducing a pedagogical transformation where the community is the curriculum rather than the path to understanding or accessing the curriculum and that higher education institutions should integrate social media platforms that enable the creation of personal and social learning spaces to support more learner-centered "personalized" education systems (Dabbagh & Reo, 2011b; Dron, 2007; McGloughlin & Lee, 2010; Selwyn, 2007). As a result of these social media induced pedagogical challenges and practices, the concept of Personal Learning Environments or PLEs is listed in the 2011 Horizon Report as an emerging technology that is likely to have a large impact on teaching and learning within education around the globe and a time-to-adoption of four to five years (Johnson, Adams, & Haywood, 2011). We discuss this emerging technology and its potential as a pedagogical or educational approach for integrating formal and informal learning in higher education contexts using social media.

2. Personal Learning Environments (PLEs) and social media

A PLE is a new construct in the e-learning literature that is premised on social media and steadily gaining ground in the e-learning field as an effective platform for student learning. Martindale and Dowdy (2010) posit that PLEs are an outcome of the tools that social media has provided learners enabling them to create, organize, and share content. PLEs are built on externally hosted (in-the-cloud) Web 2.0 tools and services designed to help students aggregate and share resources, participate in collective knowledge generation, and manage their own meaning making (Dabbagh & Reo, 2011b; Dron, 2007). The EDUCAUSE Learning Initiative (ELI) (2009) "seven things you should know about" series defines PLEs as the "tools, communities, and services that constitute the individual educational platforms that learners use to direct their own learning and pursue educational goals" (p. 1). Rubin (2010) and McGloughlin and Lee (2010) posit that PLEs empower students to take charge of their own learning prompting them to select tools and resources to create, organize and package learning content to learn effectively and efficiently. Rubin adds that PLEs are inherently self-directed placing the responsibility for organizing learning on the individual. These definitions and conceptual descriptions imply that PLEs can be perceived as both a technology and a pedagogical approach that is student-designed around each student's goals or a learning approach "chosen by a student to match his or her personal learning style and pace" (Johnson et al., 2011, p. 8).

In the e-learning domain, PLEs are becoming increasingly effective in addressing issues of learner control and personalization that are often absent in institutional LMS. Although LMS were initially designed to provide a flexible framework for advanced learning pedagogies, research has progressively shown that LMS emphasize faculty dissemination tools over student learning tools even though the latter is more likely to promote student engagement and interaction (Harasim, 1999; Harvey & Lee, 2001; Hedberg & Harper, 1998; Marra & Jonassen, 2001; Oliver, 2001). LMS have always been under the control of the institution, its faculty and administrators, leaving little room for learners to manage and maintain a learning space that facilitates their own learning activities as well as connections to peers and social networks across time and place (Valjataga et al., 2011; van Harmelen, 2006). In the physical world, learners typically rely on lunchtime discussions, student organizations, brown bag sessions and study groups for peer support and informal learning networks (Martindale & Dowdy, 2010). Web 2.0 technologies are now affording similar opportunities through social media. Consequently, PLEs can be perceived as a manifestation of a learner's informal learning processes via the Web, or, as a single learner's e-learning platform allowing collaboration with other learners and instructors and coordination of such connections across a wide range of systems (Martindale & Dowdy, 2010; van Harmelen, 2006).

While there is growing evidence that social media is increasingly supporting informal learning at home and in the community and that informal learning is becoming a vital element of education for learners of all ages (Selwyn, 2007), research has also revealed that PLEs can help integrate formal and informal learning in higher education contexts (McGloughlin & Lee, 2010). Formal learning is described as learning that is institutionally sponsored or highly structured, i.e., learning that happens in courses, classrooms, and schools, resulting in learners receiving grades, degrees, diplomas, and certificates, whereas informal learning is learning that rests primarily in the hands of the learner and happens through observation, trial and error, asking for help, conversing with others, listening to stories, reflecting on a day's events, or stimulated by general interests (Cross, 2007; Selwyn, 2007). Attwell (2007) reported that in the workplace, informal learning through asking questions, observing coworkers, and other uncoordinated and independent learning activities accounts for 80% of an individual's knowledge about this/her job. However, Cross considers formal and informal learning "ranges along a continuum of learning" (p. 16) rather than either–or dichotomies. Moreover, Hall (2009) suggests that formal and informal learning should be connected to optimize learning and that learning is most effective when the learner engages in both formal and informal learning activities. Attwell (2007) suggests that PLEs can be perceived as individuals organizing their own learning in multiple contexts where informal learning can be used to supplement formal learning and added that PLEs play an important role in advancing the understanding of e-learning. While Web 2.0 technologies seem to be scaling up students' informal learning, PLEs can be considered as a promising pedagogical approach for the deliberate or intentional integration of formal and informal learning spaces.

Specifically, a PLE consists of social media tools that allow students to gain competence or knowledge regardless of whether the tool enables interaction with another student about a class project or

going online to find examples or suggestions on how to approach a project. A key feature of a PLE is that the learner develops an online identity where the personalized learning environment provides cues (affordances or possibilities for action) that prompt the learner about what to share, what not to share, who they choose to share with, and how to effectively merge formal and informal learning. Several researchers have examined how students use social media for formal and informal learning. We describe such studies next.

Clark, Logan, Luckin, Mee, and Oliver (2009) investigated how adolescent students perceived and used Web 2.0 technologies (social media) both in formal and informal learning contexts. Students were asked what types of Web 2.0 technologies they used and why, and completed a learning map where they were instructed to visually map out the different technologies they used and for what purpose. The results showed that while students tended to use more Web 2.0 technologies during their free time than in school, they did use Web 2.0 technologies for school purposes. However, the most common technology used was email to transfer files and seek help from teachers or peers. This result shows that students are not fully taking advantage of the benefits that Web 2.0 technologies have to offer for formal learning. The authors conclude that in order for students to use Web 2.0 technologies as formal learning tools they need training. Similarly, Cigognini, Pettenati, and Edirisingha (2011) reported that learners need support, guidance, and pedagogical interventions to make the best possible use of social media to support their learning goals.

While most learning experiences are a blend of both formal and informal learning, social media is also inherently enabling informal learning experiences in higher education. For example, the results of a study (Harrison, 2011) that examined whether college student participation in a blog helped reinforce classroom learning by extending communication outside class hours revealed that students perceived the use of blogs as an outlet for thinking about class topics beyond the weekly class meetings both individually and in collaboration with peers through blog commentaries. The results revealed that blogging helped students direct their own learning, increased engagement in course material, and promoted the development of informal learning communities. Correspondingly, a study conducted with college students by Churchill (2009) revealed that a blog-based environment can help foster a learning community in which learners feel they are an important part of the classroom and that their needs and opinions matter. Findings also showed that blogs are most effective when they are designed to facilitate student access of course material, posting reflections on artifacts created through the learning tasks, and commenting on peer contributions.

Furthermore, Ebner, Lienhardt, Rohs, and Meyer (2010) examined whether the use of microblogs facilitated process-oriented learning and subsequently informal learning in higher education. The researchers tracked college students' use of microblogs throughout an entire course and analyzed them in order to explore their pedagogical affordances. The results revealed that students used microblogging for private informal communication as well as for more formal project-oriented communication to support social interaction in group work. Informal communication facilitated through microblogging was also an important factor in encouraging students to adopt more formal uses of microblogging.

Hemmi, Bayne, and Landt (2009) examined the use of social media in three courses across two semesters: two on-campus undergraduate courses and one online postgraduate course using a variety of social media tools. One undergraduate course used a visually rich wiki to support teaching and learning, the other used blogs to increase participation in classroom discussions, and the postgraduate course used a range of social media technologies including Facebook, Delicious, blogs, wikis, and Second Life (a virtual world) to support a variety of learning activities. The results revealed that social media engendered a pedagogical shift towards more collaborative modes of inquiry and placed increasing emphasis on the importance of group self-regulation.

In a study conducted by Valjataga et al. (2011), college students' perceptions of the pedagogical affordances of social media in supporting the development of PLEs were examined in order to evaluate a course design that was premised on social media. Students were given the freedom to select social media tools to create personal and distributed learning spaces (PLEs and DLEs) to facilitate individual and collaborative learning tasks in an educational technology course. Affordances were defined in this study as cues for action or action potentials that are evoked by multiple technologies in the learning environment and changed dynamically based on students' learning goals, tasks, and interaction with other students and course facilitators. For example the affordance evoked by the use of social bookmarking tools like Delicious would differ based on whether one or multiple students used it and what it was used for. Findings showed that students' perceptions of the affordances of PLEs and DLEs dynamically changed as they navigated the course landscape of social media tools to construct and perform learning activities aligning with the researchers' operational definition of affordances of social media. This led the researchers to recommend that (a) students should be encouraged to develop skills and confidence in the selection, application, and use of social media tools for personalized learning and that (b) new pedagogical models and approaches are needed to enhance students' abilities to organize and customize their own learning environments and advance their self-direction and self-awareness in a PLE.

Overall, the research suggests that social media are being increasingly used as tools for developing formal and informal learning spaces or experiences that start out as an individual learning platform or PLE, enabling individual knowledge management and construction, and evolve into a social learning platform or system where knowledge is socially mediated (Dabbagh & Reo, 2011a; Johnson et al., 2011; McGloughlin & Lee, 2010; Minocha & Kerawalla, 2011). The research also suggests that social media use in higher education is enabling the creation of PLEs that empower students with a sense of personal agency in the learning process. However, in order to successfully leverage social media towards the creation of PLEs, students must acquire and apply a set of personal knowledge management (PKM) skills, defined as "the act of managing one's personal knowledge through technologies" (p. 127), ranging from creating, organizing and sharing digital content and information, to higher order or more complex PKM skills such as connectedness, the ability to balance formal and informal contexts, critical ability, and creativity (Cigognini et al., 2011).

Specifically, PLEs require the development and application of self-regulated learning skills because PLEs are built bottom-up starting with personal goals, information management, and individual knowledge construction, and progressing to socially mediated knowledge and networked learning (Dabbagh & Reo, 2011a; Turker & Zingel, 2008). Kitsantas and Dabbagh (2010) suggest that social media have pedagogical affordances that can help support and promote student self-regulated learning by enabling the creation of PLEs and that the relationship between PLEs and self-regulated learning is interdependent and synergistic requiring the simultaneous, progressive, and transformative development and application of self-regulated learning skills using social media. We discuss this relationship next.

3. Self regulated learning and Personal Learning Environments (PLEs)

Self-regulated learning is defined as a student's ability to independently and proactively engage in self-motivating and behavioral processes that increase goal attainment (Zimmerman, 2000). More specifically, self-regulated learning can be regarded as a skill,

where students must know how to set goals, what is needed to achieve those goals, and how to actually attain these goals. Therefore, in order for students to self-regulate and direct their own behaviors, they must also be motivated or driven to attain goals (Kitsantas & Dabbagh, 2010). The motivational components of self-regulated learning help students persist in the face of difficult tasks and resist other sometimes more tempting options.

Zimmerman (2000) conceptualized self-regulated learning as a three phase cyclic model that attempts to explain why and how students achieve academically. The first phase is called the forethought phase. In this phase, prior to actually engaging in the learning task, students have a predefined set of cognitions (e.g., goal setting and planning) and self beliefs (e.g., task interest, self-efficacy) that will impact how they will approach the task. For example, a student who reports low self-efficacy beliefs in math and feels that math is not important to him/her will be less likely to excel in a mathematics course or have the persistence or effort to continue trying. In the second phase, the performance phase, the student begins to actually engage in the behaviors required to successfully achieve his or her goals. Specifically, students monitor their learning progress and use selected strategies to perform learning tasks. During the last phase of the model, the self-reflection phase, students use self-monitored outcomes to make judgments regarding their learning performance. Depending on the nature of the outcomes and the attributions students make, these self-evaluative judgments may affect future course of actions related to the first phase of the model; the forethought phase. Self-regulated learners engage in a cyclic feedback loop until they successfully achieve their goals.

Several studies have used Zimmernan's three phase model to support self-regulation in online and blended learning environments (Kitsantas & Dabbagh, 2010); however very few researchers have examined the relationship between self-regulation, social presence, and personal agency which is fundamental to PLEs (Turker & Zingel, 2008). Cho, Demei, and Laffey (2010) examined the extent to which college student engagement in self-regulated learning behaviors contributed to perceptions of peer and instructor presence in an online learning environment where courses were delivered totally online using a learning management system. Specifically, perceptions of peer and instructor presence were conceptualized as students' ability to "project oneself to others emotionally and socially" (p. 299) and perceptions of social presence were conceptualized as students' feelings of belongingness within a community. Students completed questionnaires regarding their self-regulation and perceptions of peer and community presence. The results revealed that self-regulation predicted peer social presence, instructor social presence, sense of connectedness, and sense of learning.

Furthermore, Turker and Zingel (2008) emphasized the connection between personal agency, self-regulated learning, and social media, and argued that "organizing learning resources available at a PLE into meaningful learning activities towards achieving set goals can as well be considered as an act of instructional design" (p. 4), and that this "act" corresponds to the forethought phase of Zimmerman's three phase cyclic SRL model. Schmidt (2007) suggested that social media facilitate three social cognitive processes: information management, identity management, and relationship management. These processes result in a change of self-representation based on psychological needs such as competence (perceived self-efficacy), relatedness (sense of being a part of the activity) and acceptance (social approval) which are acts of self-regulated learning (Turker & Zingel, 2008). Kitsantas and Dabbagh (2010) went further in conceptualizing the connection between SRL, PLEs, and social media, and developed a pedagogical framework for social media use that aligns with the three phases of Zimmerman's model. We describe this framework and its application next.

4. A framework for using social media to support Self-Regulated Learning (SRL) in Personal Learning Environments (PLEs)

To assist higher education faculty and instructors in scaffolding student self-regulation skills in the creation of PLEs we developed a pedagogical framework for social media use based on the levels of interactivity that social media tools enable. These levels are: (1) personal information management, (2) social interaction and collaboration, and (3) information aggregation and management (Dabbagh & Reo, 2011a; Kitsantas & Dabbagh, 2010). Dabbagh and Reo used Gibson's (1977) theory of affordances to argue that social media possess features that users can activate "to enable the degree of interaction and sharing desired and/or required for learning" (p. 13). The goal of this framework is to inform college faculty and instructors how to engage students in a transformative cycle of creating PLEs that support self-regulated learning. In doing so, PLEs can become effective pedagogical tools that influence students' cognitive processes in addition to serving as vehicles for informal learning (Turker & Zingel, 2008).

Specifically, at level 1 of the pedagogical framework, instructors should encourage students to use social media such as blogs and wikis to create a PLE that enables them to engage in self-regulated learning processes of Zimmerman's forethought phase such as goal setting and planning. The goal at this level is to guide students to create a personal or private learning space by self-generating content and managing this content for personal productivity or organizational e-learning tasks such as creating online bookmarks, media resources, and personal journals and calendars (Kitsantas & Dabbagh, 2010).

At level 2, social interaction and collaboration, instructors should encourage students to use social media to engage in basic sharing and collaborative activities. For example students can enable the blog's comment feature allowing instructor and peer feedback or create a collaborative workspace using a wiki. At this level of the framework, students are using social media to foster informal learning communities surrounding the course topics thereby extending the PLE from a personal learning space to a social learning space. These social and collaborative activities engage students in the self-regulation processes of self-monitoring and help seeking prompting students to identify strategies needed to perform more formal learning tasks. This level of social media use in a PLE aligns with the performance phase of Zimmerman's model (Kitsantas & Dabbagh, 2010).

At level 3 of the pedagogical framework, information aggregation and management, instructors encourage students to use social media to synthesize and aggregate information from level 1 and level 2 in order to reflect on their overall learning experience. These social media activities allow students to take greater control of their PLE, customizing it and personalizing it around their learning goals. This level of social media use in a PLE aligns with the final phase of Zimmerman's model, self-reflection, because it engages students in the self-regulation process of self-evaluation. This evaluation or self-reflection is then used by the student to influence the forethought phase of subsequent efforts, leading the student to make adjustments to the PLE created in level 1 of the framework and individualize it by design. Table 1 provides examples of how instructors can guide students' use of social media at each level of the framework.

The three levels of the pedagogical framework of social media use and the three phases of Zimmerman's model are interrelated in a self-oriented system of reflective feedback to support and promote self-regulated learning in the creation of PLEs. Ultimately, a self-regulated learner continues to adjust his or her strategies using social media tools across the three levels of the framework in order to optimize the PLE and to effectively direct aspects of the learning experience toward a desired outcome.

Table 1
A framework for using social media to support self-regulated learning in Personal Learning Environments (PLEs).

	(Level 1) Personal information management →	(Level 2) Social interaction and collaboration →	(Level 3) Information aggregation and management →
Blogs	Instructor encourages students to use a blog as a private journal to set learning goals and plan for course assignments and tasks	Instructor encourages students to enable the blog comment feature to allow for instructor and peer feedback enabling basic interaction and sharing	Instructor demonstrates how to configure a blog to pull in additional content and how to add the blog to RSS aggregation services
Wikis	Instructor encourages students to use a wiki as a personal space for content organization and management	Instructor encourages students to enable the wiki's collaborative editing and commenting features for feedback	Instructor demonstrates how to view a wiki's history to promote student self-evaluation of their learning across time
Google Calendar	Instructor encourages students to use Google Calendar for personal planning	Instructor encourages students to enable the calendar sharing features to allow feedback and collaboration to complete course tasks	Instructor demonstrates how to archive personal and group calendars to promote student self-valuation regarding time planning and management
YouTube or Flickr	Instructor encourages students to use Flickr or YouTube to set up a personal media archive related to course content	Instructor encourages students to enable the sharing feature of the media archive and join similar media archives created by peers	Instructor demonstrates how to aggregate media from several media archives to refine their personal archive
Social networking sites	Instructor encourages students to create an academic and career profile on LinkedIn	Instructor encourages students to connect to online communities related to their professional goals	Instructor asks students to engage in self-reflection with the goal to restructure their profile and social presence
Social Bookmarking	Instructor encourages students to use a social bookmarking tool (e.g., Delicious) to organize course content	Instructor encourages students to collaborate with other classmates and create a shared list of bookmarks related to a specific learning topic or project	Instructor asks students to self-reflect on their personal and group bookmarks to enhance the desired learning outcome

5. Conclusion

A PLE can be entirely controlled or adapted by a student according to his or her formal and informal learning needs, however not all students possess the knowledge management and the self-regulatory skills to effectively use social media in order to customize a PLE to provide the learning experience they desire. Teaching students to become effective self-regulated learners may help them acquire basic and complex personal knowledge management skills that are essential for creating, managing, and sustaining PLEs using a variety of social media. This paper provided a review of the research that supports this claim and presented a three level pedagogical framework that college faculty and instructors can use to scaffold student self-regulated learning using PLEs. Although this three level framework has not been tested empirically, it is postulated that as students engage in a self-oriented system of feedback with the help of the instructor and their peers, they become motivated and empowered to create effective and sustainable PLEs to achieve desired learning outcomes and enrich their learning experiences. Research studies should be designed to trace students' trajectories (paths) of social media use across the levels of the framework with the goal of documenting how students transition through the levels and examining the degree to which self-regulated learning strategies (e.g., goal setting, time management, self-monitoring, and self-evaluation) influence the design and advancement of their PLE. Such studies would also need to consider students' motivational beliefs such as self-efficacy beliefs as well as learning styles since PLEs are individualized by design and will differ from student to student. Results of such studies would inform higher education faculty whether PLEs can be used as an effective pedagogical and educational tool.

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