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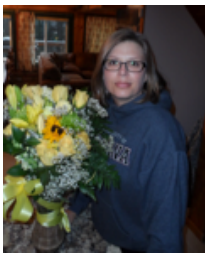

Although the proliferation of mobile devices sets the stage for a revolution of education in developing countries and the evolution of education in developed countries, the formation of an effective mLearning pedagogy remains a bit elusive. The process of discovery outlined in this study begins with identifying and applying an appropriate learning theory to mobile learning, and by evaluating the role of technology in the classroom. The mLearning pedagogy advanced here is no different than others in its focus on content, instructional assets, cognitive processes and evaluations. However, with two parts harnessing the power of the Internet and the other two parts pushing technology to the background the result is a convergence of vital human interaction with nearly worldwide reach. A learning management system-less (LMS-less) approach is the element missing from previous studies and it is also the element that puts the immediate application of the mLearning pedagogy within reach.

Keywords: *elearning, mlearning, pedagogy, social constructivist theory, learning management system*

Introduction

Development of an effective mLearning pedagogy remains a bit elusive. mLearning is a term that refers to using mobile devices to learn (Valk, Rashid, & Elder, 2010). It differs from eLearning, which uses desktop and laptop computers to learn (Fisher & Baird, 2006), and from traditional learning, which is organized around an instructor in a physical classroom. Undeniably, advances in mobile technologies have improved student access to higher education (Valk et al., 2010), but integrating that same technology into the classroom design as an effective learning tool is much more challenging. It is important to differentiate between the role of mobile technology as a system for accessing the classroom and the role of mobile technology

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in learning. Based on the interplay of existing learning management systems (LMSs) and mobile devices, new technological hurdles exist to extend access to both current eLearning students wishing to utilize mobile devices and to purely mLearning students that don't possess computers. Presumably, adjustments in the design by LMS developers and future advances in mobile technology will eventually resolve these issues. Until then, an LMS-less approach alleviates the need to force eLearning to fit mLearning and it promotes the development of a newly conceived mLearning classroom. An LMS-less approach also opens up more innate options for use in the pedagogy than are currently available to instructors in traditional or eLearning classrooms. With current access issues resolved through an LMS-less approach, the purpose of this study is to identify a pedagogical model for mLearning that works across mobile devices, but with a special focus on smartphones since they require the greatest departure from the current eLearning paradigm.

Literature Review

The pedagogical model begins with identifying an appropriate learning theory. As the name implies, learning theories are strategies to promote learning which, according to Gagne (1985) are defined as "change[s] in a learner's disposition and capabilities that can be reflected in behavior" (Wang, 2012, p. 10). These theories are often categorized based on common features, but they share the same overarching goal of guiding an instructor's pedagogy (Wang, 2012) hence, learning theories, are necessary precursors to developing pedagogy. Instructors should take note of their own role, the learner's role, and the relationship between the two (Wang, 2012) so that they can select the role that best fits student demographics and instructional topics. Therefore, two learning theories that support these roles are considered in this study: *social constructivism* and *connectivism*.

Social constructivism is a theory that is often associated with eLearning and connectivism is being debated as a learning theory underpinning mLearning (Anderson & Dron, 2011). However, connectivism hasn't developed enough to stand alone as a learning theory (Kop & Hill, 2008) in part because it seemingly overlooks the role of foundational learning on a topic before networking can be used to create new learning (Anderson & Dron, 2011). Social constructivism, which stems from Vygotsky and Dewey, builds upon the premise that foundational knowledge is a basic part of the construction of new knowledge (Anderson & Dron, 2011). Given the evolutionary nature of theories (Anderson & Dron, 2011; Baker-Eveleth, Chung, Eveleth, & O'Neill, 2011), a better way forward is to append a networking component into social constructivism until connectivism is either better developed or replaced by a new emerging theory. As a result, the learning theory being utilized in this study is social constructivism as derived from its cognitive-behaviorist roots (Anderson & Dron, 2011; Baker-Eveleth et al., 2011) with networking components borrowed from connectivism (Anderson & Dron, 2011). Broadly, the resulting pedagogy is content and asset driven with social activities and the opportunity to network included.

Drawing on the social constructivism theoretical framework, this study proceeds with sections on how social constructivism applies to mLearning, the specific role of technology in mLearning, the identification of a baseline mLearning pedagogy and conclusions. In short, mLearning has the potential to revolutionize learning in developing states and evolve learning in

developed states through a convergence of the strengths related to the traditional and eLearning classrooms: human interaction and nearly world-wide reach. The LMS-less approach makes it relevant to today rather than at some unknown point in the future and the baseline pedagogy spans across academic disciplines. However, with so many innate options available for use in the baseline pedagogy, testing is needed to narrow them down for specific academic disciplines.

Applying Social Constructivism to mLearning

Anderson and Dron (2011) identify social constructivism as the second generation of distance learning education and connectivism as the third generation. Advocates of connectivism, Siemens and Downes advance the argument that "learning *is the process of* building networks of information, contacts and resources that are applied to real problems" (emphasis added) (Anderson & Dron, 2011, p. 87). Information, so the theory goes, is found and applied when and how it is needed (Anderson & Dron, 2011). This fits with "just-in-time" learning (Cruz-Flores & López-Morteo, 2010), but it overlooks the importance of having a foundational level of knowledge on a topic first. It is more reasonable to say that *once a foundation of learning on the topic has been achieved* "building networks of information, contacts and resources that are applied to real problems" results in new learning (Anderson & Dron, 2011, p. 87).

The supporting mobile technologies already exist in an LMS-less mLearning classroom, but the theory and resulting pedagogy hasn't evolved to take advantage of the opportunities at hand.

For example, a learner with very little understanding of physics could go through the process of "building networks of information, contacts and resources that are applied to real problems" (Anderson & Dron, 2011, p. 87) without ever gaining a foundational level of understanding of physics. The ability to apply the information, which is contingent upon having a base level of understanding of it, is one link that is overlooked in connectivist theory. However, once that is achieved, the sources of information, contacts made and resources used (Anderson & Dron, 2011) that are associated to what is learned are kept by the learner, facilitated by technology, for future use and application, which should result in further learning. Networks create an opportunity for new learning, but connectivism is better described as a learning tool or asset that is best applied once foundational learning has been achieved. However, the notion that students create "networks of information, contacts and resources" for future use, at least in part through social interactions (Anderson & Dron, 2011, p. 87), is appealing and should be subsumed into social constructivism until connectivism is better developed or replaced.

Specifically as it relates to distance education, social constructivist theory evolved in tandem with advances in technology (Anderson & Dron, 2011). As one-to-one communication evolved into one-to-many and then many-to-many, social constructivism found its place in the distance learning classroom (Anderson & Dron, 2011). Arguably, social constructivism in this respect could only evolve *and* appear in practice as fast as the supporting technologies allowed. Today, the opposite is true. The supporting mobile technologies already exist in an LMS-less mLearning classroom, but the theory and resulting pedagogy hasn't evolved to take advantage

of the opportunities at hand. Chief among them is better meeting the expectations of the net generation of students.

The net generation, the first generation to always have the Internet, is substantially different than past generations of students that studied for tests and whose knowledge was based on instructor-centered modes for transferring information like lectures and handouts and the resources contained in local libraries (Fisher & Baird, 2006). The net generation seeks to learn on the spot, "just-in-time and just-in-place"(Cruz-Flores & López-Morteo, 2010, p. 10) as the need for the information develops and mLearning enables that paradigm shift (Fisher & Baird, 2006). Social constructivist theory applied to an mLearning classroom environment and corresponding pedagogy must account for the learning needs and social expectations of the net generation by wholly embracing a socially based student-centered pedagogy (Anderson & Dron, 2011; Fisher & Baird, 2006). As such, the application of technology in the pedagogy must allow students to "communicate, negotiate, socialize and learn" and, thereby network, while "on-the-go" (Cruz-Flores & López-Morteo, 2010, p. 9).

The Role of Technology in mLearning

Identifying how students access knowledge and the basic focal point of instructor interaction as it exists today determines the role of technology in learning. For example, in a traditional classroom it is very difficult to wholly deviate from an instructor centered delivery of knowledge and a content-driven approach since it is expected that students will access knowledge through the instructor. Social activities in that classroom environment may include informal student presentations or brainstorming sessions. In an eLearning environment, access to knowledge isn't centered on the instructor or the student, but rather on the LMS being used, the technology that underpins it and the classroom design (Anderson & Dron, 2011). Students independently access and review the course materials prior to engaging in socially oriented activities like those on a discussion board.

Obviously, technology has always played an important role in distance education (Fisher & Baird, 2006). In the eLearning environment, students work from a desktop centered application on a traditional or laptop computer (Fisher & Baird, 2006). However, that won't work well in the mLearning environment especially on smartphones because screen sizes are much smaller (Fisher & Baird, 2006; Valk et al., 2010) and battery life and memory are limited (Fisher & Baird, 2006). A smaller screen size on any device means that a text-based transfer of data is cumbersome for the student (Fisher & Baird, 2006). As a result, mLearning must substantially deviate from the eLearning paradigm and leverage the strengths associated to small, hand-held mobile devices toward creating new learning in students. In short, the content should be geared toward specific devices (Fisher & Baird, 2006) and around the interplay of instructors/students, data/technology, and time control/session work integrity (Cruz-Flores & López-Morteo, 2010) by integrating the "human-to-human" and "human-to-computer" aspects (Lambropoulos, Faulkner, & Culwin, 2012, p. 297). Practically speaking these can take the form of real-time chats, screen sharing, team rather than individual interactions, and formats that showcase participation (Cruz-Flores & López-Morteo, 2010).

With the device specifications and social constructivist theory in mind, the course design should be socially based. It

should account for data transmission and socially-based dialog between the course participants (Lambropoulos et al., 2012). The social presence of the participants (Aragon, 2003) and the social interaction of students with the instructor (Baker-Eveleth et al., 2011) are crucial to promoting a social learning environment or community. This social interaction can take shape in the form of mentoring sessions, practice sessions and debriefing sessions (Baker-Eveleth et al., 2011). The course design should provide opportunities for students to observe, imitate and model behavior as a part of the learning environment (Baker-Eveleth et al., 2011). Students should experience meaning and feel like they belong to the group, which in turn should become a part of their identity and result in increased involvement (Baker-Eveleth et al., 2011).

A critique of the technology used for eLearning revolves around its use to disseminate information and organize the classroom environment through an LMS rather than on creating learning in students (Lambropoulos et al., 2012). Meaningful discussions, a crucial component of a successful pedagogy based on social constructivist theory, are difficult to orchestrate in an eLearning environment (Lambropoulos et al., 2012) due to the limitations in the technology associated to the LMS. Social awareness, which includes both presence and copresence, is needed in an eLearning environment, but current LMS' provide a weak platform for students to observe themselves individually and in relation to other students (Lambropoulos et al., 2012). These weaknesses are demonstrated by nonparticipation, passive participation (reading only) and low participation in discussions (Lambropoulos et al., 2012). Two ideas studied by Lambropoulos, Faulkner and Culwin (2012) to improve both the quantity and quality of posts by students are to add visualizations regarding individual participation and participation relative to the rest of the group (e.g. who is at the center of the conversation) and to create a Collaborative eLearning Episode (CeLE) by having students use drop-down lists to label the content of a post (e.g. suggestion, question, agreement, etc.). This information, which showed the most promise in their study, can be used to show students what they contribute to class discussions along with their strengths and weaknesses (Lambropoulos et al., 2012).

The technology used for mLearning is a bit different. Smartphones and other mobile devices are used to gain access to the class and for new learning. Smartphones differ from traditional phones due to their data (Valk et al., 2010) and video features. Practically speaking, that means that students can use their phones to upload/download files like .pdfs and Word documents from online libraries. They can also watch videos either provided by the instructor or that already exist on the Internet like those on YouTube.

It is widely accepted that eLearning via desktop and laptop computer increases student access to education and LMS-less mLearning via smartphones and other mobile devices increases that access even more (Valk et al., 2010). Without the need to purchase a computer and separate Internet service, mLearning based on devices and services the student already possesses is less expensive and users are already familiar with them (Valk et al., 2010). They are expected to transform the student experience into one that is customizable and individual in ways that promote both situated and authentic learning (Valk et al., 2010). The ability to provide not just timely, but nearly continual feedback also promotes student learning and reflection (Valk et al., 2010).

LMS-less mLearning provides the opportunity to push the technology from the forefront of the class like in is in eLearning to the background. It allows instructors and students to connect and engage "just-in-time and just-in-place" (Cruz-Flores & López-Morteo, 2010), in ways that make the underlying technology largely invisible. This helps keep the orientation of the classroom design on the learning theory and pedagogy rather than on the technology. Technology provides options for the application of the learning theory in the pedagogy, which is described by Anderson and Dron (2011) as a "hardening" of the pedagogy (p. 81). Undeniably, those options are rightly taken into consideration in the pedagogy (Anderson & Dron, 2011), but technology shouldn't dictate it. Perhaps the best way to describe it is that the technology should be so invisible to the student that it is taken for granted. An eLearning student today might describe the eLearning classroom as being computer based or online. The goal of mLearning should be to have students describe it as person-to-person with adding that contact is facilitated through smartphones or other mobile technology only as an afterthought.

If the real estate mantra is "location, location, location" then the mLearning mantra for LMS-less classrooms is "options, options, options". There are so many options on how an instructor can leverage technology in an LMS-less mLearning classroom to create new learning that it is nearly overwhelming. For example, at least 16 well-known options exist for students to read an ebook associated to an mLearning classroom. A few of the most popular reader apps are Kindle, Nook and Google Play Books. Google Play Books is probably the most universal since it isn't tied to a device like a Kindle or a Nook. To use this technology in an mLearning classroom, an instructor only needs to ensure that the course text(s) are available on multiple apps. The student chooses which one to use.

A Conceptual Baseline Pedagogy for mLearning

Anderson and Dron (2011) explain three generations of distance learning pedagogies as a "dance" between technology and pedagogy (p. 81). Although theory is well-represented in the article, it is strangely absent from this dance. Imagine instead a dance between theory and pedagogy where technology cuts in. Theory provides strategic direction, whereby pedagogy applies those ideas and technology provides options for access and learning.

How students access knowledge determines the classroom type. For example, traditional learning, eLearning, mLearning and hybrid classes are types of learning whereby knowledge is accessed in a more formal, facilitated setting. They are different than a library, which is also an access point for knowledge, but it isn't a formal one--meaning that the transfer of knowledge isn't facilitated by an instructor. Identifying *how* students will access the classroom environment is important because it impacts the application of the learning theory in the pedagogy (please see *Figure 1*).

A pedagogy includes the presentation of content, instructional assets, cognitive processes for the student, and evaluation of the learning achieved (Nish, n.d.). mLearning pedagogy is no different. Pedagogies associated to traditional classrooms are content-driven and instructor-centered (Anderson & Dron, 2011) and pedagogies associated to eLearning classrooms are LMS-driven and instructor-guided (Anderson & Dron, 2011). In an mLearning classroom, the pedagogy is Internet-driven and socially-centered. Content is identified by the instructor and available to the student

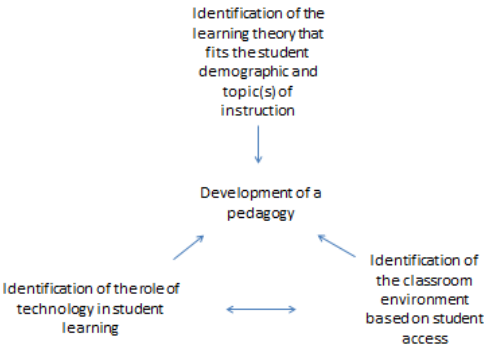

Figure 1. Interactions between theory, pedagogy, and technology

through the Internet. Presentation of the content depends on its form. Live, written, audio and audio/video are all options. The instructional assets related to learning are also related to, and provided by the Internet. Cognitive processes can vary based on the topic and student demographics due to the flexibility provided by the Internet and evaluations can include old techniques like quizzes and papers and new techniques like the "just-in-place" (Cruz-Flores & López-Morteo, 2010) application of new skills. Expressed in a formula an mLearning pedagogy looks like this: *social constructivist theory (networking component) + Internet content + Internet assets + instructor-to-student/student-to-student cognitive processes + instructor-to-student/student-to-student evaluations = a baseline mLearning pedagogy*. Leveraging the means and instruments available through the Internet to deliver course content and the instructional assets provides more natural options to "harden" the pedagogy (Anderson & Dron, 2011, p. 81) than are typically employed in traditional and eLearning classrooms. Although the cognitive processes and evaluations also use the Internet, the technology is pushed to the

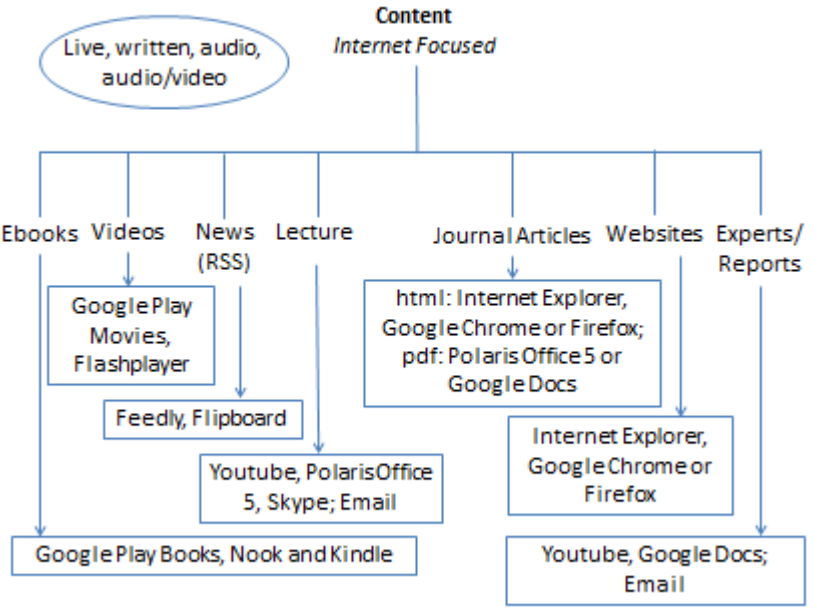

Figure 2. Examples related to the content portion of the pedagogy.

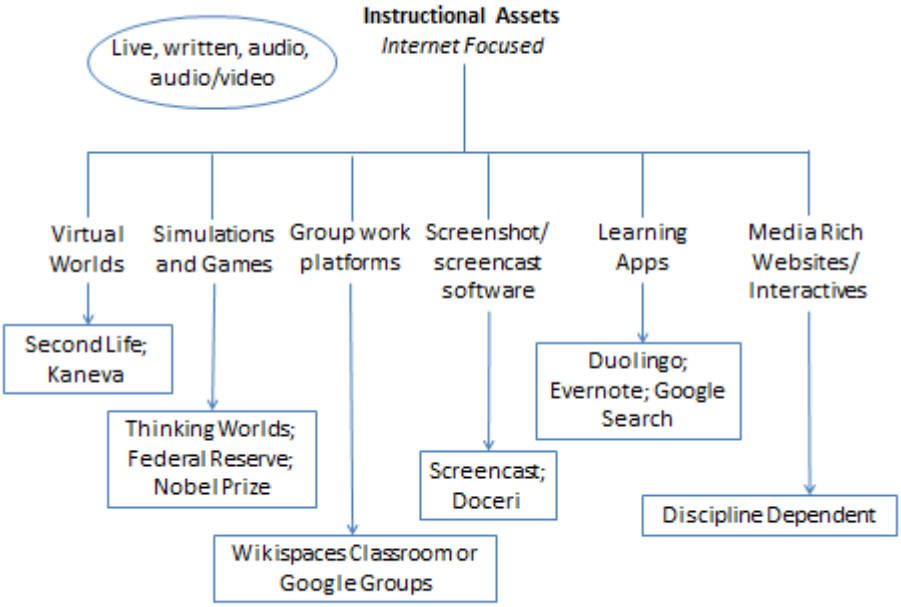

Figure 3. Examples related to the instructional assets portion of the pedagogy.

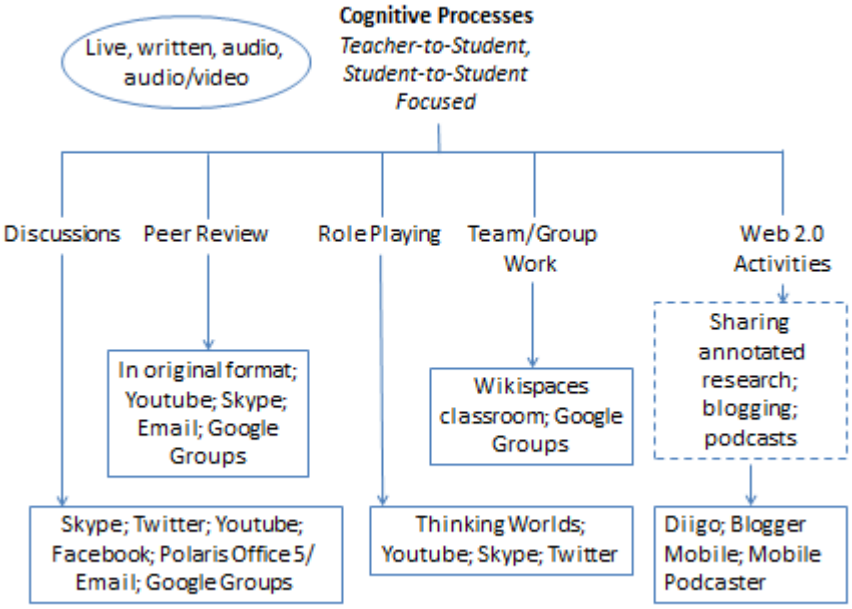

Figure 4. Examples related to the cognitive processes portion of the pedagogy.

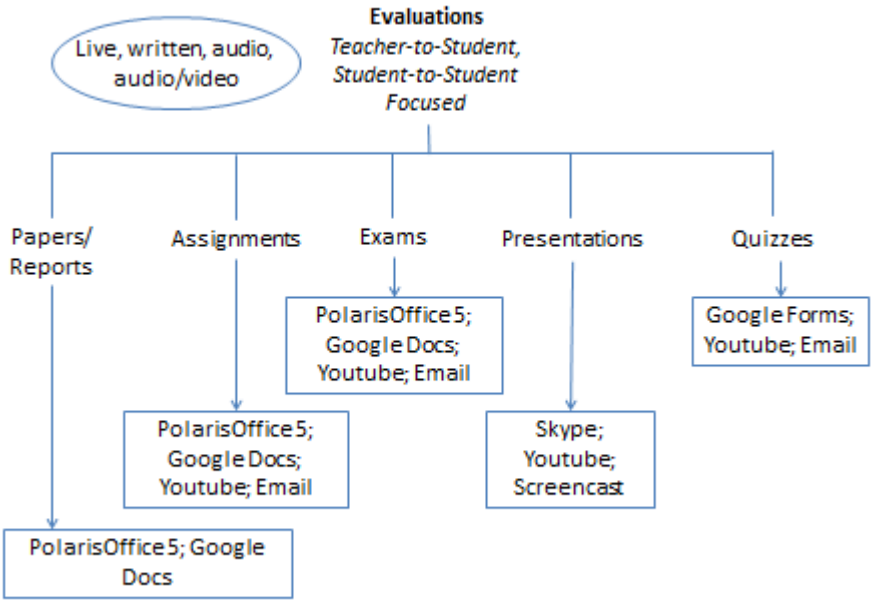

Figure 5. Examples related to the evaluations portion of the pedagogy.

background. The focus in those two areas of the pedagogy is on instructor-to-student and student-to-student interaction. To better express this baseline mLearning pedagogy, the following figures identify a few of the options related to each of the four core areas of the pedagogy:

Certainly, this pedagogy is familiar and many of these options are currently in use in traditional or eLearning classrooms. The point here is to draw in the strengths of those pedagogies while further developing the role of technology for access and creating new learning. Again, the LMS-less approach takes advantage of market demand for compatibility, which makes mLearning wholly available today.

Strengths of the mLearning Pedagogy

There are a few things that are easier or more convenient to do on a mobile device, like a smartphone, than they are on a laptop or desktop computer. For example, microblogging similar to Twitter could occur spontaneously rather than in a formal study session. Microblogging could be used in a number of ways in the classroom. For example, students could use microblogging to report, converse, and archive items (Anderson & Dron, 2011), such as sources related to a particular topic, brainstorm, vote on a debate or topic, or provide a running commentary like at the bottom of a news channel. Most of these should not serve as independent cognitive processes or evaluations, but they can be useful tools in the classroom. Microblogging, in particular, helps close the gap between the life of the student outside and inside the classroom because participation is not limited to formal class or study times. Also, providing a running commentary of an event helps close the gap between the theoretical and the applied. For example, a student could attend a local political speech or even watch a documentary on something like the Rwandan genocide and tweet about it throughout, which could

form the basis of a more formal and reflective cognitive process on that topic. Imagine forum discussions supplemented each week by student reporting and impressions of events, documentaries and the like. There exists a whole new level of dynamism that would be hard to match with a laptop or desktop computer. Being less formal, it also adds to the social interaction among students as they respond to tweets about the topic and otherwise network with each other. This idea also works in reverse, meaning that the instructor can tweet on an upcoming topic as the resident expert, which would improve the teaching, social and cognitive presence of the instructor all at once. Microblogging can add an element of continual discourse, however brief, outside of formally submitted and graded evaluations that are currently sparse in traditional or eLearning environments.

Another major benefit of mobile learning is that it can occur in very small increments. Students can leverage short expanses of down time like an unexpected wait at a doctor's office to learn. Given that mobile devices are often carried for other reasons, prior planning isn't required. Students can decide spontaneously to learn because the mood struck or opportunity knocked. Mobile learning should result in increases in new learning as students increase the total amount of time spent on learning and learning activities like thinking and analysis because they are no longer tethered to a formal class or study space and time.

Keeping social constructivist theory with a networking component in mind, cognitive processes can take a number of forms. For example, using a flipped approach, students are able review the course materials and submit questions or topics for discussion, which the instructor can choose from based on the course objectives for that week (University of Washington, 2015). Drawing from the technological options available to "harden" the pedagogy (Anderson & Dron, 2011, p. 81), the course materials could include written, audio or audio video components that are instructor-generated, or from materials developed by experts in the field that already exist on the Internet. The proposed questions or topics can be submitted by tweets on Twitter, and the discussion can be held synchronously via Skype, or asynchronously via Facebook or YouTube. In another flipped example, students can review the course materials and take a quiz early in the week with weaknesses forming the basis of the next discussion (Smith, 2013). Technologically, the quiz can be administered via Google Forms in a written format or with the questions provided by the instructor in a YouTube video. In this particular instance, students could provide their answers by emailing the link to a locked YouTube video back to the instructor. Another option is to administer the quiz via YouTube, but have the students provide their answers using Polaris Office 5 or Google Docs via email. Still another option is to email students a word document with the question and have them use Polaris Office 5 or Google Docs to edit the document to include their answers and email it back. More options exist that can be selected as required.

Imagine hands-on projects captured by video or group projects supported by six or more underlying means of communication for research, coordination, application and submission. In short, the strength of the baseline mLearning pedagogy is in its ability to be individually tailored to particular disciplines and pedagogical needs. Unlike the traditional classroom that isn't well set up to leverage the Internet to its fullest potential and the eLearning LMS that is limited by its underlying technology, the limitation factors here are related to the ability of the instructor to envision the possibilities.

Weaknesses of the mLearning Pedagogy

Despite the pedagogy's strengths, there also exist some weaknesses. First, since an LMS-less mLearning classroom isn't a place students go *to*, this type of learning environment could feel very abstract and unreal to students, which would presumably negatively affect their ability to successfully stay connected with and complete courses. A simple webpage to post announcements and provide links to the course materials for that week could help alleviate this until students adapt to the environment. Also, students could receive announcements via an RSS feed if available. Second, regulatory controls could be difficult given the number of options available. Third, abiding by laws like Family Educational Rights and Privacy Act (FERPA) may not be readily achievable in an LMS-less classroom (Mastors, 2013). Finally, a virtual campus for registration, etc. is still required, so some form of software overhead is needed.

Conclusion

mLearning has the potential to create a revolution of learning in developing countries and an evolution of learning in developed countries through a convergence of: 1) human interaction - a strength in a traditional classroom; and, 2), nearly world-wide reach - a strength of an eLearning classroom. The revolutionary potential in developing countries comes from the ability to provide education to people living in the global south *at a level never before experienced*. Six billion people in the world have mobile phones (UN News Centre, 2013) and 2.1 billion people have broadband subscriptions for them (mobiThinking, 2014). Of those, 1.16 billion are located in the global south (mobiThinking, 2014). The evolutionary potential in developed countries comes from the ability to expand mLearning so that it incorporates other mobile devices and fee based apps, which could provide a more cohesive learning experience for students.

In both environments, pedagogies related to mLearning should be driven by theory and envisioned without the dependence of an LMS in order to take advantage of the demand for compatibility between devices in the civilian market. Two portions of the pedagogy, content/presentation and instructional assets, should leverage the options available on the Internet. Doing so provides more options for use in the pedagogy than are currently available to instructors in traditional or eLearning classrooms. The remaining two portions of the pedagogy, cognitive processes and evaluations, should focus on instructor-to-student and student-to-student interaction by pushing the technology to the background.

Significant testing across disciplines is needed to identify the best practices. Having a nearly unlimited number of options is great providing that cognitive processes are organized, scaffolded and result in new learning. Presumably, the options that create new learning in natural sciences aren't necessarily the same options that create new learning in other fields like history. Likewise, the options that best fit one culture won't necessarily be the same ones that best fit another culture particularly considering the differences between developing and developed countries.

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