Addressing theoretical frameworks and theory for mobile learning

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Introduction

The last decade has seen a significant increase in the usage of mobile technology through many levels of society. This incorporation of technology at numerous socio-economic, cultural, and age levels has been explored eagerly by those conducting educational research, and many studies have been conducted under this idea of "mobile learning" (mLearning). These studies have produced ideas and guided shifts in pedagogical methods for teachers and curriculum developers throughout the world. A major gap surrounding the conceptualization and theory of mLearning, however, is noted by prominent mLearning scholar John Traxler, "[w]hat has, however, developed less confidently within this community is any theoretical conceptualization of mobile learning…the mobile learning community may nevertheless need the authority and credibility of some conceptual base" (Traxler, 2007). It is this issue that guides this literature review – which seeks to explore the current trends in the development of theoretical frameworks and the base of theory for mLearning.

Defining mLearning

Before proceeding through a review of the literature revolving around this topic, there must be a discussion on the state of a definition for mLearning. This task is not an easy one, as there are many different interpretations on how to define this idea but necessary if there is to be a discussion on the conceptual background. Mobile learning is an offshoot of both the electronic learning (eLearning) and distance learning fields, and is often explored by researchers and practitioners through those two lenses (Brown, 2005; Keegan, 2005).Some researchers define mLearning through the context of the technologies used, typically PDAs and mobile phones

(Traxler, 2005, Park et al, 2011), while others focus on the mobile aspect, allowing for learning to occur at any time, at any place (Keegan, 2005; O'Malley et al, 2003; Peters, 2007; Valk et al 2010). Some researchers take this idea a step further, incorporating the idea of ubiquitous learning (uLearning) – learning everywhere, at all times, even suggesting that mLearning is merely a transitional phase between electronic learning (eLearning) and uLearning (Pea & Maldonado, 2006; Park et al, 2011). For the sake of this literature review, all three definitions will be considered to address theory and conceptual frameworks, but particular attention will be paid to the importance of mobility and ubiquity.

Focus of the Literature Review

Numerous researchers have pointed out the lack of conceptualization and theoretical basis and framework when discussing mLearning. As noted by Traxler (2007), the field of mLearning has not adequately addressed conceptual and theoretical framework to provide authority and credibility to the studies performed. This idea is supported through an earlier description of the very same problem two years earlier, where Sharples (2005) states "what we lack, however, is an innovative and enhancing educational framework for the mobile age."

Since these statements, there have been attempts to address this gap in research and knowledge, based in in educational theory. It is, therefore, my intent to examine the current state of knowledge regarding the conceptual frameworks and theories applied to mLearning. This literature review will address two themes regarding the conceptualization and theory of mLearning: (1) The theoretical basis for using mLearning by examining the educational theories mLearning address, and (2) specific models used to apply these theories into practice. The final

portion of this literature review will explore the commonalities between the various theories and models in an effort to view the base components mLearning addresses.

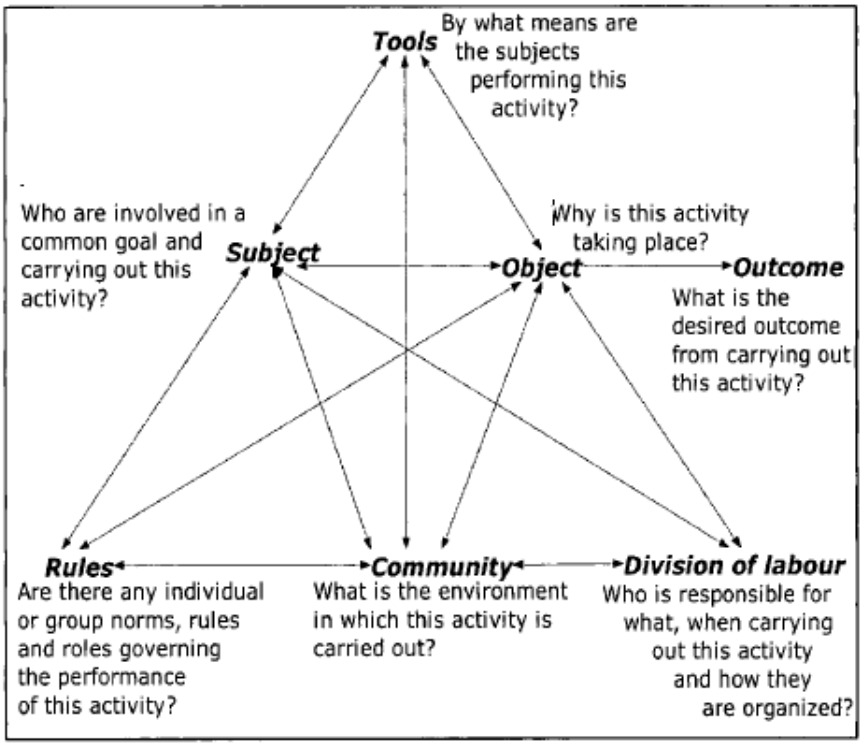
Theories addressed by mLearning

In order to understand how the various frameworks and models have the potential to aid learning both inside and outside of the classroom, it is important to understand the underlying educational psychological theories that mLearning addresses. The literature in this area addresses several theories, focusing mostly around the ideas of social constructivism, activity theory, and recently, Transactional Distance theory.

Perhaps the most cited educational psychology for mLearning is Social Constructivism. This is due to a number of factors regarding the benefits of mobile technologies in the classroom. As mLearning allows students to customize the transfer and access of information on their own skills and knowledge (Sharples et al, 2005), the student must take a greater responsibility in the learning process (Valk et al, 2010). Typically, the activities used in mLearning strategies focus around three areas of Social Constructivist theory: Collaboration, Communication, and Inquiry/Problem-based activities. Jeng et al (2010) cite numerous studies which apply constructivist theory and pedagogical methods through mobile learning activities. Pinkwart et al (2003) discuss the use of Personal Digital Assistants (PDAs) as a collaboration tool within interactive-constructivist environments, which they suggest results in 'collaborative mind tools.' Sharples (2005) notes that through this movement towards constructivism, the "teacher has no ontologically privileged position, but is simply another participant in the conversation of learning" (p. 148). Sharples places much focus on the idea of learning as conversation throughout his works (as will be discussed further through the Conversation Framework in the

later Framework and Models section), pointing back to theories put forth by Dewey on the importance of communication to the educational process (Sharples, 2005). This conversational model is important, as it "creates a continuing process of conceptual development (as the learner re0interprets situated activities as general principles)" (Karmiloff-Smith, 1992; as cited in Sharples, 2000).

Connected to the Social Constructivist approach to mLearning is Activity Theory. At its base, Activity Theory is the "understanding of human activity and work practices" (Uden, 2007). This theory addresses the interactive nature of objects, subjects, and communities through the view of a cultural-historical activity system, and providing support for learners to transform their knowledge and skill (Zurita & Nussbaum, 2007; Sharples et al, 2005; Cobcroft et al, 2006; Moses, 2008). Because of this triumvirate nature of the theory, it can be easily applied to mLearning environments, which rely on the interaction between the community (nearby and distant resources, including human), a device with which to communicate, and an subject being analyzed with the device. The implementation of activities which address these pieces of activity theory (to be addressed in the framework and model section) allow for meaningful learning experiences for the students as described by Vygotski and refined by Engeström (as cited in Zurita & Nussbaum, 2007), as long as they are properly designed to meet the needs of the activity.



Engestrom's expanded Activity Theory model, as cited in Zurita & Nussbaum (2007)

Much of the literature also focuses on the importance of constructivist techniques of inquiry, problem-based learning, and stresses proper scaffolding by the teacher so enable students to learn more effectively. These techniques should be implemented in the design of lessons focused around mobile devices within school contexts (Elias, 2011). This becomes more important to schools and classrooms as learning occurs in an ongoing fashion, and in a multitude of places, instead of focusing just on in the classroom during class.

Transactional Distance Theory is one that has only recently been adapted and applied to the idea of mLearning. Transactional Distance Theory addresses the psychological separation between the learner and the instructor when they are spatially separate from each other (Moore,

2007), and how the students and instructors address this separation through three factors: program structure, dialogue between learner and instructor, and extent of student autonomy. In this theory, there is a balance between these three factors, but the overall structure suggests the inverse relationship between structure and dialogue (less structure leads to increased dialogue), and the inverse relationship between dialogue and transactional distance (more dialogue decreases the transactional distance), resulting in the hypothesis that as transactional distance increases, so does learner autonomy. This idea is adapted into a framework for mLearning by Park et al (2011), which is to be discussed in the next section. Much of the TD theory comes from, explains, and compliments distance learning (Traxler, 2010).

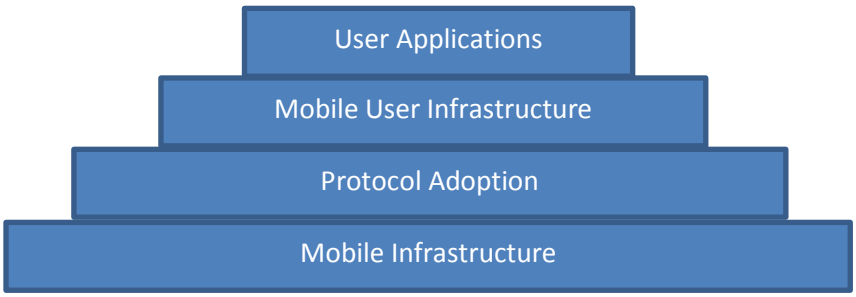
The learning theories described above are by no means an exhaustive list of the various learning theories addressed by mobile learning environments, as each theory can be applied in some way, shape or form to these types of environments and lessons. In their article, Keskin and MetCalf (2011) provide a comprehensive list of learning theories with connected examples to each theory,

Frameworks and Models of mLearning

With the underlying theories addressed, it is now possible to explore the many models and frameworks that have been presented with regard to mLearning over the past decade. Each of these frameworks and models approach mLearning from a different angle, based on the particular author's attitude towards the definition of mLearning, and each author has their own view on how education is changing due to this movement towards mobile education. As noted above, all of the definitions are taken into account when examining the frameworks developed

and used to apply these frameworks. There are, however, arguments that suggest mobile learning ought not to be addressed by or through theory, and should remain solely in the real of practice and practicality (

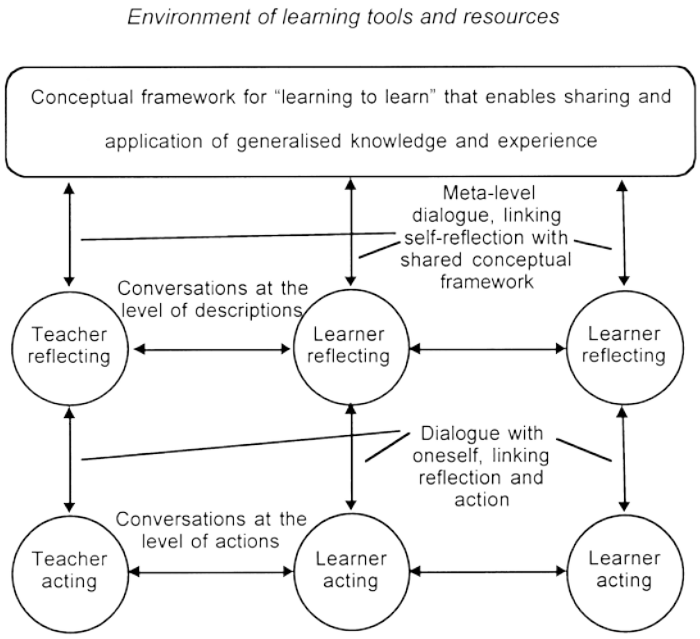
From the perspective of designing and developing for mobile learning environments, Leung et al (2003) propose a framework focusing on the structure of the needs for technology. This attitude towards developing a framework is reflected in the definitions proposed by those who have focused on the tools for mobile learning, as well as the developing infrastructure of mobile networks occurring at that time period. The framework is a layered approach, focusing on the actual infrastructure (what would be considered layer 1 by network administrators), and built upon by the protocols used, and then moving towards the user infrastructure (mobile devices, the software used such as the web browser), and finally, the actual applications used by the learner.



Mobile Learning Framework, Leung et al (2003)

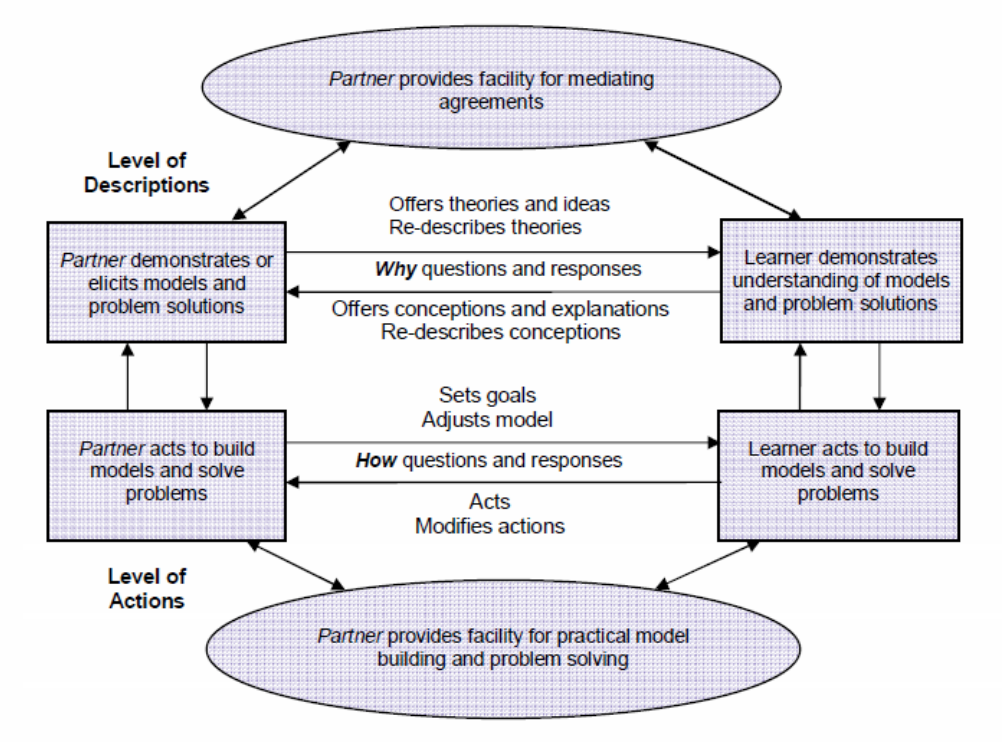
This particular framework allows for each component to "build on top of the functionalities provided by others" in order to spread the workload of infrastructure among different parties (e.g. vendors, providers, designers) (Leung et al, 2003). This provides the groundwork for the actual application of the other frameworks in the classroom – without these necessary components, implementation of mobile learning strategies will not be effective, and possibly non-existent.

As noted in the above section on theory, mLearning allows the students to learn in a more collaborative, constructivist, and conversational way when compared to traditional teaching methods and strategies. This conversational aspect of mobile learning as pioneered by Sharples (2000; 2005), which he focuses and conceptualizes through a connection to the models of technology-mediated lifelong learning. In his framework, there is a continual movement between action and reflection, on both the part of the teacher and the student, as shown below:



A conversational framework for personal learning, Sharples (2000).

Through this model for personal learning, the act of reflection and action are integral to the development of the learners, and must include dialogue between the learners and the teacher for effective development to occur. Sharples later refines this diagram to describe conversations (particularly through technology) to reflect the two levels conversation takes place it: the level of Action (doing), and the level of Description (seeking agreement), and is reflected in the following model:



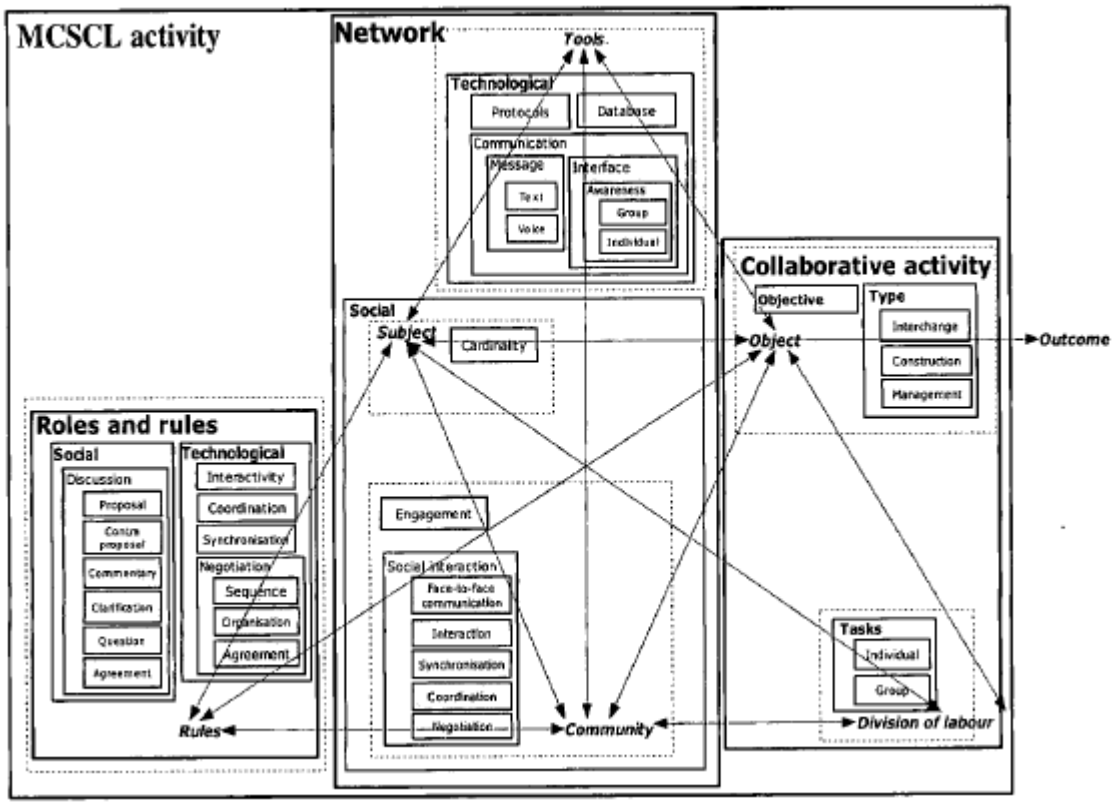
Conversational Framework for Learning with Technology, as adapted from Laurillard (2002) (Sharples, 2005)

In this model, we see the clear distinctions between the two levels, and the interaction between the levels of conversation. The importance of the technology in this model is stated by Sharples (2005):

> Some educational activities, such as science lab classes, are explicitly designed to support this structure of conversation. Mostly, the conversations only cover one part of the framework, either because the learner has no conversational partner available, or there are no tools for model building to hand, or learners lack the language and concepts to converse at the level of descriptions. That is where technology can assist. The conversational framework shows a conversation between learner and partner. The partner may be a teacher, or another learner, or it may be computer or communications technology. (p. 150)

Learners are not limited in conversation to that of a conversant who is with them at that moment in time, and can discuss at the level of descriptions to students who are across the room, the state, or the world, and promote discussion which can lead to the level of actions (continuing the cycle), promoting reflection and inquiry.

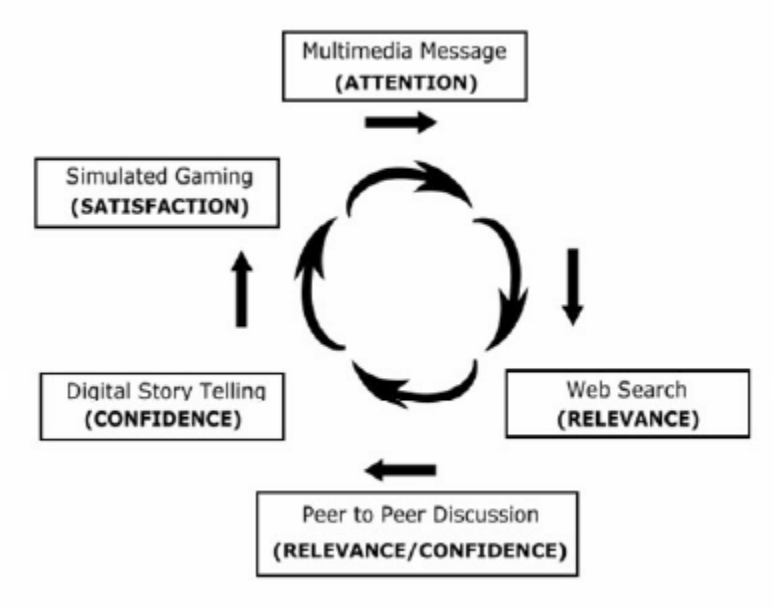
According to the above model, technology has the potential to play more than one role; it can be either the facilitator for conversation, or it can be a part of the conversation (through flashcards, review activities, etc.). Zurita & Nussbaum (2007) frame this in a different light, adapting Engestrom's Activity Theory model for use in a Computer-Supported Collaborative learning(CSCL) design. This model lays out the important aspects for each subsection described in activity theory for application in mobile CSCL environments, and in particular, mobile CSCL environments.



The Mobile CSCL framework based on Engestrom's expanded Activity Theory Model, as cited in Zurita & Nussbaum (2007)

Shih's mobile learning model and enhanced learning model both address similar aspects as those described above, but continue to approach from different angles than the previously described models and approaches from a more macro level, analyzing how different activities

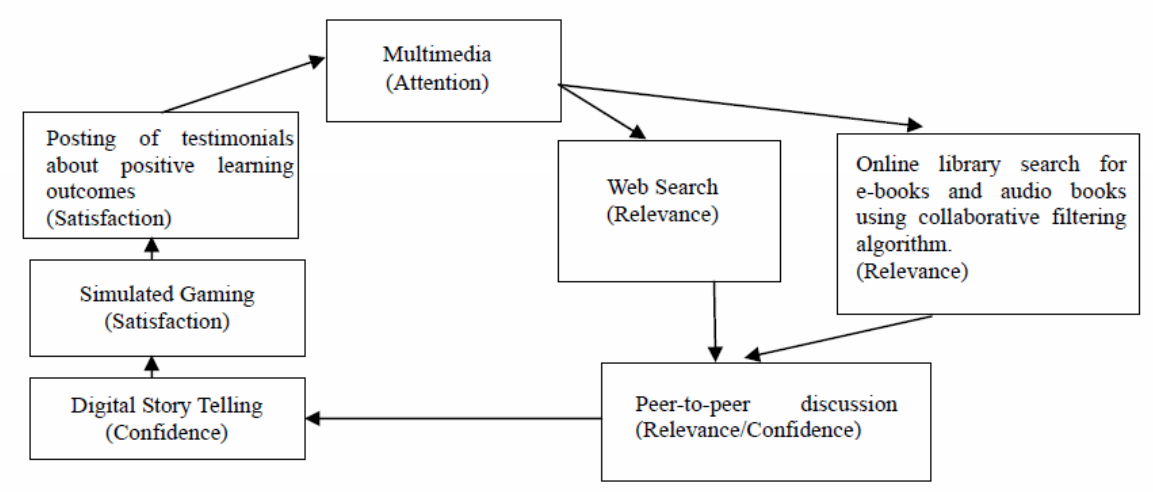
affect the learner through motivational means. The five steps of this model, based on the ARCS (Attention, Relevance, Confidence, Satisfaction) model of motivational design provides designers of instruction clearer guidelines on strategies they should implement in these lessons and curricula.



Shih's mobile learning model (Moses, 2008)

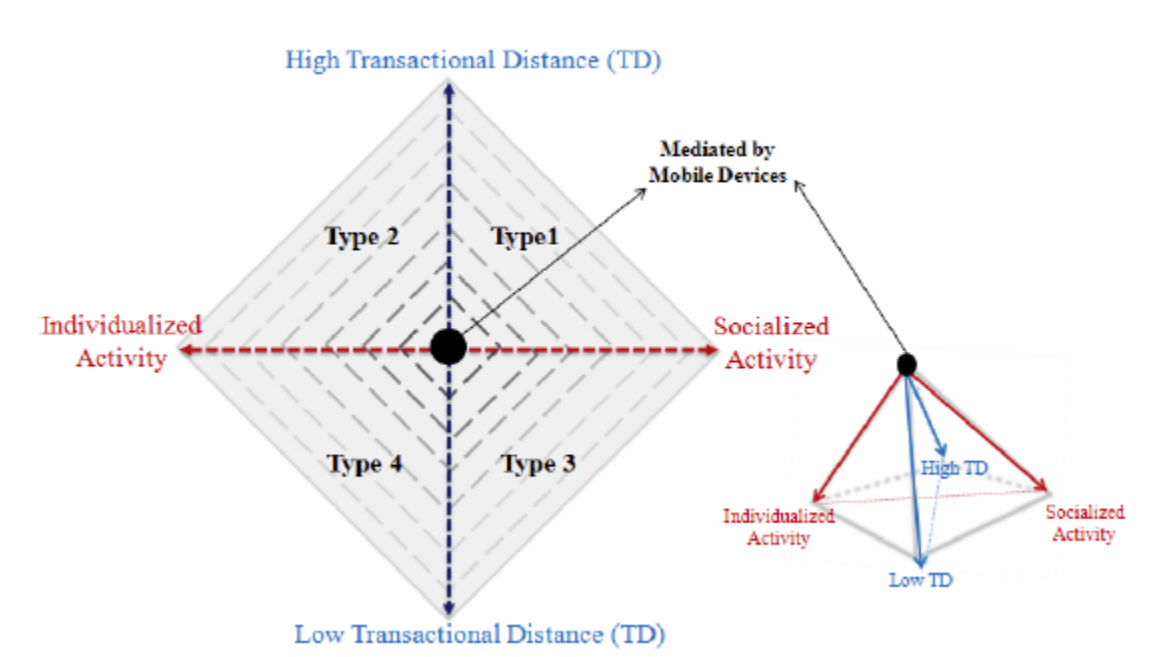
Moses (2008) opts to expand Shih's model from the modified ARCS model into something more robust, a model which strengthens the relevance of the content to the activities and learning through additional activities, as shown below. Adding these modules allows the designer of instruction to overcome the constraints of mobile devices (e.g. battery life, screen size), and to "improve the learning experiences of mobile learners and cater for the ways different people learn…and enrich their learning experiences" (Moses, 2008). These experiences should be focused around inquiry methodology, particularly through scaffolding techniques to enhance

learning as well as facilitate peer cooperation and interaction with the instructor (Shih et al, 2010; Looi et al, 2011).



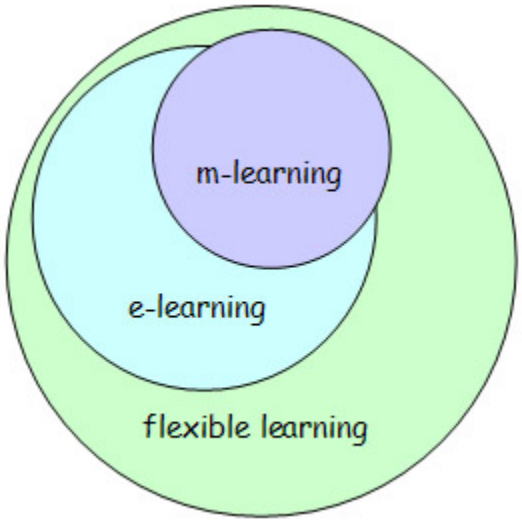
Shih's Mobile Learning Model Enhanced (Moses, 2008)

Park et al (2011) opted to address the conceptual and theoretical framework of mLearning in an entirely different manner, instead examining mobile learning through a modified version of Moore's Transactional Distance theory (as described in the section on theory). In their discusson of TD theory, Park et al discuss a four-type pedagogical framework, broken up into four sections through context of activity (social vs. individual) and transactional distance (low TD vs. high TD). Each particular subsection is defined based on the communication level with the instructor or instructional support and the interaction level with the content and with fellow learners. The authors also point out that the activity can be changed and move seamlessly from one of the four regions to another.



Mobile Transactional Distance Model (Park et al, 2011)

The final framework investigated takes a completely different perspective, instead examining mLearning as a smaller subset of what is termed “flexible learning” (Peters, 2007). Flexible learning focuses on a “just enough, just in time, just for me” approach to learning interventions, of which; mLearning is a smaller subset of eLearning. This learning approach addresses the changed relationship between teachers and learners, from one of formal teacher to working together to explore and build knowledge and understanding of concepts.



Flexible Learning Model, Peters (2007)

Conclusion

With this broad range of models and theories, it can be difficult to discern which aspects make up the core needs and requirements of mobile learning. However, by analyzing these different models and approaches, similarities can be seen, and address the key points when designing instruction using mobile learning strategies. Generally, mobile learning must:

1. Be mobile (a definitional claim, but one that addresses both the user and the technology.)
2. Allow for the use of communication and collaboration inside and outside of the classroom
3. Utilize inquiry and scaffolding methods and activities to allow learners to internalize information.

Use of these three general guidelines, as extrapolated through the models examined above do not, however, guarantee learning success, as the context and implementation strategies will be very important to the the promotion and success of learning.

As mLearning has grown and matured as a field, so have the analysis of theory related to mLearning and the creation, development, and refinement of different theoretical and conceptual frameworks with which to design and implement mobile learning strategies. While still a relatively new field, progress has been made to address the gaps in research as seen even only a few years ago. Mobile learning is slowly, but surely, defining itself as a separate and distinct field, instead of a subset of both distance learning and electronic learning through the analysis of theory and concepts at its core. This refinement is drawing new scholars and research in to examine the potential effects of a wide range of disciplines, but perhaps none seem more excited than that of education.

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