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WHAT DRIVES M-LEARNING SUCCESS? –DRAWING INSIGHTS FROM SELF-DIRECTED LEARNING THEORY

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Abstract

Contrary to its rapid diffusion, m-learning is short of concrete theoretical underpinnings. This study serves as a first important step to apply self-directed learning theory to the m-learning field. Based on a review of both m-learning and self-directed learning theory literature, present study applies findings of prior self-directed learning research to portray current m-learning activities. Evidence is also found, suggesting that self-directed learning theory should be an important theoretical underpinning of m-learning. Based on a reflection on current m-learning initiatives, the paper suggests that, to design a sound m-learning system, a sufficient consideration of learners' self-directed learning attributes is critical and essential.

Keywords: Mobile learning, Self-directed learning, Education, Implementation, Adoption.

1. INTRODUCTION

The advance of mobile technology along with the accelerating prevalence of handhelds initiates a new education approach, which is termed as 'mobile learning' or 'm-learning'. Currently m-learning is ushering us into a new era of training and learning. Stated Sharma and Kitchens (2004): the advent and subsequent development of m-learning indicates a profound evolution in education from distance learning (d-learning) to electronic learning (e-learning) and to m-learning. Based on a review of over 400 recent publications, Cobcroft, Towers, Smith and Bruns (2006) stated that m-learning extends the scope of users to include those who are aged, gifted and remote, but also those with cognitive, social, physical or mental difficulties. A long list of m-learning potentials has been specified with a growing number of promising applications (Attewell, 2005; Duncan-Howell & Lee, 2007). As Naismith et al. pointed out, m-learning would enable a kind of 'highly situated, personal, collaborative and long term; in other words, truly learner-centred learning' (Naismith, Peter, Giasemi and Sharples, 2004, pp: 36).

Nonetheless, m-learning research has long been in need of theoretical underpinnings (Muyinda, 2007). Even if m-learning applications abound, they are implemented separately without a unified education strategy. Further, most m-learning research is built upon a teacher-centred pedagogical approach whilst m-learning activities are learner-centred in essence. As a result, the current understanding on m-learning offers limited insights for practitioners to comprehend m-learning phenomenon. This lack of sound theoretical underpinnings will impede us to further explore the potentials of m-learning.

This paper serves as a first important step to apply learner-centred andragogy (self-directed learning theory) to describe m-learning activities. After a close reflection on both m-learning and self-directed learning (SDL) literature, the paper proposes that SDL theory contributes to a better understanding on current m-learning applications. SDL theory therefore should be an alternative theoretical underpinning for future m-learning research and implementation. Insights can be drawn for practitioners not only to implement a sound m-learning system but also to engage distance learners for a sustainable success. After literature review part in section 2, the paper attempts to interpret current status of m-learning initiatives from an SDL viewpoint in section 3. In section 4, conclusions are made followed by a brief report of limitations in the fifth section.

2. LITERATURE REVIEW

2.1 SELF-DIRECTED LEARNING THEORY STUDIES

SDL theory is one of the most important education theories, which has long been stressed and applied in problem-based, lifelong and distance learning settings (Fisher, King, & Tague, 2001; Stewart, 2007a). It is derived from adult education, but has already extended to the scope of adolescents and young students (Taylor, 1995; Thomas, Reio, & Davis, 2005). There are two general manners in defining SDL: (a) as a process of learning (Garrison, 1997; Grow, 1991), and (b) as a personal attribute (Guglielmino, Guglielmino, & Zhao, 1996; Oddi, 1987). In its broadest meaning, 'self-directed learning describes a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes' (Knowles, 1975). A common aim for SDL research is to assist individuals in developing the requisite skills for engaging in self-directed learning such as planning, monitoring, and evaluating their own learning (Reio & Davis, 2005). The theory suggests that the level of control learners are willing to take over their own learning will depend on their abilities, attitude, and personality characteristics (Fisher, King, & Tague, 2001). Also the theory believes that SDL capability varies among individuals and that not all the learners are self-directed.

Previous literature indicates that the SDL capability is closely associated with distance and lifelong learning activities (Fischer & Scharff, 1998), in particular when learners are placed in a physical and social separation from both instructor and other learners (Long, 1998). As early as 1980, SDL research has evolved to be an empirical approach. Guglielmino (1977) proposed the notion of SLD readiness and designed a questionnaire to empirically measure learner's SDL attributes. The measurement concerns three factors, namely (i) self-management, (ii) desire for learning and (iii) self-control. Indeed, the need for self-direction, or self-management of learning, runs clearly across distance

education and resource-based flexible learning literature (Evans, 2000; Smith et al., 2003). Study of Shapley (2000) concerning online distance education revealed that learners need to have a high level of self-direction in order to succeed in online learning settings. The students who have low readiness for SDL will exhibit high levels of anxiety when exposed to an SDL project. In addition, the level of self-directed learning is widely found as a strong factor for predicting learners' academic success in various education contexts (Hsu & Shiue, 2005; Stewart, 2007b). In an online learning environment, Warner, Christie, & Choy (1998) proposed the notion of readiness for online learning (ROL) to measure personal attributes in affecting learning performance, which is conceptually similar to SDL readiness. Self-management capability as an important dimension included in both SDL readiness and ROL theories, has been found to significantly impact m-learning intention (Wang et al., 2009).

SDL capability exists along a continuum and in all individuals to some degree (Fisher et al., 2001). Research found that matching teaching delivery with learners' SDL capability enables the best learning opportunities (Fischer & Scharff, 1998; Grow, 1991; O'Kell, 1988). Across both m-learning and SDL literature, these two research directions constantly share similar research scenarios, basis, objectives and tasks. However, SDL theory has not yet been extended to the m-learning context. While there are a handful of studies making a reference to SDL capability in m-learning settings, we found no studies that enable SDL as a concrete m-learning theoretical underpinning.

2.2 CHALLENGES OF M-LEARNING RESEARCH

There are many critical assessments of m-learning research and applications. Currently m-learning runs danger of becoming a buzz work as empty as 'e-learning', as Ullrich et al. (2008) noted that, 'some years ago, every learning software that used the Internet in some way was coined as 'e-learning software', regardless of whether it was innovative or helpful for learning'. Patten, Sanchez, & Tangney (2006) classified m-learning services into seven broad categories and stated that much of the work presented across the categories has limited success 'in the field'. Whilst m-learning applications are many, they tend to be occasionally used in an education context and have not yet had any great impact on education (Pozzi, 2007).

Based on a summarization of current m-learning projects, argued Herrington et al. (2007) current m-learning applications are predominantly within a didactic, teacher-centred paradigm. A contradictory view however is that m-learning is a learner-centred approach as acknowledged by almost all the scholars. These pedagogical approaches well explain how learners can learn better in a stable and mostly pre-defined learning context, but offer limited understanding on the learning activities in a constantly changing social context with limited or even no intervention from teachers. Consequently, these theories fail to establish a unified education strategy in aligned with the unique nature of m-learning. Even if there are already tens of m-learning initiatives available, strategy as to how to integrate them into a sound system is lacking. First, although m-learning is acknowledged as an education approach offering great autonomy and freedom, little considerations is made regarding in what way these freedoms can benefit learners. Second, the so-called, 'at the right time', 'at the right place', 'on the right device', 'for the right person with the right content' access of m-learning (Bhaskar & Govindarajulu, 2008; Wagner, 2005), remains a slogan instead of a reality.

There is also a lack of understanding on the long-term impact of m-learning activities. Indeed, prior studies indicated that mobile technologies are being widely adopted and inherently engage young generations nowadays (Cobcroft, Towers, Smith, & Bruns, 2006). However, more recent findings report that simply availability of technology doesn't guarantee the adoption of m-learning services (Carlsson, Hyvonen, Repo, & Walden, 2005; Corbeil & Valdes-Corbeil, 2007; Wang, Wu, & Wang, 2009). Students are still not ready for m-learning even with advanced handhelds (Corbeil & Valdes-Corbeil, 2007). On the other hand, many students are not willing to use handhelds for accessing training and education (Attewell & Savill-Smith, 2003; Attewell, 2005). Good explanations for these phenomena are lacking.

3. SELF-DIRECTED LEARNING IN M-LEARNING ENVIRONMENT

As m-learning is still in an initial stage, we propose to introduce the previous findings of SDL research to m-learning contexts and to not adopt an empirical approach. Similar to SDL (Smedley, 2007), m-

learning is an approach to learn that heavily depends on students to take the responsibility for, and possess the ability to be self-directed in their own learning. As McFarlane et al. (2007) pointed out, the increased learner autonomy and personalization posit a heightened requirement for appropriate self-direction learning capability, such as a capability of locating and evaluating resources, critical thinking and reflecting on their own learning. In this light, it stands to reason to apply SDL in studying m-learning for a more complete understanding.

- SDL capacity increases steadily during childhood and rapidly during adolescence (Knowles 1984; Thomas, Reio et al. 2005). Readiness for SDL is increased with life experience.

Misuse of mobile devices by school students has been frequently reported. Most schools and colleges do not treat informal networked interaction as legitimate learning; they forbid children to bring phones into the classroom (Sharples, 2006). Brain research indicates that meta-cognitive, self-regulatory capability is developmental in nature. Hence young students are not necessarily self-directed in particular when they are physically immature in brain capability. It would lead to a disaster to offer great autonomy while students can not properly manage it. A project in the USA including thousands of students across a number of schools shows us a clear case. After issuing laptops to school students one-to-one, students however are found to exchange answers on tests, play games and hack into local businesses, and some students are found to rarely or never use their laptops for learning. Thus some schools now start to drop laptops in the project (New York Times, 2007). Whilst some researchers openly criticize that teachers' effort to avoid the misuse of mobile phones in classrooms is derived from the conservative education system, SDL research indicates that young students' misuse of mobile phones for learning tends to be an inherent nature since students are not mature enough to be self-directed. Instead a successful implementation of m-learning is widely initiated in China's primary schools. A series of new handheld devices—digital electronic education devices, are designed and allowed to be used in classrooms in China by limiting the autonomy offered (Liu, Liu, & Yu, 2008). These devices give up the wireless connection capability but instead embed a great amount of built-in education resources (Liu et al., 2008). These devices have gained a wide-spread acceptance by both schools and the market as 6 million of them are predicted to be sold in 2008 (Assme news, 2006).

Propositions: The greater autonomy and responsibility heightened by the m-learning approach calls for a corresponding self-direct learning capability. By simply offering great autonomy and responsibility, m-learning won't succeed in formal education scenarios while young students can not properly self-direct themselves. It instead would result in a disruption of well-organized learning contexts. Based on the success of digital electronic education devices in China, a practical solution should be a reduction of the autonomy that students have to manage.

- SDL is critical in distance education settings as learners are physically and socially separated from both the instructor and other learners (Long, 1998; Song & Hill, 2007). 'For SDL to occur, students may need direction or facilitation to achieve their end goals' (Knowles, Holton, & Swanson, 1998; cited by Timmins, 2008, pp: 302).

A lack of physical communication between instructor and learner would increase the requirement for the level of self-directed learning. This sort of need is in line with the m-learning paradox proposed by Tella (2003). Building on a study of Sahlberg (1996), Tella (2003, pp: 16) contended a paradox in m-learning, which is 'the more the studying and learning environment is decentralized, the more important will be the guidance and support given to the learner by the teacher or a peer because the environment itself no longer supports the use of familiar and safe learning processes'. The unstructured learning environment is associated with a high level of anxiety for the learners with a low level of SDL (Wiley, 1983). Anxiety in turn will impede a student's continuous intention to utilize, for instance, web-based learning (Chiu & Wang, 2008). In the unstructured environment, a lack of both personal contact and in-time feedback may easily happen, which further cause learner dropout (Fozdar & Kumar, 2007). This situation can be somewhat improved in m-learning contexts due to the personal nature of handhelds. Based on mobile technologies, personal communication becomes ubiquitous and is easy to be initiated in a number of formats, such as phone call, SMS, mobile blog, mobile communities and online discussion boards. In the study by Rau, Gao and Wu (2008), SMS communication between students and instructors is found to give students' positive attitudes toward

the instructor and learning, which can't be found through the methods of e-mail and online forums. In addition students' communicating through SMS with the instructor can alleviate the studying pressure and significantly increase the students' extrinsic motivation when combined with Internet communication media (Rau et al., 2008).

Propositions: The level of self-direction required can be decreased by offering appropriate and timely instruction. Due to the ubiquitous and personal nature of handhelds, m-learning has an advantage in terms of its personal and ubiquitous nature to connect peers or experts over a distance.

- The level of self-direction needed is associated with the learning scenarios being implemented, and may change in different contexts (Brockett and Hiemstra 1991; Song and Hill 2007). After a review of SDL literature, Fisher et al. (2001) stated that "there is a definite correlation between SDL readiness and student preference for structured teaching sessions".

In contrast to the limited success in a formal education setting, authentic m-learning tends to be the most successful application. Previous research indicated that authentic m-learning bring about most desirable learning outcomes and it is currently widely implemented for tourist attractions, such as museums. In authentic m-learning, a situated environment can provide guidance for learning activities with the support of locating technologies. As suggested by previous SDL research, the level of self-direction required relates to personal attributes, the design of the learning process and learning contexts (Song & Hill, 2007). This suggests that the change of environmental factors could help to reduce the requirement of self-direction capability and thereby leads to a more successful implementation of learning activities. In many tourist attractions, tourists' learning process is organized by GPS, audio guidance, digital maps and preset learning objectives based on the predesigned environment. Consequently, the requirement for self-direction capability can be greatly reduced where the situated environment provides a learner with the hints about where, when and how to conduct learning activities.

Propositions: As the level of self-direction required can be changed and reduced in relation to an authentic environment, m-learning excels in authentic studies by offering a predesigned learning process and guidance.

Based on the above discussion, our propositions can be summarized as follows:

1. Education is not inherently a gratification process; anxiety initiated either by education or by lacking of social interaction will impede learners in the pursuit of m-learning. Hence there is a need to sustain students learning desire.
2. Success in m-learning initiates a requirement for SDL capability, but not all the learners have a proper SDL capability for m-learning; hence technology and services should help learners to organize their learning process and to evaluate their learning outcomes.
3. The misuse of mobile phones in a classroom happens naturally since young students inherently have a limited capability of self-management and self-direction;
4. Great autonomy and freedom placed on learners do not guarantee effective m-learning as well as positive academic outcomes;
5. An unstructured learning environment tends to be the typical environment for m-learning; this type of environment may cause anxiety for learning and lead to arbitrary learning;
6. For those with a low SDL capability, solutions to reduce the requirement for SDL capability are essential otherwise students may not use m-learning or discontinue the use after starting to use it;
7. From an SDL viewpoint, there are four alternative solutions to implement a successful m-learning system:
    - To provide learning environments with proper guidance particularly for situated m-learning.
    - To reduce the autonomy and freedom offered to an appropriate level that most learners feel comfortable with.
    - To help learners manage their learning process using for instance SMS reminders and distance instruction.
    - To motivate students and alleviate learning pressure using more personalized communication and a social network.

Apparently, any m-learning application has a potential to benefit a learner. However a single application alone can't bring about a complete success of m-learning. In this light, we make an attempt to summarize innovative m-learning applications reviewed and seek to build them into a framework for successful m-learning implementation. A classification of these services is made from the perspective of functionality, which includes 24 kinds of m-learning initiatives.

Categories	M-learning services
Informal learning	Extracurricular study (Liu et al., 2008); Searching answers with for instance Google in wireless Internet;
Administration function	Sending reminders for examination or assignments (Rau et al., 2008); Informing about schedule or coordinating schedules (Yau & Toy, 2007); Calendars (Schreurs, 2006); Collecting feedback (Stead, 2005); Recording attendance or test taker (NMC & Educause, 2006); Recording lecture (Corbeil & Valdes-Corbeil, 2007); Recording information of patients (Kenny, Park, C. Neste-Kenny, J. M. C., Burton, & Meiers, In press); Retrieving school-related information, such as timetables (Kim, Mims, & Holmes, 2006); Library services (Sharma & Kitchens, 2004); Digital dictionaries, translators (Sharma & Kitchens, 2004); Environmental detectives or recorders (Klopfer & Squire, 2008); Collecting and analyzing the data of learning processes (Liu et al., 2008)
Social network	Interaction between instructor and students, or between peer students (Proctor & Burton, 2003); Learning collaboration, such as the virus game (Colella, 2000); Mobile 'blogging' (Yerushalmy & Ben-Zaken, 2004); Accessing online communities, discussion boards and chat rooms via mobile phones (Armstas, Holt, & Rice, 2005);
Learning material utilization	Situated learning, such as learning in a museum (Chou et al. 2004), watching birds in open air (Chen, Kao, & Sheu, 2003) and mobile excursion games (Costabile et al., 2008); Displaying lecture videos and courseware (Corbeil & Valdes-Corbeil, 2007); Podcasting lectures (Maag, 2006); Playing quizzes (Stead, 2005); M-learning in language studying (Liu, Yu, & Ran, 2008), and mathematics (Yerushalmy & Ben-Zaken, 2004) .

Table 1 A summarization of current m-learning initiatives

The classification is made based on the following consideration of application functionalities:

- Informal learning: applications support the learning activities outside predesigned educational establishments.
- Administration function: applications are used to administrate the learning process and organize learning activities.
- Social network: applications facilitate peer communication as well as instructor-students interactions.
- Learning materials utilization: handheld devices are used to store and display learning materials, such as reading e-books and watching lecture videos.

From an SDL perspective, we propose a framework for m-learning implementation as shown in Figure 1. Apparently, many innovative m-learning initiatives are not directly related to education and thus are not pedagogy significance, such as services in administration category. However, these m-learning services contribute to an improvement of SDL attributes, which includes sustaining learning management, learning desire and effective self-control. For instance, learners can use administration services to manage their learning activities, such as using SMS reminders. Also, it is suggested that social network is useful for reducing anxiety and thus helps to sustain learning desire. Informal learning is associated with personal interest and therefore contributes to maintaining the learning desire. Finally, to design a sound m-learning system, functions offered should contribute to either an improvement of learners' SDL capability or to a reduction of requirement for conducting SDL learning. Only in this way can a successful m-learning system which is suitable for most learners be worked out and implemented.

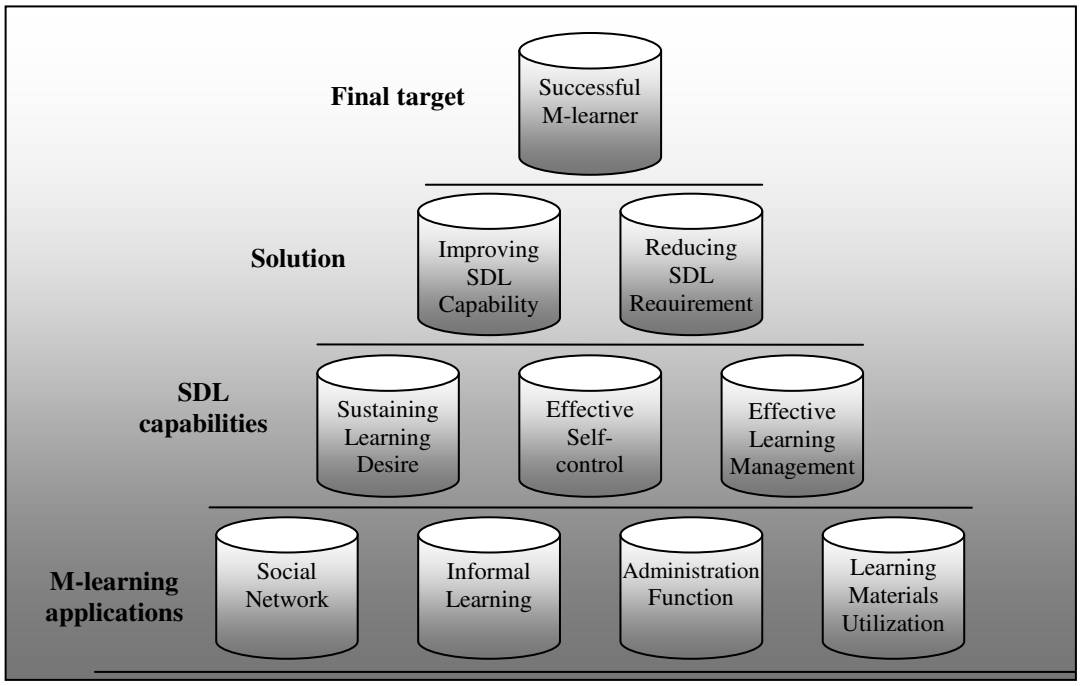

Figure 1. An M-learning Pyramid

4. CONCLUSIONS AND IMPLICATIONS

M-learning is a personal issue typically initiated in an unstructured environment. As a result, m-learning can only be better explained using learner-centred education approaches, such as self-directed learning theory. In typical m-learning contexts, most learners are situated outside a pre-organized learning environment and physically separated from both teachers and peer students. Hence a capability to be self-directed and self-managed is important for being a successful m-learning user.

On the other hand current m-learning applications are mostly initiated separately without concrete theoretical support. This paper is a first step to introduce SDL theory into the context of m-learning and offers an alternative theoretical underpinning. As the fields of SDL and m-learning are largely overlapped, an adaption of SDL in the m-learning context will deepen our understanding of both research directions. Based on SDL theory along with the unique nature of m-learning, a conceptual pyramid for m-learning implementation is proposed. To support this framework, a summarization of current m-learning initiatives is made in concert with their functional uniqueness whilst the summarization is far from exhausted.

Note that m-learning is expected to be an approach that enables training at the right time, on the right place, for the right person. It is problematic that learners themselves are aware of when, where and what way is right for m-learning, as it initiates a heightened requirement for proper self-direction and self-management capability. An m-learning environment initiates less structured learning activities and more freedom along with more SDL tasks. However, previous research indicated that some learners are not well self-managed and self-directed in independent learning scenarios. In particular, the less self-managed learners are less likely to accept m-learning (Wang, 2008). Based on the SDL approach, the solutions for effective use of m-learning are either to promote learners' SDL capability, or to reduce SDL requirement by helping learners to organize learning processes.

Based on an elaboration of the unique nature of both m-learning and SDL, it is self-evident that a learner's personal attributes will affect the learning outcome, and that simply the availability of technologies do not guarantee the use of m-learning. Also unrestrained freedom doesn't guarantee effective learning as well as subjective adoption. To design a sound m-learning system, a full consideration of learners' SDL capabilities is important and essential. Meanwhile, SDL should be a concrete theoretical underpinning in m-learning research and more research in this regard is required.

5. LIMITATIONS

This paper is an attempt to introduce SDL into the m-learning field based on a reflection on current m-learning applications. A logical next step would be an empirical study of SDL in m-learning contexts that would provide more concrete supports.

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