Mobile learning: Where is the niche?

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Abstract: The paper explores how the mobile technology can be appropriated as a tool to mediate learning in the "sweet spot" where meaningful mobile learning (m-learning) occurs. The author proposes examining m-learning under two intertwined conditions of (a) the properties of the context that enable the effectivities of the mobile technology, and (b) student capabilities and interpretations to take learning actions. When these conditions are met, the mobile technological tool is deemed to be appropriated at the "sweet spot" that involves the three interacting elements of affordances of the device, the context and student positive interpretations and actions. This "sweet spot" is termed as the "niche" for m-learning, and learning taking place in the spot is termed as "niche m-learning" in this paper. Five individual students' use of the mobile technology for learning in a university has been traced and examined for one year. Various qualitative data were collected and triangulated for the data analysis. The research findings show that niche m-learning resulted from the three interacting elements. Discussions are made and conclusions are drawn.

Keywords: Niche m-learning, affordances, student interpretations, context

Introduction

Mobile technology has been increasingly used in education. Paralleled with it are different understandings of mobile learning (m-learning). *According to* Hoppe, Joiner, Milrad, and Sharples [1], m-learning is "e-learning using mobile devices and wireless transmission" (p. 255). Both of the definitions convey the message that m-learning is "e-learning" using mobile devices. Kukulska-Hulme and Traxier [2] posit that m-learning refers to the use of small, portable devices - such as Personal Digital Assistants (PDAs), palmtops, smartphones, and Tablet PCs - in classroom situations or "on the move". Laouris and Eteokleous [3] go a step further and contend that m-learning should be considered in an environment where various components are integrated; thus, m-learning no longer means that learning happens when the learner is moving with the device, but means that learning happens when the learner is moving with the whole learning environment. This definition recognizes the importance of learning environment that transcends physical settings, emphasizing the "mobility" of m-learning in learner generated context. From these definitions, it is noted that m-learning is evolving from focusing on intersecting mobile computing with e-learning, to focusing on the "mobility" of learning in context, reflecting the shift of m-learning educational research from a technological focus to foregrounding contextual, and "just-in-time and -place" learning.

However, existing mobile technology application in education literature shows that the majority of research on m-learning has been examined from researcher perspectives in designed learning environments where students have used mobile technology as a tool to accomplish pre-defined tasks. From a constructivist perspective, meaningful learning is active, intentional, authentic, collaborative and constructive; technologies foster meaningful learning when interactions with technologies are learner initiated and

controlled [4]. Thus, whether current mobile technology applications really support "just-in-time and -place" learning, and whether meaningful m-learning occurs are challenging questions for researchers in this area. This study aims at examining the "sweet spot" (a place where optimal learning is achieved) [5] for "just-in-time" and "just-in-place" meaningful m-learning. This "sweet spot" is termed as the "niche" for mobile learning, and learning taking place in the spot is termed as "niche m-learning" in this paper.

The rest of the paper first presents the literature, and develops a framework for studying niche m-learning, followed by research methods and data analysis. Finally discussions are made and conclusions are drawn from this research.

1. Literature

1.1 Issues in Mobile Technology Educational Applications

Mobile technologies have been used as a range of technology tools intended to support student learning. However, it has to be noted that a considerable number of mobile educational applications have been conducted from a researcher rather than student perspectives. Issues have been reported in some studies: (a) some learning systems are premised on a transmissive type of traditional pedagogical principles such as such as delivering course material to students through a designed communication tool on mobile devices; it supports "one-way teacher-to-student communication and use the mobile device to deliver content rather than encouraging students to communicate with each other or with their tutors" [6]; (b) another important factor that impacts the applications is technical constraints regarding the small screen size of mobile devices, lack of standard platforms among different devices, problems in browsing websites, lack of computational power and the like [7], these constraints inhabit students' capabilities in using the mobile technology to support their learning; and (c) in some situations, students do not perceive the usefulness of the designed m-learning systems to support their learning due to their concerns related to the ownership, lack of connectedness, lack of interactivity to support their studies [8], hence students are not enthusiastic about the use of the learning systems. "In order for students to learn meaningfully, they must be willfully engaged in a meaningful task" [4]. In the light of this, Fischer and Konomi [9] suggest that research on m-learning should shift the focus from who can get access to the m-learning systems to who can use the mobile technology to facilitate their learning in significant and meaningful ways. What is crucial in mobile educational practices is not whether the m-learning tools work or not, but how students perceive the usefulness of the tools for their learning needs and take learning actions using the tools.

Another important issue that is seldom sufficiently addressed in the m-learning literature is the question of context. Many researchers agree that m-learning is highly dependent on context [10]. They propose that context has to be understood in "multiple virtual and physical contexts" [10], redefined as "multidimensional construct that has overlapping and interacting layers" [11]. In practice, numerous studies have been designed to exploit the capabilities and constraints of m-learning systems in specific settings rather than focus on how students interpret the context and take learning actions.

1.2 Niche m-learning and its Framework

To examine learning, Edward [12] proposes two intertwined focuses, with a strong Vygotskian legacy, on (a) how learners interpret and act on their worlds, and (b) the opportunities afford them for those interpretations and actions. This view is in line with

Jonassen, Hernandez-Serrano and Choi's [13] notion that learning technologies are tools for mediating the practice of learning, and if we examine the potential of learning technologies from the learners' perspectives, then "the affordances of any [learning] technology are the properties of that environment that enable the effectivities of the technology, the abilities of the learner to take learning actions" (p.113). This is to say that technology tool mediated learning results from not only the possibilities that the environment provides to put the tool into use for learning, but also the learner's interpretation of the possibilities for taking learning actions. Thus, to examine learning in a technology-rich environment, we need to consider the three components: the affordances of the technology, the learner interpretations as well as the context in which learning takes place.

This echoes with what has been reviewed in the literature in the previous section – to examine m-learning, we need to take into account the affordances of the mobile technology, the context, and the student interpretations and actions. The three elements interact with each other simultaneously to make m-learning occur (See Figure 1). If the context allows the affordances of mobile technology to be put into practice (Area A), but without the learner or the agent, the affordances cannot be appropriated for learning; if the student perceives the affordances of mobile technology to use the technology (Area B), but the context does not enable the technology to be put into practice (e.g. in a lecture room where no mobile device use is allowed), m-learning cannot happen; if the context enables the student to use the technology for learning (Area C), but the technology is broken down, then m-learning cannot be achieved. Whereas, when the context enables the effectivities of mobile technology, and the student perceives the affordances and is willing to take learning actions (Area D), then "just-in-time and -place" m-learning can be achieved. To put it another way, when the conditions of (a) the properties of the context that enables the effectivities of the mobile technology, and (b) student interpretations and willingness to take learning actions are met, the mobile technological tool is deemed to be used at the "sweet spot" where meaningful learning occurs. This "sweet spot" is termed as the "niche" for m-learning, and learning taking place in the spot is termed as "niche m-learning" in this research. Then the question arises: How did niche m-learning occur? To address this question, we need to investigate:

(a) What affordances of the mobile device did the student use?
(b) What factors of context influenced student mobile device use?
(c) What factors were related to the student interpretations and actions of the mobile device use?
(d) How did the student interpretations, affordances of the mobile device and context interact to make niche m-learning occur?

These are the questions that this study attempts to answer. The "framework of examining niche m-learning" (See Figure 1) is used to investigate "what" and "how" research questions.

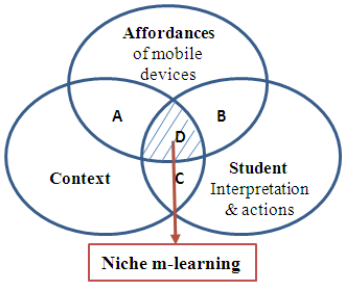

Figure 1. Framework of examining niche m-learning

2. Methods

To examine how niche m-learning happened, a holistic understanding of the student mobile technology use experiences was required. Consequently, a one-year qualitative research utilizing a multiple-case study approach was considered appropriate for this study [14].

2.1 Context and participants

Participants in this research were five first-year undergraduate students from different academic departments at a university. The mobile device used in this study was the Smartphone with both PDA and phone functionality for one year use, free of charge. It ran the Windows Mobile operating system. In addition, a one-year mobile service package was granted to each student to encourage them to maximize their use of the Smartphone.

2.2 Data collection and analysis

To understand students' interpretation and use of affordances of the Smartphone for m-learning in context, data collection instruments employed in this study included: student reflective electronic journals (e-journals), student artifacts - a collection of Smartphone screenshots that showed what the students did using the Smartphone to support their learning, various interviews, observations, field notes and memos. The multiple sources of data provided the opportunity for us to get a holistic understanding of students' niche m-learning grounded in this research.

The data analysis process was an ongoing and iterative process, in tandem with data collection. Three complementary streams of data analysis were involved: (a) "a preliminary exploratory analysis" was used to obtain an understanding of the data [15]; (b) categorizing strategies were used to code categories of affordances, context factors and student interpretations of Smartphone use of the participants that contributed to niche m-learning [16]; and (c) contextualizing strategies were employed to understand better how niche m-learning happened to the participants [16]. The data was analyzed with the assistance of the computer-based qualitative analysis software – Nvivo 7.

3. Results

3.1 Affordances of the mobile device

Ten types of mobile device affordances were identified and conceptualized from the five participants: *resource access, resource collection, communication, representational, constructional, resource sharing, location-aware, scheduling, analytical,* and *productivity affordances.* Table 1 illustrates these affordances and their descriptions.

Table1. Conceptualized mobile device affordances and their descriptions

Affordances	Descriptions
Resource access	Accessing resources downloaded and stored in the mobile device or online
Communication	Communication via various channels such as SMS, phone call, email, and MSN
Resource collection	Collecting audio, pictorial, and text data in varied contexts
Scheduling	Managing schedules using Calendar, Tasks, or Excel

Representational	Creating representations using images, drawings, pictures, and video clips
Constructional	Writing and editing work using Word, or other software
Resource sharing	Sharing files by connecting the mobile device to other handheld devices via Bluetooth or Infrared functions
Location-aware	Locating places using MapKing software
Analytical tool	Helping process certain data using Excel or downloaded graphic calculator software
Productivity	Helping manipulate and calculate numbers using Calculator

3.2 Factors in context

As is noted, the student niche m-learning was examined in a framework of relationships between affordances of the mobile technology, the social context, and the student capabilities and interpretations of the social context and actions. In contextualizing the mobile device use of the five participants through data analysis, the research findings reveal that mobile device use was mainly affected by the interacting factors of *tasks, learning resources, time and place, and institutional factors*. These factors and their corresponding descriptions are shown in Table 2.

Table 2. Contextual factors and their descriptions

Factors	Description
Tasks	Tasks include (a) assigned tasks by the lecturers or required by the university, (b) self-defined tasks that students defined by themselves such as exam preparation, and (c) emerging tasks that appeared opportunistically in academic studies, particularly when tasks were time-sensitive such as exploring information online just-in-time.
Learning resources	Learning resources include (a) learning material provided by the lecturers; (b) learning material explored, collected and created by students; and (d) social support from peers, friends, professors and tutors with whom students interacted using the mobile device.
Time and place	Time and place of use refers to when and where the student used the mobile device such as in lectures, meetings, during breaks, while commuting, and doing self-studies in physical buildings, on campus (outside physical buildings), and on public transports (e.g., bus, MTR).
Institutional, community culture	Institutional factors refer to institutional practices in terms of required exams, assignments, policies regarding the awarding of degrees in different classes. The culture of the community refers to the culture in which the individual student was raised or situated.

3.3 Factors related to student interpretations and actions

Different users interpret the context in which the tools are embedded differently. This is true for the participants in this research. The “subjective interpretations” of the context made by the students, can either make them negatively anticipate learning to happen or support spontaneous involvement in a learning task [17]. The interpretations of the context are closely related to the goals, motivations and their prior experiences of the student in question, hence influence students’ adoption of mobile device use. Students perform best if they are actively involved in tasks and integrate new information with their prior knowledge to achieve their goals.

3.4 Examples of niche m-learning

Example 1 - Kan was a male participant and a Hong Kong permanent resident, majoring in Mechanical Engineering. He wanted to graduate with a first-class honors degree. He aimed at passing all exams, lab reports and assignments with high marks. He worked very hard towards these goals, which were manifested in his active involvement various tasks accomplished by taking advantage of different learning resources. Kan made the most creative uses of the affordances of the mobile device. Kan reported that he seldom used the mobile device to search for other information online if he had no immediate need for the information due to the small screen size, inaccessibility of the online forums and WebCT and so on. However, if exploring information online could support his studies, he would make every effort to use the mobile device. A good example he provided was that he used the mobile device as a resource access tool to *explore* information online to help design a mold in a training plant with his group members during a summer training course organized by the Department. In the course, the lecturer demonstrated how to design a mold of a three-dimensional object. After the demonstration, the students were asked to design a three-dimensional mold of any object of their choice in groups using a laptop computer. However, the laptops did not have internet connection. Kan and his group members did not have any idea of what mold they were going to design. He explained in an e-journal:

> *… At the beginning, our group didn't know what to design. We wanted to search the internet, but in the training plant, no Wi-Fi was available. I remembered that I could use my phone card to connect the Smartphone to the internet via GPRS… I searched and downloaded some pictures from the internet and discussed with my group members. Finally, our group chose a good picture and made a beautiful mold [see Figure 2]… Hope that we can get good grades for the design.*

To perform the mold-making task assigned by the professor, Kan perceived the affordances of the mobile device as a resource access tool for exploring images on the internet via 3 G in the context where WiFi was unavailable in the training plant. By downloading pictures as a learning resource, Kan, together with his group members, was able to create a "sweet spot" where the affordances, the context and positive interpretations were met and made the assigned mold-making task accomplished successfully. This "sweet spot" is the "niche", and the task accomplished at this spot is the Kan's niche m-learning.

Example 2 - Ling, majoring in Journalism, was raised in Mainland China and considered her English was not as good as her classmates from Hong Kong. She made more use of the Smartphone to achieve her goals of improving English language learning. Motivated by the goal, she tried every effort to learn to use the mobile device although she never used it before. Different from Kan, Ling often made use of the affordance of the mobile device as a resource access tool to search online English reading and listening material using small chunks of time. In addition, she used the affordance of the mobile device as a resource collection tool to take down good English expressions and mottos from lectures, talks and reading materials. As Ling put it in an interview:

> *I always feel that I'm short of words to express myself, especially when writing English essays… so when I come across good expressions, I'll note them down for later use.*

She reported one experience of taking down notes in her e-journal,

> *It was the annual high table dinner, Rita delivered a speech about how to face challenges. Her speech was very impressive and encouraging…*

Because I didn't bring pen and paper to dinner, I used the Smartphone to take down the great quotes and learn them by heart [Refer to Figure 3].

In the above example, in the context of a social occasion, Ling came up with an emerging task of taking down good expressions in Rita's speech as the learning resources. Although Ling had no paper and pen on hand, she perceived the affordance of the Smartphone as a resource collection tool to capture the useful English expressions, and learn them by heart. The context of social occasion, the perceived resource collection affordance of the Smartphone and Ling's interpretation interacted with each other to formulate the "sweet spot", where Ling achieved optimal learning for her learning needs at the right time and place. It is termed as Ling's niche m-learning.

Figure 2. Screenshot of the finished mold

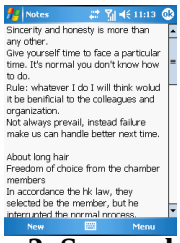

Figure 3. Screenshot of notes taken

4. Discussion

The paper discusses how niche m-learning happened due to the three interacting components – affordances of the mobile device, context and student interpretations and actions. It is noted that in this research, different students with different goals, motivation and prior experience, interpreted the opportunities and constraint of the context and affordances of the mobile device differently, and hence formulated different "sweet spots" or "niches" for m-learning. The results of this research show that students' individual interpretations played an important role in making their decisions on whether to take learning actions. Even though the student could perceive the affordance of the mobile device and the context allowed the use of the affordances, the students with negative interpretations would inhibit them from taking learning actions.

If the context does not allow the students to use the affordances of the mobile device to take learning actions such as lack of resources, inappropriate tasks and cultural constraints, the "sweet spot" also cannot be created, and niche m-learning cannot take place. In addition, some of the affordances of the mobile device in a situation may impose constraints on the student's ability to effectively accomplish their tasks to achieve their goals [18]. For example, the students can compose and send emails using the communication tool on the mobile device for immediate needs, but lack of spelling and grammar check and the difficulty in inputting letters may hinder their abilities and willingness to write emails to the professors using the mobile device.

Thus, tools cannot impose on the users to use them. They are useful only when users perceive their affordances and use them in context [19]. The creation of the "sweet spot" or "niche" for m-learning depends on the perceived affordances of the mobile device, the context that enable the effectivities of the mobile technology, and the student positive interpretations of the context and the affordances.

5. Conclusions

This study investigated how niche m-learning occurs under the "framework of examining niche m-learning" consisting of the three interacting components: the affordances of the mobile device, the context in which learning takes place, and student interpretations and actions. Niche m-learning happen only when the conditions are met: (a) the properties of the context that enables the mobile device affordances to be put into use, and (b) student interpretations and willingness to take learning actions. Although it is demanding to lay two focuses simultaneously [12] on examining learning actions mediated by mobile devices, it is advisable for educators, practitioners and designers to maximize the possibilities that the context provides for mobile device use to support student learning. In order to maximize the possibilities of mobile devices for learning, future research should shift from emphasizing technical aspects of developing and designing mobile learning systems to pedagogical practices and social context, especially in terms of pedagogic designs, resources development and provision, pedagogically sound mobile technology tool development, and institutional support for learning to happen just at the "sweet spot", or for "niche m-learning" to take place. Further questions to be investigated are: What kind of pedagogical practices and learning environments best support the development of "niche m-learning"? Can students' "positive interpretations" be cultivated so that they can spot more "niches" for m-learning?

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