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M-LEARNING CONTEXTS COUPLED WITH CONNOTATION OF 4G CONNECTIVITY

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ABSTRACT

An immense deal of consideration has been given in recent times to the prospective applications of mobile devices in educational environments. The evolution to 4G (fourth generation mobile technology) with its enhanced technical features and cost efficiency provides a unique opportunity for developing applications focused on the modern requirements of learners and facilitators. It is widely predictable that portability, coverage, and access to mobile networks (among other elements) prove great potential for the exploration of a wide range of applications of this technology in education. At the same time, significant research is necessary in order to understand the psychological, ergonomic, organizational, and social factors that conclude how people interact with and function using these networks in learning environments. This article proposes research strategies intended to integrate the technical, educational, and usability aspects of mobile technology in education and briefly discusses the potential of 4G as a detonator of converging and appropriate m-learning applications.

KEYWORDS
M-Learning; 4G Networks; Educational Technology

I INTRODUCTION

The hi-tech development of wireless networks and their fiery penetration in practically all regions of the world has shaped opportunities, not previously available, for exploring applications of mobile devices in communal, cultural, economic, and educational contexts. The consumption of 3G (third generation technology) is advancing and fueled by converging applications that consist of multi-functional features which enable the user to capture advantage of services such as MMS (Multimedia Messaging Services), mobile video and more importantly, mobile Internet, that allow access to social network applications and other related services. With the emergence of 3G and its evolution to 4G, the mobile device is seen more as a platform rather than just a telephone, creating challenges for its usability and acceptance by ordinary users. on the other hand, service providers and device manufacturers are in the hunt for strategies to facilitate the adoption of mobile telephones as worldwide terminals for communication and access to the Internet.

The fiery penetration of mobile technology, pooled with its portability and technical capabilities for Internet access, has captured the attention of educators fascinated in exploiting these capacities in learning environments. The ubiquity and mobility features have been considered as key assets for elevating personal learning environments (PLE) in which handheld devices with 3G and ultimately 4G connectivity are key components. The promising control of mobile learning, coined as m-learning and primarily conceived as an extension to e-learning, has been the theme of pilot projects and initiatives designed to discover the use of mobile devices in education in many parts of the world. Even though the fact that the number and scope of such projects is increasing, it is accepted that significant research on the educational aspects of m-learning is necessary. The use of additional advanced mobile technologies with enhanced technical capabilities such as 4G does not guarantee the implementation and penetration or the successful application of mobile devices in educational contexts.

II ADVANCEMENT TO 4G AND ITS RELATIVE TO M-LEARNING

In the evolution of 3G to 4G (fourth generation mobile technology), two key technologies contend for power in the market: WiMax (Worldwide Interoperability for Microwave Access) and LTE (Long term Evolution). It is anticipated that both technologies resolve converge and become parallel in operational features. WiMax is paying attention on open systems, while LTE, offered by the major cellular incumbents, will still have to make major adjustments to obtain the degree of openness WiMax providers already offer. In both cases the applications are centered on IP technology, while their broadband capabilities are enhanced in comparison to 3G. It is most likely that firmware and integrated chips with both technologies embedded in the mobile terminals will provide worldwide and flawless access to the mobile Internet, despite of the type of 4G involved.

The main technical differences between 3G and 4G are that 4G offers higher data rates (in the order of 100Mbps compared to a peak 3 Mbps of 3G) and better quality of service and security. 4G will also provide global mobility, service portability, and ubiquitous and smooth roaming with expected lower cost. Various technology experts consider 4G more as a conceptual framework, given that it integrates different kinds of technologies with efficient standards in order to provide services and applications in a faultless and transparent fashion. We will have at our disposal a powerful technological tool with great potential for impacting the value and exposure of education.

III EDUCATIONAL IMPLICATIONS OF 4G EVOLUATION

Taking into consideration the market dynamics in the evolution toward 4G and the surplus of mobile devices available, increasingly better informed and knowledgeable users will take benefit of the fast moving mobile technology situation. This is part of a "mobile divide" created by fiery technology growth in which teachers, more than students, are affected. New generations - termed digital natives - will be better able to manage with this divide due to their skills, orientation, and natural adoption of digital technologies. Teachers will face the challenge of requiring constant attention and training, not only so they will be able to use the new generation mobile technologies, but more prominently, in order to contribute to the progress of applications relevant to education.

The accelerated pace at which mobile technologies are evolving has created a space of basic research regarding m-learning. As an end result, we can observe that in order to create a notional framework for m-learning, researchers sketch on existing learning theories such as behaviorism, constructivism, situated learning and others. In many instances the resulting contributions become only theoretical in nature with realistic implications of m-learning limited to the teachers' or researchers' interpretations.

Undoubtedly 3G and 4G technologies create encouraging circumstances to acquire, operate, represent, process, and understand information. However, as Coll mentions, information *per-se* is not synonymous to knowledge, nor does the efficient reception and access to such information guarantee learning. The key is to generate an environment or context for learning supported by semiotic resources conducive to the construction of meanings.

The word "mobile" has been connected with technology, learning, telephone and quite a few other concepts and devices. However, the importance must be placed on the mobility of the person - the student or teacher - more than on the mobility of the device. It is the learning activity connected with a "moving person" who is supported by an m-device that distinguishes m-learning from other types of learning. Mobility of individuals and devices in conjunction with wireless Internet connectivity grant the platform where models of interactivity and interactions must be developed.

It is also suitable to point out that the educational modalities or formats are favorable toward the differentiated use of mobile technologies. Thus, the traditional in-classroom format makes use of mobile technology out of the conservative educational environment to allow for the contact between teacher-student-teacher and student-student and providing the option of conforming social networks among all of them. In the case of the on-line and hybrid formats, the use of mobile devices is extended and enhanced to allow for a higher degree of communication and collaboration. The use of advanced handheld devices with 4G connectivity will play an important role providing a more efficient communications channel and an improved user experience based on the design of relevant and pertinent content that includes, among others, the involvement of pedagogues, information technology experts, psychologists, and instructional designers.

The accessibility of a more vigorous and improved communications channel with wide coverage allowing ubiquitous and mobile communications will have an impact in a location-dependent, time-dependent and situation-dependent traditional educational system. In this circumstance the role of the teachers will evolve transitioning from topic experts to facilitators and coaches. In order to take advantage of the benefits of 4G connectivity, the handheld device must have the capacity of processing and managing major flows of information.

Concerning the above mentioned ideas, an approach to the educational process that involves the triad teacher-student-content from the perspective of the potential support of 3G and 4G technologies is presented in Table 1. The Triad Teacher-Student(s)-Content

Relation	Characteristics
Teacher-Content	The teacher can have right to use and transport content connected to his or her course at several time and any place. The availability of superior data rates provided by 4G and the emergence of additional resourceful processors and operating systems will be crucial for content management and creation as well as for mobile videoconferencing applications. The knowledge gained in e-learning can be extrapolated to m-learning; however, screen size, memory, and processing capacities of handheld devices are important restrictions.
Student-Content	The student can contact and transport content at any time and any place. This communication takes place out of the habitual educational context; the emergence of 4G (LTE and WiMax) might offer a universal multifunctional device that, in conjunction with standardized tools, could bear content management and creation for the m-learning context.

A layered structure (shown in Figure 2) considers the following elements as part of this framework:
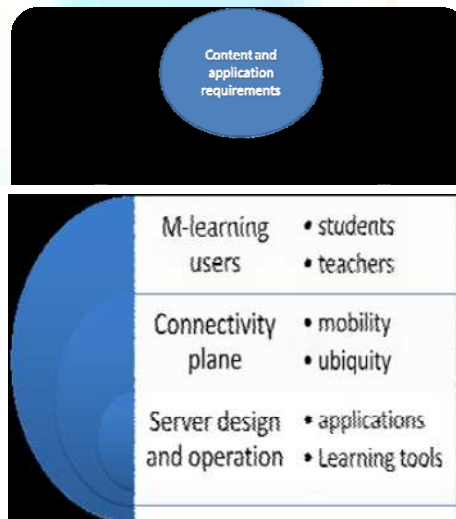
Capability of Instant Communication: This communication capacity in the form of voice or text messaging, mobile video, and Internet connectivity provides the access and provides social networks with potential to maintain the learning process in the form of interactions with teachers and students, relatives, and friends regarding academic or daily life concerns. 4G will improve the user's experience, enhancing in this way the quality and quantity of interactions and interactivity involved in the educational processes.

Message size restriction: Handheld devices have imperfect processing capacities compared to laptops or other computers. This limitation, connected with the screen size, restrains the kind of content to be managed by the devices. 4G will get better communications features (coverage and connectivity) and extra powerful devices are currently available. on the other hand, the size of the devices is still an important concern for developing significant educational applications.

• *Context management*: Context is a key factor connected with learning. Students and teachers can practice and speak about the different types of information when moving during the length of a voyage or in route to school or home. The management and understanding of interactions and interactivity with the contexts using mobile technology becomes critical to establish a relevant framework for m-learning. Context personalization is another important factor to consider.

• I*mpulsiveness:* The portability and accessibility of handheld devices with 3G and 4G connectivity provide immediate opportunity to communicate with other parties or to set up a social network for solving a specific academic need. It will be important to identify which applications are applicable and relevant for taking full gain of this capacity.

• *Informal learning*: The use of mobile devices in non-traditional academic environments using m-learning applications provides opportunities for informal learning experiences. There are many pilot projects all over the world that have exploited the technological benefits of m-learning in informal settings using 3G technology. These projects have created an important platform to identify the main challenges involved in developing relevant applications of m-learning in different academic environments.

• *Technology skills*: In order to take gain the full potential of 4G mobile devices, it is important to understand their main capacities, functions, and applications. The common contact of teachers and students with mobile devices allows the development of skills to properly operate such devices. Teachers who might practice the "mobile divide" perhaps reject the use of mobile technology and will face important challenges for adopting or participating in m-learning educational efforts.
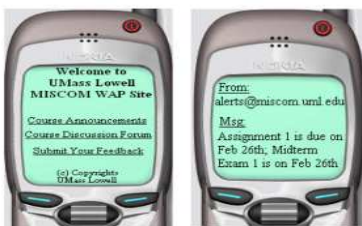
FIG: FRAMEWORK OF M-LEARNING
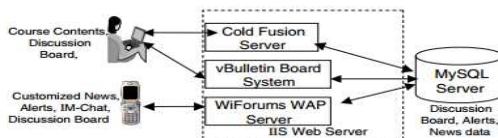

Fig. 3. WML wapsite.

Fig. 4. Mobile learning application architecture.

IV THE ROLE OF CONNECTIVITY AND COVERAGE

Connectivity and coverage are essential factors in m-learning environments. It is accredited that with the first generations of wireless technologies (1G and 2G), m-learning applications were incomplete. The emergence of 3G and 4G provides a platform to get better the transport and exchange of content, also enhancing the possibilities of meaningful interactions and interactivity. Wireless providers and device manufacturers, on their part, are developing dominant tools that allow for a better user experience; however, there is still a lot to do in the processes of establishing and putting into practice effective contexts. Given the complication of the mobile development, our present research suggests a multivariate and integrated approach to better understand the new models of interactivity emerging from mobile personal learning environments.

Definitively-improved connectivity and coverage allow flexibility in the interactions and interactivity processes, making the use of handheld mobile devices more gorgeous. The screen size is still an important constraint, but it is predicted that the development of new mobile interfaces and healthier understanding of human-terminal-human interaction will bring about enhanced tools to support education and learning. With all the elements in place, the m-learning scenario will progress from its exploratory stage to a more established situation.

V THE CHALLENGES AND RISKS OF A TECHNOLOGY-CENTRIC APPROACH

The diffusion of mobile technology in practically all endeavors of society and the fiery growth of wireless technologies present special challenges and risks for educational processes and contexts. On the one hand, it is tempting to apply the evident and immediate benefits of mobility and Internet connectivity in the learning environment in an effort to increase the coverage, efficiency, and effectiveness of education in all social strata. On the other hand, the vertiginous pace of technology development necessitates notice to factors that, if not considered, may render mobile broadband and connectivity technologies such as 3G and 4G intangible tools for supporting learning. Some of these factors are:

The need to develop strategies and programs for training teachers and administrators in the use and application of emerging wireless technologies. This aspect is key if we wish to mitigate the effects of an ever-increasing mobile digital divide.

• The importance of stressing the educational elements of m-learning by creating frameworks that focus on the mobility and interactivity of learners and educators, rather than just on the portability features and technical capabilities of current and future converging devices.

• The challenge of developing suitable and pertinent content for handheld devices, considering the limiting factors of screen size, memory capacity, processing speed, and data rate connectivity. One element observed in our current research is that handheld technology centric designs may become extremely intrusive and not necessarily conducive to supporting learning.

• Applications should stress simplicity and usability, while taking into consideration real scenarios regarding student ownership of 3G and 4G handheld devices and the connected fees of local wireless providers. The structure and fees of wireless plans, the plethora of handheld devices available in the market, and technical compatibility issues, as well as a lack of standardized frameworks and platforms for interoperability, may become limiting factors to deploying significant applications to support learning.

• Security and ethical issues are factors that are increasingly relevant in relation to the use of mobile devices. The improper use of handheld devices in the educational environment is more and more becoming an important concern of teachers, students, administrators, and parents. This is an area that needs special attention, and not only requires more research and development, but also a higher degree of collaboration and multidisciplinary focus to understand all the issues involved.

VI CONCLUSIONS

With the evolution toward 4G, it is anticipated that the improved technical capabilities of mobile devices will afford a greatly improved experience for users. The case in point of this paper is that technical progress is not enough, since due to the lack of substantial research there are still countless challenges to be faced in developing comprehensive theoretical frameworks for m-learning. There is also a courseware space with relevant and pertinent content for the m-learning context. To what amount will the development to 4G overlay the way for better and more insightful m-learning experiences? The answer to this question requires a multidisciplinary vision and focus. To date, content for entertainment and communications capture the attention of students all over the world, as 4G provides better connectivity and the potential of a better user experience. on the other hand, the urgent need now is to develop adoption and usability strategies and to create educational content suited for specific m-learning environments, taking into account the cultural, social, and human development issues involved.

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