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Identifying Research Priorities and Needs in Mobile Learning Technologies for Distance Education: A Delphi Study

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The main purpose of this study was to identify, categorize and rank the future research priorities and needs for mobile learning technologies. The key research inquiries were the following: (a) What are the major research issues and challenges identified by online workers for mobile learning technologies over the next ten years?, (b) What are the major research categories identified by online workers for mobile learning technologies over the next ten years?,(c) What are the major research priorities identified by online workers for mobile learning technologies over the next ten years?, and (d) What are the major research needs identified by online workers for mobile learning technologies over the next ten years?. A Delphi study was used to represent a constructive communication device among a group of experts. A total of 72 participants (24 female and 48 male) were selected for participation. These experts identified top research issues and challenges, categories, priorities, and needs for mobile learning technologies.

The aim of this study was to systematically investigate the current difficulties in, and the dilemmas and arguments around, mobile learning technologies while considering how the problems might be faced and overcome. The need for clear definitions and critical action has never been more pressing. On the one hand, mobile learning technologies in distance education have been modeled and influenced by a variety of new communication technologies. There are patterns and customs of mobile learning technologies drawn from the distinctive improvements in online communications. On the other hand, as noted by Burniske and Monke (2001), we should carefully identify future research needs and priorities which will affect and modify the development of mobile learning technologies in a post-modem world; we need to learn how to break down the digital walls. Past and future developments must be considered in order to devise a unique, open, and democratic system of distance learning through technology in the higher education system.

There has been some public dissatisfaction with mobile learning technologies which needs to be addressed. Responsible online workers must be found to identify the priorities and needs of mobile learners. A critical approach must be taken to handle the increased volume of distance learning, the frequency of its use, and to ensure a growth in the quality of online communications. Research on mobile learning technology should address practical and technical issues, but it must also consider the philosophy behind interactive online communications. The objects and goals of online programs must be subject to constant critical attention and revision.

Mobile learning technologies have been the subject of serious academic research. However, there is little attention paid to the impact of the latest technological developments on distance education. Online workers such as communication designers, the learners themselves, support staff, managers, and stakeholders need to keep abreast of the latest research in mobile learning technologies. Furthermore, key workers should incorporate such research into their decision-making processes and focus on future trends. Identifying future research needs and priorities for mobile learning technologies is necessary to foster these improvements. Future research needs must be identified and priority given to the social and political impact of technological developments on society and the relation of those developments to the idea of a free society. All of those concerned with and involved in mobile learning technologies and distance education must consider the impact of the digital world not just on themselves but at a global and international level.

Purpose

Recent years have seen rapid movements in mobile learning technology, a powerful utilization of new approaches, and methods and techniques that will have an impact on social and political issues and problems. A major issue is the identification of a set of global values, norms, and ethics to relate to the diverse needs of users in the digital world. One of the major issues appearing perpetually throughout this concern is how to identify global values, norms, and ethics (Green, 2002; Hine, 2003; Kirby, 1999; O'Sullivan, Morrell, & O'Connor, 2002; Perrons, 2004). Establishing appropriate interactive online communication environments empowered by mobile learning technologies is essential and complex. As suggested by Dhillon (2002), making the right decisions to maintain and improve online workers' sense of social responsibility in the Information Age is important not only because of our increased dependence on mobile learning technologies, but because these online communication technologies pose complex challenges, which will have an even greater significance in the near future. When addressing major research priorities and

needs, and examining the major research issues and challenges for mobile learning technologies in the near future, it is essential to clearly identify, rank and categorize the research and to take into account the online workers' values, norms, and ethics in relation to these revolutionary communication technologies. The main purpose of this research, therefore, is to identify, categorize, and rank the future research needs and priorities of mobile learning technologies. Based on the stated aims of this study, four research questions were asked to meet the goals and determine the direction of this research:

1. What are the major research issues and challenges identified by the online workers for mobile learning technologies over the next ten years?
2. What are the major research categories identified by online workers for mobile learning technologies over the next ten years?
3. What are the major research priorities identified by online workers for mobile learning technologies over the next ten years?
4. What are the major research needs identified by online workers for mobile learning technologies over the next ten years?

In essence, I aimed to provide a rich collection of online workers' ideas on projecting future trends in mobile learning technologies in order to enrich prospect analysis and practices in this area as it relates to a complex decision making process. The use of mobile learning technologies will be different, perhaps, from the more conservative approaches to the technologies in previous decades. Understanding future research priorities and future needs in this field can help online workers be more successful in their current professional roles.

The Background of Study

Understanding the future priorities and needs of mobile learning technologies can help online workers understand (a) how to manage their roles and tasks and (b) how to pay careful attention to the needs of a diverse online community. They can also be made to understand the importance of their roles and responsibilities, learning how to establish a sense of global values, norms, and ethics by utilizing mobile learning technologies. Thus, in this study, I combined media richness theory and radical constructivist theory with the theoretical and philosophical foundations of mobile learning technologies.

Media richness theory is utilized to identify, categorize, and rank the future research needs and priorities in mobile learning technologies as recognized by online workers. Media richness theory is based on contingency and information processing theory, one of the most widely used media theories. It argues that task performance is improved when task information needs are matched to a medium's richness or its "capacity to facilitate shared meaning" (Daft, Lengel, & Trevino, 1987, p. 358). Media richness theory points out that media vary in certain unique ways that affect the personal ability to communicate rich and complex information. According to Daft and Lengel (1986), information richness can be defined as the ability of information to change understanding within an interval of time in addition to media being capable of sending rich information better suited to tasks with ambiguous or equivocal information. As highlighted by Kahai and Cooper (2003), empowering online communications can have significant and positive impacts on design quality and that effects of participant deception can be mitigated by employing a critical pedagogy. Kurubacak (2006) notes that a purposeful, coherent approach can considerably decrease the communicational ambiguity that several online workers are facing. In this context, the critical pedagogy approach can decrease ambiguity through the theory of media richness for empowering online communications. As Kahai and Cooper (2003) point out, empowering critical online communications as a richer medium can have a significantly positive impact on generating democratic online societies.

Radical constructivist theory, on the other hand, was founded by psychologist Ernst von Glasersfeld (1987, 1989, 1991), and was part of a larger constructivist movement in the philosophy and sociology of science (Schwandt, 1994). Radical constructivism is based on two main assumptions: (a) knowledge is not passively received but actively built up by the cognizant subject, and (b) the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality (von Glasersfeld, 1989). von Glasersfeld claims that knowledge is the self-organized cognitive processing of the human mind (1987, 1989, 1991). That is, the process of constructing knowledge regulates itself; knowledge is a construct rather than a compilation of empirical data. Therefore, it is impossible to know the extent to which knowledge reflects an ontological reality. von Glaserfeld's radical constructivism emphasizes the ability of human beings to use the understandings they construct to help them navigate life (Raskin, 2002). In this context, mobile learning technologies can help learners operate in their own private and self-constructed worlds, interpersonal communications, and social interactions. Replacing an emphasis on the validity of human perception with an emphasis on its viability can help online workers

understand the future priorities and needs of mobile learning technologies.

Mobile learning technologies provide online workers with radical constructivist communication milieus combined with the principles and strategies of the media richness theory (Daft & Lengel, 1986; Daft et al., 1987), which helps online workers concentrate on significantly decreasing the boundaries of time and space. This is also an alternative approach to increasing learners' knowledge, improving their professional skills, and expanding their personal networks (Pulichino, 2006). Media richness theory helps online workers to look closely at the extent to which the human environment affects their learning experiences and to be interested in the relationship between linguistically mediated human social interactions. As described by Corrent-Agostinho and Hedberg (2000), a radical constructivist learning environment based on media richness theory has four general principles: (a) learning is a process of construction, (b) learning occurs through social negotiations of meaning, (c) learners are immersed in authentic contexts, and (d) reflective thinking is an ultimate goal. These generic principles can be implemented in practice and direct how mobile learning technologies can be incorporated. In this sense, media richness theory and radical constructivism theory can form the theoretical and philosophical foundation for this study for gathering invaluable and detailed information about the future priorities and needs of mobile learning technologies. Recognizing these social interactions as a source of knowledge helps online workers to build a viable model of experience formed within an individual but still influenced by the global context within which an activity is experienced (Doolittle, 2006).

Method

The purpose of this study was not only to identify the major research issues and challenges of mobile learning technologies but also to consider the complex problems of people and natural resources. To accomplish this, both quantitative and qualitative research techniques were utilized. Moreover, the combination of these methods helps to generate new perspectives and stimulate new directions in the data analysis. The methodology combinations provide data triangulation from a variety of data sources, and also methodological triangulation from multiple methods (Patton, 2002).

Despite considerable variance in the application of the technique, the Delphi study methodology was used in this study as a powerful communication device for a group of experts. The Delphi application was utilized to reach decisions from a diverse group of people with different ideas for the solution (Woudenberg, 1991). As noted by Helmer (1994), a Delphi study is a reliable method for investigating the formation of a group judgment, the exploration of ideas, and the production of suitable information for decision making. Furthermore, a Delphi study provides the researcher with a tool for facilitating consensus among individuals who had special knowledge to share, but who were not always in contact with each other (Adler & Ziglio, 1996).

A Delphi study was designed to develop the instrument necessary for the survey of mobile learning technologies. The incorporation of the Delphi method in the Internet milieu makes possible a number of significant refinements to the priorities and needs in the area of mobile learning technologies. The Delphi method was used to take advantage of the judgments of a group of experts for making decisions, determining needs and priorities, and predicting future needs. It provided an opportunity to obtain diverse opinions from a wide variety of experts across the world. The survey data were grouped according to the four sub-research questions: (a) the major research issues and challenges, (b) the major research categories, (c) the major research priorities, and (d) the major research needs. As noted by Osborne, Ratcliffe, Collins, Millar and Duschl (2000), the number of rounds for a Delphi study will be determined by how efficiently the panel reaches a consensus. On the other hand, many Delphi studies confine themselves to three rounds for pragmatic reasons. For reasons of time, a three-round Delphi application was chosen to determine the extent to which consensus exists among experts within the distance education community about future research priorities and the needs to be met by mobile learning technologies.

Research Setting and Participants

The research was conducted online during the 2005-2006 academic year. The researcher sent email messages and a demographic survey to different professional listservs to introduce the study and to ask the digital community whether they would like to participate voluntarily in this research. The process for conducting the study reported here involved an initial gathering of topics of interest to distance education followed by a broad emailed solicitation of nominations of people who would be appropriate participant experts for the study based on the following general criteria:

- at least three years work experience in the distance education sector, and/or
- a wide variety of experiences and activities of working in settings where educational service providers are transforming to distance education, and/or

- knowledge of design and delivery of distance learning courses, and/or
- comfort with utilizing new hardware and software tools, and skill in multimedia production

After the steering committee identified potential members for the Delphi panel from the initial pool of nominations, one hundred and seventeen (117) participants were formally invited to participate; of these, seventy two (72) agreed to complete the required three rounds of the survey. The researcher assembled an online panel of 72 online workers (24 female and 48 male) from across the world, including online administrators, online communication designers, online content providers, online learners, and online support staff from the broad area of distance education. These expert panelists identified top research issues and challenges, categories of research, the priorities and needs for future research for information, and the dissemination and partnership development between online workers. After the data were collected from the Delphi study, strategic planning around the main concerns identified in the research resulted in a planning document to outline needs and priorities in research for online workers up to the year 2016.

Data Sources

This Delphi study began with a questionnaire developed and revised by the researcher. First, the steering committee brainstormed the major research issues and challenges, categories, priorities, and needs for mobile learning technologies over the next ten years. Secondly, the researcher categorized these according to media richness theory and radical constructivist theory with the theoretical and philosophical foundations of mobile learning technologies; specific items were then organized into a draft survey instrument. Thirdly, the steering committee reviewed and critiqued the items on the instrument to confirm that the 52 items, along with their sub-topics, reflected the committee's thoughts and ideas about potential research issues and challenges, categories, priorities, and needs for mobile learning technologies. Finally, the feedback from the steering committee helped the researcher form the final shape of the Delphi survey, which had 48 items along with their sub-topics.

The survey was posted on a secure Internet website for a small team and for a larger group of experts. At the end of the survey, a series of questions seeking feedback about the survey was posted. After the questionnaire was returned, the researcher analyzed the results. The evaluative portion asked for specific feedback about survey content and layout, as well as the concerns, categories, priorities, and needs of mobile learning technologies. At the end of the evaluation form, a question was added asking if there was anything else they would like to address. Participants were advised to visit the website and complete the survey and the evaluation form. The experts were allowed the opportunity to change their responses based on the results, and these second-round and third-round results were re-evaluated by the researcher. This process was to be continued until a consensus was reached. It would become clear that no consensus was possible.

The first round of the Delphi method asked the participants to respond to sixteen specific questions on identifying top research issues and challenges, categories of research, the priorities and needs for future research for information, and the dissemination and partnership development between online workers. The second round used questions developed from responses to the first questionnaire. The participants were asked to rate each statement on a 1 to 5 scale (1 = *very important*, 2 = *important*, 3 = *neither important nor unimportant*, 4 = *unimportant*, and 5 = *very unimportant*) and to optionally comment on each statement. The third round used the same statements as the second round and asked the participants if they would like to modify their answers based on the responses of the other participants.

Analysis

This Delphi study process essentially provided an interactive communication structure between the researcher and experts in distance education in order to identify, categorize, and rank the future research needs and priorities for mobile learning technologies. Both qualitative and quantitative questions were asked of the experts, and the information was then analyzed and provided to each person, via further questions. Their responses were analyzed again, recycled for feedback, and so on until the goal was reached: when a consensus was reached which offered a synthesis and clarity on the question. The three rounds of the Delphi study were followed in accordance with descriptions provided by Rockwell, Furgason and Marx (2000) as well as Osborne et al. (2000).

In the first round of the Delphi panel, the researcher asked each expert to rate each item based on two factors: (a) identifying top research issues and challenges and categories of research of mobile learning technologies, and (b) identifying the priorities and needs for future research for information and the dissemination and partnership development between online workers. The researcher used a scale of 1-5 for each question (1 = *very important*, 2 = *important*, 3 = *neither important nor unimportant*, 4 = *unimportant*, and 5 = *very unimportant*). The first round instrument was posted on a web page. All of the panel participants

accessed and answered the questionnaire electronically. Seventy-two panel members participated in the first round.

In the second round of the Delphi panel, mean scores were calculated for each item from the first Delphi panel response using a five-point scale (1 = *very important* to 5 = *very unimportant*). For the Delphi panel's second instrument, the mean score was marked on an importance scale for each of the original items; panel members were then asked to rate the accuracy of the mean scores using a three-point scale (1 = *should reflect more importance*, 2 = *is an accurate representation of importance*, and 3 = *should reflect less importance*). From the comments written in on the first round, eight new items were added to the second round questionnaire. Respondents were asked to rate the importance of these items using the same five-point scale (1 = *very important* to 5 = *very unimportant*) employed in the first round instrument. Seventy-two panel members completed the second round instrument.

Finally, in the last round of the Delphi study, frequency distributions were calculated for the accuracy ratings given to each of the original items. This meant that scores for the second round were adjusted based on the net difference between the proportions of responses, demonstrating that the item was judged either "*more important"* or "*less important."* The adjusted means were added to the instrument for a third round. The third round instrument again asked for a rating of the accuracy of the mean scores using a three-point scale (1 = *should reflect more importance*, 2 = *is an accurate representation of importance*, and 3 = *should reflect less importance*). A principal contribution to the improvement of the quality of the third round results, moreover, improved the understanding of the participants through analysis of subjective judgments to produce a clear presentation of the range of views and considerations (Turoff & Hiltz, 1996); it also detected hidden disagreements and judgmental biases that should be exposed for further clarification, and missing information or cases of ambiguity in interpretation by different participants.

Three faculty members who were experts in distance education coded the participants' response in the reliability check process. The anonymous and iterative nature of this process allowed the participants to submit their diverse opinions and make their critical decisions without meeting in person (Patton, 2002; Turoff & Hiltz, 1996). Finally, this Delphi application generated forecasts in mobile learning technologies (Cornish, 1977) and empowered expeditious understanding on the future consequences of present choices (Amara & Salanik, 1972).

Findings and Discussion

The present study focused on identifying, categorizing, and ranking the future research needs and priorities for mobile learning technologies. In addition, the factors necessary to investigate the major research issues and challenges identified by online workers over the next ten years were investigated. The findings of the study provide a pragmatic analysis, as well as a discussion of the four main areas identified by the online workers for mobile learning technologies over the next ten years: (a) the major research issues and challenges; (b) the major research categories; (c) the major research priorities; and (d) the major research needs.

The Major Research Issues and Challenges

The major research issues and challenges were those which provided online learners with diverse solutions to the future's most pressing dilemmas, problems, or barriers (see Table 1). To best prepare themselves for different situations of technological, pedagogical, and social leadership in the global online world, online workers were concerned about three main areas: (a) realizing the dialectic relationship between personal technology and everyday learning, (b) accommodating the diversity of learners, (c) and promoting strong interdisciplinary research agendas. These areas are important for online workers who need to be increasingly aware of the challenges involved in meeting the needs of multicultural online communities. In order to manage these communities well, online workers must be able to assess and analyze global thinking and trends, taking into account a range of viewpoints and philosophies (Ketterer & Marsh, 2006; McLean, 2006; Yang & Cornelious, 2005). These situations require more responsible and potent world wide distributed mobile technologies (McIntrye Boyd, 2008) to generate online community-based reactions and modify attitudes to better reflect the values of diversity and opportunity. In this context, the public responsibility, the management of the online community, and the need for specialists are the three key factors for online workers to participate in transforming technological and social change, accommodating the diversity of learners, and promoting strong interdisciplinary research agendas (Bonk, 2001; Pulichino, 2006). They need to be committed to and share in the values of independent online communities. The specialists participating in building technological and social change will, as future leaders, (Attwell, Dirckinck-Holmfeld, Fabian, Kárpáti & Littig, 2004; Martins & Kellermanns, 2004) need to embrace a large range of diverse opinions and perspectives,

make critical decisions, address the questions of radical movements, and consider communications on radical actions for the global public good (Holland & Childress, 2008; Kurubacak, 2006). Online workers, therefore, should focus on preparing for their leadership in mobile learning technologies; this will derive from their being familiar with democratic global online communities.

Online participants stressed that it was vital to develop the multicultural standards of accreditation for mobile learning technologies, provide learners with novel opportunities for synchronous online communications, and support a range of knowledge-based activities coupled with the increasing use of mobile technologies; less important, on the other hand, were access to learning to broaden from traditional approaches to become part of real-life, provide appropriate strategies for managing changes for technology implementation, and cover a variety of research topics ranging from the technologies through to socio-cultural research. Online workers, therefore, should consider how mobile learning technologies can provide digital citizens with the communication tools to better themselves and strengthen democracy, to generate a more egalitarian and just society, and thus to deploy distance education in a process of progressive social change (Holland & Childress, 2008; Yang & Cornelious, 2005).

TABLE 1
The Major Research Issues and Challenges for Mobile Learning Technologies
as Reported by Distance Education Experts

How important is it to:	
Very Important (1.00 to 1.49[a])	
1.03	realize the dialectic relationship between personal technology and everyday learning
1.04	provide critical reflects the diversity of learners
1.05	promote strong interdisciplinary research agendas
1.12	develop the multicultural standards of accreditation for mobile learning technologies
1.13	provide learners with novel opportunities for synchronous online communications
1.25	support a range of knowledge based activities coupled with the increasing use of mobile technologies
1.27	evaluate the usability of mobile applications
1.29	develop individual technologies that support a person through a lifetime of learning
1.31	adopt appropriate mixed research methodologies
1.34	increasing access to learning opportunities in diverse societies
1.37	promote a lifelong learning increasing the skills of the global workforces
1.40	provide learners with all the knowledge they need to flourish throughout a lifetime
1.42	provide learners with best practices for utilizing mobile learning technologies
1.46	offers new possibilities for interactive online communications
1.48	support learning outside formal educational settings over a learner's lifetime
1.49	access to a wireless network change the dynamics of learning-in and out of the classroom
1.49	manage the social, societal and cultural impacts of research in mobile learning technologies
Quite Important (1.50 to 1.99[a])	
1.50	support learning communities including new forms of improved critical thinking skills
1.61	cope with various network conditions which must be taken into consideration
1.69	forecast the exact situations of the mobile application use
1.78	focus on limited bandwidth and unreliability of wireless networks
1.79	investigate the rationale for implementing mobile learning technologies
1.84	develop models of diverse learners which embrace the widely varying timescale
1.86	improve a sustainable economy for mobile learning technologies
1.93	develop the effective use of new mobile technologies
1.96	improve gradually educational excellence
1.99	provide location-based services for educational networks
Somewhat Important (2.00 to 2.49[a])	
2.10	access to learning to broaden from traditional approaches to become part of real- life
2.18	provide appropriate strategies for managing changes for technology implementation
2.46	cover a variety of research topics ranging from the technologies through to socio-cultural research
Neither Important Nor Unimportant (2.50 – 2.99[a])	
2.86	provide learners with ubiquitous access to information

[a] 1 = Very important, 2 = Important, 3 = Neither important nor unimportant, 4 = Unimportant, 5 = Very unimportant

The Major Research Categories

The major research categories were those that helped to define the important and urgent areas of research for mobile learning technologies (see Table 2). Online workers emphasized that the following must become important research categories for the future: (a) their new roles, (b) a multicultural curriculum, (c) global patterns influenced by mobile learning technologies and interactive synchronous communications, and (d) cultural biases and stereotypes. There should be adjustments, agreements, and recognition of diversity in communications when integrating mobile learning technologies into curricular activities (Alexander, 2004). Mobile learning technologies must supply full and accurate communication milieus that the learners can base their judgments without cultural biases and stereotypes (Traxler & Bridges, 2004). Therefore, online workers have to respect the multicultural diversity; the rights of digital citizens; the varying ethics, values, and norms connected to the societies online learners live in; and digital people's connections with their societies that influence the technological management and leadership of mobile learning technologies (Bolliger & Martindale, 2004; Bonk, 2001; Ketterer & Marsh, 2006; Martins & Kellermanns, 2004; McLean, 2006; O'Neill & Palmer, 2004; Rossi, 2004). Table 2 shows that online workers would like to see a focus on diverse views as well as the biases, opinions, stereotypes, and prejudices of management in mobile learning technologies.

According to online workers, existing programs run by different educational institutes from all over the world need to re-evaluate their programs in the light of current internal and external trends (Ketterer & Marsh, 2006; Oakley, 2004), such as changing roles, multicultural curriculum, and global patterns influenced by mobile learning technologies. Therefore, mobile learning technologies should achieve the goal of equal participation of digital citizens in decision-making and provide a balance that more precisely reflects the composition of a free online society, which is needed to fortify democracy and promote its proper performance. There are few arguments involving the following: (a) working with subject matter experts in the planning and scheduling of the design and development of distance education, (b) assuring course design meets accessibility standards, and (c) managing and supplying pedagogical support for distanced learning program. On the other hand, as illustrated in Table 2, computer hardware and software developments as well as internal institutional trends rank as less important. The results indicate less interest in collaborating with subject matter experts on updates, revisions, and maintenance; providing online workers with the best practice models, and faculty reward systems.

TABLE 2
The Major Research Categories for Mobile Learning Technologies as Reported by Distance Education Experts

How important is it to:	
Very Important (1.00 to 1.49[a])	
1.12	Changing roles
1.23	multicultural curriculum
1.23	global patterns influenced by mobile learning technologies
1.30	interactive synchronous communications
1.35	cultural biases and stereotypes
1.38	the philosophy of mobile learning
1.39	current trends that influence the technological managements and leaderships
1.41	global values, ethics and norms
1.42	trends outside of the organizations
1.46	Stakeholder involvements
Quite Important (1.50 to 1.99[a])	
1.51	higher accountability
1.68	funds for mobile learning technologies
1.94	infrastructure developments
Somewhat Important (2.00 to 2.49[a])	
2.26	computer hardware and software developments
2.37	internal institutional trends
Neither Important Nor Unimportant (2.50 – 2.99[a])	
2.53	interactive asynchronous communications
2.73	best practice models
2.81	faculty reward systems

[a] 1 = Very important, 2 = Important, 3 = Neither important nor unimportant, 4 = Unimportant, 5 = Very unimportant

The Major Research Priorities

The major research priorities were those that relate to how programs are delivered via mobile learning technologies are as follows: (a) addressing specific curriculum areas by diagnosing communication problems, and (b) ensuring privacy for the distance learners as well as enhancing different capacities for a more rich social interaction (see Table 3). In this case, priority should be given to those strategies, which are completely in accord with global agreements on equality and diversity issues (Ketterer & Marsh, 2006; Paulson, 2002; Roffe, 2002; Rovai, 2003; Yang & Cornelious, 2005). In line with this, online workers should expand their abilities to provide learners with emerging practices relating to the use of mobile learning technologies (Fabian, Kárpáti & Littig, 2004; Oakley, 2004) and should adopt suitable applications to match the needs of the users of the digital world (Amin, Mahmud, Abidin, Rahman, Iskandar & Ridzuan, 2006).

Online workers highlighted that mobile learning technologies would enhance different capabilities for rich social interactions, explore emerging practices relating to the use of mobile learning technologies, and adopt suitable applications that match the needs of the digital world. To promote learning within authentic contexts and to find new strategies based on learners' previous and current knowledge, online workers should affect the shaping of learning and communication events (Attwell et al., 2004; Traxler & Bridges, 2004). Additionally, there should be new dimensions added to the provision of interactive course materials for learners.

Online workers also indicated that online educators and technical developers should be encouraged to rethink their roles and responsibilities. This would help these professionals to plan and control their leadership roles in a technologically advanced learning setting (Oakley, 2004; Roffe, 2002; Trifonova & Ronchetti, 2003). Online workers believed that moving more outside of the traditional classroom, empowering learning through social interactions, and ensuring security for the distance learners required the appropriate use of mobile learning technologies to focus on improving more diverse skills for an authentic contextual awareness.

TABLE 3
The Major Research Priorities for Mobile Learning Technologies as Reported by Distance Education Experts

How important is it to:	
Very Important (1.00 to 1.49[a])	
1.12	address specific curriculum areas
1.14	diagnose communication problems that learners have with mobile learning technologies
1.19	ensure privacy for the distance learners
1.29	enhance different capabilities for rich social interactions
1.35	explore emerging practices relating to the use of mobile learning technologies
1.37	adopt suitable applications that match the needs of the digital world
1.39	design difficult activities simulated from real-life
1.41	provide interactive course materials to learners
1.43	promote learning within authentic contexts
1.46	prompt interactive communications within diverse culture
1.47	find new strategies based on learners' previous and current knowledge
1.49	develop strategies that map efficiently to the curriculum needs
1.49	become more embedded with diverse skills for context awareness
Quite Important (1.50 to 1.99[a])	
1.50	encourage educators and technical developers to rethink their roles and responsibilities
1.54	move more and more outside of the traditional classroom
1.59	Empower learning through social interactions
1.63	ensure security for the distance learners
1.64	assist in the management of learners and resources for online communication activities
1.78	investigate advantages and disadvantages of each mobile learning technology
1.96	investigate a cost model for infrastructure, technology and services
Somewhat Important (2.00 to 2.49[a])	
2.23	consider the use of mobile technologies for student administration tasks
2.47	present a main guideline to empower current educational practices
Neither Important Nor Unimportant (2.50 – 2.99[a])	
2.53	utilize new technologies for attendance reporting and reviewing student marks more effectively
2.57	customize mobile learning technologies for individual learners
2.71	connect mobile devices to data collection devices or a common network
2.79	identify the different types of mobile technologies that are applicable to learn

[a] 1 = Very important, 2 = Important, 3 = Neither important nor unimportant, 4 = Unimportant, 5 = Very unimportant

On the other hand, online workers were less interested in connecting mobile devices to data collection devices and a common network, and identifying the different types of mobile technologies that were applicable.

The major research priorities for mobile learning technologies have generated a new paradigm for distance education (Burniske & Monke, 2001; Sharples, 2000; Sharples, 2003). Successful participation in intercultural communications requires that online learners recognize and understand cultural influences on collective action and global participation, especially since the major research priorities for mobile learning technologies focus on cross-cultural communications and global cultural patterns (Alexander, 2004; Corrent-Agostinho & Hedberg, 2000; Martins & Kellermanns, 2004).

The Major Research Needs

The major research needs indicate that online workers should be provided with the tools necessary to facilitate the design and delivery of distance programs supported by mobile learning technologies (Trifonova & Ronchetti, 2003) to support collaborative learning, transform learning into a part of real-life, and support digital interactions dedicated learning milieus.

The results indicated that there was a significant interest in engaging in activities that did not correspond with the curriculum, linking with multicultural activities in the outside world, and using mobile technologies to support group learning. In this context, addressing issues of power, authority, and ownership could have novel effects in the new technological milieus (Rockwell et al., 2000; Rovai, 2003; Woudenberg, 1991), which raises specific concerns about the power of global companies, new perspectives on the meanings of democracy, multiculturalism, and so on (Alexander, 2004; Attwell et al., 2004; Chen, 2001; Traxler & Bridges, 2004).

Online workers stressed that instructors needed to provide effective technical supports, assist learners in the development of online communication skills, and construct critical cultural perspectives via mobile learning technologies. These actions can enhance

TABLE 4
The Major Research Needs for Mobile Learning Technologies as Reported by Distance Education Experts

How important is it to:	
Very Important (1.00 to 1.49[a])	
1.02	consider the use of mobile learning technologies to support collaborative learning
1.13	Transform learning into a part of real-life
1.27	support digital interactions dedicated learning milieus
1.27	engage in activities that do not correspond with the curriculum
1.32	link to multicultural activities in the outside world
1.36	consider the use of mobile technologies to support group learning
1.37	provide effective technical supports to the faculty
1.37	assist learners in the development of online communication skills
1.38	construct critical cultural perspectives via mobile learning technologies
1.38	enhance different possibilities for online communications
1.41	investigate issues of power and culture in mobile learning technologies
1.43	provide learners with authentic guidelines as to how the real-life problems may be approached
1.47	support intentional online learning activities
1.48	draw on context-aware applications to enhance the multicultural learning activities
Quite Important (1.50 to 1.99[a])	
1.52	address diverse issues along with more practical concerns such as cost, usability and pedagogy
1.53	address multicultural issues that do not immediately inform practices
1.61	consider the various intersections of context, technology and learners
1.66	assign the necessary roles for supporting mobile learning
1.67	support human-computer interactions (HCI)
1.75	communicate with other devices of the same and/or similar types
1.76	provide critical developments beyond the classroom experiences
1.76	enhance new communicational activities powerfully
1.85	enable learners to share data, files and messages
1.89	support for administrative duties
Somewhat Important (2.00 to 2.49[a])	
2.35	provide learners with the various potentials to escape the classroom
Neither Important Nor Unimportant (2.50 – 2.99[a])	
2.50	facilitate for informal online communications
2.86	develop strategies for the management of mobile equipment

[a] 1 = Very important, 2 = Important, 3 = Neither important nor unimportant, 4 = Unimportant, 5 = Very unimportant

communication in a multicultural context (Attwell et al., 2004; Corrent-Agostinho & Hedberg, 2000; Dhillon, 2002; Martins & Kellermanns, 2004; Trifonova, 2007) and that this advent of mobile learning technologies could build completely new communication and learning environments. The results indicate that addressing diverse issues along with more practical concerns (e.g., cost, usability, and pedagogy); multicultural issues; and considering the various intersections of context, technology, and learners were considered more important; on the other hand, much less interest was reported in providing learners with the various potentials to escape the classroom, facilitating informal online communications, and developing strategies for the management of mobile equipment.

Conclusion

The main purpose of this research was to identify, categorize, and rank the future research needs and priorities in mobile learning technologies. This paper contains a series of original ideas, viewpoints, and insights identified by distance education experts on the roles and responsibilities that need to be addressed concerning mobile learning technologies over the next 10 years. The discussions raised numerous major issues at play in the present as well as questions about scientific, technological, and pedagogical productivity in the future. Several professionals had strong opinions on the impact of mobile learning technologies on social, societal, and political life, and they contributed well-articulated viewpoints from their own real-life experiences indicating different approaches to future research.

The collected data showed that cutting-edge technology improvements and diverse relationships changed by power and ownership could lead to various opportunities for scholarly research and inquiries related to mobile learning technologies (Bolliger & Martindale, 2004; Bonk, 2001; Dhillon, 2002). These experts would like to concentrate on these technological developments given that values, ethics, and norms can be overwhelmingly affected by this digital world. These experts need to be able to adapt to continuously changing conditions and the needs of sustainability, while taking into account the values and interests of the collectivity before collective action. Online workers should play an important role in strengthening technological, societal, economical, and political developments and in the facilitation of collaborative action (Ketterer & Marsh, 2006; Roffe, 2002; Yang & Cornelious, 2005). Online workers, moreover, should stimulate the global development process and strengthen online learners' ability to learn, adapt, and innovate (Attwell et al., 2004; Rockwell et al., 2000; Roffe, 2002; Traxler & Bridges, 2004). Finally, the responses of these experts suggested three main areas of concern:

- the distinguishing qualities and factors of technological change strongly affect the role and responsibilities of future research,
- the problems of social adjustments to technological change powerfully impact socio-cultural patterns and a democratic way of life, and
- the responsibilities and roles of online workers professionally generate new dimensions in the process of change.

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