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Utilizing Mobile Technologies for Economic Development: The eCANDLE Project

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In the next 50 years, the world's population will grow by almost one half, most of the growth coming from developing countries. Concerns over poverty increase the desire to understand how to foster economic growth in developing countries. In this paper we explore issues regarding the use of education and technology for economic development. We then examine the particular opportunities and challenges associated with the use of mobile technologies in education. We also provide an in-depth description of a case study, the eCANDLE initiative (electronic Coalition for Aggregation of Net-based Digital Learning Environments).

Keywords: Mobile Technologies, Education, Developing Countries

The Population Reference Bureau (http://www.prb.org) projects that by 2050 the population of the world will reach 9.3 billion, an increase of 50%. India will soon pass China as the most populous country, both over one billion. The growth is not from developed countries (with either a steady or a declining population), but in the developing countries. As Anderson (1992) explained: "To reach, and to teach, [those] not served by existing educational systems, new approaches to education are needed"; especially when more than one-half of the world's people live below the internationally defined poverty line (less than 2 USD a day); for example, Uganda (97%), Nicaragua (80%), Pakistan (66%), and China (47%) (http://www.worldbank.org/). One question we must ask as we move into the future is how can we reach and help these growing populations, and what new approaches will allow us to promote education and economic growth for all? And on

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an even more fundamental level, will education alone be enough for economic growth, or what other initiatives and policy supports are needed?

This paper explores the nature of education and technology in socio-economic development. As a growing area of interest, we discuss mobile technologies and their potential role in education in a general way, and then explore a specific case study, the eCANDLE initiative (electronic Coalition for Aggregation of Net-based Digital Learning Environments). We include a description of the concepts we are testing (in conjunction with Tsinghua University using e-business content and Chinese context) and we describe our initial findings.

EDUCATION FOR ECONOMIC DEVELOPMENT

Some discussion has occurred regarding the value of education as a key factor in fostering economic development. One of the most widely known idealizations of this is the World Conference on Education For All sponsored by UNESCO (United Nations Educational, Scientific and Cultural Organization), UNICEF (United Nations Children's Fund), the World Bank, and the United Nations Development Program. The official declaration that followed this conference advocated Education For All (EFA), seeing education as a way to promote a safer, healthier, more environmentally friendly world, along with stimulating social and economic progress. The initial goal from the 1990 conference was to have universal primary education in every country by the year 2000, although for obvious reasons, that goal has been readjusted since then. Regardless of their initially unmet expectations, the belief still holds that education is a powerful factor in promoting economic growth along with other social goods.

Amartya Sen (1999), winner of the Nobel Prize in economics, offered the comparison of India and China as an example of how education might be related to economic growth. Whereas both governments have been moving for some time towards a more open and internationally friendly market economy, China has excelled much more quickly than India in being able to make use of the market economy. Sen states that the primary reason for this was pre-reform China's emphasis on "basic education and widely shared health care," which created good schooling facilities across much of the country and a highly literate people. Sen positioned China's situation as opposed to India's elitist orientation towards higher education, "massive negligence of school education," and "half-illiterate adult population when it turned to marketization in 1991" (p. 42). Sen argues that although China has some handicaps that India has not experienced, the net result is that education and health care provide a necessary foundation for economic growth in addition to an increased quality of life and human development.

Regardless of the positive rhetoric around educational initiatives, others are not so convinced that it is a self-evident truth that education leads to economic development. Easterly (2002) reports a series of surprising studies that trace how decades of government-sponsored educational growth and spending in several African countries resulted in very little (and occasionally even negative) growth of GDP per capita. Easterly concludes that there needs to be more than just education: "Creating people with high skill in countries where the only profitable activity is lobbying the government for favors is not a formula for success. Creating skills where there exists no technology to use them is not going to foster economic growth" (p. 73). Easterly argues that education leads nowhere without real incentives through opportunities and resources following the schooling, and that enrollment in formal schooling may also simply be a poor measure of creation of skills that are useful in economic production.

Johnson (2006), a top executive at Microsoft, offered one model that provided a more comprehensive picture of what is needed for true economic development. Johnson

described the need for policy advocacy in areas related to all of the following: (a) a general education system, (b) top quality research institutions, allowing for public and private partnerships, (c) commercialization, (d) IP policy that rewards innovation, (e) access to capital, (f) a local software economy, (g) a technology partner ecosystem, and (h) global exports. Sen (1999) concurred that there is a synergistic relationship between different types of policy. He argued that:

> Social freedoms (in the form of education and health facilities) facilitate economic participation. Economic facilities (in the form of opportunities for participation in trade and production) can help to generate personal abundance as well as public resources for social facilities. Freedoms of different kinds can strengthen one another (p. 11).

Sen (1999) advocates the idea that education provides not only personal benefits (to the individual who is educated) but also social benefits (e.g. enhancing economic progress, decreasing mortality rates, etc.) that should make education of primary importance for state and public institutions. When weighed in the balance, although not a panacea, it seems clear that the expansion of services for both basic and advanced education is very desirable, especially in the context of incentives through supportive policy and technological availability.

TECHNOLOGY FOR ECONOMIC GROWTH

Major efforts and resources have been put towards technological innovation and diffusion, particularly because of their perceived connection with economic growth. However, new technological developments have both positive and negative implications in the developing world.

When new technology simply complements existing technology, it is of little benefit to those who never had the original. Cost issues with new technology also provide a formidable barrier to diffusion and adoption in the developing world. The result is the much talked about “digital divide” that separates those who can leverage the power of technological developments from those who cannot. Take the simple example of using technology to get a greater amount of output from an equivalent amount of input. Easterly (2002) gives statistics showing how differences in productivity growth explain over 90% of the differences in per capita growth between 1960 and 1992. Then he explains the relationship between productivity growth and the level of technological infrastructure, with specific comparison between China and the U.S. in years past:

> Just as productivity growth explains most of the differences in per capita growth across countries, so differences in technological levels explain most of the differences in income per capita. U.S. workers produce twenty times the output per worker than Chinese workers do. If Chinese workers had the same technology as U.S. workers, then U.S. workers would produce only twice as much as Chinese workers (which would be explained by more education and machinery for U.S. workers). Most of the higher output of American workers compared to Chinese workers is explained by higher technological productivity (Hall & Jones, 1999)…Technology by itself does not improve life everywhere. (p. 176)

The main point is that technological infrastructure is related to productivity, and productivity growth has a major impact on economic growth.

Although initially at a disadvantage, there are some ways in which new technologies could prove even more advantageous for developing countries than for the already developed ones. Much of new technology is disruptive in the sense that it replaces old technology. Those who have already invested much in the old technology find it difficult to make the switch, and even the producers of old technology erect barriers to entry because of the threat the new technology poses. This provides those in the developing world an opportunity to catch up quickly by skipping straight to the new technology without the same level of growing pains that the developed world must endure. As communication and transportation costs fall, additional educational opportunities and global markets come within reach. This increased access to communication allows for developing nations to borrow technology from rich nations, and transform those opportunities into increased knowledge and economic growth, (especially true when some protection and incentives are in place for integration and innovation). However, because "low average skills pulls down the returns to new technology in poor countries" (Easterly, 2002, p. 191), it is helpful to remember the importance of basic educational opportunities and look at the development of education in the context of the rapid rate of technological infusion.

THE BLENDING OF MOBILE TECHNOLOGY AND EDUCATION

The diffusion of wireless mobile technologies in the developing world has been one of the most astonishing trends of the present and future (e.g. the profusion of computer-based mobile phones with increased digital capacity for things like PDA scheduling, wireless Internet connectivity, text messaging, photo and even video capabilities). An increasing variety of mobile devices are being produced (e.g. mobile phones, PDAs, hand held radios, tablet PCs, MP3 players, e-book readers, Ultra-mobile PCs, etc.) and it is becoming rare for them not to be equipped with things like video capability and Internet connectivity.

In relation to education, mobile devices offer new potential, with m-learning (or mobile learning) becoming a common phrase. A few of the key themes that emerged from the 2005 South African "mLearn" conference included: (a) the world is populated with an increasing number of "digital natives," those who are familiar with technology, (b) there is an enormous potential to address the digital divide by using mobile devices, (c) wireless technology is present and will be the future, (d) there is enormous potential to use mobile and portable learning in developing countries, (e) lessons learned by early adopters can benefit later adopters, and (f) there is an urgent need for more research and high quality evaluation and a greater synergy between research, practice, pedagogy and technological developments. These themes highlight what many have already recognized: the potential opportunities that exist to utilize mobile technologies for educational and economic benefits. While aware of the concern not to make any learning "technology-driven" (Beatty, 2003; and Salaberry, 2001), mobile technologies (e.g. PDAs, multimedia cellular phones, MP3 players, digital dictionaries, digital recording devices, and so on) offer new potential to merge the boundaries between formal and informal learning environments in order to make education more immediately applicable and pertinent.

One example of this is in the opportunity new mobile technologies have presented for advances in ESL and second language acquisition (Zhao, 2005). Chapelle (1998), explained how "it is useful to view multimedia design from the perspective of the input it can provide to learners, the output it allows them to produce, the interactions they are able to engage in, and the L2 tasks it supports." In terms of Computer Assisted Language Learning (CALL), and in particular Mobile Assisted Language Learning (MALL), there are numerous ways in which mobile technologies facilitate more effective practice.

Among these is the measured recognition of increased interaction time, in addition to customized feedback in specific task areas. Although Chapelle mainly refers to interactions with the computer, the Information and Communication Technology (ICT) can also open up communication opportunities with other learners, multiple instructors or teaching assistants, and perhaps even others at a partner institution in a foreign country.

One other option that ICT, and specifically mobile technologies, allow is for the scaffolding and support of face-to-face interactions. Essentially, PDA's, tablet PCs, or even mobile phones can be used as tutors to prompt, correct, and answer questions *in situ*, or in the moment that a learner is trying to interact with others: for instance prompts can be given when interacting with an ESL teacher, a tourist, or when traveling in another country with anyone that they might need to interact with.

Chinnery (2006) offers an extensive list of examples where mobile technologies have been used for language learning (MALL). Among these are (1) the BBC World Service's Learning English section offering English lessons via SMS in Francaphone West Africa and China, (2) the EU funded 'm-learning' initiative to provide English lessons for non-English speaking young adults, (3) MobiLearn's efforts to turn PDAs into 'talking phrasebooks,' and (4) a variety of ESL lessons available through podcasts (using iPod devices). And though funding is always a concern, it is encouraging that "Gilgen (2004) has demonstrated the possibilities of developing mobile labs for schools with limited funding" (Chinnery, 2006, p. 13). Additionally other researchers have explored the use of interactive TV (iTV; Pemberton, Fallahkhair & Masthoff, 2005), messaging, peer-to-peer sharing, and gaming (Goodwin-Jones, 2005).

Some of the pedagogical difficulties that have been encountered in m-learning include the following: increased opportunities for cheating, an increased potential for distractions from technical difficulties (Alexander, 2004), a potential clash between gathering contextual info and the learner's wish for autonomy and privacy (Naismith, Longsdale, Vavoula & Sharples, 2005). Additionally, mobility introduces greater capacity for the student to 'escape' the intended curriculum or simply be distracted by the outside world in debilitating ways. Further, new tools are constantly needed to track, retrieve, and assess mobile learning experiences; and a conflict sometimes occurs when classroom dynamics are at odds with the students' desire to own and control their personal technologies (Naismith, Longsdale, Vavoula & Sharples, 2005).

Chinnery (2006) also points out some of the current technical challenges of mobile technologies. Among these are the limited audiovisual quality (from limited screen size), difficulties associated with one-finger data entry, limited message length and power, lack of cultural context (which could include difficulties transitioning from traditional expectations of teaching and learning: see also Rogers, 2006), limited online connection times, and limited ownership in certain populations for various types of media.

Despite these disadvantages, Stead (2005) has observed that "In the short space of five years, mobile learning (m-learning) has moved from being a theory, explored by academic and technology enthusiasts, into a real and valuable contribution to learning." In doing extensive research with groups as diverse as traveling families across Scotland, lorry (truck) drivers, inner-city refugees and recent immigrants in Stockholm, and hard-to-reach learners in a variety of targeted workplaces, Stead has consistently found positive research results. Referencing the current research in this arena Stead (2005) asserts, "We know that m-learning can empower and engage. We know that the engagement and motivation can continue beyond the initial 'gadget honeymoon'. We know that learners are more comfortable engaging in personal or private subject areas via a mobile device than via traditional methods. (Attewell 2005)" (p. 3). M-learning provides an avenue for learning and makes a unique contribution in the methods of learning that are enhancements to traditional methods.

A UK-based organization dedicated to developing and disseminating research regarding emerging technology and ICT's impact on education compiled a report on the current research in m-learning. Among the compelling advantages for the use of m-learning, they listed the following key benefits:

- General pupil learning gains derived from increased enthusiasm, motivation, confidence and a sense of ownership,
- Greater integration into classroom use and across the curriculum compared to other forms of ICT,
- Increased independence and self-initiated learning in pupils, and the extension of learning beyond the classroom. (Becta report, 2004, p. 1)

Benefits outlined in the Becta report (2004) include how m-learning has allowed more integration across curriculum with minimum disruption of existing practices (Moseley and Higgins, 1999), a general saving in both space and the time needed to move to specially equipped ICT suites (Perry, 2002), and a greater enabled connection between home and school that can foster greater feelings of ownership over work (Passey, 1999). Additionally, Anderson has noted that some types of mobile learning that increase engagement and participation have had an increase in "students' ability to retain material by establishing new neural connections" (Alexader, 2004, p. 7). Although the limitations still provide formidable challenges, they do not seem to be dampening the spirits of a growing number of those interested in mobile learning, where the opportunity for increased accessibility, applicability (through integrating more informal, "just-in-time" learning), adaptability, and scalability is great. This interest and promise shifts the focus not on rejecting these approaches because of their limitations, but rather attempting to overcome or mitigate their limitations through creativity, and often through blended learning environments. Many of these issues are being addressed in the case study presented here, the eCANDLE initiative.

BACKGROUND TO eCANDLE

In context of all the issues discussed, in this section we present an initiative that is seeking to assist with economic development through facilitating mobile learning in a particular way. The eCANDLE initiative (electronic Coalition for Aggregation of Net-based Digital Learning Environments) has the goal of utilizing the wireless ICT (Information and Communication Technology) access that people in even the most remote areas will soon have for educational purposes.

The eCANDLE Foundation is originally sponsored through the Kevin and Debra Rollins Center for eBusiness at Brigham Young University. What Curt Allen and Dr. Wayne Brickey first envisioned as the "mobile learning project" in early 2004 has now grown to a coalition of public and private institutions, including Tshinghua University, Franklin Covey, Agilix, MediaRain, and BYU-Hawaii, who recognize both the need to expand educational opportunities and the opportunity to partly assist in this through ubiquitous mobile technologies. Although all current operation costs are covered through donations, various subscription-based revenue models are being explored, keeping in mind the sensitive needs and limited resources of the targeted end-users.

The eCANDLE Foundation is intended to function as a vehicle for delivering education to the people of developing nations around the world. eCANDLE will accomplish this by working toward identifying, organizing, refining, improving and developing online instructional content in whatever format is most suitable for foundational courses in each of the target "Seven Es" of content: e-business,

entrepreneurship, ethics, English as a second language, electronic information technology, economic self-reliance, and environmental stewardship. Recognizing that there is already a lot of good educational information, and even an "information overload," eCANDLE's coalition will help identify and repurpose some of the best existing resources, in addition to creation of new resources when necessary, for utilization in m-learning. With the initial products currently in development, we utilized this opportunity to test some of our assumptions regarding the use of mobile technology for educational purposes in China. Our main research questions included: What are the most common uses for the Internet and current perceptions toward mobile learning? How accepted would non-linear and informal approaches to pedagogy be? What content would be most helpful? What are some potential target audiences?

METHOD

RESEARCH DESIGN

With the focus on user-centered design (Courage & Baxter, 2005), mainly qualitative data was collected in helping the product fit the user instead of making the user fit the product.

PARTICIPANTS

Most of the initial participants in this research were contacted through eCANDLE partners on the campus of BYU-Hawaii, Communication University of China, Tsinghua University; others were participants of the IAMOT and GCCCE Conferences, held in Beijing. Participants were a cross-section of male and female, professors and students.

PROCEDURES

Primary research data regarding the use of educational technology in contemporary Chinese society was collected through several methods: survey, focus group, user testing and tutorials. Researchers traveled on-site to meet with eCANDLE participants in Bejing during the summer of 2006.

Surveys. Depending on the survey audience, we adjusted the surveys to be applicable to participants. Questions included information regarding understanding of distance learning, applicability, ranking of content genres, internet connectivity, interest, and demographics. Answers have been compiled and analyzed, and some results are presented below.

Focus group. Our focus group was designed to be small and informative. The group consisted of six people from mainland China. In the focus group we explained the purpose of eCANDLE and provided a demonstration of what eCANDLE might look like in the future. After explaining and demonstrating some eCANDLE ideas, we followed standard protocol in asking our research questions recording the resulting discussion in both audio and video formats.

User testing. We asked volunteers to go through Dr. Stephen Liddle's E-business presentation from start to finish without explaining to them what we were looking for and without any explanation of eCANDLE. As part of the test, we asked participants to think out loud and share what they are thinking as they went through the lesson. We recorded volunteers' actions, body language, comments, and reactions. Some of the questions we asked in these interviews included, What did you understand from the presentation? Did you like the presentation—why or why not? Was the content engaging? Would you pay

for content in this format? What was your understanding of e-Business before watching the presentation and what is it now? and other demographic questions.

Tutorials. As a cosponsor to the Global Chinese Conference of Computer Education, we had a three hour tutorial with 30 male and female educators from all over China. We provided an introduction to eCANDLE, outlined our goals and motivations, and showed a brief interactive demo of e-Business content. We then asked questions and tallied responses regarding understanding, usage, connectivity, validity, and also demographics. Students comprised of 64% of all participants, with 27% educators, professors, and administrators, and 9% of industry professionals. Participants were 95% Chinese and 5% Mongolian. There are the normal limitations regarding generalizability with qualitative analysis; however, these methods are intended for collecting thick, rich data (Patton, 2002).

RESULTS

Each of the main research questions are addressed below. We begin by stating some of our original assumptions, followed with short discussions of initial research findings.

MOBILITY AND INTERNET USAGE

Perceived Benefit of Mobility: One perceived benefit is an increased accessibility to education, specifically for those who want to go to a university, but cannot for a variety of reasons. In addition to accessibility other student benefits in other research have included:

- Gains in understanding and analytical skills, including improvements in reading comprehension (Lewin *et al.*, 2000)
- Development of writing skills (including spelling, grammar, punctuation, editing and re-drafting), also fluency, originality and elaboration (Lewin *et al.*, 2000)
- Increased motivation, organisation skills and responsibility amongst pupils (Perry, 2003)
- Encouragement of independent and active learning, and self-responsibility for learning (Passey, 1999). (Becta report, 2004, p. 2)

Additional considerations about mobility have led Mclean (2003) to observe that because of the prevalence of certain mobile communication technologies “There are strong proponents of the notion that developing countries could find m-learning attractive...” (p. 11). In our research and testing stages we needed to discover what were the most widely used mobile technologies in contemporary Chinese society, and what were the barriers to their use. We were interested in questions of capability and cost. A summary of our findings with regard to these questions follows.

Initial Findings: In the universities of China with which we are familiar, very few teachers and students use PCs with wireless connections because there is no wireless campus network to support that kind of connection, and there is a very high cost for using public wireless telecommunication networks to access the Internet. We found that cell phones are very prolific; every attendee at the conference, and those that we interviewed without fail had a cell phone. Even though most have the technology, most users don’t normally use cell phone in the same way that people in the US do. It is important to note that payment structure and customer service agreements with the service provider is different. Most cell phone users purchase pre-paid phone cards instead of receiving a

monthly bill, they purchase time as needed. Additionally, cost issues prohibit accessing or downloading anything from the Internet onto mobile devices, other than an occasional ring tone. Although the capability of these devices to connect to the Internet existed, it was rarely used. The most common ways to connect to the Internet are still PCs, and very few of the PCs are wireless.

The people who use the Internet the most are scholars, university students, and high school students. Most scholars use the Internet for searching academic information and communicating using web-based tools, such as email, BBS and so on. Most students use the Internet for getting news, chatting, and playing web-based games. In Beijing, the cost is currently about six USD per month for 40-hour monthly home subscription to a broadband Internet connection. One hour of Internet access at a cyber café costs about five cents (USD). On a university campus there is free access to the national network, but there is a small charge for each megabyte of data sent to or from the network outside China. Thus, some of the concerns that were raised by Chinnery (2006) regarding current technical limitations were also evident in China.

Additionally, we knew that complexities emerged not only in using the new technology, but also in doing something cross-culturally. In order to understand the dynamics of the cross-cultural context and content issues first, we therefore also conducted some of the initial testing through e-learning on the PC (personal computer) with content and communications coming via the Internet (wireless or not). This has allowed us to test and refine certain critical aspects of the educational material (pedagogy, content, etc.) prior to combining all of the variables.

PEDAGOGY

The eCANDLE initiative is developing educational material in a different way than is typically expected. As opposed to the very linear (start and proceed through a fixed amount of content or time period) approach, eCANDLE is experimenting with a "just-in-time" approach. Essentially the material is chunked and presented in a way that allows for more flexibility and customization in both the timing (length and order) and the depth (being sensitive to the student's need and ability) of the material.

Perceived Benefit of this Pedagogical Approach: This method can be timely, applicable, and flexible, allowing more learner customization and choice. The "just-in-time" approach allows students to learn what they need to know right when and where they are going to use the knowledge. It was chosen to exploit the additional mobility of the technology in ways that engage, teach, assist in practice, and assess (Stead, 2005).

Related to pedagogy, "m-learning seems to have a place at all stages of the accepted learning process" (Stead, 2005, p. 5). Both the novelty of the approach and the increase in visual and auditory components help with engaging students (Colley & Tomlin, 2005 in Stead, 2005). As people are engaged and interested they are more likely to learn. The ability to practice can be enhanced because as students carry the devices with them, they can either use their spare time waiting for a bus, commuting to work, and so on (Stead, 2005). Certain activities can also be enabled in locations and situations that can not be reconstructed in a classroom. With regard to teaching and instruction, although not many expect m-learning to replace live teachers, mobile devices can help to connect learners to the teachers in both synchronous and asynchronous ways. There is also evidence that "being able to look at learning as many times as you like, in your own time and at your own pace, might be the ideal way for some learners to understand a concept" (Stead, 2005, p. 5). M-learning assessment capabilities allow for summative evaluation, but also are heavily utilized in formative evaluation. Various methods are being used both in and

out of classes to check the engagement and understanding of learners through mobile devices (Anderson, 2004; Stead, 2005).

Initial Findings: In initial testing, eCANDLE has asked questions regarding the appropriateness and effectiveness of this pedagogical approach in China, and most of our initial results were encouraging. We found that although m-learning can enhance the experience of all types of students (Stead, 2005), relying more heavily on mobile technology outside of the traditional classroom environment seems more attractive for part-time learners who have existing limitations due to mobility issues. Mobility issues are concerns for populations like those that are hard-to-reach as well as for those who are too mobile that they can not stay in the same place for long (like certain working professionals). These groups are not easily served well by the current institutional structures. These kinds of learning methods are also welcomed by learners who have time constraints, such as professionals who cannot block out time for a traditional class, but who still need to learn new knowledge that is required to develop their competence. Even with accommodation of these constraints, however, at least some live communications are very strongly desired by most online learners.

The general perception towards e-learning in China is similar to that in the US. Although not usually the prefered method of education, sometimes it is the best that is available, and therefore it is both increasingly used and legitimized. Certain circumstances in China intensify the need because of supply and demand issues with quality education. Although they recognize that perceptions are changing, some individuals are concerned that because the Internet is currently used primarily for entertainment that some may find it difficult to use for educational purposes. Some specific data in relation to this question was collected as a part of the tutorial session held in Beijing at the GCCCE. Of those in attendence, 80% had either taught or participated in a class that was at least partially conducted over the Internet. In their opinions, 43% felt like distance learning was “somewhat effective”, 43% felt like it was “effective” and 14% felt as if it was “very effective.” We received zero responses indicating that distance or e-learning was “not effective” in accomplishing learning objectives. The overall experience and perception we met towards e-learning in our interviews and focus group was both cautiously positive and optimistic. It seems that using technology in education is becoming more common and accepted.

As a result of this research, additional eCANDLE efforts have been put toward improving accompanying mentoring resources. Although m-learning obviously is not the best approach for certain needs, at the very least it might be the only one that some people have. Thankfully, however, there is also more. Certain researchers are even confident enough that they are willing to assert “The question is no longer whether m-learning works for hard-to-reach learners, but rather how best to fit it into your blend!” (Stead, 2005, p. 1)

CONTENT

The target “Seven Es” of content (e-business, entrepreneurship, ethics, English as a second language, electronic information technology, economic self-reliance, and environmental stewardship) will come from university and corporate experts in each field. Personal development and leadership skills will be included. And ideally, although each course will be available in local languages (e.g. Mandarin), one of the most valuable features of the eCANDLE course content is that ESL (English as a Second Language) can be included as a secondary objective throughout all of the courses.

Perceived Benefit of this Content: Content is derived from experts in each field, with contributions made by multiple coalition partners (but approved by central quality control

checkpoint) to increase validity. Personal and leadership development focus will be useful for improving employability, management skills, and entrepreneurship capability. ESL will assist in networking globally.

Initial Findings: Due to the cross-cultural nature of this endeavor, we needed to ask questions regarding the level of importance in a Chinese context of each of the proposed content areas. Although ESL is very important in China, face-to-face learning is the most popular method. E-business in China has essentially the same meaning as in the U.S., that is: IT-based business activities, including production, transportation, circulation, distribution, exchange, and consumption. Scholars and practitioners of e-business in China are learning from those in the U.S., so a course on e-business that is developed in the U.S. is valuable. There was also a strong desire for more classes that deal with law and also that address philosophy. Any course in Chinese will be more popular than if it were developed in English.

AUDIENCE

The goal of eCANDLE is to eventually increase educational access to very poor (perhaps even illiterate) populations. However, we are beginning by focusing on middle-class learners who are in their late teenage and adult years, and who are literate (at least in their native language of Mandarin).

Initial Findings: Questions also emerged concerning our assumptions about the most likely target audience in China. A series of surveys and focus groups conducted on the campuses of BYU Hawaii, Communication University of China, and Tsinghua University, and at the IAMOT and GCCCE Conferences held in Beijing provided most of our data. We found the most likely learners are those who have a profession and can only invest part-time to learn new knowledge needed for developing their competency. They are willing to participate in online learning if (1) they can afford the expense of taking the time for learning, and (2) the contents and learning methods fit their wants. There are two kinds of motivation: one is to get a degree or certificate and the other is to develop their professional competency.

Educational fees are very different among Chinese cities. In Beijing, fees are about 80 USD/month for a computer programmer whose salary is about 600 USD per month. These expenses include school fees (80%), travel costs, and books (20%). That computer programmer is probably willing to pay about 25 USD on average for a high quality online course that meets a direct need. There is some access to credit cards which have been used mainly in China's larger cities. The degree granted by a college or university, especially a famous university is highly valued as important for learners to get a good job (certain participants could not overstate its importance to them). In order to increase the eCANDLE reputation, research participants encouraged experiments to be done in conjunction with a few Chinese universities to demonstrate the expected learning outcomes. Participants felt that the Chinese government is likely to support these kinds of efforts because the fourth session of the National People's Congress put forward the eleventh five-year plan of national economic and social development in which promoting professional education is one of the most important activities of the government. This plan approved an increase in spending over the next five years for compulsory education from 2.79 percent to 4 percent of GDP (Huanxi, 2006). In China, there are currently 68 universities that have set up online courses for learners to get their bachelor degrees or other more limited certificates. They have websites and learning management systems to support this kind of online learning. And they have also have set up many learning sites in some important cities by which they also conduct face-to-face tutorials. They might be

seen as competitors in China, but instead those at eCANDLE rather view them as potential partners.

CONCLUSIONS

Mudhai (2004) writes: "As the UNDP indicates in its *Human Development Report 2001: Making New Technologies Work for Human Development*, technology is not inherently good or bad; the outcome depends on how it is used (Boer, 2001)." Both education and technology do not automatically lead to economic growth. A base of opportunity for basic and advanced education and technology, however, are two key building blocks to socio-economic development.

Nations like China are having difficulty providing enough educational resources at the pace needed to meet the escalating demands for higher learning. "The Ministry of Education estimates that in 2008, the pool of college-age students will be 124 million." (Messelaar, 2006, p. 67). The number of potential students, a saturated job market, and unsubsidized education costs prevent the building, staffing, and maintaining of traditional universities, especially in remote areas.

The eCANDLE coalition is offering one approach to help meet those needs through a suitable match of delivery method (seeking to utilize easily accessible and affordable technologies), pedagogy (appropriate both to the Chinese context and to the new teaching capabilities), and content (that is both desired and useful) in order to meet the needs of the most likely beneficiaries of such efforts. The combination of elements taken into consideration in eCANDLE's approach are intended to help make at least two of the ingredients of economic development (technology and education) more of a reality for under-served learners. Although all the details are not yet worked out, eCANDLE is following the admonition of Stead (2005) to just start. He said:

> The first step into m-learning seems to be the most important. In a majority of our trials, the organisations have continued to do their own m-learning long after the trials have finished. The key starting point for them on their m-journeys was taking that first step, and trying it out. Now, many are creating their own learning. (p. 8)

As illustrated in the eCANDLE initiative, the future impact of mobile technologies and mobile learning on socio-economic growth and development is promising and will become more so as we mitigate the challenges and capitalize on the opportunities ahead of us.

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