J Comput High Educ (2008) 20:81–91
DOI 10.1007/s12528-008-9009-9

Ubiquitous technology for language learning: the U-Japan movement in higher education

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Published online: 23 October 2008

Abstract This paper reviews the u-Japan movement and recent reforms in the higher educational system in Japan, examines the needs as well as readiness for ubiquitous learning in Japanese universities, and reports on a selection of mobile-assisted language learning projects (MALL). It analyzes the current status of ubiquitous technology applications in language learning for millennial or neomillennial learners in Japan and overseas, and discusses the issues and challenges for ubiquitous technology integration in higher education.

Keywords MALL · Ubiquitous technology · Mobile learning · Language learning · Mobile technology · Japan's higher education

Introduction

The Japanese Ministry of Internal Affairs and Communications (MIC) aggressively initiated a new, comprehensive u-Japan Policy in December 2004 with the goal of creating a ubiquitous network society by 2010 (MIC, n.d.). Education and lifelong learning, in particular, were specifically identified as among the key social systems that the u-Japan Policy would address through the integration of ubiquitous technologies in Japan. Colleges and universities were recognized as major players in the partnership with government, corporations, consumers, and academia (MIC) for the advancement of technology in solving social problems. As the target year approaches, it is useful to examine the status of ubiquitous technologies in Japan's higher education through a critical lens to understand the current status quo and the

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emerging challenges. Thus, this paper reviews the u-Japan initiatives concerning how it impacts ubiquitous learning in Japan's higher education, examines the major mobile-assisted language learning (MALL) projects in Japan, and analyzes the critical issues and challenges associated with mobile learning.

u-Japan policy and university reforms in Japan

The u-Japan policy is a core part and a further extension of the "e-Japan Strategy," which was lunched earlier in 2001 by the Japanese Cabinet (Cabinet Office, n.d.; MIC, n.d.). With the ambitious goal of becoming the world's most advanced information technology nation, the e-Japan Strategy was headed by the Prime Minister and the Cabinet. In the u-Japan Policy timeline (MIC 2008, n.d.), the government envisioned that by 2005 there would be 40 million households with high-speed or ultra-high-speed Internet access, and by 2010 the number would reach 100% of the population. It also recommended tripling the number of Japanese universities that use advanced e-learning technologies by 2005. As a result of consistent government initiatives and continuous national efforts, Japan has successfully established a solid information and communication technology (ICT) infrastructure nationwide (MIC, n.d.) and achieved steady increases of broadband availability as well as noticeable decrease in its cost to consumers (Telecommunication Carriers Association 2008).

With the mission clearly established, the u-Japan Policy sketches the details for a society where people have anytime, anywhere access to the ubiquitous network in all aspects of their social, professional, and personal lives from any ubiquitous device (MIC, n.d.). The "u" here indicates not only the "ubiquitous" network it envisions but also the characteristics of the network—universal, user-oriented, and unique (MIC). More specifically, the policy describes three major stages required to achieve the u-Japan in 5 years. Stage One aims at building a seamless ubiquitous network, with easy access to and full deployment of both wired and wireless infrastructures. Stage Two advances utilizations of various ICT technologies to solve social problems, including ubiquitous, lifelong learning. Stage Three further strengthens the u-society through constant upgrading of the network's environment, as well as addresses problems and concerns that emerge from the cyber society. The u-Japan Policy ultimately creates a seamless society, utilizing ubiquitous technologies in all social systems. And, unlike its previous e-Japan Strategy, it moves far beyond the research and development of hard technologies and focuses on addressing social problems through ubiquitous technologies.

In the ambitious and aggressive governmental initiatives, higher education is expected to play a critical role in the creation of a seamless ubiquitous society through research, development, implementation, and dissemination of mobile technologies in teaching and learning. The national efforts in developing and utilizing the ICT infrastructure have made technologies widely available to the Japanese people. In addition to supporting the development of ICT network infrastructure, the Japanese government has also lifted its strict regulations in higher education, making online and mobile learning more socially acceptable and educationally accreditable (Aoki 2006; Arima 2003; MEXT, n.d.).

The revised University Establishment Standards now allow regular on-campus students to obtain up to 60 out of the 124 required credits for a bachelor's degree through e-learning. For nontraditional, distance educational institutions, all required 124 credits may be obtained through e-learning. More specifically, as in Article 25 Sect. 2 of the University Establishment Standards, universities may employ a variety of communication media (e.g., satellites, optical fiber, Internet, etc.) and learning technologies (video, audio, etc.) for courses or learning experiences that are educationally equivalent to the traditional face-to-face learning. Synchronous and asynchronous, interactive or single-directional instructions may also be counted towards the e-learning hours. Similar reforms were conducted by Japan's neighbors, mainland China (Zhang 2005) and Taiwan (Zhang and Hung 2006). These significantly revised policies were in response to the increasing demand for access to higher education and, at the same time, the emerging technologies that make it possible.

As a result, many universities now offer e-learning or blended courses and programs, and newly established e-campuses or fully online cyber universities are also attracting nontraditional learners in higher education. Also, with the recent privatization of universities, more and stronger partnerships are being established between universities and corporations, especially in areas of technology or related research and development (Arima 2003; DCC, n.d.; Kato and Ricci 2006; MEXT 2006; MIC, n.d. 2008). Japan Cyber University (JCU), for example, made its first cellphone-based course free of charge for learners, immediately after its establishment in 2007, through a partnership with an Intenet guru company, SoftBank Corp. Cyber universities—known as e-universities—like JCU, typically are backed with strong partnerships with ICT industry giants. They symbolize the new wave of privatized higher education with a customized focus on nontraditional learners. These institutions are among the most active and aggressive pioneers, creating learning opportunities via a plethora of technologies—wired, ubiquitous, commercial, or free—for those who demand mobility, flexibility, and immediacy.

Ubiquitous technology and Japanese millennials

A plethora of ubiquitous technologies are widely available in Japan. Most cell phones in Japan use 3G or higher telecommunication technology with multiple functions including Internet services, GPS navigation, digital camera, video recording, etc. (Telecommunication Carriers Association 2008; MIC, n.d.; MEXT 2006; n.d.). Most young Japanese millennials own at least one cell phone with multiple functions. According to the Telecommunication Carriers Association's latest statistics (2008), as of May 31 2008, about 86.26% out of the total of 103.35 million cell phone service subscriptions were with browser phones with IP services, and 75% of the subscribers, about 73.15 million people, use a 3G phone. The wide availability of cell phones in Japan has led to active research and practice examining their educational power and potential (e.g., Kato and Ricci 2006; Houser and Thornton 2004; Thornton and Houser 2003, 2005; Qiu and Thompson 2007).

Researching some characteristics of Japanese millennial, Goda and colleagues (2008) found that college students had varying degrees of familiarity with an iPod or podcasting in general. Surveying 185 undergraduate students in three universities in Tokyo, Anzai (2007b) found similar results. Forty-eight percent responded that they had not heard of the term podcasting; 24% had actually listened to a podcast, and even fewer had any experience in creating or publishing one. She further pointed out that Japanese millennial's blogs tended to have fewer media objects, which was, at least, partially due to their culture: Japanese typically would be hesitant to disclose themselves in public. Likewise, Brown (2004) pointed out that Japanese students tended to be quiet and less talkative in front of strangers or in a group; such social anxiety presents a challenge in language learning.

Mobile language learning in Japan

With the fast-pacing life style, decreased birth rate, and highly populated metropolitan areas, higher education institutions have to proactively implement ubiquitous technology for mobile learning, reaching out to nontraditional learners at home and attracting overseas students as a means of increasing enrollments (Aoki 2006; Kato and Ricci 2006). Many traditional mortar and brick universities have highly active e-learning programs and have formed international consortiums to co-develop and share courses, materials, and programs, some of which are accessible from mobile devices. For example, the multi-university iCampus project specifically aims at "using advanced multimedia processes in a ubiquitous society" (Miwa, n.d.). This integrated e-learning project provides free access to a variety of Web-based learning materials, tools, resources, and lecture videos for overseas language students, and those taking the Web-based Japanese language exams for college Admissions (Miwa). Furthermore, 17 universities have joined the Japan Open Courseware Consortium (JOCC), including some of the oldest and most prestigious universities—Keio, Kyushu, Tokyo, Osaka, and Waseda to name a few. Most of the JOCC content is available in multiple languages—Chinese, English, Japanese, and Korean—that clearly indicates an international focus.

Foreign language learning has long been highly valued in Japan. However, Japanese face additional challenges in language learning, as they tend to be self-critical and anxious about making mistakes in front of others (e.g., Brown 2004; Kurman et al. 2003). Ubiquitous technologies—iPod and other handheld devices—enable instructors to customize the learning experiences for smaller groups in language practices, conversations, and exams. It also allows tactical selection among different communication modes (e.g., one-to-all, one-to-one, or one-to-more, etc.) for oral or written communications among learners and between the learner and the instructor or tutor. Furthermore, it facilitates the creation and delivery of portable, flexible, reusable, and smaller modules of instructions, drills and practices, or exams (e.g., Motlik 2008; Qiu and Thompson 2007).

With wide availability and educational benefits, ubiquitous technology has been implemented in language learning in many different ways in Japan's higher

education (e.g., Chinnery 2006, Goda et al. 2008; Kato and Ricci 2006; Kukulska-Hulme and Shield 2007; Motlik 2008; Qiu and Thompson 2007). Many language educators in Japan have been experimenting with mobile learning using iPods and social networking technologies (e.g., Anzai 2007a, b; Goda et al. 2008), since Osaka Jogakuin College first introduced iPods in English education in April 2004 (Kato and Ricci 2006). Results showed that ubiquitous technology enables contextualized, dynamic, interactive, problem-base learning (e.g., Kato and Ricci 2006; Houser and Thornton 2005; Motlik 2008; Thornton and Houser 2003, 2005; Ogata et al. 2005; Ogata and Yano 2004).

The following sections review a few of the most influential MALL projects in Japan's higher education. The selection criteria focus on the scope of the project, the impacts, and its future potential to scale up.

Mobile Phones in MALL

Houser and Thornton (Houser and Thornton 2004, 2005; Thornton and Houser 2003, 2005) are among the many proactive educators engaged in MALL in Japan's higher education. In a series of studies, they have implemented various MALL projects for learning English as a foreign language (EFL). For example, the Learning on the Move (LOTM) project uses mobile phones to send English vocabulary to students at timed intervals via SMS or mobile e-mails. The Vidioms project delivers short, Web-based videos and 3D animations via mobile phones and PDAs, to provide visual explanations of English idioms. More recently, they have worked on Poodle, a cell phone-based Moodle—one of the most popular open-source course management systems—for mobile learners. Consistently, they have received positive feedback from learners on the varied benefits of mobile technologies in EFL (Houser and Thornton 2005; Thornton and Houser). Some complaints, however, were often voiced about the quality of videos on the mobile devices and the small screen displays (Thorton and Houser).

The University of Tokyo has developed the iTree, a dynamic system that generates visual representations of learners' participations on the discussion boards, using growing branches to illustrate increased participations and interactions. The system displays the "tree" image as wallpaper on students' mobile phones with real-time updates whenever the phone is on. It received favorable reviews from students and was found effective to promote collaborations and participations (Nakahara et al. 2005). These different projects showcase some of the various ways of integrating ubiquitous technology to facilitate and support learning. With continuous technological improvements, ubiquitous technology, especially advanced mobile phones, will play a more active role in MALL projects and include other subject areas.

The CLUE and the PERKAM

The CLUE (Collaborative Learning Support System with a Ubiquitous Environment) is a highly integrated, personalized, and contextualized learning support system for international students learning Japanese in real-world situations (e.g., Ogata et al. 2005; Ogata and Yano 2004). The CLUE system integrates a variety of

technologies, such as PDAs, GPS, and RFID tags, with programs specifically designed to support right-in-time, problem-based, situated learning. The learning environment involves those learning Japanese as a foreign language and native Japanese student helpers. The system's database stores user information, activity paths and logs, and dynamically provides suggestions and peer support.

Focusing on polite expressions, a most difficult feature for foreigners to master in Japanese, the CLUE system provides language and conversation suggestions, based on a variety of factors—social, physical contexts, and users information (e.g., location, gender, age, social distance, etc.). In addition, a TANGO system (Tag Added Learning Objects) detects the objects around the learner using RFID tags and provides appropriate learning materials accordingly. Users can also use the system to label and annotate the objects in scenarios for vocabulary learning, store useful expressions in CLUE's database, or ask questions in their everyday communications. Japanese student helpers can refine the expressions and help with any questions. When a learner walks around, CLUE provides adequate expressions or suggestions instantly, realizing just-in-time, contextualized learning. Participants are empowered to share their individual knowledge and experiences and receive help from their best matching helper, who is identified by the system automatically based on user information analysis. The CLUE also generates a knowledge awareness map for self-reflection and peer collaborations, based on data dynamically collected in the system.

A more integrated system, the PERKAM (PERsonalized Knowledge Awareness Map) was developed and utilized in computer supported ubiquitous learning (El-Bishouty et al. 2007). This system supports performance and decision making in computer courses through personalized, contextualized peer support (El-Bishouty et al.). The knowledge map available on ubiquitous devices can increase learners' self-awareness and reflection in the learning process and also facilitate personalized learning and customized support.

Researchers have utilized ubiquitous learning systems like CLUE and PERKAM with students in language learning and computer science programs in Japanese universities and received favorable feedback in surveys, interviews, and performance assessments (Ogata et al. 2005; Ogata and Yano 2004; El-Bishouty et al. 2007). Similar ubiquitous learning systems, with advanced developments, would likely be appreciated for content learning, decision making, community building, cultural sharing, and ubiquitous performance support in various subject areas. Given the complexity and demanding nature in the design and development of such ubiquitous systems, however, scalability is probably a challenge for wider adoptions. In addition, more rigorous research studies are needed to empirically investigate the effectiveness and efficiency of such systems to support and direct future development, practice, and research.

The Digital Campus Consortium

The Digital Campus Consortium (DCC), founded by Waseda University is an industrial-academic consortium that represents a new model of education for the 21st century through widespread collaborations (DCC, n.d.; Nakano 2008). The ultimate mission is to educate global citizens while promoting international

Table 1 Summary of DCC phases and tasks (DCC 2007, n.d.)

Phase	Time duration	Major tasks
1	1999–2001	• Cross-Cultural Distance Learning (CCDL) • On-demand lectures • Tutorial-based foreign language learning program
2	2002–2004	• Groundwork for the Cyber University Consortium (CUC) • Establishment of the Forum for On-Demand Lecture Circulation (FOLC) • Establishment of the Accreditation Council for Practical Abilities (ACPA) • Establishment of the Open Source Software (OSS) Research Institute
3	2005–2007	• Creation of Asia Cyber College • Supporting the establishment of the CUC • Supporting the activity FOLC • Promoting and facilitating more on-demand lectures • 43 academic members and 22 corporation members (as of March 3, 2005) • Supporting the activity of ACPA • Evaluate and recognize the skills of individuals through cooperation with academia and industry • Supporting the activity of the Open Source Software (OSS) Research Institute • Educational research and human resources development into OSS centered mainly in Japan, China and Korea • Spread of the transition to OSS for on-demand lectures/university standard business systems • Establishment of the Project Research Institute

intellectuals (Nakano). The DCC progressed in three phases with the major tasks summarized in Table 1.

Among DCC projects, the cross-culture distance learning (CCDL) system was one of the most influential distance learning programs in Japan involving six languages (Nakano 2008; Nakano and Bonham 2005). It has established collaborations with Japanese universities and 56 non-Japanese universities in 19 countries in Asia, Europe, Australia, and North America. The CCDL integrates a wide range of technologies, such as teleconferences, Web-based text and video chat, e-mail, BBS, Web-based notetaking, real-time tutoring with native speakers, cultural exchange field visits, and streamed lectures, a recent addition. However, CCDL is not a single MALL project in terms of content area or major delivery technology. Still, given its broad influence and its recent pilots with mobile technologies, it is an appropriate and important part of this review.

The Cyber University Consortium, which was initiated during the second phase of DCC, was charged with the mission of promoting globalization in education and research through collaborative efforts. Responding to the needs and readiness for international, industrial-academic collaborations, one of DCC's most recent tasks was to support the establishment of Asia Cyber College (ACU). The ACU currently functions through partnerships with universities and corporations in five Asian countries—China, Japan, Korea, Thailand, and Vietnam. Consistent with the u-Japan mission, the ACU focuses particularly on lifelong learning and the development of competitive workforces with practical skills and global perspectives (DCC, n.d.; MIC, n.d., MEXT, n.d.).

Mobile devices and the Web2.0 technologies bring new opportunities to busy, fast-pacing, multitasking neomillennial (Dieterle et al. 2007) in Japan and overseas to learn in highly collaborative, culturally diverse environments (Anzai 2007a, b; Goda et al. 2008; Nakano 2008). Further extending the well-established CCDL system, researchers at Waseda and other DCC institutions have also conducted research on mobile devices whereby Japanese students learning Chinese use cell phone- or PDA- based drill and testing systems (e.g., Liu, et al. 2005a, b). As researchers (Liu, et al.) continue their innovative applications of mobile devices for language learning, the CCDL system may soon integrate more MALL innovations and further empower learners with mobile, personalized learning experiences.

Implementation of similar ubiquitous learning tools (e.g., CLUE, PERKAM, TANGO, iTree, LOTM, Vidiom, etc.) on a larger scale within and beyond the CCDL system may well enrich the learning experiences with more mobility (e.g., Brown 2004; Nakahara, et al. 2005), immediacy and personalization (e.g., El-Bishouty et al. 2007; Ogata et al. 2005; Ogata and Yano 2004). Even though DCC has not promoted ubiquitous learning, with the powerful governmental initiatives, it is most likely that DCC institutions will catch up with the u-Japan movement by (a) engaging in research and development of ubiquitous learning tools or systems; (b) preparing instructors with the required pedagogical, technical knowledge, and skills for learning; and (c) supporting the standardization, evaluation, and accreditation in ubiquitous learning design and implementation, nationwide and internationally. With the well-established technology infrastructure paired with productive partnerships, DCC and similar consortiums should play a more important role in the u-Japan movement in higher education.

MALL challenges in u-Japan

As the proactive educators develop and implement innovative learning systems with ubiquitous devices, they are also critically aware of the problems and challenges, both technically and culturally in MALL. Technically, the display of some languages such as Chinese—one of the most in-demand foreign languages in Japan—was reportedly quite challenging in the development of MALL systems (Liu, et al. 2005a, b). The unsatisfactory quality of videos and the small display screens on mobile devices prevented some learners from taking full advantage of MALL (Brown 2004). Japanese millennials and neomillennials are well equipped with advanced cell phones (Telecommunication Carriers Association 2008) and are comfortable typing on their mobile devices (Houser and Thornton 2004). Still, many college learners reported the need for appropriate training with iPods and associated software to fully benefit from podcastings in their language learning experiences (Anzai 2007a, b). Even though most MALL projects were designed for anytime, anywhere learning, the busy millennial or neomillennials learners reported that they did not attend to the carefully-timed MALL materials immediately; rather they typically chunked the time when they could focus on learning (Brown). Some MALL projects (e.g., CLUE, PERKAM) have enabled dynamic, just-in-time, informal learning, together with contextual peer support for performance and

decision making. The scalability of such systems, however, poses serious challenges to developers and requires major shifts in pedagogical beliefs of both instructors and students.

Besides the MALL developers and researchers, however, it is unclear if educators are ready to integrate existing technologies into their curriculum to create dynamic mobile learning. Online instruction models, such as the R2D2 (read, reflect, display, and do) Model (Bonk and Zhang 2008), provide over 100 learning activities for diverse learners with a plethora of free Web-based resources and technologies. To fully realize u-Japan in education, faculty development is critical, and it should address not only technical skills but also pedagogical foundations that are required for creating and implementing mobile learning (Zhang and Hung 2006). Likewise, similar training should be available for learners who are experiencing technical difficulties and pedagogical shifts.

As the country moves to the third stage in the u-Japan movement, the key missions in higher education would require systemic approaches to advance the integration of ubiquitous technology, address technical, pedagogical, psychologic, and social problems emerged in the ubiquitous network society (MIC, n.d.; MEXT 2006, n.d.). At the national level, standardization and evaluation in the design and development efforts are needed to facilitate more rigorous collaborations across institutions and disciplines. Consistent to the u-Japan movement nationwide, academic-industrial collaborations need to be further strengthened. In addition, rigorous empirical research is required to guide and support future research, development, and implementation of ubiquitous learning.

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