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Practical Applications of Technology for Learning e-Magazine

THIS WEEK: Development Strategies

Mobile Learning in Japan: Why the Future has Already Arrived in Asia

By Michael K. Kato and Vincent C. Ricci

Although many people around the world think of m-Learning as a program with a “promising future,” we have found that in Japan, m-Learning already has a rich and vibrant history. Many companies, schools, organizations, and individuals are successfully implementing mobile learning solutions now. In this article, we present ten real-world cases that show how m-Learning is progressing there.

To many people around the world, it won't be a surprise to learn that Japan is a global leader in m-Learning. A plethora of electronic gadgets populates the Japanese landscape. Most Japanese phones are already extremely advanced and run many different kinds of applications and services, including music, games, television, email, Web page viewing, GPS/navigation, megapixel photography, and learning. Mobile phone wallets are now common, and with them, the Japanese purchase drinks from vending machines and pay train fares. (See Figure 1 on page 2.) Already, we see that over 60% of Japan's mobile phones are using 3G (third generation) or higher telecommunications technology.

Practically 100% of college students and working adults in Japan own a mobile phone, while only about 50% of all households have Internet-capable PCs according to the Japan Ministry of Internal Affairs and Communications,

In the West, for the past decade, we have been thinking about mobile learning and about using games to teach. In Asia, and especially in Japan, practitioners have gone far beyond merely speculating about these channels for learning, to developing a broad range of innovative applications. This week's article provides readers in other parts of the world with insights into the possibilities, and it may even inspire some similar attempts.

A publication of



Statistics Bureau, *Survey of Household Economy*, conducted in 2006. Mobile phone-based m-Learning is a compelling platform for targeting young adults in Japan, a fact that many Japanese universities and companies realize and respond to in their recruitment and training.

This is already a boon to many application developers and content providers. But the availability of high tech handhelds does not mean that the Japanese use all or even most of the technology. In fact, nearly all surveys in Japan show that, of the many advanced capabilities available in Japanese mobile phones, the most commonly used are email, photography, Web page viewing, games, and, increasingly, music.

Why, then, are both the supply and the demand for m-Learning in Japan increasing?

The dominant forces driving m-Learning adoption in Japan are not technology-related, but social and historical factors. More importantly, these factors are also likely to influence adoption and use in the West.

Among these key drivers, the most significant is the declining birthrate and the resultant aging population. Schools and companies compete vigorously for the declining number of young candidates. Pressures and incentives to build flexible learning organizations will



← **Figure 1**
Paying a train fare with
a mobile phone

continue to drive learning to technology that captures the attention, imagination, and interest of target audiences. The need to motivate the children and young adults of the twenty-first century will be the greatest driver of m-Learning.

In addition, a combination of forces continues to drive people to higher density metropolitan areas. This uneven distribution increases pressures to build non-traditional school and workplace systems. Finally, increasing energy prices and greater reliance on public

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transit and telecommuting will advance ubiquitous training, learning, and productivity enhancing systems.

Many m-Learning projects, programs, and products point to the potential profits and pitfalls of this challenging future. These ten case studies of m-Learning in Japan are only a handful of those we have examined the past few years, and especially during the past six months. Due to time and space constraints, we were unable to include case studies from Korea, Taiwan, and China, where many similar and original m-Learning programs are appearing.

Brain Training and Adult Learning Toys

Nintendo's highly successful "Nō wo Kitaeru Otona no DS Torōningu" ("DS Brain Training for Adults" [DSBTA]), has led a giant wave of m-Learning games in Japan. These games may be the biggest evidence that m-Learning has advanced from extrinsic to mainstream.

(Editor's Note: For readers who aren't up on handheld game technology, "DS" refers to the Nintendo DS, a handheld game console released in 2004. "DS" stands for both "Dual Screen" and "Developers' System." In June 2006, Nintendo released the DS Lite, a redesigned model.)


Of course, puzzles and mind games have existed for thousands of years. Not surprisingly, they have been popular with PC, television, and mobile game developers. Electronic versions of crossword puzzles have also been around for many years; Sudoku has rapidly become popular on game handsets and mobile phones, and the Japanese toy conglomerate Takara Tomy produces a dedicated portable Sudoku device.

Other brain-training games feature quizzes, brain-teasers, and other activities. DSBTA challenges the player's speed and accuracy in a variety of activities, including memorization, arithmetic, logic puzzles, and reading. The developers believe that these games stimulate the brain and maintain its health and "youth," delaying or even preventing dementia and senility.

At the Tokyo International Toy Show 2006 in July, Japan's biggest trade show for toys and games, the hottest products were those that claimed to have brain training and "healing" functions. Both categories of toy products target Japanese adults, particularly the Baby Boomer generation who start to retire en masse in 2007.

This phenomenon is revolutionary in that these applications and software are driving former technology agnostics to purchase hardware that would otherwise be unfamiliar and undesirable. In a classic case of the tail wagging the dog, brain-training games may well force the dog to grow many new tails. Since these new users are unlikely to turn into hardcore

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gamers, it is likely that hardware vendors will need to forge partnerships with application developers to create more games featuring puzzles and brain stimulating activities, as well as games that offer the chance for relaxation and peace of mind.

Bizcom-Japan: TOEIC® Test Ketai Master

Bizcom has been an m-Learning trailblazer in Japan since its founding in 1998, offering solutions for a broad range of corporate and educational clients.

One of Bizcom's most successful implementations of m-Learning and its showcase application is the TOEIC® Test Keitai Master (TTKM). TOEIC is the Test of English for International Communication, taken by 4.5 million people a year, with a large percentage of that number in East Asia. The service provides users with a full range of study services, including drills, assessments, communication features, multimedia elements, games, and downloadable applications. Since its first release in 2000, TTKM has not only been Bizcom's core offering, but by implementing the most innovative features, TTKM has become Bizcom's primary marketing tool.

Four features of the system are significant for the way in which they enhance m-Learning and business acceptance of this new channel for learning.

First, there is perhaps no other deployment of mobile phone-based m-Learning worldwide that employs video technology as extensively as TTKM. Although in TTKM "video" uses just a still image and audio to test listening comprehension, the technology itself is capable of full audio and video. (See Figure 2, right.) Using iMotion since 2005, Bizcom has implemented 40-second video simulations for a Japanese mobile carrier's business-manners training for new employees.

Second, Bizcom not only uses the spiral approach in TTKM to master grammar and word comprehension, but also employs this same regimen of drills and assessments in a broad range of compliance training. It provides clients with analysis not only of each student's demonstrated knowledge, but also the organization's overall compliance aptitude. By showing a statistical performance report for its entire workforce, Bizcom provides the client with insight to the training program's ROI. (See Figure 3, right.)

Third, Bizcom's use of community features is particularly prominent. Bizcom nearly always provides clients with a program discussion board, encouraging them to share information and study tips as they would in real-world classes. In corporate projects, communications services have included mentored forums, allowing the companies to offer m-Learning that more closely parallels offline training programs.

Fourth, TTKM uniquely deploys user-scheduled

messages to serve both as a lesson reminder and as a motivational tool. The system sends messages to the user's mobile phone with a link to the study site. Even though there is no pressure on the user to attend a scheduled class as in the real world, this arrangement psychologically reinforces the user, much as when she sets her own alarm clock.

Link and Motivation

Link and Motivation (LMI) is a Japanese consulting company that focuses on the boosting of employee motivation. Among its core services is assisting clients to recruit employees who already exhibit higher motivation and better work disposition, and who demonstrate a higher potential for success.

One of LMI's new-employee training programs is a two- or three-day program called Darwin. Darwin does

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Figure 2
Video in TTKM

Figure 3
Corporate Compliance Assessment Chart



not attempt to fill the heads of new recruits with loads of information about company products and rules, but instead encourages them to START: Say, Think, Action, Role-play, and Target, i.e., to provide them with some general rules they can use to guide themselves in work situations.

This April, LMI tested an m-Learning program with their own recruits, designed to extend retention of the core Darwin concepts beyond the initial face-to-face study. Their assumption was that if employees used mobile phones to access a knowledge base and contribute work experiences that showcased core concepts of the training program, then the recruits could meaningfully extend their on-the-job training.

The program has been largely successful, using a unique blend of daily business insights, a two-quiz-per-day ritual, and a forum for the recruits to post their own stories about how they were able to apply Darwin concepts on the job. In addition, this year LMI deployed the same pilot program for one of its clients, a Tokyo travel agency called ST World, and is planning expansion of the program.

One of the program's key components was a point system rewarding employees who log in each day, correctly answer the quiz questions, and post stories deemed beneficial by the HRD implementation team. The recruits who accumulated the highest points through the program received prizes, worth approximately \$1000 for first place, \$500 for second, and \$300 for third.

The program lead, Yosuke Kano, indicated in an interview that incentives were invaluable for getting the recruits to buy into the program. He said, "Although it is easy to get people to participate actively in training when they are in the same room, it is more difficult otherwise. Getting them to start is the key. Once they start to use it regularly, they tend to find their own motivation for study, that is, they see real benefits without incentives. But the prizes really help to push people over the edge at the beginning."

CanGo

CanGo is a catchy name for an e-Learning project developed at Osaka Prefecture University's School of Nursing. In Japanese, the sound of "cango" can mean nursing; thus, the acronym (**C**ommunication, **A**rt, **N**ursing, **G**ood practice, **O**saka Prefecture University) implies that nursing students can make effective progress by using the system.

The most distinguishing feature of the system is effective utilization of Sony's PlayStation Portable (PSP). (See Figure 4, right.) The project also uses mobile phones and PCs, but PSP is the program's core delivery method. While many universities, research institutes, and other instructional design spe-

cialists around the world have pointed to the many advantages of PSP in developing programs, we have found very few other significant learning/training deployments using mobile game consoles.

CanGo's design intended to provide practical training support and to enhance problem solving in real-life nursing situations. The university's School of Nursing decided from the outset that ubiquitous study was essential, as it is practically impossible to force interning nurses to study continuously in groups in a classroom or even in front of a PC.

In 2005, CanGo was started by first creating a database of 57 situations and 641 units of case study learning materials. These include both still images and video materials. Case studies include topics ranging from treating stomach ailments of working mothers, to bathing infants, to feeding a paraplegic.

Students download case studies that directly relate to situations that they encounter in their hospital internships, as well as other materials they study during downtimes both inside and outside of the hospital. In addition, the students can create and maintain a personal nursing dictionary, which allows them to organize the teaching materials in their own individual style, enhancing the integration of knowledge and practical problem-solving ability. Currently, 273 students participate in the CanGo program. By next year, the university will offer the program to all 400 students.

Another feature of the CanGo system is that the university and the Corporate Research Laboratory of Kobe Steel, Ltd (KS) developed it from scratch entirely through collaboration with each other. Thanks to a ten-year friendship between Associate Professor Yukie Majima, PhD, and Yoichiro Sou, a senior KS researcher, their combined team developed the CanGo system to match the nursing program's needs. The system has proven to be a robust and flexible one, and KS is currently planning implementation of the same system in one of their factories. According to Mr. Sou, the system offers a unique combination of high quality



This phenomenon is revolutionary in that these applications and software are driving former technology agnostics to purchase hardware that would otherwise be unfamiliar and undesirable. In a classic case of the tail wagging the dog, brain-training games may well force the dog to grow many new tails. Since these new users are unlikely to turn into hardcore gamers, it is likely that hardware vendors will need to forge partnerships with application developers to create more games featuring puzzles and brain stimulating activities.

 **Figure 4**
CanGo in action

multimedia content, user friendliness, portability, networkability, high interactivity, great reliability, and performance.

In fact, participating users do use their time efficiently to study using their PSPs, and are far more inclined to do so very near their actual encounter of similar situations. Participants express positive feedback about the usability of the system. Familiarity with portable game devices among younger generations of students and the accessibility of video, audio, and multimedia make the system intuitive and fun.

CanGo attests that just-in-time learning is quite possible in a mobile environment. Furthermore, because the PSPs themselves are game consoles of reasonably high economic value and intrinsic value as entertainment devices, the motivational value of providing them for training is another important feature.

Anki-kun

Anki-kun (literally translated as “memorization boy”) is an original handheld learning device developed by Makitech (MT) to assist users in learning material that is best learned through repetition. (See Figure 5 at right.) Using what they call “multi-spiral learning method,” Anki-kun uses AI programming to increase the frequency of content not yet mastered by the user, and scores as incorrect any question not answered in a preset amount of time. Multiple scores are stored along with the total duration of the problem set. As in a standard role-playing game, players compete to earn more points, and compete against the clock to complete each level. MT has sold Anki-kun and a variety of contents since 2005. Most contents are for English study, Japanese study, or for students cramming for college entrance examinations.

Most important to our analysis, MT also provides a simple content converter application, which allows the user to create his own drills and quizzes via an Excel spreadsheet. Thus far, this approach has proven to be a very significant feature among Anki-kun’s early adopters. Through discussions with MT’s sales and support staff, and reviewing customer surveys, this seems to be one of the primary methods adopted by their users.

One might presume that the primary reason to purchase an m-Learning device is to access available content, much like the games for a PSP or Nintendo DS. It may seem that the ability to create personal study materials would not be so valuable since in the process of setting up drills and assessments, the user reveals all of the answers. The evidence, however, suggests that the ability to create personal learning content is one of the primary reasons for using the device. Many of Anki-kun’s users study self-created

materials, ranging from an employee trying to remember details of his company’s financial service products, to a university student maintaining a personalized English dictionary, to a woman studying to earn her real estate agent’s license.

People who have the self-motivation to use their otherwise non-productive time are the most likely users of m-Learning. Consequently, not only are these people likely to purchase published m-Learning content, but they are also likely to use m-Learning to study self-generated material. Neither mobile phones nor portable gaming devices offer development environments that are easy for users to create content for self-study. Perhaps in this regard, devices such as Anki-kun may have a much greater impact on m-Learning than could be imagined at first glance.

K-tai Campus

K-tai Campus (KC) (K-tai is Japanese for “portable”) is a “University Sharing Campus Information System” developed by the National Institute of Multimedia Education (NIME), an independent administrative institute that conducts research and develops advanced media tools for Japanese universities.

KC launched in 2005 as a system that allows universities to provide a mobile phone messaging system to their students, faculty, and staff. KC allows each university to easily set up four basic user groups: super-users, faculty and academic staff, students, and general public. Both super-users and faculty are able to distribute content, using bulletin boards and email. Administrators use the system to announce academic and event information primarily for the student and in-school community, and to provide information to the general public, such as open lectures, symposia, and transit information.

In the near term, NIME intends to extend functionality to email announcements, including the ability to preset multiple distribution groups, and to add images to messages optimized for both 2G and 3G mobile phones as well as for PCs. Further, NIME hopes to integrate KC to a number of e-Learning and assessment systems.

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Figure 5
Anki-kun

Moodle for Mobiles

Moodle for Mobiles (MooMo) is an effort in Japan to develop a mobile phone module for the Open Source Moodle LMS, with the first widespread deployment planned for fall 2006. MooMo is being created primarily by six university lecturers and software developers: Jamie Pratt, a freelance developer, Don Hinkelman of Sapporo Gakuin University, Gordon Bateson of Kanazawa Gakuin University, Bob Gettings and Narumi Sekiya of Hokusei Gakuen University, and Tim Takemoto of Yamaguchi University.

MooMo can deliver content created by teachers to over 98% of mobile phones in Japan. Thus, MooMo makes it extremely easy for teachers to use e-Learning content already administered in Moodle, and to provide it to every student.

Using Moodle, many organizations have been able to develop inexpensive e-Learning solutions for their students and staff. By bringing some of their existing content to users on their mobile phones, MooMo enables them to learn efficiently while in transit, between classes and on breaks, and in other environments where a PC or other material is inconvenient or unavailable.

The first open demonstration of MooMo was at the June 2006 JALT CALL (Japan Association for Language Teaching – Computer Assisted Language Learning section). There, 190 conference participants used the software to give real-time feedback on presentations through their mobile phones as well as through WiFi-enabled notebooks. In addition, a test run was started at Yamaguchi University to 28 English classes, involving 10 teachers, 600 students, a 14-chapter textbook, and one Moodle administrator. Recording the results of this pilot is only starting, but the deployment of MooMo across Asian universities should be particularly swift.

Kotodama

Kotodama, a rare Japanese phrase that implies that words can have a powerful influence on reality, is an m-Learning application that provides a customized presentation/lecture solution to the mobile instructor. Currently, schoolteachers are the primary users of the application, but it can easily find a place in many other learning environments.

Kotodama is highly significant for m-Learning as it provides a platform that not only enables the teacher to more effectively present learning material, but also provides electronic and printed handouts that capture the prepared presentation texts along with the annotations, highlights, drawings, and other additional elements that an instructor frequently provides to her class.

Unlike PowerPoint, which forces instructors to present their instructional information as discreet pages of material usually broken up into short bullet points, Kotodama is functionally more like a virtual whiteboard than a slide show. Like an actual whiteboard, the Kotodama instructor can use any given area to present her material. Furthermore, Kotodama can contain both prepared and impromptu content. Often used with a tablet PC, the instructor not only moves between prepared screens (like a slideshow), highlighting or adding comments to the “pages” as she speaks, but can also scroll to a blank part of the page to present additional material or extrapolate on an important topic.

Moving beyond the capabilities of an actual whiteboard, Kotodama allows the instructor to zoom in and out of a particular “page,” scroll extensively in the same environment without erasing, and add text, graphics, formulas, video, audio, and live Web links without ever leaving the single lecture “page.” Because the original development environment and the presentation environment are the same, all of the additional components, notes, illustrations, highlights, and other material added during the lecture are “recorded” by the application. One can then easily distribute the lecture material to students, not only as the original presentation handout, nor as a printout from an electronic whiteboard, but as a real-time record of the lecture material prepared and presented by the teacher.

All presentation materials reside in a standard PC file that the teacher can copy repeatedly, so she can create a new presentation file each time she presents the same material. Through the cyclical process of creating and presenting, the Kotodama lecturer can develop a highly effective combination of prepared material and “scripted” highlights that are added during the lecture itself.

Kotodama is an application optimized for m-Learning. A lecturer, trainer, mentor, or coach in most universities and companies moves around frequently to a scheduled space, whose availability is dependent on many factors beyond the instructor’s control. For such a teacher, a classroom can be anywhere that learners gather and a projector, screen, and PC are available. Of all cases reviewed in this article, perhaps Kotodama is the most revolutionary in the way that it promises to fundamentally alter the way instructors and trainers present information, and the way that learners interact with both the teacher and the material.

Oyako de Science

The *Oyako de Science* (OdeS) program was developed and administered during November 2005 by a group of academic and industry researchers led

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by Assistant Professor Jun Nakahara of the University of Tokyo. Professor Nakahara and his team developed a three-week m-Learning program to teach 60 primary school student/parent pairs about fundamental scientific principles of light. The entire group, consisting of all 120 students and parents, faculty, and staff, met only on two days, on the program's first and last days. Between meetings, the students were required to conduct two weekday experiments each week on their own, and two weekend experiments together with their parent. All teaching materials used were delivered entirely by mobile telephone. (See Figure 6 at right.)

Several important reasons determined this format. First, many students in Japan begin carrying their own mobile phones around Grades 4 or 5. Second, with mobile phones, not only could the students and parents carry the instructional materials anywhere, but also parents could assist and observe their children in learning even when physically apart. Third, the hope was that the parent would serve as a facilitator, catalyst, and peer, enabling both parent and child to feel a greater symbiotic relationship with regard to the child's academic growth.

In their final evaluations, the children reported greater respect for their participating parent, possibly because of an expanded role as the child's mentor during the program. The research also revealed that one could teach certain science concepts quite effectively through the mobile telephone format.

In terms of curriculum design and delivery, one very significant misstep in the original curriculum design points to a pitfall of designing m-Learning based on PC-based e-Learning concepts. In the original design, students linked to many experiment examples from the main page. When user data revealed that neither students nor parents were clicking through these links, the team hurriedly reconfigured content, so that both instructions and examples appeared on the same (long) page. This seems to indicate that when students are studying using mobile phone texts, the linking (and downloading of new packets) is counter-intuitive or troublesome. Although this single case is by no means conclusive, the results do suggest that designers should consider the natural workflow of m-Learning to be quite disparate from PC-based learning.

Educational podcasts

In Japan, as in the US and elsewhere, educational Podcasts have expanded in tandem with the explosion of iPod adoption. According to Business Computer News in late 2005, iPods accounted for 60% of all digital music players in Japan.

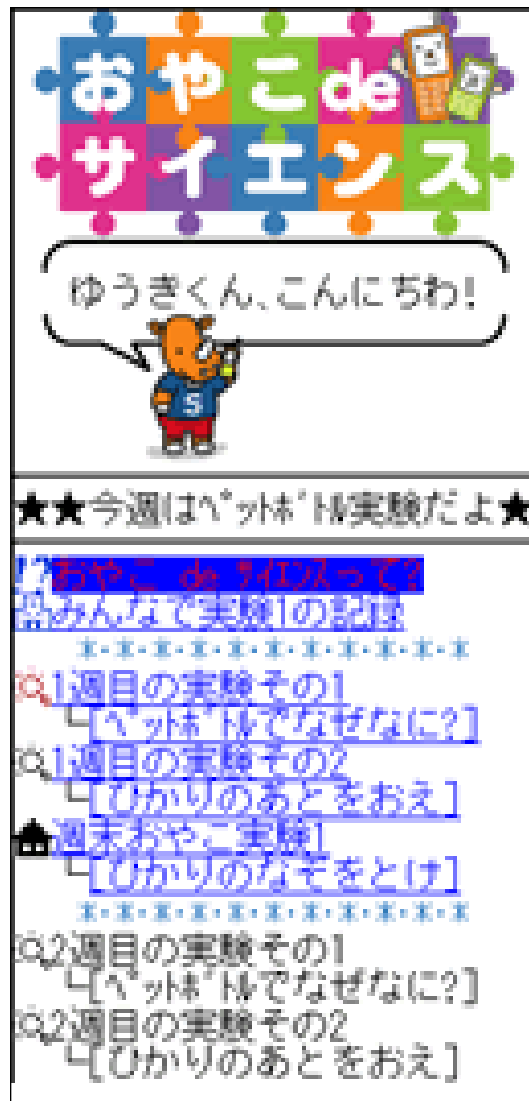
Osaka Jogakuin College first introduced iPods in English education in April 2004, about six months

before Duke University. Many Japanese iPod-based projects and programs have followed that target language instruction.

Beyond language learning, several Japanese companies offer a range of business courses bundled with iPods. Tokyo Legal Mind offers a whole range of courses, including job applications and interviewing, real estate license, Personal Information Privacy Act, Certified Financial Planner, and TOEIC study. Their iPods are bundled with from 20 to 340 hours of audio and video course materials. At least two other major training companies provide downloaded video and audio courses. Staffing company AtHuman offers courses in color coordination, Information Technology, and System Administration. Finally, TAC, a major trade school and e-Learning provider, provides CPA, tax accounting, and labor specialist certification training.

Summary

Through these ten case studies, we have shown



One of the program's key components was a point system rewarding employees who log in each day, correctly answer the quiz questions, and post stories deemed beneficial by the HRD implementation team. The recruits who accumulated the highest points through the program received prizes, worth approximately \$1000 for first place, \$500 for second, and \$300 for third.

Figure 6
Oyako de Science mobile phone interface

that m-Learning in Japan is a viable and increasingly common choice for both adults and children. No doubt, m-Learning will be for some time a complementary aspect of a blended learning approach; however, this does not mean that m-Learning is peripheral. Rather, for a core group of users, it represents a vital part of their overall learning experience.

First, we have seen that while many of the m-Learning applications and products target the younger generations of early adopters, older populations have started to find mobile devices as useful in providing opportunities for brain stimulation, relaxation, and wellness.

Through the CanGo study, we observe that m-Learning can play an important role in just-in-time knowledge acquisition. Focus on situational learning and role-playing can make m-Learning highly relevant in many real-life situations, whether in a hospital or factory. Both the Bizcom and LMI examples also point to the value of simulations and integrated drills and/or assessments in the development of business skills.

Several of the cases also showcase communicative aspects of m-Learning. Whether implemented as bulletin boards (Bizcom), messaging (K-tai Campus), or merely enabling children and parents to work on learning projects together (Oyako de Science), technology-assisted communication can provide significant benefits not so easily measured in tests and assessments.

Although many successful m-Learning applications have featured language study, we have seen that one can use these same devices and methodologies to assist in nursing, science, business manners, and even training on the factory floor. In addition, solutions have successfully targeted people of all ages: children as young as 10-12, young adults, and even older populations.

The benefits of m-Learning for the instructor, too, should not be ignored. K-tai Campus, MooMo, and Kotodama all feature m-Learning that allows instructors to customize education for her learners and learning environment.

Perhaps most significantly, in the Anki-kun case, we have shown that all m-Learning is, ultimately, self-study. (See Figure 7, at right.) The m-learner is someone who is highly motivated to utilize time efficiently, not unlike the person who always takes a newspaper to the toilet. A successful m-Learning initiative, then, is likely to integrate intelligent design and, possibly, artificial intelligence in meaningful ways, perhaps to an even greater extent than on a PC or other learning device.

Though the mobile phone is the most significant m-Learning device in Japan due to its penetration (nearly 100% of the 15-65 year old target market)

and high technical capacity, other devices may emerge. Devices including Anki-kun, portable game consoles, Willcom's W-Zero3 and other smart phones (with both pen-based input and full QWERTY keyboard) may garner a successful market. (See Figure 8 below.)

Conclusions

Although the hardware chosen for a particular program may affect its usability and marketability, we have tried to show that one can develop viable solutions for many kinds of hardware and devices. We believe that the software, content, concepts, and instructional design of an m-Learning solution are much more important success factors.

Many m-Learners are going to use these tools at the office, at home, on the train, queuing up at the bus stop, in a café, or waiting for a friend outside the bookstore. The form factor of the device will make it much more successful as a learning method, mostly because you will have it with you – it is small and light – and because the content pool can change and grow by accessing new material either in real time or downloading/synchronizing between uses.

By designing m-Learning systems so that the inspired and motivated can achieve real results, instructional designers are likely to achieve greater success. In designing such programs, the appropriateness of your


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← **Figure 7**
Learning is for the highly motivated individual

↙ **Figure 8**
W-Zero3 and Windows Mobile Smart phones



hardware, software, design choices, and usability of the system are, as in most learning experiences, critical to adoption and success. 

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