Mobile Mazes: Investigating a Mobile Phone Game for Language Learning

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Abstract

Mobile phones are an important but under-used technology for language learning. Most current mobile phone assisted language learning (MPALL) applications focus on discrete language points and use a behaviourist approach to learning. In this paper, we investigate a communicative MPALL application, action reading mazes. Through interviews and think-aloud protocols, we found that the accessibility of mobile phones enabled users to use the MPALL program in different situations for short periods, although hardware constraints caused problems. Users' initial motivations had an impact on their reactions to the software, while enjoyable gameplay encouraged users to play the games repeatedly.

Introduction

Mobile phones are now ubiquitous with over 3.3 billion in use (Reuters, 2007). In many educational situations, all students have mobile phones, and these devices have become a central part of the students' lives to the extent that the phones are part of their identity (Pettit & Kukulska-Hulme, 2007; Prensky, 2004). With mobile phones so common and so important to students, it is not surprising that the last five years have seen the genesis of a new approach to language learning centering around mobile phones. In many ways, however, the movement for mobile phone-based language learning is reminiscent of CALL in the 1980s, and many initiatives can be criticised for not following sound language learning principles in the same way that early CALL programs were criticised. In this paper, we intend to examine one feature of mobile phones that has been under-exploited in language learning but which holds the promise of countering such criticisms, the ability to act as a platform for interactive games and to investigate the effects of an attempt to exploit this feature through the use of action reading mazes.

Mobile Phone-Assisted Language Learning

MALL, or Mobile-Assisted Language Learning, and the broader M-learning, or Mobile Learning, have recently become buzzwords in language education. MALL covers language learning involving the use of any portable device, including mobile phones, PDAs, iPods, and other MP3 players, and notebook or tablet computers used in a wireless environment. Of these options, MP3 players for podcasting (e.g. McQuillan, 2006; Stanley, 2006) and wireless computing (e.g. Lan, Sung & Chang, 2007; Zhang, Xiong & Luo, 2007) have become widely used, perhaps because of their affinity to existing

applications of technology in language learning and their ease of use for teachers. Mobile phone-assisted language learning (hereafter termed MPALL to distinguish it from MALL) has perhaps been less exploited up to now, despite the ubiquity and importance of mobile phones among students.

Most extant mobile phone-based applications in language learning concern discrete points of the language. These include SMS messages sent to students of the a-word-a-day variety (Chinnery, 2006; Lu, 2006; McNicol, 2004; Prensky, 2004; Song and Fox, 2005), mini-lessons either sent via SMS or accessible through the web (Chinnery, 2006; Prensky, 2004; Thornton and Houser, 2004, 2005), short closed-ended quizzes available through SMS, the web or downloads (Attewell, 2005; Chinnery, 2006; McNicol, 2004; Uther et al., 2005), and a downloadable game (Kam et al., 2008; Marshall, 2007). Other applications include using mobile phones to talk with tutors (Chinnery, 2006) and classroom applications such as a medium for information-gap tasks and recording students' speech for later analysis (Watson Todd, 2006).

Previous reports on MPALL have highlighted several advantages and disadvantages of this approach. The most frequently cited drawbacks of mobile phones for learning concern hardware issues, such as screen size, difficult keyboarding, and limited message lengths (Chinnery, 2006), while Pettit & Kukulska-Hulme (2007) point out that, although mobile phones are embedded in many users' lives, only a small minority of users see them as potential tools for learning. The reported advantages of mobile phones fall into two types. First, they have certain characteristics that make them appropriate as learning tools - their ubiquity, their accessibility, their centrality to users' lives, and their portability enabling any time any place learning (Chinnery, 2006; Prensky, 2004). Second, investigations of mobile phone-based learning comparing pre- and post-test scores have shown some surprisingly large beneficial learning effects (e.g. McConatha and Praul, 2007; Thornton and Houser, 2004, 2005) and have reported very positive affective responses to mobile phone-based learning (although Attewell (2005) reports a slight preference for laptops over mobile phones). The findings of these investigations, however, need to be treated with some skepticism for two reasons: the reports have been written by the application designers themselves who have a vested interest in their success, and learning is measured through discrete-point tests of language knowledge, measures which do not reflect current theories of language and learning.

In addition to being open to criticism for focusing on discrete-point linguistic knowledge, most mobile phone applications can also be criticised for their reliance on behaviouristic theories of learning. For instance, the listening application developed by Uther et al. (2005) appears to consist of minimal pair discrimination drills, the vocabulary learning of Song and Fox (2005) relies on SMS messages of English words with their Chinese translations, and the vocabulary lessons of Thornton and Houser (2005) are short definitions of words with examples of use. If implemented on a computer, these applications would fall into the behaviouristic phase of Warschauer's (1996) categorisation of CALL. Thus, it could be argued that current MPALL applications are at the same stage of development as CALL was in the early 1980s.

Current Mobile Phone-Assisted Language Learning and CALL in the 1980s

The early 1980s were the time when the Communicative Language Teaching movement was taking off, and when the limitations of audiolingual drilling and teaching focusing on discrete-point features of grammar and vocabulary were becoming apparent (Richards and Rodgers, 1986). At the same time, however, CALL was dominated by behaviouristic tutorials and drills (Richard-Amato, 1988). Unsurprisingly, the typical CALL programs of the 1980s were heavily criticised.

Criticisms of CALL at this time attacked both the content and the methodology. There were calls for the linguistic objectives of CALL to move beyond discrete-point items to more authentic longer texts (e.g. Higgins, 1982; Otto, 1988), and the drill and tutorial-based methodology of CALL were execrated. CALL drills were described as "tedious" (Nyns, 1988: 254) and tutorials as "page-turning activities ... that frequently rival the dullest, most pedantic presentations of more conventional media" (Schreck and Schreck, 1991: 472), views supported by meta-analyses of research showing the effect sizes of learning from both drills and tutorials falling far short of what was desirable (Desroches and Gentry, 2004). The reason for the existence of so much "methodologically retrograde" CALL (Phillips, 1986: 8) was that such programs were the easiest to conceptualise and design (Screck and Schreck, 1991). In other words, technological and practical issues were prioritised over learning issues, a situation still apparent ten years later when further calls for learner-based CALL were made (e.g. Watts, 1997).

With both dominated by drills and tutorials of discrete linguistic forms, there are clear parallels between current MPALL and CALL in the 1980s. Whether these parallels extend to the negative criticisms is less clear, but the emphasis placed on the technology over learning principles is apparent in mobile phone-based learning. SMS messages are the easiest mobile phone application to conceptualise and design, and much mobile phone-based learning (including this paper) is driven by a desire to use the technology rather than a desire for students to learn. Given their ubiquity, however, the arguments for using the technology of mobile phones for learning now are probably stronger than the arguments for using computers were in the early 1980s. There are also differences between the two situations, most notably the familiarity and connectivity of mobile phones, yet there is much that can be learnt from the parallels. If we are to learn from history, it is useful to look at how CALL developed from its easily criticised state in the 1980s to see if the same developments can be applied to mobile phone learning now.

The criticisms of the 1980s CALL and, by implication, current MPALL is perhaps overstated since drills and tutorials can serve useful purposes. Nevertheless, sole reliance on behaviourist paradigms in software limits learning opportunities and other paradigms need to be explored. Several of the articles cited as criticising 1980s CALL also included potential directions for developing software. Predominant among these were games and simulations (Richard-Amato, 1988), and the move from behaviouristic CALL to communicative CALL started with software such as reading mazes (Towndrow and Vallance, 2004) or branching stories (Higgins and Johns, 1984). Most notable among these was London Adventure (Hamilton, 1986) which provided a much higher degree of interactivity than most previous CALL software and an environment in which language could be acquired "without the overt didacticism so redolent of most computer-based materials" (de Quincey, 1986: 64).

If the parallels between current MPALL and 1980s CALL apply, the next stage in developing mobile phone learning is to design educational games and simulations. At present, these are almost non-existent with the m-learning games of Kam et al. (2008) the

most notable exception. Even these games, however, are really discrete language point drilling dressed up in the framework of a game. In this paper, therefore, we intend to report on a mobile phone-based language learning game which would incontestably be categorised as communicative CALL.

The Mobile Mazes software

To move from a behaviouristic to a communicative paradigm in MPALL, we decided to design an action reading maze for mobile phones. First used in ELT in 1980 (Rinvolucri, 1980), action reading mazes are an interactive reading activity where students are given choices at various points in a story and the way the story progresses depends on the choice made. Reading mazes are claimed to be intrinsically motivating and beneficial for reading and grammar comprehension skills (Hadley and Stalcup, 2002), and they have been used successfully on computers for many years and have recently made the transition to iPods (Vallance, 2006). Action reading mazes, therefore, appeared to be a suitable activity for MPALL.

Following guidelines in the literature, we designed three mazes, called The Researcher, The Fire Wizard Heir, and The Detective which contained between 50 and 700 pages each. The content of the mazes was based on the interests of the main audience for the mazes - university students in Thailand. The English in the mazes was designed to be challenging but comprehensible for a typical Thai university student, with glosses provided, largely in Thai, for words, phrases, or other language points which were believed to be difficult for the target audience. Because of screen size limitations, most pages comprised one or two sentences only. The mazes also stressed thinking skills with two of the mazes containing puzzles for which answers could be submitted by SMS for prizes.

To make the mazes more attractive, each page included an illustration in the style of Japanese manga, which is popular with students. Originally, it was intended to have animated illustrations and to include sound, but mobile phone memory limitations made this impossible. Indeed, for the largest maze, The Detective, the illustrations had to be simplified to fit with memory constraints. An example maze, playable on the computer, can be found at http://arts.kmutt.ac.th/mom/detective.php.

One problem with mobile phone software design is that there are a number of mutually incompatible operating systems. The most common operating system on mobile phones in Thailand is Symbian, so the mazes were designed using Flash Lite to be compatible with Symbian 2 phones. Further details of the programs can be found at http://arts.kmutt.ac.th/mom/, from which the three mazes can also be downloaded either onto a computer for transfer onto Symbian phones or directly onto the phone.

Investigating Mobile Mazes

Since the Mobile Mazes software is the first attempt we are aware of to implement a communicative paradigm in MPALL, we decided to focus our investigation of the software on the motivational, technological and use issues important for guiding future

developments, rather than investigate learning outcomes, although informants were asked to report reactions to the software and what they believed they had learnt. The nature of reading mazes whereby different paths through the maze mean users encounter different language points also make a reliable measurement of learning outcomes difficult.

The first issue we decided to investigate concerns motivations in learning English through mobile phones. Since MPALL, especially communicative MPALL, is likely to be a new experience for users, we need to investigate the reasons different users have for both deciding to play and engaging in extended use of the software. These motivations can be divided into two aspects: promotion of the software, and features that motivate (or demotivate) users. With a broad target audience of Thai university students and an innovative product, downloadable language learning software for mobile phones, traditional approaches to getting the target audience to use CALL software, such as making the software available in an institution's computer laboratories, were not applicable. For the Mobile Mazes software, a website for downloading the games was designed (http://arts.kmutt.ac.th/mom/) and this was promoted through the Internet, especially popular Thai language mobile phone software websites, and through traditional media such as newspapers (although this resulted in just a single one-paragraph article in a national newspaper). Within the first six months, 240 people downloaded Mobile Mazes from the main website. The promotion of the software, therefore, appears to be moderately successful, but further information could help in identifying promising directions for promoting MPALL software. The second aspect of motivations in MPALL concerns features or aspects of the program that either motivate or demotivate users to play the game. The first research question, therefore, concerns motivations in downloading and playing with Mobile Mazes.

A key argument in favour of using mobile phones for language learning is their accessibility and portability. It is therefore important to see whether users take advantage of these characteristics. To investigate this, we need to find out when, where, and for how long users use the program. This is the focus of the second research question.

With language learning games for mobile phones an innovation, technological issues such as ease of downloading and ease of keyboarding are important. The third research question, therefore, concerns whether technological issues had an impact on the use of the software. In addition to the three research questions, general reactions to the software and reports of learning were also collected.

Data collection and analysis

Three groups of subjects provided data in this study using three different instruments.

The first group of subjects was people who had downloaded the software from the main website. Before downloading, users are asked to fill in their name and mobile telephone number, and the agreement licence for the software includes a consent form for being contacted for research purposes. Eleven interviews were conducted by telephone with people who had downloaded Mobile Mazes. The interviews were conducted in Thai and asked about why the subjects had downloaded the programs, how often they used them, their reactions to and learning from the software, any problems they had encountered, and suggestions for improvement. These interviews are termed Interview 1 with subjects A to K.

Because of problems of cold calling in Interview 1, it was decided to select a second group of subjects. These were students at the university where the software was developed. These students had suitable mobile phones and volunteered to download the software, use it for a couple of weeks, and then be interviewed. Twenty students (12 undergraduate and 8 postgraduate with an even number of males and females) formed this second group. The interviews were again conducted in Thai by telephone and focused on when and where subjects played the games, general impressions, convenience in using the software, and suggestions for improvement. These interviews are termed Interview 2 with subjects 1 to 20.

To gain more in-depth details of technical issues, a further three volunteers from the same university played with the mazes while following a think-aloud protocol. These subjects are named X, Y, and Z.

The data collected from all three sources were analysed recursively for themes based around research concerns with reliability between the two researchers' interpretations checked. Themes were identified from the frequency and saliency of mention in the data. How the three data sources provide information for the research concerns are shown in Table 1.

Table 1:
Research concerns and data sources

Research concern	Data source
Background: Reactions and reports of learning	Interview 1, Interview 2
Research question 1: What motivates users to download and play with the programs?	Interview 1 (downloading and playing), Interview 2 (playing)
Research question 2: Where, when and for how long do users play with the mazes?	Interview 1, Interview 2
Research question 3: What technical issues have an impact on the use of the software?	Interview 1, Interview 2, Think aloud

Findings

Overall, the Mobile Mazes software was received positively. Of the 28 subjects in Interviews 1 and 2 who expressed an opinion (3 subjects in Interview 1 talked about technical problems only), 20 were positive about the games. 21 subjects mentioned that they had learnt English from the programs, with vocabulary (N = 19) and reading (N = 9) being the most frequently mentioned aspects learnt. Other aspects learnt included patterns of everyday conversation (N = 5), grammar (N = 3), translating (N = 3), and thinking (N = 3). Two points were mentioned only once each, but they are salient. One subject talked at length about how the games promoted "social consciousness" since, in one of the mazes, the protagonist can be arrested for driving on the hard shoulder of a motorway; and one subject mentioned how the games changed his "vision about learning English" so that he now believed that English could be learnt anywhere. These generally positive reactions and reports of successful learning mean that more specific investigations of the MPALL software are worthwhile.

Motivations in downloading and playing Mobile Mazes

The first motivational issue concerning the software is why users decided to download the programs. Respondents reported that they downloaded Mobile Mazes because they like playing games and want to improve their English. However, the more direct reasons for obtaining the software are that their friends downloaded it and passed it on to them or told them about it and that they believed the software would be of high quality because it was promoted as originating from a respected university. Only one subject mentioned the newspaper article as the stimulus for downloading the programs. It, therefore, appears that, in promoting free language learning software for mobile phones, word of mouth is more important than media promotion, and that evidence that the games originate from a reliable source is also important.

The second issue is what motivated users to play the game. These motivations can be divided into initial motivations related to prior expectations or purposes in playing the games and motivations for playing the games several times.

The initial motivations fall into two broad categories: language learning motivations (e.g. "I want to learn English (Subject A), "I can improve my English through playing this game" (Subject 6)) and gaming or entertainment-oriented motivations (e.g. "I want to play to kill time and I'm interested in the technology of mobile phones" (Subject 19), "I just want to relax" (Subject 10)). There is a clear pattern between these initial motivations and the ways users reacted to the program. As stated above, 20 subjects felt positive about Mobile Mazes while 8 subjects, all from the second group who were asked to use the software, reacted negatively. Of these subjects, 17 of those who felt positive and all who felt negative stated initial motivations. Of the 17 positive subjects, 12 mentioned language learning as an initial motivation with 5 focusing on gaming, whereas for the subjects who reacted negatively, 7 mentioned gaming and only one language learning. It, therefore, appears that if users approached Mobile Mazes with an initial motivation of language learning, they were far more likely to react positively than if they had gaming motivations.

The initial motivations seem to create expectations concerning how interesting the software will be. Many of those whose initial motivations concerning language learning appeared to be pleasantly surprised by the software. For instance,

> "This is the first time I've played a game like this. Well, actually I don't like to play games but, after playing this game, I think it's good. I have a chance to practise my English, so, yes, I'm interested in learning English from mobile phone games ... The computer games that I used to play aren't like this. For Mobile Mazes, they're really useful. If we talk about games, everybody thinks about relaxation and fun, but there are few games which are really useful like this." (Subject 2)

> "I think the games look good ... The graphics and design are nice. For me, I don't normally like playing games but this game's OK for me. I like the choices of paths in the games. I enjoy choosing the paths, but it's not very challenging for people who enjoy playing computer games, but that's OK for me." (Subject D)

For those whose initial motivations concerned gaming, however, the language learning aspects of Mobile Mazes and the need for extensive reading proved demotivating:

"Actually I feel serious while playing because I have to translate all the time, but I can't translate every word. Some words are difficult so it makes the game no fun." (Subject 15)

"Actually the story is good but I have to read quite a lot. I don't think it's fun, because sometimes I don't understand the story so I don't want to continue reading. It's also because of the vocabulary and as I said I have to read a lot. I think reading and games are not related for me, so I don't like the game ... Like I said, I don't want to read because normally when I play a game I don't have to read a lot like this. Just reading makes me feel sleepy." (Subject 10)

"I don't like these three games because there are a lot of texts in English. You know, I think it's not any different from general English books. When I play or I read, I feel bored ... For the game itself, as I said it's not a game but a book. It needs to be more entertaining than this. For language, I think there are a lot of details to read. For example, in the introduction I feel bored reading. Actually I don't normally like to read." (Subject 13)

For these users, it appears that their expectations for a gaming experience of comparable quality to computer games were not fulfilled, and so they reacted to Mobile Mazes negatively.

In addition to initial motivations, we also need to consider what motivated users to play the games several times. In Interview 2, subjects were asked for the factors that motivated them to play the games more than once, and some subjects mentioned their motivations in Interview 1. The most frequently mentioned factor concerned gameplay (mentioned by 18 subjects). Once exposed to the game, 11 users wanted to be able to complete it:

"I have to play more than once because of the game itself ... Although it's not a difficult game, I can't win the first time. So I have to play again and again until I can complete the game." (Subject 6)

"For the first game, I played it more than ten times before I could reach the end of the story. For each round that I tried, I did my best trying to make the best plan for an appointment and thinking about what to do ... When I hadn't reached the end, I didn't get bored. I kept on playing." (Subject I)

Other gameplay issues mentioned include wanting to know what would happen if a different choice was made, enjoyment of being able to choose different paths, and the adventure style of the story.

The other key factor encouraging users to play more than once was the level of language (mentioned by 4 subjects):

> "I play more than once because of the language. I don't understand some vocabulary. The game itself is not difficult but the problem is language. That's why I need to play many times." (Subject 7)

Users' motivations concerning Mobile Mazes appear to fall into three separate stages. First, users download the software primarily because of friends' recommendations. Second, users have initial motivations for playing the games based on what they expect. Those with expectations of learning language generally react to the program positively since they believe that it fulfills this expectation while also providing entertainment. Users who expect an enjoyable gaming experience, on the other hand, are more likely to have a negative reaction to Mobile Mazes since the games do not provide the level of entertainment found in non-educational computer games and also require extensive reading. Third, once users try the games, gameplay becomes important in motivating them to play more than once.

How users play with Mobile Mazes

A key argument in favour of MPALL is its convenience. This relates to where and for how long users play with the games. From Interviews 1 and 2, 21 subjects explained about where they played the games. While some responses are not particularly enlightening, such as playing in free time (N = 6) or at home (N = 6), two categories of answers are interesting. 19 subjects played with the mazes as a way of killing time, such as when on the bus (N = 4), while waiting for friends (N = 3) and even when on the toilet (N = 1), and 8 subjects used the games to relax, especially before going to bed (N = 4). The first of these involves occasions for which mobile phones are particularly suited.

MPALL may also be particularly appropriate for learning in small chunks, and 21 subjects reported the amount of time they spent playing the games each time. The minimum amount of time spent was 2 minutes, and the maximum a surprisingly long 40 minutes, with an average time of 14 minutes (S.D. = 9.5 minutes). These times are generally shorter than would be expected in most computer-based or non-technological language learning applications.

The Mobile Mazes were also used on more than one occasion by all 25 subjects who provided data regarding this. While 6 subjects only played games twice, one subject played 20 times. The average number of times for playing with Mobile Mazes is 7.5 (S.D. = 5). The average total amount of playing time for the software is therefore 105 minutes. Given that most interviews were conducted within two weeks after the programs had been downloaded, these figures suggest that generally the software was used for short lengths of time, but relatively frequently.

Technical issues in Mobile Mazes

The claimed disadvantages of MPALL are primarily technical issues (Chinnery, 2006), and these issues did affect Mobile Mazes. Most seriously, 3 subjects in Interview 1 did

not succeed in loading the software onto their phones because of hardware problems. For those who did play the games, two complained about how the screen size made it difficult to read the texts, even though these had been kept purposely short for each page. Six subjects reported problems with using buttons on their phones, and this issue also emerged from the think-aloud protocols:

> "Do I have to wait or do I have to press a button? So ... I'll press buttons indiscriminately [Subject reads the text] Um ... I have to use the left button, and where should I go then? Back ... I have to go back to see what ... How to play, press one ... Oh! Start ... I see, I have to press this one [Subject reads the text] Um ... The phone rings. Will I answer the telephone? Um, will I? ... Will I? OK, I will because it's annoying. [Subject reads the text] Do you help him? For sure, I'll help. Oops, I chose 'No'. I pressed the wrong button." (Subject Y)

One reason for the keyboarding problems became apparent from another of the think-aloud protocols:

> "I'll play The Detective ... I'm too lazy to read this ... There are a lot of instructions ... Lazy ... Lazy ... There's no guide about the control buttons ... about the buttons on mobile phones. For someone who plays this game for the first time, it will be very difficult to find the way to use the control buttons ... What does it mean? [Subject reads the text] ... There's no guide about what button I should press ... What do I have to do?" (Subject X)

In fact, all the details about the controls to use in playing the game are on the pages that Subject X scrolled through quickly while saying "Lazy ... Lazy". With mobile phone games still relatively new and with many phone models having different button set-ups, instructions in MPALL games are paramount. If users do not pay attention to the instructions, keyboarding becomes an impediment to playing the games effectively.

Users' suggestions for improvements to Mobile Mazes also highlighted technical issues. The two most common suggestions were adding sound (N = 16) and adding animations (N = 6). Originally when designing the games, we had hoped to include sound and animation, but memory constraints made this impossible. The hardware drawbacks of using mobile phones for learning are therefore borne out in this study.

Discussion

Our investigation of the Mobile Mazes software suggests that using mobile phones in a communicative paradigm of language learning is realistic and worthwhile. The claimed advantages of mobile phones as learning devices, especially their accessibility and portability, enabled users to gain exposure to English in situations that would otherwise be wasted, such as on the bus. However, the generally short periods of use of the games implies that MPALL software needs to be designed for frequent, but brief uses.

A key finding of this study concerns two somewhat conflicting motivations for playing the games. A desire to learn English provides an effective initial motivation for using the software leading to generally positive experiences, whereas an initial desire for enjoyable gaming leads to disappointment. In promoting language learning games, it, therefore, seems wise to emphasise learning over gaming. However, to motivate continued use of the software, the gaming experience, particularly gameplay, becomes crucial. Thus, even if a game is promoted for its ability to enhance learning, serious attention still needs to be paid to gameplay in the software design. The potential benefits of high-quality gameplay probably apply across a wide range of MPALL and CALL applications. In the case of Mobile Mazes, the quality of the gameplay was largely a serendipitous by-product of the decision to use action reading mazes, but the design of much language learning software could probably benefit from consideration of the literature on gameplay (e.g. Bradshaw, 2007; Fabricatore, n.d.; Prensky, 2002) leading to increased repeat use of the software.

The technical disadvantages of mobile phones as learning tools were also borne out in this study. The findings highlight keyboarding problems, but the whole design process was affected by technical issues. The programs are only usable on one of the ranges of mobile phone operating systems, and memory considerations prohibited the inclusion of sound and animation. As technology progresses, the memory issues will become less important, but the main technological development likely to have a major impact on MPALL is easy and practical access to standard websites, as pointed to by the iPhone (see Godwin-Jones, 2007). With mobile phones able to provide relatively normal access to websites, issues of operating systems and keyboarding will become less important, and MPALL applications easier to design. Technological developments in other mobile phone features could also have an impact on MPALL. For example, GPS capabilities could lead to actions reading mazes in which players need to participate in integrated real-world treasure hunts (see Vallance, 2006). These developments suggest that MPALL, now in its infancy, is likely to grow to become a key tool in the repertoire of language learning resources.

References

Attewell, J. (2005). Mobile technologies and learning: A technology update and m-learning project summary. London: Learning and Skills Development Agency. http://www.lsda.org.uk/files/pdf/041923RS.pdf

Bradshaw, H. (2007). Computer game 'playability' - 'learning' through gameplay design. http://www.leedsmet.ac.uk/inn/documents/H_Bradshaw.pdf

Chinnery, G. M. (2006). Going to the MALL: Mobile assisted language learning. *Language learning & technology*, 10(1), 9-16. http://llt.msu.edu/vol10num1/emerging/default.html

de Quincey, P. (1986). Stimulating activity: The role of computers in the language classroom. *CALICO journal*, 4(1), 55-66.

Desroches, M. N. & Gentry, G. D. (2004). Effective use of computers in instruction. In D. J. Moran & R. W. Malott (Eds.) *Evidence-based dducational methods* (pp. 127-141). San Diego: Elsevier Academic Press.

Fabricatore, C. (n.d.). Gameplay and game mechanics design: A key to quality in videogames. http://www.oecd.org/dataoecd/44/17/39414829.pdf

Godwin-Jones, R. (2007). E-texts, mobile browsing, and rich Internet applications. *Language learning & technology*, 11(3), 8-13. http://llt.msu.edu/vol11num3/ emerging/default.html

Hadley, M. & Stalcup, J. (2002). Action mazes revisited. *Modern English teacher*, 11(3), 26-30.

Hamilton, T. (1986). *London adventure* (computer software). Cambridge: The British Council in association with Cambridge University Press.

Higgins, J. (1982). State of the art ? Computer assisted language learning. In Higgins, J. (ed.) *Computers and English language teaching* (pp. 7-26). British Council.

Higgins, J. & Johns, T. (1984). *Computers in language learning*. London: Collins ELT and Addison-Wesley.

Kam, M., Agarwal, A., Kumar, A., Lal, S., Mathur, A., Tewari, A. & Canny, J. (2008) Designing e-learning games for rural children in India: A format for balancing learning with fun. Paper presented at Designing Interactive Systems Conference 2008, Cape Town. R http://www.cs.berkeley.edu/~mattkam/publications/ DIS2008.pdf

Lan, Y., Sung, Y-T. & Chang, K-E. (2007). A mobile-device-supported peer-assisted learning system for collaborative early EFL reading. *Language learning & technology*, 11(3), 130-151. http://llt.msu.edu/vol11num3/lansungchang/ default.html

Lu, M. (2006). Effectiveness of vocabulary learning via mobile phone. *3rd PacCALL conference*. Nanjing, China.

Marshall, J. (2007). Smartphones are the PCs of the developing world. *New scientist*, 2615, 24-25.

McConatha, D. & Praul, M. (2007). Mobile learning in the classroom: An empirical assessment of a new tool for students and teachers. Paper presented at *Washington Interactive Technologies Conference 2007*, Arlington, VA. http://www. hotlavasoftware.com/article_info.php?articles_id=14

McNicol, T. (2004). Language e-learning on the move. *Japan media review*. http://ojr.org/japan/wireless/1080854640.php

McQuillan, J. (2006). iPod in education: The potential for language acquisition. *iPod in education white papers*. Apple Computer Inc. http://e2t2.binghamton.edu/pdfs/ iPod_Lang_Acquisition_whitepaper.pdf

Nyns, R. R. (1988). Using the computer to teach reading comprehension skills. *ELT journal*, 42(4), 253-261.

Otto, F. (1988). Using the computer. In J. Berko Gleason (Ed.) *You can take it with you: Helping students maintain foreign language skills beyond the classroom* (pp. 71-91). Englewood Cliffs, NJ: Prentice Hall.

Pettit, J. & Kukulska-Hulme, A. (2007). Going with the grain: Mobile devices in practice. *Australasian journal of educational technology*, 23(1), 17-33.

Phillips, M. (1986). CALL in its educational context. In Leech, G. & Candlin, C. N. (eds.) *Computers in English language teaching and research* (pp. 2-10). London: Longman.

Prensky, M. (2002). The motivation of gameplay: The real twenty-first century learning revolution. *On the horizon*, 10(1), 5-11.

Prensky, M. (2004). What can you learn from a cell phone? ? Almost anything. http://www.marcprensky.com/writing/Prensky-What_Can_You_Learn_From_a _Cell_Phone-FINAL.pdf

Reuters (2007). Global cellphone penetration reaches 50 pct. Reuters 29 November 2007. http://investing.reuters.co.uk/news/articleinvesting.aspx?type=media&storyID=n L29172095

Richard-Amato, P. A. (1988). *Making it happen: Interaction in the second language classroom from theory to practice*. New York: Longman.

Richards, J. C. & Rodgers, T. S. (1986). *Approaches and methods in language teaching: A description and analysis*. New York: Cambridge University Press.

Rinvolucri, M. (1980). Action mazes. In J. W. Oller & P. A. Richard-Amato (Eds.) *Methods that work* (pp. 323-326). Rowley, MA: Newbury House.

Schreck, R. & Schreck, J. (1991). Computer-assisted language learning. In M. Celce-Murcia (Ed.) *Teaching English as a second or foreign language*, 2nd edition (pp. 472-485). Boston: Heinle & Heinle.

Song, Y. & Fox, R. (2005). Integrating m-technology into web-based ESL vocabulary learning for working adult learners. *Proceedings of the 2nd IEEE international workshop on wireless and mobile technologies in education*. Jhongli, Taiwan, IEEE Computer Society.

Stanley, G. (2006). Podcasting: Audio on the Internet comes of age. *TESL-EJ*, 9(4). http://tesl-ej.org/ej36/int.pdf.

Thornton, P. & Houser, C. (2004). Using mobile phones in education. *Proceedings of the 2nd IEEE international workshop on wireless and mobile technologies in education*. Jhongli, Taiwan, IEEE Computer Society.

Thornton, P. & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of computer assisted learning*, 21(3), 217-228.

Towndrow, P. A. & Vallance, M. (2004). *Using IT in the language classroom*. Singapore: Longman.

Uther, M., Zipitria, I., Uther, J. & Sigh, P. (2005). Mobile Adaptive CALL (MAC): A case-study in developing a mobile learning application for speech/audio language training. *Proceedings of the 2nd IEEE international workshop on wireless and mobile technologies in education*. Jhongli, Taiwan, IEEE Computer Society.

Vallance, M. (2006). Interactive stories on an iPod. *Modern English teacher*, 15(1), 59-62.

Warschauer, M. (1996). Computer assisted language learning: An introduction. In Fotos, S. (ed.) *Multimedia language teaching* (pp. 3-20). Tokyo: Logos International.

Watson Todd, R. (2006). Getting the most out of mobile phones for language learning. *Guidelines*, 28(2), 40-43.

Watts, N. (1997). A learner-based design model for interactive multimedia language learning. *System*, 25(1), 1-8.

Zhang, G., Xiong, F. & Luo Q. (2007). Research on mobile English assistant learning system based on wireless communication.