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An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction

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Abstract

Mobile learning is undergoing rapid evolution. While early generations of mobile learning tended to propose activities that were carefully crafted by educators and technologists, learners are increasingly motivated by their personal learning needs, including those arising from greater mobility and frequent travel. At the same time, it is often argued that mobile devices are particularly suited to supporting social contacts and collaborative learning - claims that have obvious relevance for language learning. A review of publications reporting mobile-assisted language learning (MALL) was undertaken to discover how far mobile devices are being used to support social contact and collaborative learning. In particular, we were interested in speaking and listening practice and in the possibilities for both synchronous and asynchronous interaction in the context of online and distance learning. We reflect on how mobile language learning has developed to date and suggest directions for the future.

Keywords: MALL, m-learning, collaboration, distance learning, independent learning

1 Introduction

Several years ago, it was already being claimed that, at least in the UK, mobile technologies were "a familiar part of the lives of most teachers and students" (Facer, 2004:1). Yet their integration into learning and teaching has been more gradual, as educators have sought to understand how best to use these tools to support various kinds of learning. A review of mobile learning projects funded by the European Union since 2001 (Pęcherzewska & Knot, 2007) confirms that mobile phones are the most frequently used device in these projects, followed by personal digital assistants (PDAs) and other

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handhelds, with personal listening devices (e.g. iPods) receiving a little less attention. Whilst a number of projects concentrate on creating learning materials for mobile devices, several others are focusing on communication and interaction. Our aim in this paper is to review the current state of mobile learning with specific reference to language learning, and, in particular, to examine the extent to which mobile devices can support listening and speaking activities in situations where learners may wish to collaborate. In doing so, we pay special attention to the needs of online and distance learners for whom the challenges of speaking and listening practice can be particularly acute.

Until comparatively recently, offering interactive[1] listening and speaking activities in the context of online and/or distance learning[2] has been problematic because of issues of bandwidth and sound quality. Such activities, therefore, have tended to be excluded from these contexts. Distance learning institutions such as the Open University, UK[3] have addressed this issue by distributing audio-cassettes or audio CDs of pre-recorded listening materials and asking learners to send their own oral work to tutors recorded on audio-cassette. Tutors then marked and returned work, using both paper and audiocassette to provide feedback. This, however, does not allow learners to interact with each other. Since language learning is, essentially, a social activity (see Norbrook & Scott, 2003, Warschauer, 1999), lack of such interaction may be seen as disadvantaging learners participating in courses distributing learning materials via the regular mail service. Increasingly, however, interaction between learners and between learner and tutor can be provided via Voice over Internet (VoiP) applications. Such applications may be proprietary, (e.g., the Open University's audiographics conferencing system, Lyceum, as described in Wikipedia) or available to all (e.g., Skype, as described by Rao (2007), for instance).

Having defined mobile learning (m-learning) in the next section, this paper then offers an overview of Mobile Assisted Language Learning (MALL) research, describing and critiquing the approaches taken. We ask whether MALL can currently successfully support collaborative listening and speaking activities. Based on the findings of earlier studies, we suggest areas for further research.

1.1 What is mobile learning?

Mobile learning is undergoing rapid evolution. Early generations of mobile learning projects tended to propose formally-designed activities, carefully crafted by educators and technologists, and using emerging technologies that were not yet widely accessible or well understood. Current, widespread ownership of mobile and wireless devices means that learners are increasingly in a position to take the lead and engage in activities motivated by their personal needs and circumstances of use, including those arising from greater mobility and travel (Kukulska-Hulme, Traxler & Pettit, 2007; Pettit &

1. In this paper, the term 'interactive' and its derivatives refer to human-human interaction.
2. Distance and blended learning models may include an online component.
3. The Open University, UK offers synchronous online language learning tutorials via its own audiographics conferencing system, Lyceum.

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Kukulska-Hulme, 2007). Whilst, in the past, mobile learning has often been defined in terms of its use of mobile technologies, more recent thinking has foregrounded the mobility of the learner (Sharples, 2006). Often, the informal aspects of m-learning are also emphasised (e.g. Masahita, 2003, Fallahkhair et al., 2007).

While it could be argued that m-learning involves the use of any portable learning material, so includes books, audio-cassettes, audio-CDs, and portable radios and DVD players, for example, m-learning usually concentrates on the most recent technologies. Trifanova et al. (2004:3) define mobile devices as "...any device that is small, autonomous and unobtrusive enough to accompany us in every moment".

Typically, m-learning is identified both by being available "anywhere, anytime" (Geddes, 2004) and by the tools used: mobile learning can perhaps be defined as "any educational provision where the sole or dominant technologies are handheld or palmtop devices" (Traxler, 2005), although in reality it is more usually confined to being one aspect of the provision. For our purposes, then, 'mobile learning' refers to learning mediated via handheld devices and potentially available anytime, anywhere. Such learning may be formal or informal.

2 Mobile Assisted Language Learning: an overview of the field

As access to wireless networks expands and ownership of devices that can communicate with such networks increases, the use of mobile devices to support language learning becomes ever more common. MALL differs from computer-assisted language learning in its use of personal, portable devices that enable new ways of learning, emphasizing continuity or spontaneity of access and interaction across different contexts of use. As has been pointed out by Laurillard (2007: 165), "a typical m-learning activity could build in more opportunities for digitally-facilitated site-specific activities, and for ownership and control over what the learners do". In general, MALL would be expected to use technologies such as mobile phones, MP3/MP4 players, PDAs and palmtop computers. An investigation of the MALL literature reveals that it is, indeed, these devices that research in the field has tended to employ. For the purposes of the current paper, a survey was carried out of MALL-related literature published in major, peer-reviewed, CALL-related journals (such articles were found in *ReCALL, Computer Assisted Language Learning, JALT-CALL* and *System*). The Academic Search Complete database and Google Scholar were also queried to search for literature in this field, whether this was published in the area of CALL or in more general e-learning journals. Furthermore, several relevant papers presented at mobile learning conferences are included. While the overview presented here is not – and, because of the rapid rate of publication of MALL-related articles cannot be – comprehensive, it identifies current trends in the use of mobile devices to support language learning.

2.1 Content or design-related? Approaches to MALL

Studies appear to be divided between those that are content-based (i.e. the development of activities and learning materials) and those that concentrate on design issues related to developing learning materials and activities for mobile devices. While studies that are related to content development usually focus on more formal contexts that are associated with learning courses rather than independent language learning,

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investigations in the area of design issues tend to refer to the "informal" nature of many manifestations of mobile learning.

2.2 Content-related MALL studies

As noted above, studies that address the development of activity types and learning materials often focus on more formal language learning contexts. Although there are some exceptions, this type of study often employs mobile devices as a means of delivering content to learners. As Petersen & Divitini (2004:169) remark: "Little or no emphasis is given to providing learning support where the learner is able to interact with other learners or parties that can support the learning process".

2.2.1 Mobile phones

Currently, in line with Pęcherzewska and Knot's findings (2007) concerning m-learning in general, the majority of MALL activities appear to make use of mobile phones. Although Collins (2005) outlines very clearly how such activities could take advantage of what these devices offer, the most frequently-suggested seem to employ text messaging for vocabulary learning (Andrews, 2003; Levy & Kennedy, 2005; McNicol, 2005; Norbrook & Scott, 2003; Pincas, 2004), and quizzes and surveys (Tomorrow's Professor Listserv, 2002; Norbrook & Scott; 2003, Levy & Kennedy, 2005; McNicol, 2005). Stockwell (2007) links the use of mobile phones for vocabulary learning to an 'intelligent tutor system'; learners complete vocabulary activities either via their mobile phone or via a desktop computer. The intelligent tutor system creates a profile of each learner and then delivers activities according to the areas they find most difficult. As a result of a poll that revealed that an overwhelming majority (99%) of 333 Japanese students regularly sent and received email via their mobile phones in preference to using desktop PCs or PDAs, mobile-based email has been used to promote vocabulary learning in Japan (Thornton & Houser, 2005). Students have also been encouraged to use mobile phones to access web-based video clips explaining English idioms (ibid).

Such approaches support one-way teacher-to-learner communication and use the mobile device to deliver content rather than encouraging learners to communicate with each other or with their tutors. Some studies, however, do promote learner-learner interaction. For example, Dias (2002a, 2002b) set up a web-board accessible by mobile phone for purposes such as providing links to English language learning websites. Accessing the web-board via mobile phone, learners could also interact asynchronously with each other, their teachers and any guest lecturers. Dias (ibid) also set up a mobile-phone accessible mailing list to communicate to students administrative issues such as room changes. Again, these activities are solely text-based. Multimedia approaches to mobile phone-based MALL are, however, occasionally reported (see JISC, 2005): City College, Southampton set up a web-based "media board" (similar to a web-board but supporting MMS as well as SMS) and supplied learners of English as a Second Language (ESL) with mobile phones with inbuilt cameras and voice recording facilities. Learners were required to obtain specific information, either oral or visual, from the immediate locality and to send it to the media-board for access by other learners as well as tutors. Here, learners took part in activities that could only be carried out because of the portability of the devices; they had to visit certain locations in order to obtain the information they needed.

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Although mobile phones were developed to allow oral interaction, MALL rarely seems to make use of this affordance, at least in published research. Exceptions are found in a study at Stanford University (Tomorrow's Professor Listserv, 2002) and in the learning and teaching of Irish as a Second Language (ISL), as reported by Clooney & Keogh (2007). In the Stanford research, native speakers of the target language (L2) coached learners via mobile phone. This approach was abandoned when scheduling difficulties intervened. A second activity requiring oral interaction was also tested at Stanford University, where learners used their mobile phones to take part in automatic voice-controlled grammar and vocabulary quizzes. Although these were accessible at any time and from any location (provided there was mobile phone network coverage), the activity was abandoned, primarily because of problems with voice recognition software. Although this study promoted oral production, like many other documented MALL activities, it used the mobile device to deliver materials, albeit materials to which the learner could respond rather than receive passively.

The Irish study describes the use of mobile phones and iPods to support ISL at secondary level. Cooney & Keogh describe a five-week pilot study whose aim was, "…to facilitate school-based oral assessment and students' self-assessment, increase students' communicative competence and motivate students to learn Irish with the fun and familiar props of a mobile phone and web-chat." (2007:1). In this instance, everyday tools (mobile phones and iPods) were chosen specifically because of their familiarity to learners. Having logged into a voice response system, learners used their mobile phones to listen to and record their answers to a series of questions on different topics. The answers were saved by the system as .wav files and teachers were then able to listen to and mark these responses either online or by downloading the answers in the form of a podcast, whose content could be listened to and marked in the teacher's own time. Students could also download and listen to podcasts containing model responses. As well as this, laptops were provided to enable learners to take part in text chat sessions whose aim was to offer monitored communication by, and support from, teachers. In this case, mobile phones used voice rather than text input to support formal learner assessment.

2.2.2. Handheld computers

Samuels (2003) reports on the use of wireless-enabled, handheld computers by languages students for written, Web-based activities such as grammar drills, adding diacritics to Latin texts and participating in synchronous chat. Audio activities included listening to digitised recordings of Latin poems while following the text on screen. Here, we find a mixture of drill-like activities coupled with activities that allow learners to communicate directly with each other. Rather than concentrate on using them only as deliverers of content, then, tutors for this project made use of the multimedia opportunities presented by the devices to offer audio and text-based materials as well as encouraging synchronous interaction in L2.

2.2.3. Tablet PCs

Noting that the small screen size of PDAs and other mobile devices can be problematic for the purposes of reading, Lan et al. (2007) used tablet PCs to promote "mobile-supported peer-assisted learning" (MPAL) among school students studying English as a

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Foreign Language (EFL) in Taiwan. On the basis of a computer-based test of reading, and reading an EFL text to their teacher via a Skype connection, the first five students to pass these tests had their names "…added to a list of those eligible to assist their peers in online peer assessments or in text reading" (Lan et al. 2007:137)). Each learner could call upon two of the 'online helpers' to listen to and assess their reading via Skype. Helpers could indicate mispronounced words by clicking on them with a stylus, sharing the highlighting with the reader. If one of the two helpers judged the reading test to be "a fail", the learner would need to repeat the test. If, on the other hand, both peer helpers passed the learner's reading, then that learner could be added to the MPAL system and become a helper, too. Here, then, the mobile device (the tablet PC) was used to display a text for reading aloud; this text could be marked up by peers to indicate errors in pronunciation. Learner-teacher communication and peer-peer communication and collaboration were facilitated through audioconferencing via the mobile device.

2.2.4. MP3 players and podcasting

Osaka Jogakuin College, Japan provided first year undergraduates with iPods in early 2004 to support their English studies (McCarty, 2005). They accessed the Web to download podcasts of English language news broadcasts in order to carry out homework assignments. Students only participated in MALL to complete assignments for teachers rather than to communicate with other learners, tutors or the wider world and the mobile devices were used as deliverers of content.

There are, however, examples of more varied MP3 player-based MALL activities. According to Belanger (2005), Duke University supplied iPods to each of its new undergraduates in 2004. Language learners were able to use these devices for listening and speaking activities, although, again, the reported communication routes were tutor-student/student-tutor only. As well as access to Spanish songs, activities included downloading and listening to audio information and glossaries supplied to accompany course textbooks, narratives recorded by native speakers of L2 and tutor feedback on students' work. In this case, learners also used the devices to record their oral assignments for assessment purposes. They then uploaded these to the assessment areas of their courses' virtual learning environment (VLE) so tutors could provide feedback.

Stanley (2006) concentrates his attention on how podcasts may be used by teachers and learners to support classroom-based learning. He describes several ways in which podcasting may be used as a delivery mechanism, either for targeted language learning materials or for providing a source for real materials in the target language. Furthermore, he notes, learners can be encouraged to make their own podcasts which they then upload and share with their peers. He notes, "…there is much to be said about involving learners in the act of publishing a podcast, especially if there is a real audience out there, which the learners can detect." (2006:5) When his own students were required to make podcasts, evaluation questionnaires "…showed they [the students] appreciated the value of the publishing project" (2006:6). Here again, the communication is one way, between podcast and learner but also, possibly, from learner to a wider, unknown audience.

O'Byran and Hegelheimer (2007:163) believe "… drawing on the popularity of MP3 players among university students, the use of podcasting can transform classroom instruction when students begin to listen not just to music, but to language learning

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materials that are integrated into the curriculum". They go on to describe a study in which they attempted to integrate podcasting into an ESL classroom by using tutor-produced podcasts as input into the development of learners' listening strategies. These podcasts were listened to during formal class time, and students used the institution's VLE to complete comprehension questions after listening to them. Here, although students may – and do - listen to the podcasts as often as they wish outside the formal educational setting, the focus is on formal, classroom-based activity. O'Bryan and Hegelheimer acknowledge this, noting, ".. because the podcasting technology is inherently mobile, future research could look at how using MP3 players outside of a lab setting affects the integration of podcasts into the language classroom" (2007:178).

2.2.5. Digital voice recorders and multi-function mini-camcorders

To date, little research appears to have been carried out into using relatively inexpensive, easily portable devices such as digital voice recorders or multi-function mini-camcorders for MALL activities. Such devices, though, do seem to offer considerable educational potential: for example, the software provided with them permits users to archive audio, photographic and video recordings on a storage device via a USB connection to a PC where they can be edited and then shared with a wider audience via websites and blogs.

At Dublin City University,[4] students of French work with a combination of digital voice recorders, Audacity,[5] authentic websites in L2 and Moodle, the open source VLE. Choosing their own topics, from a list supplied by their tutor or from their own knowledge and experience, students identify appropriate websites – such as news broadcasts – and save relevant audio materials into MP3 format via Audacity. Rather than store these audio files on public computers where they may be deleted or edited by other users, digital voice recorders are used as storage media. This is more effective than employing, say, a USB key, as learners are able to listen to their audio archives at any time and in any location. Eventually, learners upload edited audio materials and create individual multimedia projects in the institution's VLE. These projects can be viewed and commented on by fellow learners and tutors.

At the Open University, UK, it was hypothesised that access to very portable mobile devices (voice recorders with built-in cameras and multi-purpose mini-camcorders) would allow language learners to participate in various MALL activities that took advantage of this portability (Kukulska-Hulme & Shield, 2006 – see Table 2, Appendix B for a list of possible activities). Drawing upon Shneiderman's 'Relate-Create-Donate' philosophy (1998), which suggests that the prospect of their work being viewed by an audience beyond immediate peers and tutors motivates learners to higher levels of achievement, the outcomes would be made available to a wider audience via web-based learner blogs and wikis. In 2004-2005, a very small number of volunteers (seven in total) took part in investigations at residential summer schools in France, Germany and Spain. The outcomes of these studies were inconclusive because too few volunteers

4. Unpublished research
5. Audacity is "...free open source for recording and editing sounds". Available from http://audacity.sourceforge.net/

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participated, and the time available was restricted to one week (the length of a summer school) so the final, collaborative activities – creating blogs and wikis – did not happen. Despite these issues, analysis of the data obtained revealed several points worthy of further investigation. Learners:

- need time to learn how to use the new devices and software. When interviewed after taking part in the research, the majority were unaware the devices were multifunctional;
- use devices in unpredictable ways. Although given advice about how they might use the devices, learners did not necessarily follow this. One of the activities at residential schools requires them to interview local residents using L2. Tutors suggested these interviews could be recorded to supplement any notes taken. No student took this advice, preferring instead to record each other using L2 and to take photographs of items, such as shop windows, that they considered representative of the target culture. Anecdotally, however, one Spanish tutor reported that students who had used the devices went on to make more oral contributions in class than those who had not;
- do not use devices they consider intrusive. Mini-camcorders were used less often than voice recorders because learners considered the former "got in the way".

2.3 MALL – design issues and learner needs

Like the majority of research in the areas of materials development and activity types, those studies dealing with design issues and learner needs concentrate on text-based content. They do, however, seem to differ from the content-based approaches already outlined in that their emphasis is less "…on a traditional educational paradigm, where students are provided material by the teacher" (Petersen & Divitini, 2004:172) than on an approach where learners define their own learning and even provide materials to other learners.

2.3.1 Mobile phones

Naismith *et al*. (2004) refer to the fact that a web-based Japanese system for English language learning – Pocket Eijiro – receives more than 100,000 hits per day. This system was designed for access via WAP-enabled mobile phones. Morita (2003) also draws attention to the popularity of this material and emphasises the necessity to redesign web-based material for mobile access. Web- and mobile-based learners may have different needs, he suggests:

> "A WBT [web-based training] system assumes that learners will prepare time to study in front of a computer, but a MBL [mobile-based learning] system ought to assume that learners will not prepare time to learn with MBL; instead the learning takes place in their spare-time such as during their waiting time" (2003:1).

In their discussion of the Stanford study outlined above, Trivanova and Ronchetti (2003:1796) revisit the issue of formal / informal learning and the time available to learners to take part in m-learning. Like Morita, they point out the importance of

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ensuring that language learning materials for use with mobile devices should be appropriately designed and, at the same time, they suggest that the Stanford study aimed to make use of the "highly fragmented" attention of m-learners by providing "short (from 30 seconds to 10 minutes) learning modules".

Pemberton and Fallahkhair (2005) and Fallahkhair et al. (2007) extend the use of web-enabled mobile phones, describing the development of a cross-platform approach using mobile phones and interactive television for informal language learning; they argue that, while mobile devices afford a wide variety of personal activities and learning on-the-move, they are less powerful for enabling learning from authentic and immersive content. In contrast, television provides rich multimedia presentation of authentic and immersive content that is constantly renewed. Programmes such as news, soap operas and documentaries have the potential to enhance language learners' experience by showing the target language, culture and context of use (2007:312).

We have already seen that m-learning in more formal language learning contexts tends to concentrate on the delivery of activity types such as quizzes and vocabulary items that the provider believes to be relevant to their students' needs. Considering the less formal end of language learning, Fallahkhair et al. suggest solutions that empower learners to take control of their own learning, tapping into 'authentic', TV-based presentations to do so.

2.3.2. Handheld computers/ PDAs

Cho et al. (2004) outline the design of 'mobile-based courseware' that allows learners of Korean based in Korea to make use of the many wireless hotspots in urban Korea. Using a games-based paradigm, the authors describe an approach where, using a PDA and the wireless network, " a learner solves some problems to feed or bathe a cyber-pet" (2004:174). This, they suggest would be an engaging activity; learners would communicate with the courseware to 'care' for the cyber-pet, reading and / or listening in Korean to language-related problems (vocabulary, grammar, reading, writing, listening) requiring solutions, with the option of reading the menu in English. They would also be able to communicate with volunteer Korean language tutors via SMS, text chat or telephone. Their performance would be recorded by the system and sent to the tutor for the purpose of monitoring their progress. Here, the design of the system draws together formal and informal approaches to mobile assisted language learning; progress is formally monitored while learners are able to access the system 'anytime, anywhere' and tutors are volunteers who "…can easily help and teach learners while doing their jobs" (op. cit). Cui and Bull (2005) describe an intelligent tutoring system – TenselITS – specifically designed to support Chinese students of English in learning about verb tense in English. The system adapts the interaction according to a user's current knowledge state, their location, their ability to concentrate at that location, the likelihood that they will be interrupted, and the amount of time they have available for learning (2005:365).

This approach allows for high portability and provides learners with 'anytime, anywhere' access they can specify according to their context, although limitations around storing large amounts of material on handheld computers at present mean that synchronisation with a desktop computer is advisable when large files are involved. Again, it is noticeable that learners take control of what they learn rather than having pre-defined learning delivered to them, whether in 'chunks' or in larger units.

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Context sensitivity is an issue addressed by Ogata and Yao (2003) in a description of CLUE, a computer-supported ubiquitous language learning environment that interacts with sensors in the environment to provide learners of Japanese with the appropriate polite expressions for their current context. Unlike the majority of studies described so far, this one outlines how the system described supports collaboration between learners via a bulletin board and instant messenger-like chat tool: for example, learners are able to see who entered a particular expression and can use the communication tools to ask text-based questions of that person about the entry. The language learning context is, once more, less formal than those for the content-related studies outlined above. Again, learners are encouraged to take control of what they learn.

3 MALL: anytime, anywhere?

Many of the studies described in the above section that addresses content-related MALL activities, appear to subscribe to a model whereby materials are delivered to learners via SMS or a website (see Table 1 in Appendix A for a summary of the research reported here). Very few activities support learner collaboration or communication. While Dias (2002a, 2002b) promotes learner-learner interaction, of the work using more expensive mobile devices, only Southampton (JISC 2005) used MALL to encourage collaboration and co-construction of knowledge; learners had to find information and share it with their peers in order to build up an overall understanding of a real-world problem, namely, the layout of the campus and the location and purpose of various buildings. Although Lan et al.'s study (2007) encouraged learners to support each other in developing their skills in reading aloud and listening to each other doing so, it does not seem to facilitate synchronous interaction of any other sort, either through text or voice. The chat sessions reported by Samuels (2003) allow learners to communicate with each other, but in text rather than voice. The chats themselves do not appear to have been structured in any way, so there is no evidence they were planned to help with knowledge co-construction.

Mobility and portability too often seem not to be fully exploited in the design of MALL activities, even though it is precisely these affordances that justify using mobile devices at all. Many of the studies ignored the 'anytime, anywhere' affordances supposedly offered by mobile devices; for example, SMS messages were sent to learners at set times, on set days (Levy & Kennedy, 2005) rather than learners being able to obtain this information as and when they wanted it. Turning to low-tech, low-cost mobile devices, there is, as yet, too little evidence to make claims concerning their efficacy for MALL. The studies reported adopt models where learners use mobile devices in conjunction with web-based tools to reach outcomes that can be viewed by an audience beyond their immediate peer group. In both cases, the mobile device is integral, adding an extra dimension to the learning experience by allowing learners to identify, edit, and share their own materials in a way analogous to Shneiderman's 'relate' (identify), 'create' (edit), 'donate' (share) philosophy (1998).

Studies that deal with design issues and learner needs seem to take a somewhat different approach. We have seen that they tend to address issues of 'anytime, anywhere' learning as part of the design process. While the activities that are reported rarely allow for collaborative learner interaction, there is a movement towards giving the learner the

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power to choose what, when and where to learn that is not always apparent in the more formal contexts of the content-related MALL studies.

Some researchers into the use of m-learning for language learning purposes have moved towards defining ways in which mobile devices can support language learning communities of practice when their members are separated by distance. Petersen & Divitini (2004) bring together mobility of person with the ways in which mobile devices can be used to empower language learners. For instance, they suggest, a language learner visiting a target culture (say, a 'year abroad') could use mobile technologies to capture and share their experiences in that culture with a community of practice (e.g. language learners) at home. In other words, they create their own content either to satisfy their co-learners' request for specific information or to share material that seems to them in some way useful or relevant to the needs of the community of learners. This is a very different approach from that taken by Dias (2002a, 2002b) and City College Southampton (JISC 2004); those studies asked users to create content on a media board in response to an activity defined by the teacher; Petersen and Divitini suggest that learners define what material they need and create content based upon that, sharing that content via mobile devices.

It is noteworthy, however, that although Petersen and Divitini's emphasis is still on informal or "unofficial" as they term it (2004:172) materials, the types of activity in which they expect learners to take part – they suggest learners might share audio and video clips as well as urls - do not include oral interaction.

4 Barriers to uptake: practical issues

While there seems to be very little published MALL research in the areas of speaking and listening, what has been reported so far does suggest that collaborative speaking and listening activities could be successfully supported by mobile devices. It is noteworthy, however, that the majority of those studies focus on asynchronous speaking and listening activities. Indeed, the majority of the synchronous studies reported here are either text-based (Samuels 2003; Ogata & Yano, 2003) or were abandoned due to technical and scheduling difficulties (Tomorrow's Professor Listserv, 2002). An exception to this is the study reported by Lan et al. (2007) in which students read aloud to each other via Skype and received feedback in the form of errors in pronunciation being indicated on screen by peer helpers and a summative assessment. In this example, the activity does support interaction and collaboration, but within a formal setting. Returning to the definition of m-learning with which this paper began, it is perhaps unsurprising that synchronous MALL activities should be difficult to support – their demand that learners be available at a specific time violates the 'anytime, anywhere' principle of m-learning, but we have seen that much published MALL research does not really make full use of this principle, distributing materials at specific, pre-set times, for instance. Barriers to synchronous speaking and listening activities for MALL often seem, then, to be related to practical issues such as scheduling, an area that has proved to be difficult for language learning providers working with computer mediated communication in general; many studies using desktop technology have foundered as a result of scheduling difficulties (see, for example, Shield & Weininger, 1998). Since mobile technology is available to support realtime voice discussions, developing

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learning activities to take advantage of this cost-effectively must surely be worth consideration, whether such activities fall into the more or less formal sphere of language learning. It should be noted here, however, that cost to the end user is a major consideration and can be a barrier to successful uptake when using mobile devices. In a report about Pleasurable Cities, "an exploratory study into how personally owned technology might be used to provide young people with a voice within their local communities, have a say in changes to their local environments, display ownership and use of social spaces and become more 'active citizens' within their localities" (Lee 2006:1), the author notes that all three groups of young people who participated in the investigation raised the cost of using the mobile technology as an issue:

> "Without exception, the participants would not be prepared to spend or 'waste' 10p of their credit to make visible their opinions about the place in which they spend most weekdays. When probed further and asked whether a chance to make a real difference and affect change would encourage them to send a text, the answer was still negative, across the whole group" (2006:12).

Lee (2006:15) offers a plausible explanation for this finding: the informants were all members of groups who could easily meet face-to-face to discuss the issues raised in the study. And it may be true, as Lee (*ibid*) claims, that using mobile phones to send citizenship-related messages makes more sense in a distributed community. Other studies have also tried to address the barrier to participation raised by the cost of mobile devices and their use. For instance, rather than expecting students to use their own device, projects described by McCarty (2005) in Japan and Belanger (2005) in the USA both provided iPods to undergraduates, in order to encourage their participation; the Southampton study (2005) provided mobile phones to learners and had a budget to cover the cost of using the devices to send MMS or SMS. On the other hand, Pocket Eijiro is accessed by thousands of users, at their own cost, every day. Here, again, there seems to be a difference between the formal MALL research we have summarised and less formal, design-related investigations. In the formal contexts, learners often seem to require that their studies be subsidised in order to provide the motivation to use mobile devices to support their learning, while learners in informal contexts appear to be less concerned about cost, accessing learning materials at their own convenience and to suit their own needs. Of course, other factors such as the relative costs of using mobile phone networks in different geographical locations or from different providers must play a role here, but the cost – real or perceived – of participation in m-learning is another area that requires careful exploration and further research by those working in MALL.

5 Conclusion

Rosell-Aguilar (2007:481) notes that "Having audio or video online is not new, but what is innovative is to provide it as stand-alone items for independent learning delivered direct to your computer or portable media player." As yet, however, few researchers appear to have considered how to use mobile devices to support a pedagogical approach that is not teacher-led; those devices, such as mobile phones, that might be expected to

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encourage collaboration, seem to have been employed primarily to support a teacher-learner rather than learner-learner / collaborative approach. Conversely, devices such as digital voice recorders that might appear to be more suited to individual learning activities have been suggested as ideal tools to support collaborative learning. Clearly, the ways in which different mobile technologies can be employed by different pedagogical approaches and in different more or less formal learning contexts requires further investigation.

Finally, then, MALL seems to be in its infancy; until relatively recently, MALL activities rather mirrored early CALL activities where electronic quizzes, grammar drills and vocabulary lists dominated. Overall, our survey revealed that although there are currently few reported occurrences of speaking and listening activities employing mobile devices, the range of approaches and learning activities using MALL is developing very quickly, expanding in the space of two or three years from a purely teacher-learner, text-based model to one that is beginning to support multimedia, collaborative listening and speaking activities and to allow learners to co-construct knowledge to solve problems and fill information gaps.

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Appendix A

See Table 1. overleaf.

Appendix B

See Table 2, overleaf.

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Table 1 *MALL activities by device, medium and communication route*

Device	Activity	Medium	Individual	Collaborative	Route
Mobile Phone	SMS: Administration	Text	√	-	T➔L/L➔T
	SMS: Vocabulary	Text	√	-	T➔L/L➔T
	SMS: Quiz	Text	√	-	T➔L/L➔T
	Email	Text	√	-	T➔L/L➔T
	Videoclips	Video	√	-	T➔L/L➔T
	Web Board	Text	√	√	T➔L/L➔T/W➔L/L➔L
	Coaching	Voice	√	-	T➔L/L➔T
	MediaBoard	Text/Graphics/Voice	√	√	T➔L/L➔T/L➔L/W➔L
Mobile Phone + Interactive TV	Informal language learning via SMS / WAP / iTV	iTV text	√	-	iTV ➔L
Handheld Computer	Grammar drills	Text	√	-	W➔L
	Synchronous chat	Text	-	√	T ➔ L/L ➔ T/L ➔ L
	Reading poems	Text	√	-	W ➔ L

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Table 1 *MALL activities by device, medium and communication route*

	Listening to poems	Audio	√	-	W➔ L
Tablet PC	Reading aloud	Text and Audio / computer-assisted testing	-	√	L ➔ T, L ➔ L
MP3 player	Listening to songs	Audio	√	-	W➔ L
	Listening to podcasts	Audio	√	-	W ➔ L
	Listening to native speakers of L2	Audio	√	-	W ➔ L
	Listening to feedback	Audio	√	√	W ➔ L
	Recording work	Voice	√	√	L ➔ W ➔ T
Any	User-created content	Audio/Video/Text/Graphics/Voice, Etc	√	√	S ➔ S, S ➔ T, T ➔ S
Key T = Tutor, L= Learner, W = Web, iTV = Interactive TV, Audio = Listening material, Voice = Spoken material					

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Table 2 *Possible MALL activities and audiences for low-tech, low-cost mobile devices*

Learners could:	Comment	Audience
keep an audio record of their studies in a timely manner	While text-based reflective logs require learners to make a conscious effort to key in information, an audio-log allows for just-in-time entries that can be made unobtrusively and later incorporated into a reflective diary.	Self only
make audio, video and pictorial recordings of activities that required them to interview native speakers	Such recordings would give learners access to an archive of personally meaningful recordings that might be more motivating than course materials. They would also have a record of their own development in using L2.	Self only/other learners
record native speaker to native speaker interaction, to listen to and reflect on at a later stage, possibly incorporating these recordings into their own reflective logs or assignment outputs	Such recordings would give learners access to an archive of personally meaningful recordings that might be more motivating than course materials.	Self only/other learners
archive and/or upload recordings/photographs/videoclips to an individual reflective blog	This would allow learners to develop a multimedia blog, charting their progress through the course.	Self only/tutor
upload recordings/photographs/videoclips to a group blog	This builds upon the idea introduced in the Southampton mobile phone research (JISC 2005). Rather than incurring extra cost by using mobile telephone networks, however, learners here would use the USB port – or a wireless connection – to transfer data to the blog. Learners would be given an information gap to fill or a problem to solve and would use the mobile devices to collect information that could be used to construct the knowledge to fill the gap or solve the problem. If the blog were on a	Self/fellow learners/tutor/(general public)

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Table 2 *Possible MALL activities and audiences for low-tech, low-cost mobile devices*

	publicly available website, the general public would also be able to access learners' work in the way Shneiderman (1997) describes as being very motivating.	
keep a record of new vocabulary items, including pronunciation	Learners could build up a personalised, multimedia vocabulary list, possibly also addressing issues such as regional accents and so on.	Self only
download foreign language MP3 files	Use the devices' voice recording facilities listen to content in a variety of locations	Self only