Personalization of language learning through mobile technologies

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CONTENTS

Executive summary

This paper aims to help education stakeholders consider how mobile learning can contribute to improving language teaching and learning by facilitating personalized learning. A high-level overview of mobile learning is presented and the role of personalization in mobile learning is explained. A number of case studies illustrate salient aspects of mobile personalized learning from research and practice. In the final section, considerations for policy and practice are discussed.

- Mobile learning needs to be understood in terms of learner mobility as well as use of mobile technology. It often takes place across multiple contexts or settings, and it involves interactions with people as well as with learning content.

- Learning that is both mobile and personalized holds many attractions. According to UNESCO, adoption of personal mobile technology in learning is likely to supersede 'one-size-fits-all' models of education that do not cater to individual requirements.

- Mobile learning research and practice are informed by educational theories which continue to evolve. These focus on situated and embodied experience since mobile learning creates more opportunities to learn in linguistically rich or immersive environments beyond the classroom.

- Mobile learning is co-evolving with advancements in augmented reality, gamification, ubiquitous technologies, adaptive systems and intelligent personal assistants. In ubiquitous learning, devices and sensors can identify the context of the learner which can be used to automatically recommend some content or to advise the learner on opportunities to interact with other people.

- Mobile learning works best when physical and social environments align well with teaching strategies, and when economic and individual differences between learners are taken into account and appropriate alternative arrangements are put in place. A personalized teaching strategy needs to consider how mobile devices, applications and content relate to other available means of personalization including personal support and traditional media accessed by the learners.

- Mobile learning lends itself to activities involving sustained language practice over time and learning beyond classroom walls, including exploration of authentic language problems and challenges in everyday life. Learning experiences should allow learners to express and follow their interests, to work towards personal goals, and to engage in content creation and sharing, while raising awareness of strategies in listening and speaking.

- Case studies of research projects and initiatives show that personalization can be oriented towards individuals or groups of learners. In case studies presented in this paper, personalized learning takes account of learners' interests, preferences, prior knowledge, competencies, movements and behaviours.

- The case studies show how personalized mobile learning has been applied to learning vocabulary and idioms, listening, speaking, reading, the development of literacy and oral assessment. They highlight learner-focussed activities that are responsive to learner demand and capability and are grounded in everyday life experience.

Mobile technologies impacting education across the world

Personalized learning with mobile devices is one of the latest trends making an impact on a global scale, promising to deliver new ways to enhance and promote language learning. Many people see technology as a way to facilitate personalized learning and mobile learning in particular has received increased interest because of the widespread use of mobile phones and other personal devices. At the same time there are some questions and concerns being voiced around access, security, affordability, teacher and learner competency in using digital tools, and possible threats posed by ever smarter technologies.

One thing is clear: mobile devices are convenient tools that are often used for informal learning. Use of phones, smartphones, tablets and wearables (such as fitness tracker wristbands) for everyday activities like checking facts, getting advice from friends on social networks or monitoring progress towards fitness goals, highlights both the broad appeal of personally-relevant learning and the potential to advance the idea of personalization in education at all levels.

The devices, and the practices and behaviours associated with their use, have been attracting the attention of education stakeholders for a variety of reasons:

- the sudden abundance of technologies and media where previously there was scarcity, high expense and other high thresholds to adoption;

- the enormous potential to expand the reach of educational opportunity and to provide the same opportunities for all;

- the promise of more sustained learner engagement leading to completion of study programmes and qualifications;

- new ways to improve the quality and appeal of teaching and learning by means of technology-mediated innovations in content and interaction.

Mobile learning is providing solutions to some of the world's acute educational problems such as poor levels of literacy, shortages of teachers, and gender bias preventing access to education (UNESCO, 2013). It has been applied to diverse challenges involving groups of people with particular needs, with projects targeting:

- refugees in need of a second chance to continue their education (GBCE, 2016);

- unemployed young people who are not attending formal education or training (Attewell, 2004);

- learners with disabilities (McMahon et al., 2013);

- female learners with low levels of literacy in disadvantaged communities (GSMA, 2010);

- underserved indigenous groups (Kim, Miranda, and Olaciregui, 2008).

In classrooms across the globe, researchers have collaborated with teachers on a rich variety of mobile learning projects designed to help groups of students learn challenging subjects – which for many people includes language learning – and to enable them to benefit more fully from educational visits to museums, galleries and cultural heritage sites, or field trips to collect scientific data. Teachers have benefitted by having better access to professional development that is also meeting their individual needs (Walsh et al., 2015).

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Many of these projects and initiatives are learner-centred and seek to enable a personalized learning experience. Personalization has been a central focus in mobile learning research and practice, even if it has not always been labelled in this way. Learning that is both mobile and personalized holds many attractions. The UNESCO Policy Guidelines for Mobile Learning (UNESCO, 2013) list 13 unique benefits of mobile learning, one of them being the facilitation of personalized learning; for instance, applications on mobile phones and tablets can select harder or easier texts for reading assignments depending on the skills and background knowledge of the learner (this is an active research area, see Case study 3 in this paper). The conclusion in the policy guidelines is that over time, adoption of personal mobile technology in learning 'will supersede one-size-fits-all models of education' (UNESCO, 2013, p.12). While globally, more people need to be educated than ever before, overstretched mass provision of education risks overlooking some of the needs and interests of individuals or disengaging them when difficulties occur and there is insufficient support to get them back on track.

This paper presents a high-level overview of mobile learning and its relationship to personalization, in order to inform education policy and practice and ultimately to improve language learning. It presents a conception of mobile learning that is human-centred and recognizes the importance of human agency. When personalization is realized entirely through technology, the ensuing risk is that 'human work is replaced by technology [and] algorithms provide users with content based on an analysis of their past behaviour and demonstrated interests', which would lead to a dangerously narrow view of education that overlooks the value of general knowledge and learners' social and psychological development (Kurcirkova and FitzGerald, 2015). Well-designed mobile language learning experiences and applications should support personalized learning while also guarding against too narrow a view of second / additional language education.

What is mobile learning?

The term 'mobile learning' is sometimes used casually to refer to any informal learning activity that makes use of mobile phones or tablets, for example searching for information on Google, watching instructional videos, listening to podcasts or reading ebooks. The everyday meanings of mobile learning are thus shaped by people's experiences. The term is also popular in workplace contexts where mobile learning may be seen as a flexible mode of delivery of self-paced instruction or performance support:

'Mobile learning can be leveraged to deliver quick hands-on training, on-the-go learning, and just-in-time performance support to learners at the moment-of-need.' (InfoPro Learning, 2014: 3)

In education contexts (primary, secondary and tertiary education), more attention is paid to how mobile learning supports or disrupts social, cultural and pedagogical practices. Mobile devices are proving to be highly versatile tools inside and outside the classroom, while also helping learners to develop digital competence (the ability to use a range of digital tools effectively) which is increasingly considered to be a key part of contemporary education (Gallardo-Echenique et al., 2015). Mobile learning can be a positive catalyst for rethinking relationships between teachers and learners and considering the extent to which learners may be able to take greater ownership of their learning and increase their active participation (Kukulska-Hulme, 2010).

On the other hand, mobile device use among young people is implicated in issues such as cyberbullying, undermining of teacher authority in schools, and distraction caused by easily accessible social networks and entertainment. Implementation of mobile learning in education also poses some challenges. One of these is a lack of relevant training for teachers (Traxler and Wishart, 2011; Baran, 2014). Another is that learning involving online social networks or content downloads relies on ready access to the internet, but in many places internet connectivity is still expensive, intermittent or unreliable. So there have to be sufficiently strong reasons for integrating mobile device use in education.

Mobile learning tasks can be designed so as to take advantage of the tools and software available on a device, and various contexts in which they can be undertaken. For example, tasks can involve creation and sharing of multiple media (photos, videos, etc.), communication on social networks, or recording of language use outside the classroom (Kukulska-Hulme, Norris and Donohue, 2015). Activities like these can be motivating and create additional opportunities for language practice and raised awareness of language use.

Mobile learning can also make use of the mobility of the device and its sensors: when someone is walking around, movement tracking can alert them to interesting content related to a specific location. That content could be a task requiring communication in a target language. At the same time, the portability of the device means that it is relatively easy to sustain a learning experience across time and across different physical and social settings.

Educational theory applied to educational technology suggests that effective learning can take place through conversations between teachers and learners, between learners, and between learners and technologies, and that these conversations serve to make knowledge or reasoning explicit (Laurillard, 2002). Such conversations are exchanges of various kinds that include interactions between people and mobile applications. They can take place in different locations and learning contexts, using diverse channels or media. Sharples et al. (2007, p.225) recognized that mobile devices supported conversations 'across multiple contexts' and this key feature of many mobile learning experiences is also reflected in the definition of mobile learning suggested by Crompton (2013a: 4):

'learning across multiple contexts, through social and content interactions, using personal electronic devices'

Learning 'across multiple contexts' does not always require physical movement since contexts may be virtual. In practice, learners may move little, if at all, during a mobile learning experience, or they may move around but the learning experience does not take advantage of their mobility (Pegrum, 2014). Learners can also turn real-world contexts into learning contexts. This can happen when their local experiences 'intersect with their global communications channels' (Pegrum, 2014, p.19). What might this mean?

- An example could be someone spotting an unusual insect when they are out walking, taking a photograph of it and immediately asking an online network to help them identify the insect, as commonly happens on platforms such as iSpot (Woods, MsLeod and Ansine, 2015). Here the learner is physically mobile, but the emphasis is on conceptual mobility through the instant connection made between a personal local discovery and how this can become a socially enhanced or shared experience.

- Similarly, a person who is travelling might ask their online network how to pronounce a place name, or the meaning of a notice that is difficult to understand. Here again the learner is physically mobile and engaged in crowdsourcing answers to their questions by having access to a social network or group who share their own findings and may be able to help. The Lingobee mobile app was designed along those lines (Petersen, Procter-Legg and Cacchione, 2013, 2014).

Various definitions of mobile learning have been developed over the past 20 years with new definitions continuing to evolve. Sharples and Pea (2014: 516) have proposed a definition that emphasizes provision of educational content and services that are relevant to people's locations and accessible on multiple devices which might even include wall-size displays.

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Evolving theories and concepts in mobile learning

Mobile learning research and practice are informed by educational theories which also continue to evolve. The theory of 'situated cognition' suggests that knowledge is situated within physical, social and cultural contexts and cannot be separated from them; 'embodied cognition' is based on observations that movements of the body have a direct impact on the mind; while a theory of 'augmented place' should also consider how learning can draw on the richness of the learner's immediate surroundings or environment (FitzGerald, 2012). For language learning, this is increasingly important as mobile learning creates more opportunities to learn in linguistically rich or immersive environments beyond the classroom.

The next generation of mobile experiences will increasingly include augmented reality. In 2013, Pearson Labs created a prototype of LangAR, an augmented reality talking phrasebook that enabled users to look at their environment through the phone's camera and to select a point of interest. The app would then show useful phrases and these could be tapped on the screen to hear how they are spoken. Gamification is another concept influencing the development of mobile learning through the incorporation of game design and game elements in mobile learning. Explorez is an example of an augmented reality game in which university students interact with characters, physical items and media on their phones as they discover different areas of their university campus and at the same time practise their French language skills (Perry, 2015). The experience includes using Voki (www.voki.com), a tool that allows users to create talking avatars as an additional way to practise the target language.

Mobile learning will also be influenced by the development of adaptive teaching systems that use data about a learner's previous and current learning to create a personalized path through educational content or to add layers of computer-guided support to established practices such as textbook reading (Sharples et al., 2015). Adaptive systems build up their knowledge of a learner and can offer suitable content, social contacts for language practice or courses. For example:

- Work on adaptive computer-assisted reading of online texts in a foreign language includes a system that offers repeated exposure to previously encountered unknown words to improve the rate of an individual's vocabulary growth. Students read a text and click on any words that seem unfamiliar or new to them. The clicked words are then automatically placed in the student's 'unknown word list' and are used to select subsequent texts and comprehension exercises for the student (Wang, 2016).

- Social recommender systems can suggest people who are potential suitable new friends. 'Friendbook' discovers lifestyles of users from sensor data collected by their smartphones, based on their daily routines. It measures the similarity of lifestyles between users.

- Course recommendation systems can help students choose and access courses of study (Lee and Cho, 2011). Online courses are increasingly popular and learners might appreciate help identifying and selecting appropriate language courses that can easily be accessed on a mobile device.

Predictions in the field of mobile learning are unreliable; however, it is likely that in the future, new wearable devices and clothing, together with smart environments where devices, displays and objects communicate with one another (and with their owners / users), may turn mobile learning into ubiquitous learning, at different rates across the globe. In a ubiquitous learning environment, devices and sensors can identify the context (the location, activity, problems, etc.) of the learner which can be used to automatically recommend some content, or to advise the learner about opportunities to interact with certain people (Aljohani, Davis and Loke, 2012).

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These developments have implications for language learners and teachers: first, learning is likely to become even more intimately entwined with personal daily experience, and second, learners will likely spend more time using voice communication with devices which may or may not 'speak' a familiar language. Communication between people and technologies takes on many forms, including the use of spoken natural languages that are very similar to ones that people already know (e.g.: their 'native' language) or ones they are learning, as in the case of Apple's voice-controlled intelligent assistant Siri (Sadun and Sande, 2012) and other assistants that have followed.

Eventually, intelligent personal assistants that currently answer questions and give recommendations on smartphones are likely to evolve into more sophisticated human-like help. It is claimed that Viv, a next generation voice-controlled personal assistant, will be able to perform thousands of tasks, and rather than just being in a mobile phone it will be integrated into everyday objects, starting with fridges and cars: 'Tell Viv what you want and it will orchestrate this massive network of services that will take care of it.' (Kittlaus, 2016)

As we approach the age of artificial intelligence (AI), there are warnings about the dangers of using AI in morally problematic situations (Boden, 2016), and educators will certainly have to examine these issues. These new virtual assistants could be seen as encroaching on the territory of the teacher, personal coach or tutor, but they can also be seen as providing some forms of assistance that complement what humans are uniquely able to do. In a positive vision of the future, human and artificial intelligences can work together to help learners or challenge them in productive ways. For now, educators should collaborate with learners to find out how mobile technologies can best assist in language learning and also meet individual and group needs.

How are mobile technologies and new learning designs used for personalizing learning?

Personalization features of mobile devices cover an extensive range of possibilities, from simple adjustments to the settings (also known as customization), through to software agents that may be able to lend intelligent assistance. Examples of adjustments to settings could be changing the font size or colour scheme to improve readability, or changing the language to facilitate typing in a different character set.

Personalization in the context of teaching and learning may be understood as a teaching approach that takes account of learner differences and preferences while enabling individuals or groups to reach pre-determined or negotiated goals.

Traxler (2011) lists personalized learning as one of the key achievements in the development of mobile learning. Since mobile devices are usually personally owned, and since they help people to focus on their personal goals (for example to memorize more vocabulary through sustained practice every day), and to make personal media choices (for example to listen to a text being read aloud by text-to-speech software while relaxing with a coffee), mobile learning has also been characterized as 'personal learning'. It is useful to notice the distinction between personalized and personal learning. Personalization foregrounds the teacher's leading role, whereas personal learning foregrounds the learner's role and agency, as in these examples:

- In a formal school or classroom setting, a personalized learning approach 'allows every different student a different way into the same learning' while also ensuring that all students are working towards the same goals (Wiliam, n.d.)

- In informal contexts such as community action or leisure pursuits, people may be seen as being capable of setting their own goals and even building their own learning environments according to their needs and aspirations, so that they can take complete control of their learning (Mikroyannidis, 2013).

Consequently, while personalized learning implies a strategy to adapt content, methods, environment and so on to target learners, in learner-led contexts the learning might best be described as personal. Both descriptors can apply to learning by individuals or groups. It is important to note that there does not have to be a disjunction between personalized and personal learning: in many situations teachers can negotiate with learners, or work with them to support their personal goals and preferences.

Prain et al. (2013: 672) have argued that personalized learning:

'depends on the expertise of teachers to support students' meaningful goal-setting, accompanied by the provision of an engaging curriculum that offers timely strategies and learning experiences to address student goals.'

Language learning stands to benefit from this type of approach, since learning a language or seeking opportunities to practise it are processes in which personal goals, strategies and experiences play an important part. Crompton (2013b: 55—56) offers two examples of personalization through mobile devices:

- A student is catching up with classwork while travelling home on the bus by listening to a recorded lecture. The student has chosen a personally convenient time to engage with this activity, and can use the rewind feature to listen to parts of the lecture more than once.

- A group of students are learning about plants by visiting a botanical garden and using their phones to scan codes and receive information about plants. Collected information is immediately shared in a spreadsheet and this activity can be continued after the visit.

Each of the above examples could be modified to become a language learning activity, since listening on the bus or interacting with displayed information (e.g.: to discuss its meaning, or to consider alternative translations) are activities that lend themselves very well to the use of mobile devices.

Case studies: mobile learning in English Language Teaching (ELT)

The case studies in this section illustrate different ways of realising personalization of language learning through mobile learning. The case studies relate to English language teaching and learning but also to other languages since learning designs and personalization approaches are often not language-specific.

In the last few years, several online websites for informal language learning have begun to facilitate mobile access and interaction. These websites, for example Duolingo or Busuu, offer flexible ways of learning English and many other languages based on learning materials and interactions between learners. Their broad appeal may be based on any number of factors including free access, the ability to work at one's own pace, the perceived quality or attractiveness of the learning materials, or being part of a social network of other learners across the globe. For example, in Duolingo the learner can choose a daily goal (5 to 20 minutes per day), hear the target language spoken, get immediate feedback on language exercises and discuss grammar or vocabulary points with others. Such websites attract high numbers of subscribers; however, it is recognized that attrition is a problem in learning which is entirely self-motivated: many learners do not persist with their goals.

Although these freely accessible online learning environments have begun to be evaluated and analyzed (see for example Lamy and Zourou, 2013), their use through mobile appications has not been a focus of the research. The majority of research projects and published studies in mobile language learning relate to the teaching and learning of English in classrooms, or to mobile applications and resources specially prepared to be used outside class and then discussed with a teacher in class. The case studies presented here cover a spectrum of settings but with a bias towards learning outside or beyond the classroom. This is because personal learning comes to the fore in less formal settings where learners tend to have more freedom to work on their own interests and goals.

Mobile language learning combines and develops research and practice in both mobile learning and in second / additional language acquisition. Although theoretical perspectives are sometimes absent from reported studies and implementation reports, in other cases there is a clear link to a theoretical framework or learning theory.

Case study 1: Accommodating group preferences in mobile text messages for vocabulary learning

In an Australian study involving a group of university students learning Italian, text messages containing new words, definitions and example sentences were sent to the students at spaced intervals to support their vocabulary learning in between scheduled lessons (Levy and Kennedy, 2005; Kennedy and Levy, 2008). The vocabulary items were selected by a teacher from a novel that the students were expected to read and study. The messages also contained simple exercises, questions to consider, recall prompts and reminders. The instructional design was based on the affordances of mobile phones and student mobility (moving around, commuting by bus) and on the theoretical insight that carefully spaced repetition was known to be beneficial in vocabulary learning (Nation, 2001). Students were consulted as a group about preferred content of the text messages and later they were asked about their preferred

times to receive messages. One finding from this study was that some students reported voluntarily doing extra follow-up work by writing down some new words, looking them up in grammar books and considering translations. This example also illustrates how personalized learning (in this case, personalization for a group) can extend into personal learning and could be further encouraged by prompting learners to think about vocabulary gaps relating to their own personal interests or needs.

Case study 2: Developing listening comprehension by making it easy to listen to news on the phone

The Audio News Trainer for English (ANT) is an aural comprehension app developed for the pedagogically guided use of audio news podcasts (Read & Kukulska-Hulme, 2015; Read, Bárcena & Kukulska-Hulme, 2016). ANT uses different sources of audio news recordings corresponding to three levels of difficulty based on factors including speech speed and accents. Students participating in a trial of the ANT app were studying English as part of the mandatory university entry courses that all students have to complete before being allowed to study at Spain's National University of Distance Education (UNED). The learners could choose and listen to any recordings. The app was designed to be used voluntarily and independently, and guidance for its use was provided in the app and in other online resources. Two versions of the app were produced, the difference being a link to social media (Facebook) in one version as a way to motivate learners and encourage them to be proactive. In the social version, learners could share their summaries of what they had listened to and were able to 'like' and comment on other people's summaries. Research has been undertaken with the app to study its motivational properties and whether using it could modify learning habits and help to establish appropriate metacognitive strategies. Initial results indicate enthusiastic engagement with listening and with posting summaries to the Facebook social forum, and relatively shallow engagement with summaries posted by others (few reflective peer comments).
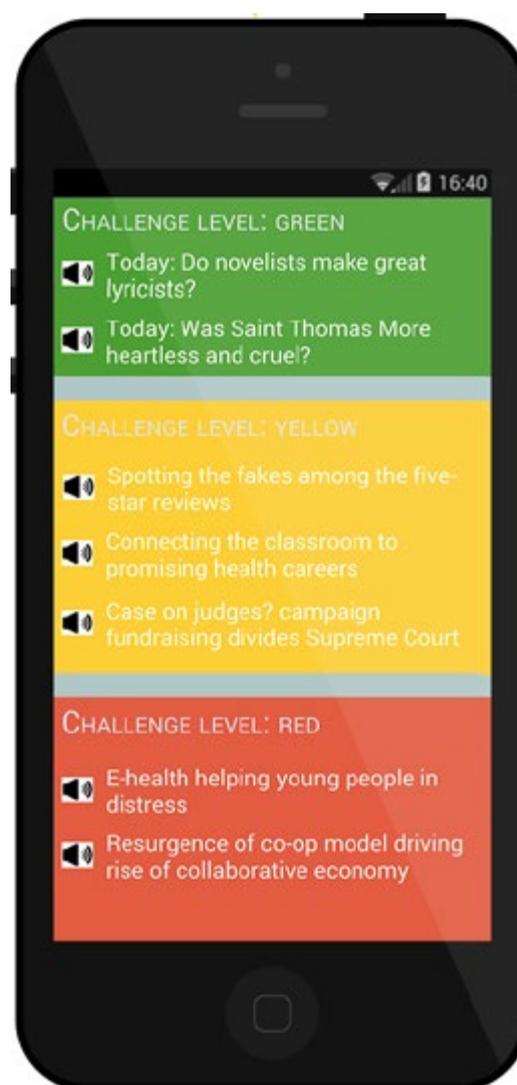
News stories at different levels of difficulty are offered to students in the Audio News Trainer

Case study 3: Using personalized recommendations and annotations to support reading comprehension in English

A mobile learning system was developed to provide reading material recommendations that would guide EFL (English as a Foreign Language) students to read articles that match their preferences and knowledge levels (Hsu, Hwang and Chang, 2013). The system includes a reading annotation module that enables students to make notes in the reading material (by selecting word translations) either for themselves or to share with other learners.

An annotation made by the student

Detailed information of the annotated vocabulary

Annotation from peers

Teachers were asked to evaluate potential additional readings based on their relevance to a selection of topics, and the system could recommend these to learners. Learners' general preferences with respect to topics were determined on the basis of a questionnaire. A pre-test also evaluated their reading proficiency. The recommendation mechanism took into account learners' preferences and proficiency. Collaborative reading and shared annotations were possible when learners were working on the same recommended text. An evaluation of this system with experimental and control groups demonstrated the value of recommendations, and of annotations in either individual or shared tools and services that learners can choose.

Peer 1

Peer 2

Case study 4: Supporting migrant learners with rich resources and contextual recommendations on their phones

The European MASELTOV project aimed to assist recent immigrants in the process of social integration and language learning by providing a suite of tools and services that could be used at any time and according to individual need. A prototype smartphone app called MApp was developed, which included a social forum, a translation tool, a cultural awareness game and a set of language lessons, among other services.
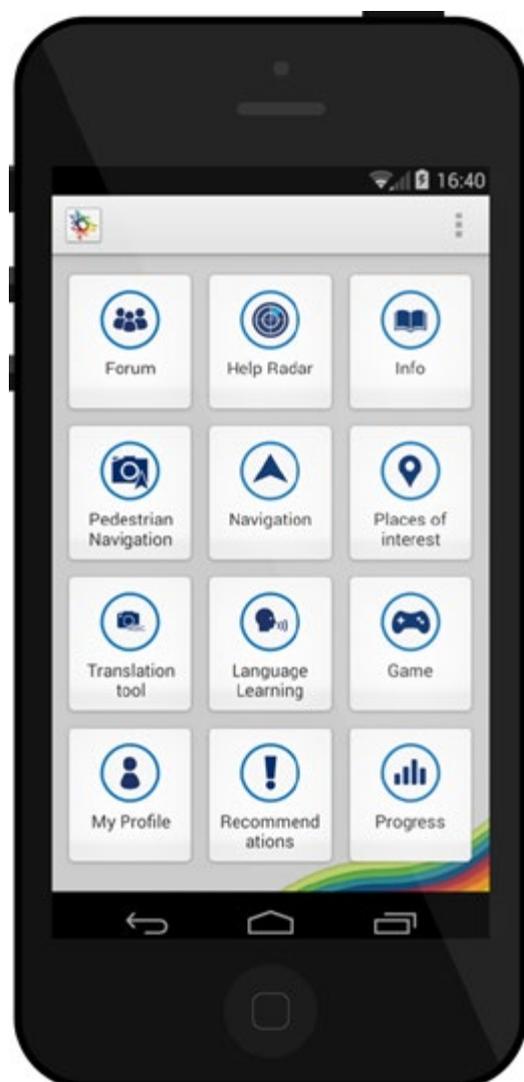
The tools and services that learners can choose to use in MApp.

Photos taken with the translation tool could help decode signs and notices in the city, and the language lessons encouraged learners to try to use new expressions they had learnt. The app could also make use of declared learner interests and their movements around a city to make recommendations of additional resources or places to visit. It was trialled in several major cities across Europe (Gaved et al., 2012). The design of the app and associated learning activities was based on an interpretation of 'incidental learning' as encompassing unplanned and social learning in the course of everyday life in a city as well as learning from any incidents that may have occurred (Kukulska-Hulme et al., 2015). Participants in trials of the app appreciated being able to interact with a facilitator in the social forum and via phone calls, being able to exchange information with others, finding out how to pronounce local place names, and being in control of their learning.

Case study 5: Facilitating learning of idioms through learner-created photos illustrating the idioms

Primary school students in Singapore used smartphones to take photos in real-life contexts to help them in the process of constructing sentences with newly acquired Chinese idioms (Wong, 2013; Wong et al., 2015). These students are learning via the medium of English in school but also attend classes to learn Mandarin Chinese, and colloquial Mandarin Chinese may be spoken at home. The children took photos related to Chinese idioms, at home and in other settings, by arranging everyday objects and toys or by getting other people to act out scenarios (e.g. to illustrate idioms like 'a sea of people', 'dance for joy'). They made sentences with the idioms to go with the photos, and then posted these artefacts in a wiki shared space for peer review by other students. They engaged in classroom and online discussion of their artefacts, checking correct usage of the idioms. Unexpectedly some students also browsed through and tidied up their photo albums on their smartphones, creating new artefacts from older photos, or mixing several photos to create new artefacts. The pedagogical design of this 'Move, Idioms!' project was based on the idea of authentic 'seamless' learning inside and outside the classroom and at home. The learning activity drew on students' personal relationships and experiences at home and with their friends, connecting formal and informal learning.

Case study 6: Improving literacy using speech recognition-supported mobile games

Speech recognition-enabled mobile games have been explored to help rural children in India read words with understanding (Kumar et al., 2012). Simple 'games' could be hearing a word and selecting a matching image, or being shown a word and having to read it aloud. This research recognizes that learning to read in a second language is challenging, and for low-income children in developing countries this task can be even more challenging because of lack of access to high-quality schooling. Practising recalling and vocalizing words for expressing an intended meaning could improve word reading skills, but for a long time there have been technical challenges with incorporating speech recognition to check that the learner is vocalizing correctly. Empirical evidence from this research shows that vocalizing words is indeed superior to receptive vocabulary training, and it also demonstrates that various types of hints can be used to support the learning process. The researchers suggest that speech-based Interactive Voice Response (IVR) systems, without the need for visuals, could be used to lower the cost of such systems.

Case study 7: Innovating listening, speaking and oral assessment on mobile phones

A research project conducted by Demouy et al. (2011) established the value of a voice response system on mobile phones enabling listening and speaking exercises to be selected and completed at any time convenient to the learner. Voice recordings produced on the phone during these exercises could be played back by learners and they were also instantly available on a website that could be accessed by language tutors. The tutors would evaluate the recordings and provide individual feedback to learners. The same voice response system was used in a pilot study on academic listening and speaking skills in the context of English for Academic Purposes (Shrestha et al., 2012). Learning activities included responses to prompts, short dialogues, mini academic presentations and production of summaries. The tool played a key part in the learners' perceived improvement and increased confidence in listening and speaking. Learners reported that the tool helped them to remember more and also to respond more quickly than they were used to doing – the ability to respond quickly being a skill that is not often addressed through other methods.

A dynamically-generated vocabulary list using the 'places' tag in the VocabNomad app.
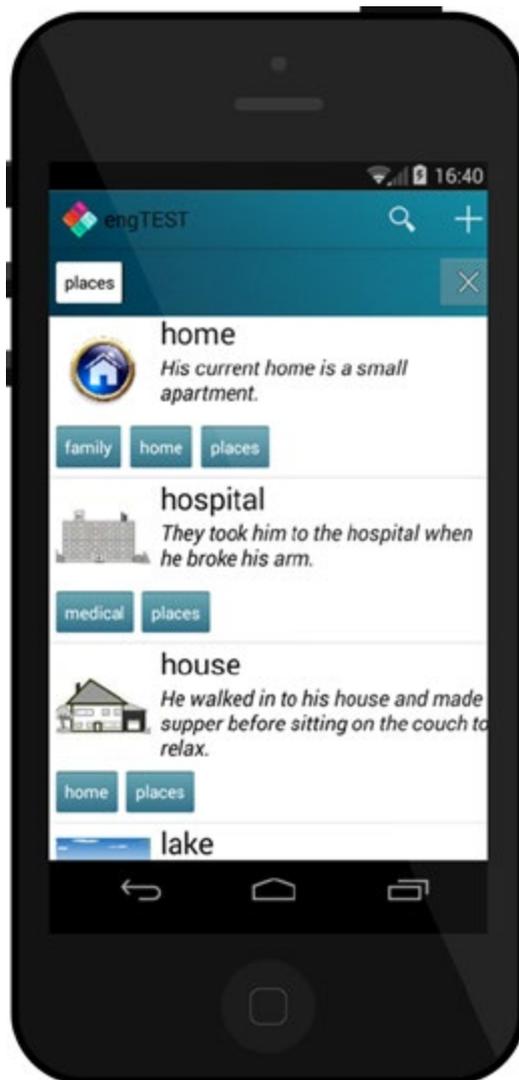
Case study 8: Supplementing language learning with dynamic on-demand content from internet-based resources

An adaptive smartphone app called VocabNomad, developed during doctoral research at the University of Toronto, aims to support English language learners in their communication and vocabulary learning needs by dynamically generating support materials from internet-based resources (Demmans Epp, 2015). To meet learners' expressed need for vocabulary support in unplanned or emergent situations, the ability to provide additional materials on demand was developed. These materials could be vocabulary collections as well as images to help explain meanings. Based on how frequently a learner has viewed a vocabulary item, synonyms may be displayed to expand their knowledge. The app's text-to-speech feature also means it can communicate on the user's behalf if needed. The app tested in situations involving activities such as making requests, negotiating and handling miscommunication.

Two studies investigated its influence on English vocabulary knowledge, communication, and affect. The evaluations have shown that the proposed approach can support English language communication, vocabulary development and the affective (emotional) aspects of language learning.

Considerations for implementing personalized mobile learning

The above case studies show that personalization can be oriented towards individuals or groups of learners and that learning is frequently a social experience. Personalized learning takes account of learners' interests, preferences, prior knowledge, competencies, movements and behaviours, but this does not imply that all mobile application designs need to take all these aspects into consideration.

The case studies demonstrate that personalized learning is never just about using a particular mobile service or application because the learning activity actually takes place within complex ecologies that include:

- digital and analogue technologies or media;
- physical and virtual settings;
- learning material, activity and interaction designs;
- systems of emotional support;
- educational challenge and guidance;
- and other components.

Personalization can be achieved through various means, but mobile learning is distinctive in its focus on easily accessible devices, support for learning across diverse settings, and an increased range of options as to content (e.g.: available on demand, user-generated) and interaction (e.g.: collaboration, discussion, peer review, monitoring, sharing).

Pedagogical considerations for implementing personalized mobile language learning include the following:

- making use of mobile devices, applications and content as part of a teaching strategy that considers how they interact with other means of personalization including personal support and traditional media accessed by the learners;

- developing and supporting learning activities that benefit from sustained practice over time and from learning opportunities beyond classroom walls, while respecting the fact that people organize their time and their lives very differently;

- exploration of authentic language problems and challenges in everyday life, through which learners can also identify their particular and emergent needs (individually or in groups);

- designing learning experiences that allow learners to express and follow their interests, to work towards personal goals, and to engage in content creation and sharing;

- investigating mobile device affordances such as speech recognition and quick voice response in order to raise learner awareness and experience of strategies in listening, speaking and individual pronunciation.

Policy considerations for implementing personalized mobile language learning include the following:

- understanding that mobile learning works best when physical and social environments align well with pedagogical strategies, so that, for example, there is reliable free Wi-Fi for internet access outside the classroom, devices can easily be charged, or learners are able to interact safely with remote and unknown speakers of the language they are learning;

- appreciation of economic and individual differences between learners, meaning that it should not be assumed that all can afford to have and to use an expensive mobile device, or that one specific device will suit them all, and therefore appropriate alternative arrangements should be put in place;

- a focus on teacher development, recognizing that in mobile learning contexts teachers are highly valued as facilitators, tutors, counsellors, and feedback providers as well as many other roles, but they need opportunities and time to become fully conversant with mobile learning;

- reconsideration of language learning programmes and curricula to ensure that learners are given opportunities to define and to follow personal language learning goals in relation to their particular interests, needs, capabilities and contexts of learning.

More suggestions on how to implement mobile learning effectively may be found in: Kukulska-Hulme, Norris & Donohue, 2015; Stockwell and Hubbard, 2013; Traxler and Wishart, 2011.

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