MOBILE LEARNING AND TEACHER EDUCATION: RESEARCHING MLEARN PILOT DEVELOPMENT

Don Passey and Joana Zozimo
Centre for Technology Enhanced Learning, Department of Educational Research
Lancaster University, LA1 4YD, UK

ABSTRACT

MLEARN, a European Union (EU)-funded project, is exploring and promoting teacher development of mobile learning practices in four member states – the Netherlands, the United Kingdom (UK) (England), Greece and Italy. This paper details the ways research findings have both fed into and been elicited from this pilot, supporting development and implementation of a teacher education programme for in-service teachers, focusing on mobile learning through appropriate pedagogic uses of mobile or handheld technologies. The research has focused on three dimensions to date: how contextual backgrounds for the programme can be considered and provided; a training needs analysis of trainers and teachers involved in the pilot; and gathering initial outcomes from teachers and learners after involvement in teacher education events and some one to two months of pilot uses in classrooms. The paper considers implementation outcomes to date, and what the next steps will be.

KEYWORDS

Mobile learning, teacher training, research roles, teachers, schools, using mobile devices.

1. INTRODUCTION

A range of mobile learning projects have already been run across Europe and outside Europe (see Dykes and Knight, 2012; Shohel and Power, 2010), and lessons learned and limitations arising have been identified across these projects. A review of research literature indicates that mobile learning practices can be developed and focused to support: behaviouralist; constructivist; situated; collaborative; informal and lifelong; and learning and teaching support (Naismith et al., 2004; Ting, 2013). Greater accessibility to information and the provision of information in context are recognised as key benefits associated with mobile learning. These contexts may be spatial/location, temporal, social, or access/technical in nature (Koshmann, 2011). Mobility, face-to-face social interactions, uses of authentic teaching and learning materials, constant alertness, the focus gained from mobile 'learning moments', and learning and time convenience are important features associated with activities in these different contexts (Economides and Nikolaou, 2008). Developing practices concerned with the concept of 'interwoven learning interactions' has been highlighted as being possible when using handheld devices in learning activities and in series of these activities (Ting, 2013). Informality and ownership are factors that influence uses of mobile technologies and the ways that activities can interweave and be interwoven (Kukulska-Hulme and Traxler, 2005; Wu and Zhang, 2010). Benefits that can arise from uses of handheld devices include alertness, choice of student preferences, saving time, broadening assessment tasks, supporting special educational needs, language learning support, all enhancing pedagogical value (Economides and Nikolaou, 2008; Wu and Zhang, 2010).

Access to and numbers of courses that focus specifically on uses of handheld devices in initial and in-service teacher education are limited, and information about these opportunities is not necessarily widely accessible to teachers in the four countries participating in the MLEARN project (Passey and Zozimo, 2014a). This report (ibid, 2014a) found that mention of handheld devices in the four national curriculum and school guidance documents is currently minimal. Although the curriculum and its intentions in Italy support practices that lend themselves to uses of handheld devices, the penetration of information and communication technologies (ICT) in schools is reported to be generally low, and teachers may not be trained in the use of these or other related ICT facilities. While uses of ICT are supported and encouraged in schools in Greece,

the use of mobile telephones is not allowed. Devices for uses in schools in Greece, therefore, need to conform to handheld computer specifications, while facilities for the capture and editing of sounds or images may need to be disabled. Many teachers in schools across the Netherlands use ICT to support teaching and learning. There are agencies in place that support ICT developments and the promotion and dissemination of ICT practices, including those with handheld devices. In England, ICT and computing are specified in curriculum documents that are statutory. Teachers are asked to adopt pedagogies to match the needs of their classes and pupils, using appropriate ICT and handheld technologies.

Research reviews indicate that teacher education should provide, in as fully a contextualised and integrated way as possible, a focus on three interconnected elements (Mishra and Koehler, 2006): technological knowledge (what the device can do and how to use it); content knowledge (what subjects and topics can be addressed using the devices and their applications); and pedagogical knowledge (how this is done through the development and deployment of appropriate teaching and learning activities). When using handheld devices there is a need for teachers to consider how the learning environment might be expanded beyond the classroom, due to the portability features of the devices. Similarly, features of these devices strongly support aspects of communication and their links to teaching and learning. Already, some schools and agencies have explored the ways handheld devices can support learners with special communication needs. Teachers have used mobile devices in curriculum activities that involve and support practices concerned with research, capturing and using imagery and video clips, presenting to teachers and peers, discussing captured and presented work with teachers and peers, recording and sharing ideas with peers, providing anonymous feedback, pupils creating their own notes and books in multimodal formats, discussing strengths and weaknesses in presented work shared by pupils, creating videos for presentation to wider audiences, presenting perfect models or techniques, organising notes and work, and pupils recording video clips of lessons for later playback. Teacher education events need to identify the many applications (Apps) that can meet specific subject and topic needs. Teachers also need to be aware of both the benefits and limitations of handheld devices for teaching and learning. Activities highlighted as being worthy of exploration in teacher education events are (Passey, 2010: 69):

- "Review and reflect", where pupils capture audio, imagery and video during lessons, use these in plenary sessions to reflect on what has been covered, consider the key elements learned, how these fit into wider subject or topic pictures, and how ideas might be used or taken further outside the classroom.
- "Think forward", where pupils access future topic material via the Internet and capture relevant thoughts or ideas to contribute to discussions or presentations in class or through on-line discussions. Pupils can be encouraged to use the handheld devices at home to research topics for themselves.
- "Listen to my explanations", where pupils record audio when they are completing homework assignments and these verbal explanations are listened to and marked by teachers.
- "Snap and show", where pupils capture imagery, which is downloaded to a server and accessed through a computer or interactive whiteboard screen, for wider pupil discussion, perhaps made accessible to parents so that they can see and discuss events that have happened in school.
- "This is what I've done and how I've done it", where pupils create presentations of how they have used mobile technologies to tackle particular activities, which are recorded and made accessible on appropriate web-sites for teachers and parents to see. Observing other pupils' stories and reports, pupils can include sound recordings of their own voice as well as text and pictures to form multi-modal 'texts'.
- "Tell me how I could improve this", where pupils can share their work in multimedia formats with peers, mentors, teachers or trusted adults in order to seek comments, evaluative feedback, assessments of their work, and ideas to improve their work.

The challenge for this MLEARN project was to identify ways to integrate details of practice and teacher education needs identified through these previous research studies, and to develop a teacher education programme that could be used to stimulate and support practice within the four national pilot groups of teachers, across schools, from nursery and special, to vocational and high schools. The following step in this process was to consider how a training needs analysis could be undertaken, and how research details could then be fed into a teacher education programme. Subsequently, the research endeavour would then focus on how the practices and experiences of teachers and learners in each of the countries were developing over time.

2. TRAINING NEEDS ANALYSIS

Training needs assessment can be considered an ongoing process, gathering data to determine what training needs exist, so that training programmes can be developed to help an individual, institution, or organisation accomplish its objectives. The importance of training needs assessment and analysis is well established (see, for example, the United States (US) Office of Personnel Management, n.d.), where it is argued that these needs should be concerned as much with identifying what is known and are strengths of individuals and organisations, as it is with what is not known and can be gained from training interventions. It is argued that training needs assessment should be considered in the context in which it is set; the context determines not only a width of what might be considered as fundamental needs, but also the values that are ascribed to these and how they might be used or deployed (and national contexts had already been identified as a part of the previous research focus, Passey and Zozimo, 2014a).

Training needs analysis can serve as a basis for evaluating the effectiveness of a teacher education programme as well as determining the costs and benefits of the same programme. Indeed, a training needs analysis can be important in identifying problems that may not be solved by teacher education itself. If policies, practices and procedures need to be corrected or adjusted, this is clearly potentially a concern for those in senior management positions, rather than it being a teacher education concern (Brown, 2002). It was recognised that this aspect might be particularly relevant when considering the outcomes of a needs assessment survey conducted in the four different countries (with their own specific policies, practices and procedures, as indicated in the initial MLEARN research report).

For this training needs analysis, two target groups were involved: 1) trainers and partners in each country; and 2) teachers to be involved in the teacher education. Four countries were involved, where there were known to be substantial differences in terms of handheld devices' acceptance within teaching practices, and resources in place to implement mobile learning initiatives and other activities. The survey was devised using findings from the previous background report (Passey and Zozimo, 2014a). Two forms of a questionnaire were developed to gather details, one for partners and trainers and one for teachers. For both groups, the surveys comprised a mixture of open and closed questions. Findings were reported at both an overall and individual country levels, for teachers and for trainers (Passey and Zozimo, 2014b).

In total, 27 teachers responded from across the four countries. The age range taught was 4 to 19 years, with most teaching across the 6 to 14 year age range. Subjects taught were wide, but most taught either all subjects or science and technology. There were 21 teachers out of the 27 who reported they had learners with special educational needs, 11 out of 27 who reported they had learners with communication needs in their classes, and 22 out of 27 who reported they had classes with special support teachers. Prior use of digital technologies for teaching was high, 25 out of 27 reporting this, with main prior digital technologies used for teaching being personal computers (PCs), laptops, internet, robots, and interactive whiteboards. Handheld devices used previously in teaching were lower, with 9 out of 27 reporting their main prior handheld devices used for teaching being iPads, tablets, and laptops. Prior use of digital technologies by learners for learning purposes was quite high, with 20 out of 27 teachers indicating main prior digital technologies used by learners for learning being PCs, laptops, internet, robots, and interactive whiteboards. Prior handheld devices used by learners for learning was lower, with 6 out of 27 reporting main prior handheld devices used by learners for learning being smartphones, iPods, Android devices, iPads, tablets, and laptops. Many teachers knew of benefits of using handheld devices for teaching and learning, with 16 out of 27 indicating main benefits concerned with handhelds being enhanced attractiveness and engagement for learners, and improving the management of courses. Fewer teachers knew of issues arising when handheld devices are used in teaching and learning, with 11 out of 27 identifying main issues as technological. Main forms of support requested from teacher education sessions were technological and content knowledge. Main features or benefits requested from the teacher education sessions were enhanced focus gained from mobile 'learning moments', the provision of constant alertness, and the use of authentic teaching and learning materials. Main pedagogical approaches requested from the teacher education sessions were collaborative, situated and constructivist. Existing knowledge of Apps or software were mainly 'a few' or 'none', with 38 items identified in total. Main practices requested from teacher education sessions were capturing and using imagery and video, research, and pupils creating their own notes and books in multimedia formats. Main examples of practices requested from teacher education sessions were 'think forward', 'snap and show', 'this

is what I've done and how I've done it', and 'tell me how I could improve this'. Main formats of teacher education sessions requested were hands-on trials of practice, and demonstrations.

In total, 4 partners and trainers responded to the survey. Their responses were similar to those from the teachers, but they differed in some important ways. Main prior digital technologies used for teaching were reported to be interactive whiteboards, netbooks, visualisers, PCs, and laptops. So their background in terms of digital technology uses was not likely to be entirely the same as those of the teachers. Main prior digital technologies used by their learners for learning were PCs, laptops, iPads, and tablets; so their experiences might not be identical to teachers in that respect. Main forms of support requested from teacher education sessions were issues and challenges, technological and pedagogical knowledge. Main features or benefits requested from the teacher education were mobility, developing face-to-face social interactions, supporting special educational needs, and language learning support. Again, this difference was highlighted as being potentially significant for the design of a teacher education programme. Main approaches requested from the teacher education sessions were collaborative, constructivist, situated, informal and lifelong learning; the latter categories might have arisen because of this group's wider or longer experience. Main practices requested from teacher education sessions were capturing and using imagery and video, creating videos for presentation to wider audiences, pupils recording video clips of lessons for later playback, and pupils creating their own notes and books in multimedia formats. These were highlighted as important differences to be considered if the focus of the teacher education programme was to support both trainers and teachers equally. Main examples of practices requested from teacher education sessions were 'review and reflect', and 'this is what I've done and how I've done it'. The first of these examples was unique to the trainers and partners, and this distinction was also highlighted.

From the details gathered from the needs analysis, a 5-day teacher education programme was devised by the key trainer and MLEARN partner group. During each day, technological knowledge (operating the devices, Apps and peripherals), content knowledge (considering Apps that supported specific subject and topic areas), and pedagogical knowledge (examples of practice and a focus on one of the five activities highlighted by Passey, 2010), were integrated into demonstration and hands-on sessions. The teacher education programme was initially run to support trainers in each partner country, and these trainers then developed their own teacher education programmes to support teachers within their individual countries. The intention was to support trainers in 4 countries, who could then train a minimum of 10 teachers in each of their countries.

3. EARLY OUTCOMES FOR TEACHERS

Early outcomes were identified through online surveys that teachers and learners completed. Teacher surveys used open questions, while learner surveys used closed questions to gather evidence from the two populations. By 20th December 2014, following one or two months of pilot uses of mobile devices (depending on the start dates of each teacher), survey responses were received from teachers in 3 countries, from Italy (18 valid responses out of 19 total), the UK (26 valid responses out of 27 total), and Greece (8 valid responses). The teachers taught in kindergarten, primary, secondary and vocational schools. Many had used the devices 1 to 5 times, but some used them more often than this. Some teachers did not find the devices easy to use, for logistical or legislative reasons, or because of lack of familiarity or understanding (which suggested that the teacher education programme was not always fully effective for all teachers). However, most enjoyed using them, but working with learners with severe disabilities was clearly not easy or not possible. Most found the devices offered greater flexibility and mobility. Most reported benefits concerned with engagement and independent learning, but teachers in Italy additionally reported enhanced motivation and opportunities for working in 'an adult world'.

In Italy, responses were received from teachers in 6 schools. About one-quarter of the teachers were from primary schools and three-quarters from secondary schools. About half used the devices 1 to 5 times, but about one-quarter used them more than this. About half found the devices easy to use, but about one-quarter did not (for technical or contextual reasons), and most enjoyed using them.

In the UK, responses were received from teachers in 4 schools. About half of the teachers were from primary schools and half from secondary schools. About half used the devices 1 to 5 times, but about one-quarter used them more than this. About one-quarter found the devices easy to use, but about half did not (for

technical and contextual reasons, and because of lack of familiarity and understanding). However, most enjoyed using them.

In Greece, responses were received from teachers in 2 schools. Most teachers were from a secondary vocational school. About one-third used the devices 1 to 5 times, but about two-thirds used them more than this. Some found the devices easy to use, but others did not (for logistical or legislative reasons). Most enjoyed using them.

4. EARLY OUTCOMES FOR LEARNERS

In terms of learner reports of outcomes following one or two months of pilot uses of mobile devices, survey responses were received from learners in 3 countries, from Italy (147 valid responses out of 148 total), the UK (61 valid responses out of 61 total), and Greece (39 individual responses and 1 group response). Learners were from kindergarten, primary, secondary and vocational schools, representing a balance of boys and girls. About 1 in 10 learners did not find the devices easy to use. For the majority, the size was reported to be 'right' and text and pictures could be seen easily; but for some, they were not sure how to use them. Most liked the devices, but a few said they did not like them. Uses were varied, with use in classrooms, with groups of learners, on their own, writing text, taking pictures, recording video, and looking at websites. Most learners felt they were benefiting – technically, cognitively, socially, widening how they were learning, but learners in Italy additionally reported motivational benefits more than learners did in other countries. Responses from learners in each of the 3 countries are shown in Table 1. It should be noted that in Table 1 numerical values are absolute, but in the case of the rows showing 'Top 6 uses', the numerical values are proportions of positive responses compared to the total numbers of responses.

To place these outcomes into a context, from the needs analysis, participants from Italy indicated that handheld devices had been used previously in teaching by 5 out of the 9 teachers, so these experiences might have particularly supported learner outcomes. Main issues identified by the teachers were concerned with overall learning issues, and teaching issues, while main features or benefits requested from the teacher education were supporting special educational needs, enhanced focus gained from mobile 'learning moments', the concept of 'interweaving learning interactions', and language learning support. These requests suggested that while some teachers had used handheld devices, they may have felt that their practices could be developed more. This view was also supported by the fact that the main teaching practices requested from teacher education sessions were research, pupils creating their own notes and books in multimedia formats, and creating videos for presentation to wider audiences. Teachers involved in this teacher education were generally already aware of issues and ways of using digital technologies in teaching and were active in using them within their schools.

From the teacher needs analysis from England (and the low number of respondents should be noted, as this might lead to a narrow picture), the age range taught was 11 to 18 years, an older age range than that for many teachers in other countries. Main prior digital technologies used for teaching were PCs, laptops, netbooks, visualisers, a variety of handheld devices, and iPads and tablets. This suggested that these teachers might have had a different technological background from those in other countries. Handheld devices used previously in teaching were reported by the teachers, so the proportion of those with experience was high. Main prior handheld devices used for teaching were interactive games, and a variety of handheld devices including projectors, microphones, iPads and tablets. Main prior digital technologies used by learners for learning were PCs, laptops, netbooks and visualisers. This suggested a different background for these learners from those in other countries. Main prior handheld devices used by learners for learning were interactive games, handheld projectors and microphones, iPads and tablets, which again suggested a different technological background for these learners. Main benefits identified were adaptability to the learner, attractiveness and engagement, improving the management of courses, and facilitating the process of learning. This width of benefits suggested a wider interest and perhaps a wider background experience with technologies. Main issues identified were technological, and teacher learning issues. The latter was different from those in other countries, and suggested a different balance of teacher concerns. Main forms of support requested from teacher education sessions were pedagogical knowledge, which again was different from those in other countries, and suggested a different focus of their concerns. Main features or benefits requested from the teacher education were use of authentic teaching and learning materials, the concept of

'interweaving learning interactions', the benefit of informality, the influence of ownership, how learners could choose or make preferences, broadening of assessment tasks, and language learning support. This width of requests suggested a different balance in this respect too. Main approaches requested from teacher education sessions were wide, again suggesting a different balance.

Table 1. Learner responses after one to two months of use in three participating countries.

Learner responses	Italy	UK	Greece
Number of valid responses	147	61	39 and 1 group response
Number of schools involved	5	6	2
Types of schools involved	Half from primary and half from secondary	Two-thirds primary and one-third secondary	More than half from kindergarten and others from vocational school
Gender balance	Half boys and half girls	Three-fifths boys and two-fifths girls	Two-thirds girls and one-third boys
Ease of use	1 in 10 did not find them easy	1 in 10 did not find them easy	1 in 100 did not find them easy
Size	For most the size was 'right'	For many the size was 'right'	For the majority the size was 'right'
Seeing text and pictures	Most could see them easily	Some could not see them easily	Could be seen easily
Knowing how to use them	Some did not know	Some did not know	-
Liking the devices	Most liked them and none did not like them	About half liked them, and some did not like them	Most liked them but a few did not like them
Top 6 uses: Working in the classroom	0.75	0.52	0.41
Top 6 uses: Working in a group with other children	0.68	0.36	-
Top 6 uses: Writing my own text	0.63	-	-
Top 6 uses: Taking pictures	0.45	0.39	0.79
Top 6 uses: Reading text online	0.44	-	0.38
Top 6 uses: Working on my own	0.41	0.33	-
Top 6 uses: Looking at websites	-	0.46	0.54
Top 6 uses: Recording video	-	0.43	0.62
Top 6 uses: Making notes somewhere	-	-	0.36
Reported benefits	Technical, motivational, cognitive, social	Technical, cognitive, social	Technical, cognitive, social
Ways they were benefiting	Widening their learning	Widening their learning	Widening their learning

From the teacher needs analysis in Greece, the teacher participants indicated that the age range taught was 6 to 16 years, with most covering the 13 to 15 year age range. So, more teachers in this group taught older learners than in other countries. Main prior digital technologies used for teaching were hardware, projectors, and multimedia. So the teachers' backgrounds with previous technologies were likely to be different from other countries. Main prior handheld devices used for teaching were experimental instruments in physics and chemistry. Again, this highlighted a difference in technological experience. Main prior handheld devices used by learners for learning were experimental instruments, and Android mobile telephones. This highlighted a further difference in terms of experience of their learners from the picture provided by the wider teacher group. Main benefits identified were facilitating the process of learning, which was a different main benefit identified. Knowing of issues arising when handheld devices were used in teaching and learning were highlighted by 1 out of 5 teachers, which was lower than that for other countries. Main forms of support requested from teacher education sessions were technological, content and pedagogical knowledge, the learning environment, aspects of communication, issues and challenges. Main approaches requested from the teacher education sessions were constructivist, situated, collaborative, informal and lifelong learning, the latter approaches suggesting the teachers would again benefit from a very wide range of approaches. Main practices requested from teacher education sessions were organising notes and work, research, discussing

strengths and weaknesses of work presented and shared by pupils, and creating videos for presentation to wider audiences. This rather different profile suggested that these teachers had different concerns in terms of practice.

When the evidence from the learner responses presented in Table 1 is considered, it is clear that there are differences across countries. Considering this evidence in terms of the initial concerns for the teacher education programme, using the Mishra and Koehler (2006) categories, the responses suggest that technical knowledge has been gained and used (for example, writing their own text, and taking pictures), content knowledge has been a focus (for example, cognitive gains are reported widely), but pedagogical knowledge has varied more in terms of responses (for example, making notes outside the classroom is reported in the top 6 uses in Greece but not in Italy or the UK, while working in a group with other children and working on their own is noted in the top 6 uses in Italy and the UK but not in Greece). Similarly, if forms of pedagogy are considered from a learning concept perspective, then behaviouralist, constructivist, situated, collaborative, informal and lifelong, and learning and teaching support outcomes are not all similarly suggested by learner responses. For example, collaborative learning (if arising from group work with other children) is highlighted most in Italy, while situated learning (if arising from making notes outside the classroom) is highlighted most in Greece, and learning and teaching support (if arising from working in the classroom) is highlighted most in the UK and Italy.

Similarly, there are differences noted in terms of the ways that the evidence suggests focus on wider learning environments, and on communication. For example, wider learning environments are suggested by the evidence of making notes outside the classroom in reports from learners in Greece, but these are not highlighted by reports in the UK or in Italy. In terms of communication, however, working in a group with other children is highlighted in Italy, particularly, and less so in the UK, while recording video is noted more in Greece and in the UK.

It is interesting to speculate at this point about the reasons for these differences. It is quite possible that differences are arising both because of the restrictions that national curricula and guidelines play, but, in balance, this might be offset by the ways that mobile devices are opening up opportunities for teachers and learners to add variety to their approaches for teaching and learning. Further future research evidence gathered may enable stronger conclusions to be drawn in terms of reasons for differences arising.

5. CONCLUSIONS

This paper has indicated how research has been involved in supporting a cross-national EU-funded project focusing on developing a teacher education programme to support teachers in effectively using mobile devices in classrooms. Background details highlighted how different national contexts needed to be considered; a training needs analysis indicated how a wide teacher education programme could be designed and developed, but that important national differences needed to be considered; and an early survey has indicated positive outcomes for many teachers and learners, with some important exceptions.

It should be noted that the number of teachers and trainers involved in this initiative is clearly not representative of the entire population of teachers or trainers in each of the four partner countries. It is also clear that national pilot teacher groups are not necessarily a representative population of teachers (from across Italy, for example), and the needs of these teacher cohorts, therefore, may not be representative of a wider population. However, the means to consider these issues further has been developed within the project; it has been shown that the needs analysis instrument can identify these variations within and across different populations. While the level of research evidence gathered is low in quantitative terms, the qualitative evidence being gained is certainly pertinent at an individual teacher level.

Although from a small and selected trainer, teacher and (perhaps less so) learner group, the initial research findings indicate that uses of mobile devices are being developed in many classrooms as well as outside classrooms, and benefits are identified by both teachers and learners. The research will continue, to identify in more detail how teacher education has supported individual teachers and how this support has been translated through specific pedagogies and learning activities to enhance learning.

This paper reports on implementation of mobile practices arising from a teacher education programme. It shows that the degree of implementation following the training programme can happen quickly (within one to two months). However, as this research is ongoing, evidence will be gathered over a period of a further 8

months to identify whether and to what extent practices are sustained, developed, shaped or altered. These later elements of evidence might then provide more in-depth and valuable insights into how more innovative approaches and more detailed teacher education programmes might be constructed to support teachers more effectively in the future.

This study has shown that a needs analysis for teacher professional development in using mobile technologies can be constructed and used to help define a professional teacher education programme. This is potentially important if teacher education is one of the important obstacles that is preventing current wider uptake and adoption of mobile learning practices. Further study results may indicate how far a wider programme endeavour could be developed.

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