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Meta-analyses from a collaborative project in mobile lifelong learning

Arrigo, M., Kukulska-Hulme, A., Arnedillo-Sánchez, I. and Kismihok, G.

Abstract

This paper focuses on the use of mobile technologies in relation to the aims of the European Union's Lifelong Learning programme. First, we explain the background to the notion of mobile lifelong learning. We then present a methodological framework to analyse and identify good practices in mobile lifelong learning, based on the outcomes of the MOTILL project ("Mobile Technologies in Lifelong Learning: best practices"). In particular, we give an account of the methodology adopted to carry out meta-analyses of published literature and accounts of mobile learning experiences. Furthermore, we present the results of an implementation of our Evaluation Grid and the implications arising from it in terms of management, pedagogy, policies and ethical issues. Finally we discuss lessons learnt and future work.

Keywords: mobile learning, lifelong learning, evaluation, best practices, policy, transitions

1. Introduction

The complexity of our lives puts pressure on employees, employers and policymakers to sustain an efficient and competitive labour market in Europe. Moreover, according to Dede (2011), we live in a time when the industrial era school system is on the verge of collapse. Our society can no longer afford a labour-intensive model of education that uses expensive human resources inefficiently. We observe that in order to make the educational model more efficient, the European Union (EU) as well as the United States Department of Education have been investing in a 21st century education that builds on the adoption of modern interactive media deployed in other sectors of society, such as smartphones, and also aims to design new processes and structures that can help students learn throughout their lives (U.S. Department of Education, 2010; Kozma, 2008). Furthermore, as Schreiber-Barsch (2009) has noted, today lifelong learning is increasingly understood in terms of the

formation of human capital and as an investment in economic development. Globalization, ageing and diffusion of new technologies are transversal phenomena that have involved almost all European countries in the last few years, but the consequences of these phenomena have not been uniform across the EU (European Commission, 2011). In fact, despite extensive government policies having been adopted on a national level to support lifelong learning (Schreiber-Barsch, 2009), each national context is different with respect to the life-long learning (LLL) policies adopted and to the diffusion of ICT. For example, in Italy there is evidence of high diffusion of mobile devices (Mediascope Europe Study, 2010) but insufficient participation in LLL activities, and the objective to increase the participation level is explicitly declared in the government's strategic plans for 2007-2013. As was stated in the Final report of the Committee of Inquiry into the Changing Learner Experience (CLEX, 2009) in the UK, the number of people involved in LLL programs is more significant and there are initiatives to analyse the impact of the newest technologies, such as mobile devices, on the behaviour and attitudes of learners. Countries like Ireland have established national targets in the benchmark areas defined by the EU in the "Education & Training 2010" program, but there has been a delay in setting out strategies related explicitly to LLL. In contrast, other countries such as Hungary have established explicit national LLL strategies, but mobile technologies have not yet been adopted as widely as in other EU countries (Council of the EU, 2008).

Mobile technologies have been evaluated as being particularly suited to the implementation of the LLL paradigm (Sharples, 2000): some mobile technology features and some LLL methodological issues combine almost perfectly (as demonstrated in Sharples, 2000, p.179), and this suggests that they could be the choice technology for fulfilling the LLL vision. Moreover, mobile learning has been considered by many researchers as the future of learning or as an integral part of any other form of educational process in the future. In EU countries, the widespread diffusion of mobile technologies offers an opportunity to develop policies aimed at participation and social inclusion, given that the use of mobile devices transcends age, social status, economic level, gender and ethnic origins. The literature suggests a positive impact of mobile technologies upon lifelong learning (Agrusti et al., 2008; Carril et al., 2008), but there has been a lack of clear evidence. There is no overall model to describe the relations which link adoption of mobile technologies and enhancement of LLL. Mobile

technologies seem able to promote social inclusion, mainly by increasing participation in learning, expanding learner choice, and favouring flexible or personalised learning programmes, which can take place everywhere and at any time. Moreover, mobile technologies have been shown to be particularly effective at reaching learners who are often overlooked by traditional forms of technology-enhanced learning and so can contribute to meet lifelong learning targets. However, in order to maximize the benefits of mobile technologies for increasing and widening participation, learners, and especially adult learners, should be given adequate support when developing their use of mobile technologies.

These considerations suggest that the impact of mobile technologies on LLL is mediated by some pedagogical variables, such as participation, choice, flexibility and personalization. In particular, this impact can broaden the number and the type of people involved in LLL. But this effect can also be moderated by contextual variables; for example, the level of support in the use of new technologies. Another moderator to consider is the national political framework aiming to encourage LLL.

These important issues formed the backdrop to our European project, MOTILL (“Mobile Technologies in Lifelong Learning: best practices”, 2009-10), which was funded with support from the European Commission within the National Lifelong Learning Strategies (NLLS) programme. In this paper we present and discuss the main outcomes of the project, including three distinctive meta-analyses:

- a collaborative tagging activity to categorize initiatives and published literature
- a collaborative reviewing activity to make published literature accessible to a wider audience
- a collaborative meta-analysis of a set of case studies produced by the project

MOTILL focused on the use of mobile technologies as a key factor in developing flexible LLL frameworks for education. As one of the MOTILL project results, an Evaluation Grid was developed to analyse and identify good practice in lifelong mobile learning. Subsequently we were able to formulate some suggestions and considerations to take into account in the use of the mobile technologies in lifelong learning. The MOTILL project also provided policy makers with evidence and good practices in the use of the mobile technologies to improve LLL, for example to help them in setting out strategic priorities that contribute to meeting existing and future targets for adult

learning, vocational training, and higher education; and to support the development of next-generation mobile networks and the reform of the European telecommunication sector.

In this article, first we give some background about LLL, we describe the use of mobile technologies in educational settings and we outline some common definitions and projects in this field. Next, we present the Evaluation Grid; in particular in section 3 we give an account of the methodology adopted to define and articulate the core components of the Grid. Furthermore, we present and analyse the results of an initial implementation of the Evaluation Grid and the implications arising from it in terms of management, pedagogy, policies and ethical issues as they relate to mobile LLL. Finally, we consider lessons learnt and future work.

2. Mobile Lifelong Learning

In this section we provide some background about mobile learning as well as lifelong learning. In particular we report common definitions and interpretations in recent literature. Then we provide a bibliographic analysis demonstrating a convergence and synchronicity between mobile learning and LLL. Moreover, to provide a broader background to mobile lifelong learning, we introduce current European policy perspectives and some representative lifelong learning projects carried out in the past few years in Europe.

2.1. Lifelong learning - background and definitions

Lifelong learning has a wide range of interpretations in current literature. Indeed, the articulation and conceptualisation of lifelong learning has witnessed developments over recent time. From an academic point of view, there is nothing new about the general phenomenon of lifelong learning (Knapper & Cropley, 2000, p. 1): “It is that deliberate learning can and should occur throughout each person’s lifetime.” According to Bentley (Bentley, 2000, p. 3) “people will need to return to formal education more often during their lifetime and ... learning will become a more explicit goal in activities not formally designated as education, especially work”. But stepping away from the learner’s perspective, lifelong learning also has implications for the institutional infrastructure of

learning services. Day argues that only those institutions which are “concerned about the lifelong development of all their members” can develop lifelong learners (Day, 1999, p. 20).

Early understanding of the construct associated it with adult workforce up-skilling to adapt to a rapidly changing society and world demands. One viewpoint, represented by Field et al. (2009), promotes the economic relevance of adult learning rather than the learners’ need for self-actualisation through experiential and transformative learning (Gouthro, 2010). For Fischer (2001), LLL encompasses more than adult education and training; it is a mindset, a habit for people to acquire.

Fischer & Konomi (2007) argue that LLL outside school is different from school-based learning because it is self-directed, driven by interests and needs, informal, often collaborative and carried out in tool-rich environments, while Thorpe maintains that LLL is ubiquitous (2000). Thus, it should include education, training, informal, formal and non-formal learning (ibid). The European Commission’s definition reflects Thorpe’s view, stating that LLL is “All learning activity undertaken throughout life, with the aim of improving knowledge, skills and competencies within a personal, civic, social and/or employment-related perspective” (European Report on Quality Indicators of Lifelong Learning, European Commission, 2002; p. 7). In order to ensure people are equipped with the skills required to engage in LLL, eight key competences have been identified: 1. Communication in the mother tongue; 2. Communication in foreign languages; 3. Mathematical competence and basic competences in science and technology; 4. Digital competence; 5. Learning to learn; 6. Social and civic competences; 7. Sense of initiative and entrepreneurship; and 8. Cultural awareness and expression (European Commission, 2007).

2.2. Mobile technologies in education settings

The eruption of mobile technology in our society has added a new dimension to education. Mobile learning emerged gradually from the middle of the 1990s and has become a controversial topic for education stakeholders. Sharples and colleagues (Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009) attribute the conceptual foundations of mobile learning to Kay’s articulation of the Xerox Dynabook concept, a “self-contained knowledge manipulator in a portable package the size and shape of an ordinary notebook” (Kay, 1972). However, it is only over the past ten years that technological

progress has enabled the implementation of mobile learning constructs and contributed to the popularization of the topic as an area of research. Those concerned with understanding the underlying learning processes supported by mobile learning assert that it “is not simply a variant of e-learning enacted with portable devices, nor an extension of classroom learning into less formal settings” (Sharples, 2009:18). For Hummel, Hlavacs, & Weissenboumlck (2002), mobility is a clear distinguishing factor between mobile learning and e-learning. To this end, a learner-centered conceptualization of mobile learning must be concerned with “how the mobility of learners augmented by personal and public technology can contribute to the process of gaining new knowledge, skills and experience” (Sharples et al., 2009). Thus, mobile learning “supports education across contexts and life transitions” (Sharples, 2009:17) as it pervades dimensions of learners’ mobility such as physical, conceptual and social space as well as mobility of technology and learning dispersed over time. Although learner mobility is currently a key concept of mobile learning, early articulations, for instance Quinn’s (2000), adopted a technical perspective which proposed mobile learning as “the provision of education and training on PDAs/palmtops/handhelds, smartphones and mobile phones” (Keegan, 2002, p. 3). Nonetheless, it is now widely recognised that mobile technology also has to serve the learners’ increasing mobility needs. Thus, learners want to navigate through their learning path, regardless of time and physical space (Brown, 2006) and at the same time they want to stay connected with their peers throughout their learning journey (Siemens, 2005). Furthermore, as mobile technologies become part of the learners’ daily routine, the boundaries between formal and informal learning are slowly starting to blur. Sharples recognized this movement early and suggested that lifelong learning is collaborative and contextual (Sharples, 2000); these are also key attributes of mobile learning.

2.3. Convergence and synchronicity between mobile and LLL

In identifying design features for personal mobile technologies for LLL, Sharples (2000) stresses that while LLL can be characterised as individualised, learner centred, situated, collaborative, ubiquitous and lifelong; new technologies are personal, user centred, mobile, networked, ubiquitous and durable. Thus the convergence of both may enable people to take ownership of their own learning as they

transition through their lives (ibid). More specifically, according to Okada et al. (2003) mobility provides authentic settings for situated learning and wireless network channels for communication and collaboration across physical boundaries.

An analysis of mobile learning projects over the last decade illustrates that mobile learning research has been very prolific in enabling LLL through supporting its key competences (European Commission, 2007). For instance, communication in the mother tongue has been supported by the FÓN (Foghlaim Ón Nuatheicneolaíocht, <http://www.foghlaim.edublogs.org>) project which uses mobile technologies to support the teaching and assessment of spoken Irish in second level schools in Ireland. Developing mathematical competence and basic science have been the target of the MobiMaths (Tangney et al., 2010) and Personal Inquiry (PI, <http://www.pi-project.ac.uk/>) projects (Scanlon et al., 2009) respectively. The acquisition of digital competence was examined and facilitated for instance by the DNA (Digital Narrative Approach) project (Arnedillo-Sánchez, 2008), the eMapps (<http://www.emapps.com>) project (building communities of primary school children from different countries) and the BLOOM (<http://www.bloom-eten.org>) project in Austria focusing on employees' digital competences in the passenger transport and logistics sector. The Mobile Game Based Learning (<http://www.mg-bl.com>) project aims to support decision making in critical situations. Mobile learning is also useful when completing tasks in an educational process, an idea that has been realized as a performance-centered mobile learning model by the mPSS project (<http://mpss.dipseil.net/>). People with disabilities also benefit from mobile technologies. Quite a few projects target learners with special needs, like the Collaborative Additional Language Learning for Dyslexic Students project (<http://www.calldysc.info/>).

2.4. European policy perspective

European Lifelong Learning policies are an integral part of the EU Information Society development programmes, and are treated as a key factor for enhancing the competitiveness of Europe in global markets. As part of the Lisbon strategy the European Commission launched the “Education and Training 2010” work programme in 2001 with various sub programmes such as the “Programme for the Effective Integration of Information and Communication Technologies (ICT) in Education and

Training Systems in Europe (2004 – 2006)”. This initiative consisted of 4 major action lines (European Council, 2009; European Parliament, 2003):

1. Promoting digital literacy
2. Establishing and supporting European digital campuses
3. Developing partnerships between schools
4. Promoting e-Learning throughout transversal actions

During the last decade, priorities of the Lisbon strategy have continuously moved towards supporting social dimensions of education and training (DG Education and Culture, Joint Research Centre, Centre for Research on Lifelong Learning, & Eurostat, 2008) and establishing the abovementioned key competencies needed for lifelong learning (European Commission, 2007). This movement concluded in the latest “strategic framework for European cooperation in education and training ‘ET2020’” notice from the European Council, which forces competency based education, creativity, social cohesion, active citizenship, mobility and innovation to become visible at all levels of education (European Council, 2009). The current lifelong learning programme (2006-2013) of the European Commission identified four target sectors for development: schools, higher education, vocational education and training, and adult education (European Parliament, 2006). Furthermore, four transversal (key) activities were envisaged, namely: policy cooperation and innovation, languages, information and communication technologies (ICT) and dissemination and exploitation of results (European Parliament, 2006). The majority of these target sectors and key activities require the use – not the development – of advanced technology.

European policy makers do not require that participants of this programme incorporate particular technologies into their activities. Their goals are different: policy makers focus on enhancing learning environments and experiences, promoting formal learning, and supporting learners in expanding their relevant skills and competencies in order to be digitally literate (European Commission, 2007).

2.5. European lifelong learning projects

Several projects have been carried out in the past in order to provide inputs for European lifelong learning policy formulation, investigating in particular the role of technology in (future) education. The main organisation behind these inputs is the European Commission Joint Research Centre – The Institute for Prospective Technological Studies (IPTS). This organisation’s Information Society unit has been engaged with European policy research for many years.

Among their past projects, eLFUT (Learning spaces in 2020: Future learning in the Knowledge-based Society in Europe enabled by Information and Communication Technology) forecasted an incremental need for fundamental transformation of education (Ala-Mutka & Punie, 2007). Development of citizens’ digital competencies, citizen’s social inclusion, the impact of web 2.0 on learning and the issue of providing learning opportunities to elderly people using ICT have also been investigated in detail, resulting in reports stimulating policy making (Ala-Mutka et al., 2009; Ala-Mutka, Malanowski, Punie, & Cabrera, 2008; Ala-Mutka, Punie, & Redecker, 2008).

The current research agenda looks into ICTs as stimuli of creativity and innovation. European legislators need to understand what skills have to be developed or upgraded in order to supply sufficient qualified workforce for future jobs, enable sustainable European economy growth and tackle unemployment (IS unit website - IPTS - JRC - EC, 2010). Projects like ICEAC (Creative Learning & Innovative Teaching: A study on Creativity and Innovation in Education in EU Member States) and FutLearn (The Future of Learning: New Ways to Learn New Skills for Future Jobs) provide outputs targeting the abovementioned objectives (IS unit website - IPTS - JRC - EC, 2008, 2009).

Besides official projects managed by the European Commission there are also several lifelong learning policy recommendations coming from professional networks. One example is the EDEN network, which is one of the largest groups of professionals active in the European eLearning area. Apart from publishing white papers on learning innovation (European ODL Liaison Committee, 2004, 2006), the network is also contributing to the European policy agenda through projects like LEARNOVATION forecasting innovation needs in learning processes and triggering dialogues among stakeholders of lifelong learning activities in Europe (LEARNOVATION Project, 2008).

3. MOTILL: Creating resources for policy and practice

One of the most important objectives of the MOTILL project has been the involvement of policy makers to promote the use of mobile technologies in lifelong learning strategies, according to local and national targets for lifelong learning in line with European benchmarks and strategic objectives. To achieve this goal, the partnership introduced policy makers to the state of the art on how mobile technologies can best support lifelong learning, as well as good practices in this field resulting from the main activities carried out in the partner countries. In this section, first we introduce the rigorous approach adopted to build the Scientific Annotated Review Database (SARD), a database that provides a comprehensive set of references to the major research initiatives and publications concerning the use of mobile technologies in Lifelong Learning, supported by integrative and critical commentary. Next, we report on the methodology adopted to design the Evaluation Grid, a methodological framework to analyse and highlight mobile learning experiences.

Considering that the SARD is aimed at researchers as well as policymakers, the partnership worked to define an appropriate methodology to ensure validity and quality of the selected papers as well as scientific reliability and quality of critical reviews. For this to happen, a rigorous approach was adopted to collect, tag, and review the selected research initiatives and publications. The project team first identified appropriate descriptive ‘common tags’ and key concepts in mLearning and Lifelong Learning and grouped these into categories; then, the tags were used to classify the research initiatives. Finally the project team designed an Evaluation Grid. The process is described below.

3.1. Identification of representative tags

The purpose of this phase was to come to an agreement about a way of classifying initiatives and publications in the area of mobile lifelong learning. To identify appropriate descriptive ‘common tags’ and key concepts, each of the project’s four partners selected and studied at least 10 papers about mobile technologies in LLL. For each paper, using a bottom-up approach, individual researchers created suitable descriptive tags. Next, collectively we defined some categories and grouped tags with a similar level of granularity. As shown in Table 1, our classification identified the

main concerns of papers on mobile-enhanced lifelong learning as belonging to 9 categories. Furthermore, for each category we identified some subcategories and a list of representative tags. Thus, the result of this phase was a group of common tags to be applied in a paper reviewing process in the subsequent phase of the project.

Position of the Table 1. – MOTILL Tag classification.

3.2. The MOTILL Scientific Annotated Review Database (SARD)

An important objective of the MOTILL project was to create a database of reviews of published papers dealing with mobile learning and lifelong learning. The purpose of this database was to make key issues and evidence from research and practice more accessible to policy-makers and other interested stakeholders. Following the Tagging phase, in order to build the SARD database, more than 40 papers were selected, tagged again and finally reviewed by the project team. A structure for each review was agreed, comprising:

- A *summary*: including the national context where the work or research took place (or ‘international’/‘European’ context), and the age of the learners. If available, the education level was considered to be useful information, e.g. first year of university.
- A comment about the *Lifelong learning context*: encapsulating the paper’s interpretation of lifelong learning (if available) and/or our own interpretation.
- A comment about *Mobile technology and learning*: including values or characteristics mentioned explicitly in the paper, followed by other opportunities or potentials we could see (e.g. supporting transitions, widening participation, development of competences, work experience capture, continuity of contact, transcending age/status/gender).
- A *Critique*: including some issues mentioned in the paper, and other issues or challenges that could arise.
- A comment about *Implications for policymakers*: any implications mentioned in the paper and other implications we could foresee. Comments were made mainly in relation to

exploiting learning opportunities, increased participation, social inclusion, difficult to reach learners, informal learning, learner choice, personalized learning, flexible learning, digital competences and communication skills.

- *Type of publication*: This could be as brief as ‘Journal article’, or slightly more elaborate, e.g. ‘An interim report with preliminary findings’.
- A selection of relevant *Tags*, taken from the classification shown in Table 1.

Moreover, in our reviews we paid attention to distinguishing between what authors had actually written in the paper and what was our interpretation. The reviews were carried out by applying a 4-phase procedure:

1. First review: The papers were split in 4 groups and assigned to each partner to be reviewed;
2. Peer review: Each review was then peer reviewed by a researcher belonging to a different partner;
3. Super review: The reviews were checked, and if necessary amended, by one designated team member, in order to guarantee a common quality level from a scientific point of view;
4. Editorial review: The super reviews were edited by the UK partner in order to improve the documents’ linguistic quality.

Finally, a list of additional relevant papers was proposed by external experts involved in the project. Eight of these papers were then reviewed, thus bringing the total to 51. The extra review phase was exactly the same as the planned review phase. A schema of the Methodology is illustrated in Figure 1.

Position of the Figure 1. Scientific Annotated Review Database methodology

The SARD creation and reviewing activity established that mobile technologies are being used in ways that support lifelong learning, or that have a clear potential to support lifelong learning. At the same time, it revealed that the potential remains under-exploited. Mobile learning projects are typically of short duration, so that support for lifelong learning can only be glimpsed or imagined, but not fully investigated or developed. Furthermore, researchers may fail to reflect fully on how their particular project, focused on school-based learning for instance, could contribute towards building a long term vision for the use of mobile technologies in lifelong learning.

3.3. The MOTILL Evaluation Grid

Following the review of published papers, the next stage of the MOTILL project focused on identifying ‘best practices’ in mobile lifelong learning by making contact with a number of mobile learning projects. The Evaluation Grid was conceived as a tool that enabled MOTILL project partners to work in a consistent manner to identify ‘best practices’ in the use of mobile technologies for lifelong learning, whilst taking national and local contexts into consideration. In particular, it was used in interviews with those involved in the best practice projects, to get more information about each instance of best practice.

The development and implementation of the Evaluation Grid enabled MOTILL partners to look at current practices in greater depth, with the aim of highlighting ‘best practice’ aspects for interested audiences such as policymakers and teachers. These practices were ones that had already been described in papers chosen for the SARD, or they were other projects and initiatives that were not represented in the scholarly literature (for example because they were very recent). Moreover, throughout the creation of the Evaluation Grid the team addressed the challenge of understanding contextual factors that may inhibit the transfer of practice.

The Evaluation Grid (Figure 2) was designed taking into account the work done by MOTILL researchers for the identification of the representative tags and the SARD described above. Starting from some of the key concepts identified in the tag categorization phase, the partnership generated 18 criteria for evaluation, grouped into the categories of Management, Pedagogy and Policy. As detailed in Table 3 in the Appendix , the criteria consist of one or more questions that can guide a

best practice in-depth examination. In the Evaluation Grid, ethical considerations are transversal to all the dimensions considered. Table 2 shows the questions used for the interviews.

Although the main focus of the Evaluation Grid is the identification of practices that support lifelong learning, it was also informed by our definition of lifelong learning, and the associated concept of ‘transitions’. Within the MOTILL project, ‘lifelong learning’ was interpreted in its broadest sense, that is, encompassing all learning activities which are engaged in throughout a person's lifespan and which facilitate the continuous development of the individual's quality of life. The aim of lifelong learning is to enhance the learner's knowledge and competencies and thereby promote active citizenship, personal development and social inclusion.

Position of the Figure 2. The Evaluation Grid

Lifelong learning involves experiences that are considered to be ‘transitions’. These are periods of change, such as:

- moving from school to higher education;
- moving between formal and informal settings (e.g. classroom and home);
- reconciling academic skills and knowledge with requirements in the workplace;
- reconciling skills and knowledge gained in vocational education with requirements in the workplace;
- reskilling and/or upskilling the workforce through adult education.

Within the MOTILL project, transitions were interpreted as transformative experiences in both society and individual development; they may be horizontal, vertical, methodological, spatial and epistemological. The Evaluation Grid's criteria interrogate how the project or initiative supports these various types of transitions.

4. Implementation of the Evaluation Grid

The aim of this phase of the project was to create the Best Practices Collection (BPC), a collection of case studies exemplifying best practices in the countries participating in the MOTILL project, as a way to share experiences and to demonstrate that mobile technologies had been used successfully to support lifelong learning. We wished to identify in each case study the elements that had worked particularly well, whilst also noting any difficulties or disappointments. It should be noted that 'best practice' is a debated term (Coffield & Edward, 2009), although it is widely used in the field of learning technology, along with terms such as 'good practice' and 'effective practice'. It reflects the demand for succinct and useful information that can act as a guide. The case studies were carried out by conducting interviews with the lead person (such as a project manager or lead academic) for each case. In addition to studying specific cases, the work for the BPC included a meta-analysis of what could be concluded by looking across all the case studies to identify common issues and lessons learnt.

Although we were conscious that this collection would not necessarily capture best practices across the whole of Europe, the project remit and resourcing determined a focus on the four partner countries. However, we wish to stress that this apparent limitation also had a positive side to it. The team felt that local examples would be more meaningful and persuasive in terms of anticipated engagement of national policymakers and education practitioners in the partner countries. Our prior experience of these audiences suggested to us that frequently they may be interested in what happens elsewhere but feel that it is not directly relevant, as the circumstances are very different. Our primary audiences for the Best Practices Collection were national policymakers and education practitioners. Nevertheless we believe the collection will also be of benefit to researchers, since nowadays researchers need to rise above their sometimes narrow focus on a specific development or idea and cultivate greater awareness of the realities of management, pedagogical design, policy implications and ethics.

4.1. Case study method

To identify a set of case studies, we began by using a collaborative online space to enable all project team members to share ‘candidate’ cases based on a general review of known and discoverable projects fitting two main criteria:

1. The projects or initiatives were not only using mobile technologies in education but also it was clear that lifelong learning was being supported in some way;
2. The projects or initiatives were sufficiently established to suggest that they would have substantial experience to share, as reflected for example in publications they had produced or information on their websites.

A ‘long list’ of 25 candidate cases was annotated according to these criteria, to facilitate final selection of up to a dozen case studies. We also strove to achieve an overall balance to include different levels of education, types of learners, and a range of ways in which technology had been used. For a while we retained the long list, knowing that in practice we would be constrained by whether projects or initiatives wanted to cooperate with us within our timescale and to be included in our BPC; therefore we had to remain flexible. Finally 11 case studies were completed and these are included in the BPC; they can be accessed freely on the MOTILL web portal and slightly shorter versions have been made available in a printed booklet (also available as a PDF file).

In nearly all cases interviews were conducted by visiting the interviewees. The questions contained in the Evaluation Grid were used as an interview schedule to ensure consistency across all case studies. We recognize that the case studies are not comprehensive accounts of each project or initiative. Although this could be considered a limitation, the value of the case studies is enhanced by bringing together a set of experiences in a consistent way to interrogate certain key aspects of their practices. The Evaluation Grid format also enables a succinct form of communication of interview findings, with the various parts of the interview being visible, ensuring a good level of transparency.

Any particular interest, for example an interest in ‘organizational support’, can be followed by reading what is reported in the relevant interview section across all of the case studies.

As shown in Table 2, the selected projects demonstrate that mobile technologies can be used to support lifelong learning in formal and informal contexts and at various stages of life. On the basis of our interpretation of the key aims of the case study projects, we can observe some recurring themes that relate to lifelong learning:

- opening up access to knowledge and resources
- establishing links between different places of learning
- supporting learners who may be excluded or at risk of dropping out
- facilitating location-based and outdoor learning
- enhancing creativity and collaboration

Position of the Table 2. Target learners and key aim of each project in the BPC

4.2 Meta-analysis of the case studies

A meta-analysis of the case studies was carried out collaboratively by MOTILL project partners with the objectives of drawing together the main points from the interviews and highlighting best practices. General considerations and suggestions on how mobile technologies can best support lifelong learning were proposed within the four categories of Management, Pedagogy, Policy and Ethical Considerations. These are briefly summarized here; full details can be obtained by referring to the downloadable PDF of the Best Practices Collection available from the MOTILL portal. In addition, we have reflected on how the case studies relate to the concept of ‘transitions’, since this is an important concept in the literature on lifelong learning.

4.2.1. Management

The projects analyzed for this collection describe a complex scenario in which the use of mobile technologies in lifelong learning is very flexible. Schools, universities and education staff have been involved in the following activities:

- Creating contents specifically designed for mobile devices;
- Setting up new pedagogies and educational practices supported by mobile technologies;
- Designing tools and infrastructures to make contents available on new channels and devices.

Although many projects have focused on the integration and testing of mobile technologies in traditional educational institutions, some projects also introduce activities aimed at meeting social needs such as mental health treatment, immigrant integration or young people's participation in cultural events. The most interesting observation about technological aspects is the role of the device in each practice: these technologies are mostly used only as a way to access, create or download particular contents. Only a few projects propose a bidirectional way of communicating, allowing learners to interact with tutors, teachers or peers while using the device. This interactive approach seems to have a positive impact on both user motivation and the creation/reinforcement of social relationships, but it introduces some management problems. These kinds of mobile learning projects require strong support from both IT specialists and educational technologists, as well as from highly skilled educational staff who feel comfortable with the technologies being used. It is in fact the teachers and trainers who may jeopardize the success of a mobile learning project in lifelong learning.

Our analysis of the collection of projects raises a number of issues that need to be considered in order to maximize the effectiveness of the mobile learning experience from a management perspective:

- Hardware and internet connection are still onerous and devices rapidly become obsolete;

- Educational staff are often lacking in technological skills and it may be expensive to train them;
- Mobile learning activities are not effective if teachers are not comfortable with the technologies being used;
- Digital content rights, policies and privacy rules need to be defined.

It is also evident from the case studies that mobile learning projects require effective procedures for monitoring quality assurance. Strong measures and indicators are needed to guarantee the quality of both the outcomes and the implemented methodologies. Guidance is available in various scientific papers (Vavoula & Sharples, 2008) in which methodologies and results have been analyzed in depth.

4.2.2. Pedagogy

The projects in this collection have utilized the unique affordances of mobile technologies to construct learning approaches in support of educational and social goals which may be summarized as follows:

In relation to learners:

- Facilitating access and social inclusion;
- Responding to learners' needs (such as collaboration) and their technology use habits;
- Enabling students to manage and direct their own learning.

In relation to contexts of learning:

- Taking learning out of the classroom and into the real world;
- Enabling construction of learning in context;
- Providing learning content based on contextual information about the user.

In relation to curricula and learning content:

- Using ontologies to create multidimensional curricula that work at scale and cater to individual needs;
- Enabling mass-customized learning content delivery;
- Helping teachers and instructors to provide personalized content for students.

A range of familiar pedagogical approaches is evident across the case studies, including behaviourism, cognitivism and constructivism; but the projects have also led to the development of new models of instruction to fulfil specific educational aims. The new models attempt to describe the agency of the learners, the various settings where learning takes place, and how it is necessary to re-think the educational process, content and objectives. The need for those in post-compulsory education to manage and direct their own learning is widely recognised as essential to their success as lifelong learners. The case studies demonstrate how the use of mobile technologies has increased learners' level of engagement with the learning activities. There is also evidence of positive impacts on learners' self-perception.

Overall the case studies show learners' positive engagement with subject matter; furthermore, it may be said that the mobile technologies have a transformative effect upon the subject matters involved and the traditional boundaries between them. The LOGOS and Contsens projects have also considered pedagogy as a means to validate technological developments, but what is notable is that both projects have used ontologies in order to give a structural description of pilot courses. Ontologies have great benefits in education as descriptors, and with the help of ontologies it is possible to create a multidimensional curricula model which both enables mass-customized learning content delivery and helps teachers and instructors to provide highly personalized learning content for students.

4.2.3. Policy

Policy related findings cover a wide range of economic and social problems, where mobile learning can make a positive contribution. However, policymakers should also keep in mind that, just like any other solution, mobile learning only works if there is sufficient financial backing. To sum up the most important policy related factors, the MOTILL project created the following list:

Educational challenges:

- national accreditation and acknowledgment of mobilized courses is still problematic;
- mobile learning addresses problems regarding the organization of educational curricula, which need to be solved;

- open content initiatives proved to be viable.

Social challenges:

- m-learning initiatives are tackling horizontal lifelong learning policies, like discrimination based on race, religion, location, health or age;
- through lifelong learning processes m-learning applications can favour social groups which are at risk of being marginalized;
- m-learning may have a significant impact on social inclusion of immigrants across Europe;
- mobile technology in education works towards widening participation in educational activities.

Financial challenges:

- there are models and good examples for cheap mobile learning;
- however, new forms of funding are necessary, as institutions have great difficulties when integrating the latest technology into their administrative and educational processes.

4.2.4. Ethical considerations

Ethical issues emerging from our analysis can be categorized under three main headings: Accessibility, Privacy and Security, and Copyright.

Accessibility

Where lack of access to mobile technologies would lead to an inability to engage with the learning experience, mobile devices were provided to the learners. However, where the provision of a mobile device in order to facilitate engagement with the learning experience could be perceived as detrimental to the learners' perceptions of the experience, their own devices were used. Keeping the cost of using mobile technologies to a minimum was an ethical consideration for the projects. As the proliferation of mobile technologies was not considered universal, for some of the projects the learning activities performed a supplementary role and other means of access to the learning experience were provided. An alternate means of access to the experience was also an ethical

consideration arising from concerns about the literacy of users in relation to using mobile technologies. Furthermore, care had to be taken not to undermine the ethos of the learning institutions' approach to mobile technologies. This was particularly evident in projects in schools and museums. Modifications to the learning experience in order to support access by learners with physical and cognitive disabilities were also undertaken to foster inclusion.

Privacy and Security

The provision of private and secure learning environments for learners was a prevalent ethical concern. Many initiatives were undertaken to protect the privacy of all partners in the learning experiences. The limitation of the functions of the devices used, the anonymity of users, and adequate mentoring and monitoring of technology use were all employed to alleviate these concerns. The use of mobile technologies to communicate with learners can be perceived as an invasion of privacy and this concern was usually addressed through consultation with the learners. The ethical use of images, video and sound recordings obtained by learners using the mobile phone was another area that needed to be addressed.

Copyright

The need to adhere to the relevant copyright and media ownership issues while incorporating mobile technologies for learning, raised ethical issues. These issues were addressed by obtaining permission to use the material from the owner, the development of unique material and the use of material available under creative commons licensing.

4.2.5. Transitions

In addition to the above analysis, we were interested in how the case studies highlighted various ways in which projects had addressed the idea of 'transitions', given the importance of this concept in explorations of lifelong learning (Field, 2006; Field, Gallacher & Ingram, 2009; Ecclestone, Biesta, & Hughes, 2010). The relevant literature deals largely with inter-institutional and intra-institutional transitions; inter-cultural transitions in learning; and transitions between non-formal/informal and formal contexts. We were able to see these classic themes reflected in our case studies, although inter-cultural transition was only discernable in the language learning case study.

Lifelong learning for career change and in the third age are also increasingly on the research agenda in lifelong learning, however there is as yet little in the way of published or formal evidence that mobile technologies are being employed to support transitions relating to career change and late-life learning.

Within our set of case studies, transition was conceptualized in the following ways:

- Transition between formal and informal learning, e.g.,
 - the *MoULe* case study describes transitions through experimental activities based on alternating onsite and classroom learning, and through the use of both mobile devices and computers;
 - *Ensemble* shows how mp3 devices allow young students to move from formal learning strategies in the classroom towards informal learning opportunities occurring outside of school, although it is noted that currently the informal learning occasions are strictly related to something occurring in a formal educational setting, and are sometimes dependent on an activity performed in the classroom;
 - *Bletchley Park Text* focuses on the transition between the museum environment and learning opportunities in the classroom or home; this activity may be entirely controlled by the learner (e.g. on a casual visit) or it may be partly managed by a teacher (e.g. on a school visit);
 - The appeal of real life learning is exploited in the *Fón* project, which extends the context for increasing fluency in a spoken language out of the classroom and into real conversations supported by mobile technologies. Transition is conceptualized here in terms of moving from knowledge acquisition to a situated learning experience;
 - In *Contsens*, students were free to discover content as they wished, without time constraints; this explorative learning method helped them to be more individual in their learning, which was deemed a great achievement compared to traditional education.
- Transition between different levels of education, e.g.,

- The *Bath SMS* case study is concerned with the transition students make from school or college to university, the latter having a different emphasis on self-motivation and self-organisation and often involving new subjects and new forms of study. The mobile SMS system in this case provides guidance, structure and motivation in the early phases of the first year of a degree course. Furthermore, it helps students to negotiate the division between the face-to-face parts of the course and interaction which takes place within the university's Virtual Learning Environment;
- In the *WoLF* case study, learners make a significant transition from foundation level to degree level study. By improving the quality of their portfolio and providing opportunities for formative and summative feedback, the PDAs used by the student teachers gave them a better chance of making the transition to a full degree programme. By encouraging them to share their experiences of different working contexts, the PDA also facilitated reflective and collaborative learning, giving them a better idea of what to expect in the workplace.
- Transition as progression towards social inclusion, e.g.,
 - In the *Federica* case study, a project which targets prospective students amongst others, the intention is to introduce the use of mobile technologies in a progressive manner, allowing even those who are economically disadvantaged to be able to use low cost resources, but also catering for those who use high specification mobile devices, e.g. professionals;
 - The *Mobile Mood Diary* supports a transition from illness to wellness which enables learners to fully participate in society;
 - Finally, *mobileDNA* supports transitions from solo and uncreative work to collaborative creative interactions, and between extra-curricular activity and mainstream education, thereby helping towards inclusion.

5. Conclusion

The MOTILL project enabled us to investigate the relationship between mobile technologies and lifelong learning in a European policy context, in a focused way that had not been attempted before. We developed a series of methodologically distinctive, highly collaborative research and analysis activities, resulting in quality-assessed resources that are now freely available to the international community of researchers, policy-makers and education practitioners. Mobile learning is a thriving field of research, and increasingly, a common way of learning, thanks to wide ownership of mobile phones and other portable technologies. Our critical reviews and case studies lead us to conclude that mobile technologies are an important, accessible means of supporting learning activities and interactions that are conducive to the long-term development of lifelong learning.

Furthermore, these results also embed the possibilities of influencing education related policy making both on national and European levels. An extensive database of academic literature, practical considerations and policy-related issues connected to the key phenomenon of mobile learning, provides a solid ground for selecting topics that need to be in the spotlight of policy makers. Academics, practitioners and most importantly learners need proper engagement with controversial themes in public discussions, which - based on evidence in a MOTILL-like database - is a possible and sustainable objective. We believe that all stakeholders in education can profit from our evidence based approach, nevertheless this approach is still in its infancy. As MOTILL has been a proof of concept study, further work needs to be done in order to enlarge and keep the MOTILL database up to date. Also, a technical improvement of the MOTILL community website should be envisaged, targeting the structural foundations of the information repository, using taxonomies, ontologies or other knowledge management tools, in order to continue with this evidence based (mobile) learning approach.

Besides content and technology, an emphasis should be given to the networking element of the mobile learning community. With a critical mass of users in the background, the MOTILL approach has the potential to assist mobile learning networks to articulate their views on problematic areas in policy formulation and deployment. Improving the lobbying power of the mobile learning community is a key concern, as this field still lacks visibility in policy making, which definitely hinders the wider exploitation of good practices. Influencing policy makers is an obvious issue for

stakeholders in mobile learning, as it is difficult to find proper channels of communication with those people. This evidence based approach however, may help to deconstruct communication barriers between theory, practice and policy, suggesting a common and inclusive way of talking about various segments of mobile technology assisted education.

We also believe that the increasing everyday use of mobile technologies will create its own momentum that will assist informal lifelong learning. However, a more sophisticated understanding of the interactions between formal and informal contexts, and continued identification of subtle points of transition, are necessary if we are to give learners the best chance of a supportive learning journey throughout their lives. Further refinement and elaboration of the Evaluation Grid and the SARD developed within the context of the MOTILL project would contribute towards the achievement of those objectives. In particular, the scope of the SARD should be extended to encompass the many mobile LLL initiatives not reported in scholarly literature. The Evaluation Grid, being a tool that enables the identification and assessment of mobile LLL good practice, can be used towards this end.

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7. Appendix

Position of the Table 3. The Evaluation Grid - Criteria for evaluation.

Table and Figure Captions

Table 1. MOTILL Tag classification.

Table 2. Target learners and key aim of each project in the BPC

Table 3. The Evaluation Grid - Criteria for evaluation.

Figure 1. Scientific Annotated Review Database methodology

Figure 2. The Evaluation Grid

Categories	Subcategories	Tags
Learning, pedagogical support, and related theories	5	21
Technologies and media	11	71
Learners	4	19
Contexts of learning experiences	4	13
Behaviours, activities and processes	7	13
Subjects being learnt	1	1
Competences	1	9
Political, economic and social issues related to LLL	1	9
Research methodologies and data analysis	3	10

Table 1. MOTILL Tag classification.

	Learners	Key aim
MoULe	Schoolchildren	To facilitate outdoor learning and collaboration
FÓN	Schoolchildren	To support language learning for life
Federica	Prospective students and others	To open up access to advanced knowledge
LOGOS	Students and adults	To enable flexible access to courseware and objects from repositories
BathSMS	Students	To support students entering university
WoLF	Students (trainee teachers)	To link college and work-based learning
Bletchley Park Text	Children and adults (museum visitors)	To personalize learning and link museum visit with school or home
Contsens	Students and adults	To enable context-sensitive and location-based learning
Ensemble	Young and adult migrants	To support integration and active citizenship by using everyday tools
MobileDNA	Young people	To support extracurricular or outreach activity and collaboration
Mobile Mood Diary	Young people	To support self-monitoring for long term health care

Table 2. Target learners and key aim of each project in the BPC

MANAGEMENT	
1. Rationale	
	What is the rationale for this new practice or innovation? Why was it introduced?
2. Technologies and media utilized	
	Specifically which technologies and media are used, and how?
3. Stakeholder & Agency	
	Who is involved in this practice? Who initiates the practice: the learner or another party? Who manages the practice: the learner or another party?
4. Organizational support	
	Who provides support for this practice? What are their roles? What is required to conduct this practice? (e.g. Staff, equipment, expertise, venue, funding etc) Does this practice have a sponsor/funding? What are the costs of implementation (for the organization and the learners)?
5. Risk Assessment	
	What are the main challenges faced by this practice? How have these been addressed? How could they be overcome more efficiently?
6. Supporting transitions	
	Specifically how do mobile technologies support transitions at the level of educational practices? (e.g. between formal and informal learning, between one level of learning and the next)
7. Achievement of economic goals	
	What economic challenges/issues does this practice address? What problems does it solve? Are these local or national?
8. Quality Assurance	
	What is the value of this innovation? Has it been evaluated or researched? Has the evaluation or research been reported & how? What were the findings? Is there evidence of quality? What is

the best of this innovation? What needs to be improved & how could it be improved?
PEDAGOGY
9. Pedagogical support
What pedagogical approach is used? What pedagogical resources? How does this practice support or enhance teaching and learning?
10. Impact on subjects being learnt
How is the subject or discipline changed by the use of mobile technology?
11. Learning behaviours, activities and processes
How does learning take place? What are the learners doing and why? To what extent do learners initiate and manage their learning?
12. Development of competences
What skills and competences are learners acquiring through the use of mobile technology?
13. Achievement of educational goals
What political educational challenges/issues does this practice address? What problems does it solve? Are these local or national?
14. Support for learning across contexts
What are the physical and social contexts in which this practice takes place? (classroom, workplace, outdoors, virtual; individuals, groups, etc...) How are learners enabled to make connections and transitions between contexts?
POLICY
15. Achievement of political and social goals
What political and social challenges/issues does this practice address? What problems does it solve? Are these local or national?
16. Evidence of transferability
To what extent is this practice transferable to other contexts (local, national, international)? Is

there evidence of transferability? Is there potential?
17. Significance for policy-makers
What makes this practice important, i.e. what is its local, national or international significance? (for example in terms of its actual or potential impact)
18. Supporting lifelong-learning
Specifically how do mobile technologies support social and cultural transitions? (e.g. social mobility, inclusion, lifelong learning)
ETHICAL CONSIDERATIONS
Were there any ethical considerations when planning, implementing and/or evaluating the project? (e.g. copyright, accessibility, privacy)

Table 3. The Evaluation Grid - Criteria for evaluation.

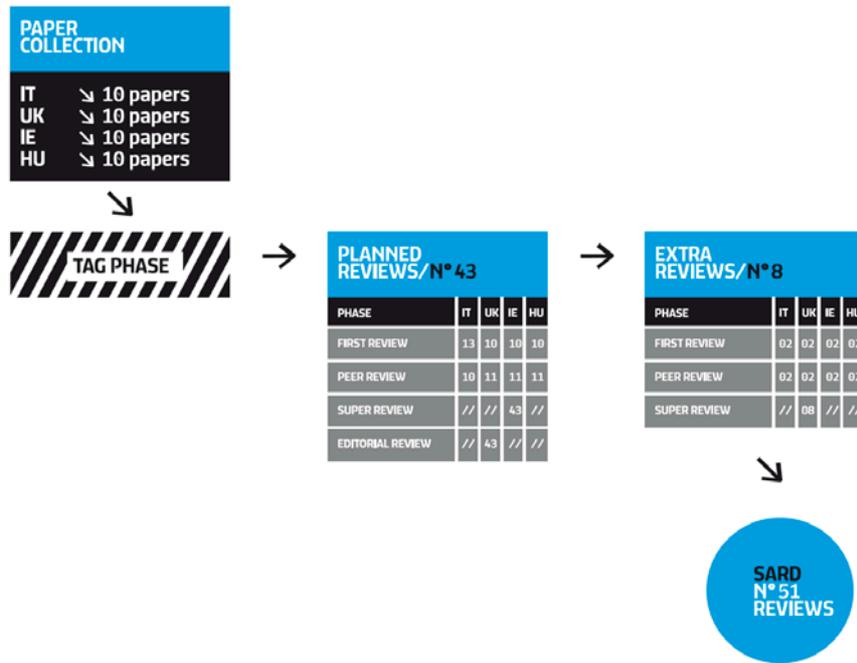


Figure 1. Scientific Annotated Review Database methodology

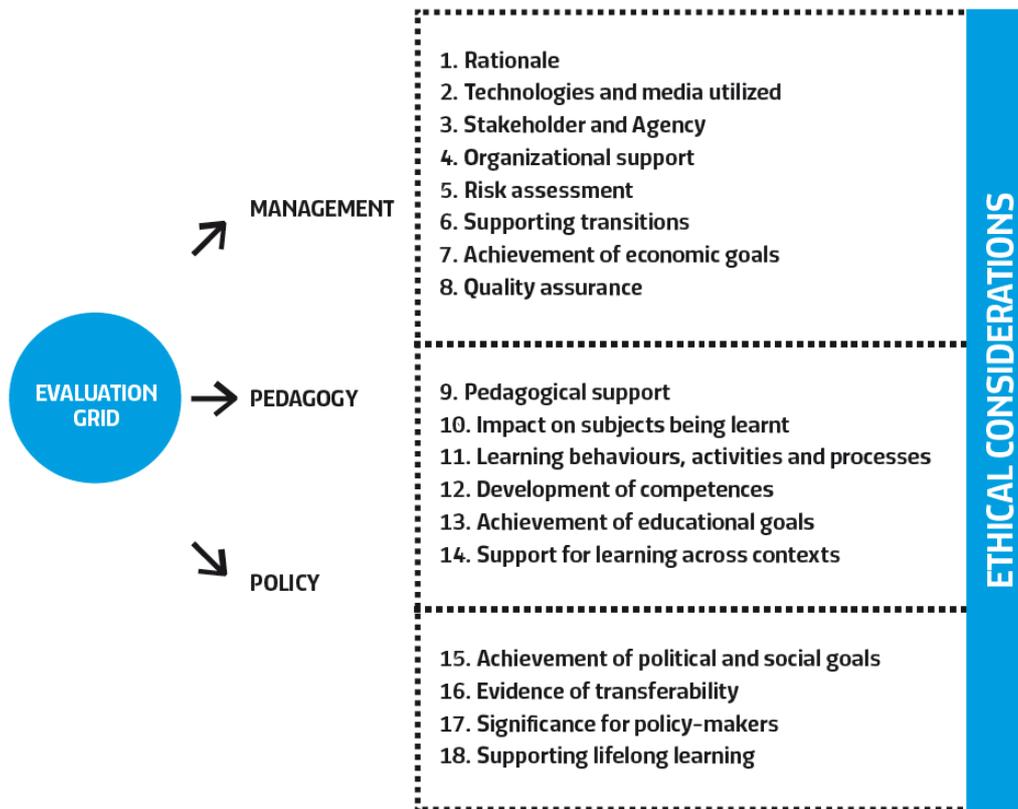


Figure 2. The Evaluation Grid