A task-centred approach to evaluating a mobile learning environment for pedagogical soundness

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Abstract

The focus of this paper is how to evaluate the pedagogical soundness of a mobile learning environment in which many users (both teachers and learners) may not have previously encountered mobile technology, so may be uncertain how best to deploy it to achieve their goals. Drawing on concepts from Activity Theory and the socio-cognitive engineering method described by Sharples (2000), it describes an approach which enables an enriched view of users' current and future activities, which in turn will allow us to understand the range of actions and opportunities open to mobile learners, and seek ways of extending this range to support what learners want to do – even if they themselves do not yet know what that is.

Keywords: learning, socio-cognitive engineering, Activity Theory, pedagogy, evaluation, mobile environments

1. Introduction

A major goal of the worldwide, European-led research and development project MOBIlearn is:

> *the creation of a virtual network for the diffusion of knowledge and learning via a mobile environment where, through common themes, it is possible to demonstrate the convergence and merging of learning supported by new technology, knowledge management, and new forms of mobile communication.*
>
> MOBIlearn Technical Annex 1, page 7

The project aims to evaluate the pedagogic effectiveness of the learning environment thus developed to ensure that it is sound. Although there are tried and tested methods for pedagogic evaluation of specific applications of technology for learning (eg Draper *et al*. 1996; Scanlon *et al*. 2000), there are no existing comprehensive frameworks for broader formative evaluation in the mobile environment, largely because of its novelty – relatively few teachers and learners have experience of working in this way, so we are simultaneously introducing new ways of engaging in learning with new artefacts *and* evaluating technical and pedagogic effectiveness. This requires careful consideration so as not to skew the evaluation data gathered from users, who may find themselves fascinated by the new devices in a way which they may find interesting, and even fun, but which produces no lasting valuable impact on their work practices. They may simply then avoid using the technology 'in anger' once the evaluation study is complete.

Therefore, to make progress in achieving our goals, we must develop a thorough understanding of:

- the learning opportunities presented by the new mobile technology
- its (potential) impact on the way people perform learning tasks
- its (potential) impact on human social processes and interactions
- how these in turn are changed or modified by the technology.

In the rest of this paper we briefly indicate how it is possible to develop this understanding driven by task-centred user requirements rather than technological advances, so describing the approach that underpins our evaluation strategy for MOBIlearn.

2. Pedagogy in the mobile environment

Developments in pedagogy have moved away from the transmissive mode of teaching and learning and toward the constructivist or socio-cognitive models, placing the active learner at the heart of activities. In this view learning is:

> *a personal idiosyncratic experience, characterised by individuals developing knowledge and understanding it through the forming and re-forming of concepts. The focus of constructivism is on learner control, with learners making decisions that match their own cognitive states and needs.*

The socio-cognitive view would also add that learning takes place in a social context (see Rogers 2002), and the forming and re-forming of concepts need not necessarily take place only at the level of the individual. Collaborative group work and sharing with peers (and others) can be a powerful way of confronting one's own conceptions (pre-conceptions), contributing to the perceived need to restructure one's cognitive schemas. So learning can be perceived as being as much about communication as it is about content. In fact, some more radical pedagogical approaches, facilitated by mobile computing, would go a step further, and suggest that no content is a useful starting point for learning. A group of learners may decide themselves what they are going to learn, and how they are going to learn it, bringing their own material to bear in whatever way they feel appropriate. The MOBIlearn project embraces this view of learning, with its emphasis on rapid communication and access to resources.

In this context, however, although usability is an important issue for evaluators, it is not enough to say that because the usability requirements have been satisfied, the MOBIlearn project has been successful from the pedagogic perspective. Pedagogical evaluation demands to understand not only whether or not a learner has succeeded in learning, but *why*. Understanding the reasons for success or failure depends on deep knowledge of the appropriate relationship of tasks to technology – an area of knowledge that spans both the pedagogic/educational, and the technical fields.

From the point of view of usability, educators and learners have raised the concern that the handheld elements of the mobile environment have very small screens which do not facilitate easy access to text, and small keyboards which impede input of, or annotation of, content and do not support skim reading (see Kukulska-Hulme 2002). These are real ergonomic concerns but they are not fatal for the learning enterprise because it depends what role the handheld is playing in the activity. For example, few would argue that using a current personal digital assistant (PDA) as an ersatz laptop, to access and read large documents, is an optimal use of the device. However, using the PDA to find or share documents to download onto a desk-top or lap-top computer for later perusal is perfectly feasible. We must beware trying to make devices perform beyond their capacity to deliver what is required, but, rather, we should examine potential activities that could be supported, and evaluate the pedagogic benefits of these activities, which may be distributed across several devices. The whole experience needs to be evaluated, not just the component parts. This will mean ensuring that mobile technologies are used appropriately to exploit their potential, for example supporting activities that might simply be impossible without them. This is quite a challenge for evaluation because we have to recognise that the integration of new tools into existing activities creates a dialectic – the tool introduces new possibilities for action, and new constraints (see Waycott *et al.* 2002) which change how the activity is performed.

We must also take into account that, in adopting the human-centred view, it would be philosophically unacceptable for us to disregard learners' existing tasks and their structures, and impose tasks upon them that we as designers or teachers think are 'beneficial' – ie possibly favouring the capabilities of the technology rather than the users. As stated earlier, the active learner is at the heart of the enterprise, so we need to observe and analyse the effect of technology on learner actions, activities, intentions and goals as they engage in learning. Sometimes they will change, for good reason; sometimes they will not.

3. Understanding activities

Addressing this issue, we have adopted the socio-cognitive engineering method for system design (Sharples 2000; Sharples *et al.* 2002) which describes a two-stage process: first, **activity analysis** sets constraints on the system design and analyses how people work and interact with their current tools and technologies; and, second, **design of new technology** is integrated into the user's or learner's environment and activity structures. One technique for activity analysis is the Future Technology Workshop (Vavoula *et al.* 2002). In these workshops, participants are encouraged to consider the range of, and benefits of, their existing activities before being supported in thinking about how those activities could be more effective when supported by new technologies and services. This allows participants to approach the concept of a new activity structure in a way that has their goals at the forefront of the discussion, rather than subsumed beneath the glamour and glitz of new technology. In addition to this method, an Activity Theory view (see Mwanza 2001) informs our analysis of the environment in which the activities are taking place, other potential collaborators in

the activity, and the ways in which organisational requirements can impinge on those activities.

Through this enriched view of users and their current and future activities, in which learning is viewed as a distributed activity, we can better understand the range of actions and opportunities on offer to mobile learners, and seek ways of extending this range to support what learners want to do – even if they themselves do not yet know what that is. This broadening of the scope of the 'learning system' enables a much deeper understanding of users' needs, and the constraints that govern their behaviour.

From the evaluator's point of view, then, the task is to evaluate the effectiveness with which learners are able to achieve their goals, and complete learning activities, irrespective of the specific devices that might have been used in doing so. Indeed, the same or similar activities could be instantiated in a variety of different ways depending on availability of technical support (eg access to wireless Local Area Network, LAN) and user preferences. In so doing, we will necessarily be evaluating the validity of the tasks themselves as vehicles for learning.

4. Conclusion

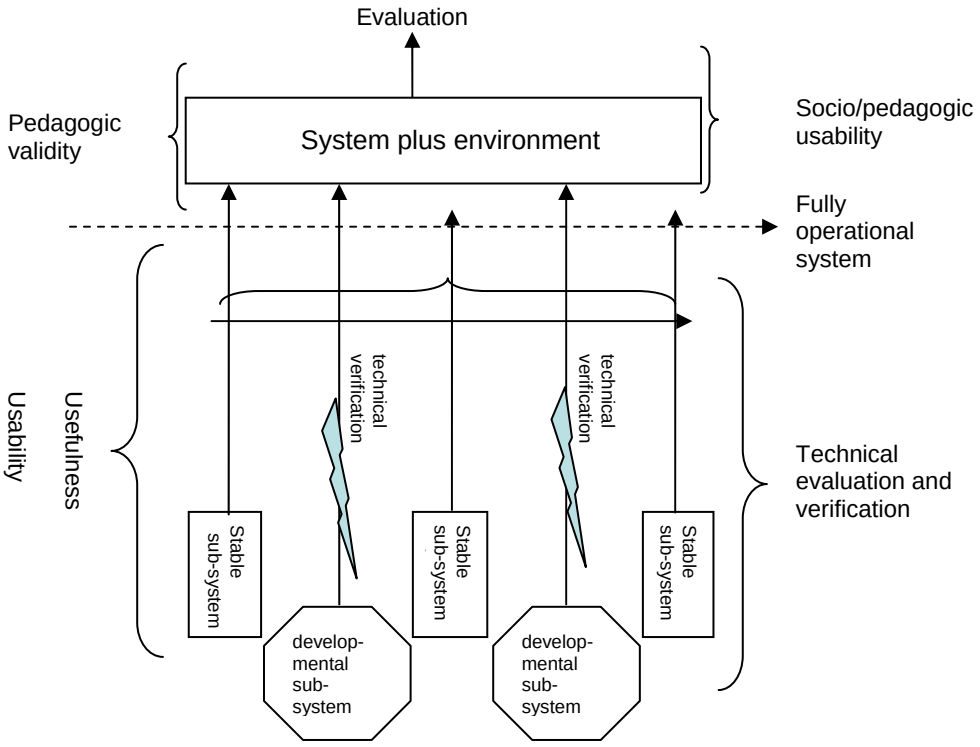
The evaluation framework for the MOBIlearn project is driven both top-down and bottom-up. The theoretical perspectives of Activity Theory and constructivism, here represented by the socio-cognitive method, allow us to analyse learners in their appropriate contexts and to understand the nature of their learning tasks, and how they go about them.

The Future Technology Workshops provide us with much useful data on the views of potential mobile learners and what they see as crucial elements in their learning activities. At the same time, usability studies are, of course, essential. As the MOBIlearn system is being developed, standard usability testing is being performed on component software and devices, in parallel with higher-level evaluations of pedagogic benefit.

Figure 1 illustrates the complexity of the task before us. At the bottom levels are sub-systems being purpose-built for the MOBIlearn system. These need to be technically verified and tested.

There are also existing sub-systems being deployed within the overall architecture which we can assume have already been technically validated. When we have brought all the sub-systems up to a common level, we will test the communication protocols between them, both in pairs and all together. At this point, we will have a basic instantiation of the MOBIlearn system.

Figure 1: The evaluation framework for an instantiation of the abstract framework

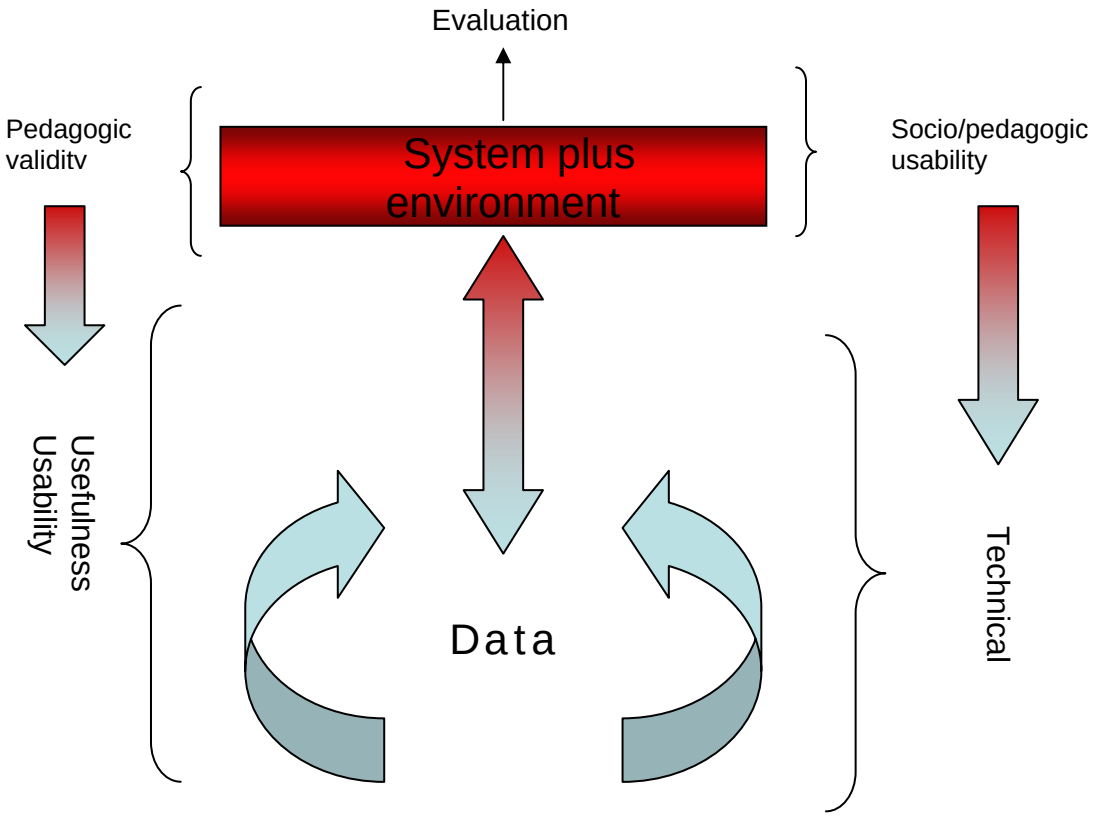


But, of course, that is only half the story. We then need to embed that system in an environment that can be used for our learning purposes. At that point, we will begin to engage in the higher-level evaluation involving socio-pedagogic perspectives and pedagogic validity.

The important point to remember is captured in Figure 2, which illustrates the flow of evaluation data around the system. Here we can see that the more technical testing, which might very well involve users, flows information up to the higher levels of the evaluation design. In turn, the more abstract analyses – meaning those further distant from the actual implementation issues – are flowing data down to inform the design.

A key issue for the project in the future will be to ensure that the two levels can meet intelligently in the middle with a mutually informing discourse. We believe that the task-centred approach will facilitate this marriage.

Figure 2: Flow of evaluation data around the MOBIlearn system



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