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Mobile learning

towards a research agenda

Editor: Norbert Pachler

WLE Centre

Occasional Papers in

Work-based Learning 1

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Work-based learning for education professionals
A Centre for Excellence at the Institute of Education

ISSN 1753-3385 2007

The WLE Centre, Institute of Education,
20 Bedford Way, London WC1H 0AL
ISSN 1753-3385

Design: rfportfolio.com
Printed in Great Britain by:
Elanders Hindson Ltd, North Tyneside

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Contents:

Editorial

In addition to developing our understanding of work-based learning in both its forms, work-related and work-located, the WLE Centre for Excellence in Work-based Learning at the Institute of Education, University of London has as part of its mission a commitment to innovating approaches to teaching, learning and assessment.

It is with this in mind that I am particularly pleased to be able to introduce here the inaugural issue of the WLE Centre's Occasional Papers in Work-based Learning. The issue features a selection of research papers presented at a symposium on mobile learning which was organised by and took place at the WLE Centre on February 9th 2007 and brought together leading researchers and practitioners in the field from the UK and Continental Europe. Presentations of the talks given on the day can be downloaded from the WLE Centre website at www.wlecentre.ac.uk (Section 'Resources', Sub-section 'Seminar materials') and it is also possible to request a DVD featuring a number of the sessions through the website while stocks last.

Unlike many other events on mobile learning, the symposium deliberately focused on learning, rather than on technology, and contributions came from invited speakers, rather than through an open call. The symposium attempted to take stock of where m-learning was at as a field of research as well as to start to delineated a future research agenda, which is exactly what the various contributions to this volume, in their different ways, attempt to do. This is particularly important, I would argue, in view of the considerable challenges that confront research into m-learning such as: the relative breadth of possible definitional bases, the rapid obsolescence of relevant technologies, its temporal and geographical distributedness, the lack of appropriacy of traditional research paradigms or the complex ethical issues involved.

The symposium as well as this publication testify to the fact that the field of m-learning has outgrown its infancy and is a maturing field in research terms as well as in terms of its conceptualisation and I hope you will concur with my contention that this publication makes an important contribution to the development of the field.

Dr Norbert Pachler
Co-Director, WLE Centre for Excellence
London, September 2007

Chapter 1
Thinking about the 'm' in m-learning

Gunther Kress and Norbert Pachler
Institute of Education, London

Contemporary environments of learning

There is, in educational contexts, a justified intensity of interest around the effects of digital, in particular portable technologies, in all manner of ways. There is a promise of greater 'reach', of more and easier access, of a kind of democratisation of education, a sense not just of a transformation, but a revolution of wide- and far-reaching areas of the educational world. The emergence of these technologies is accompanied by economic, political and social changes, which are related and connected everywhere, and, if anything, more profound in their effects; this heightens both the effects and the expectations. At the same time, social, political and economic changes are coming together with pedagogic changes at a breathtaking pace, and so it is, maybe, little wonder that the responses are equally breathless.

The social, political and economic effects are often gathered under the banner of 'globalisation'; they are multiple, often contradictory or at least in tension with each other, difficult to untangle, and seemingly impossible to control. In this chapter we want to show some of their effects on and in education in order to set the ground for a discussion around technologies and education. In any one locality – and for the purposes of our discussion here – we might say that together they amount to a transfer of power from state to market, so much so that in some places – the UK being one such – the state seems to have the role of being that of servant of the market.

Kress, G & Pachler, N Thinking about the 'm' in m-learning
In: Pachler, N (ed) (2007) Mobile learning: towards a research agenda.
London: WLE Centre, IoE

State and market once had quite different aims and goals, and as far as the education 'system' was concerned profoundly different effects therefore. The (19th-century) nation-state, in Europe at least, needed the education system to produce 'citizens' for the purposes of the state and a labour-force for the national economy. We will not attempt to sketch the meanings and values promulgated in such education systems, nor their effects; suffice it to say that they aimed at a kind of homogeneity through the notion of the citizen, and in many ways similar to the values held as essential for the labour-force.

The market differs profoundly in both respects; it has no interest in the production of a labour-force: it needs consumers; and where the state wanted – for its reasons – a high degree of homogeneity, the market in its contemporary form is interested in a high degree of differentiation. These differences have profound effects for education. Our case here is that any assessment of the effects of technologies on education have to be set in this frame, for they set the foundations of the environments of education in which technologies can become active, and in which their use is shaped. With the market as the ruling, dominant social model, identity is shaped through consumption, rather than through the achievement of a place in a social structure and a place in the labour-force. Agency is exercised as choice from commodities provided by the market. These factors become naturalised as the ruling social model and, once naturalised, become the dominant effects and forces in education, itself now experienced and lived in terms of the market.

In an educational context, the model of choice in the market makes learners into consumers, and all that pertains to the structures and experiences of consumption now becomes a feature of educational processes. The move

from teaching to learning, from the authority of the teacher to the agency of the learner, is the effect of the naturalisation of the market model in the domain of education. Teachers held scarce resources, and had the authority to dispense them. The contemporary form of the market does not know scarcity, whatever the commodity; rather it poses the problem of choice. In marketised education *learning* is *consumption*. Now all the emphasis is on the agency that attaches to choice, on the agency of the learner as consumer rather than the authority of the teacher.

In this context, digital technologies hold out the promise of unlimited access to educational commodities and of the consumer-learner's sovereignty of choice. But of course, the perspective of the learner/chooser is not the only one. The state as the servant of the market is highly interested in speeding a development which seems to hold the promise of significant saving in resources. That phenomenon, too, is not limited to education: in all social domains, the neo-liberal state attempts to reduce its commitments: whether in social services, pensions, health, whatever, increasingly the requirement on individuals is that they should assume responsibility for their own affairs.

In other words, the centrality of 'learning' is everywhere entrenched as a part of contemporary social/political trends; the digital technologies offer the seemingly best chance to achieve much of this in the domain of education. Our chapter attempts to examine what actually is entailed in this, as an advance or a benefit; or what might be surface, glass beads offered to the natives, glitter without substance. We take the case of mobile-learning as our example, though we believe that it can stand in for many, most or maybe all others.

The question of affordances: characteristics and potential of digital technologies

The intensity of interest in digital technologies is also to a large extent motivated by a certain fascination with, even fetishisation of technology by parts of society, in particular policy-makers. Perpetual developments in technology, coupled with its continued reduction in size, have resulted in an unabated integration of technology into social and cultural practices, for example leading to the possession of technological gadgetry as a status symbol.

In the literature this fetishisation of (digital) technology, depending on the author's point of view, is often conceptualised either as technological versus social determinism or as utopia versus dystopia.

Bruce and Hogan (1998) rightly point out that technologies should be viewed as ideological tools which embody social values and that they are organic "because they merge with our social, physical, and social beings". The question for them is one of how technologies are realised in particular settings and whether they become so embedded and integrated in our lives, discourses and activities that they become invisible. Bruce and Hogan also point out that effective use of technologies becomes the norm and a lack of an ability to use them can become a (negative) social and cultural marker. This consequence represents a particular danger of the **'disappearance' of technology** and is inherent in its increasing integration of digital artefacts in the 'ecology' of everyday life.

They conclude that it is less useful to focus on the technical attributes per se, instead there is a need to understand the ways in which ideology is embedded within technology.

> To understand what a technology means, we must examine how it is designed, interpreted, employed, constructed, and reconstructed through value-laden daily practices. (Bruce and Hogan, 1998)

This recommendation notwithstanding, and despite some questioning of the usefulness of the notion of 'affordance' as a metaphor (Oliver, 2005), we want to examine, albeit briefly, some of the characteristics, properties, potentials and implications of digital technologies here.

Recent years have seen a growth in the social networking capability of web-based services, known as 'Semantic Web' or 'Web 2.0'. These terms refer to online collaboration tools, such as photo- and video-sharing services, pod- and video-casting, weblogs, wikis, social bookmarking, syndication of site content etc, which facilitate the sharing of content by users. In other words, they characterise a fundamental **shift in agency** from broadcast to content generation, a decentralisation of resource provision and, as the Wikipedia entry on Web 2 dated March 23, 2007 suggests (http://en.wikipedia.org/wiki/Web_2), an enhanced organisation and categorisation of content with an emphasis on 'deeplinking'. The shift in agency is also one of user-led media content consumption, for example, with users increasingly selecting what information to access and what music and films to watch and when.

New generation digital technologies can also be characterised by a **new breed of users**. Bruns (2007, p. 3) refers to them as 'Generation C' which, according to him, is best understood as a loose grouping of participants who share a set of common aims and practices around user-led content creation communities. They 'occupy a hybrid, user-and-producer position which can be described usefully as that of

a produser' which can be seen to be characterised by the following:

- Community-Based – produsage proceeds from the assumption that the community as a whole, if sufficiently large and varied, can contribute more than a closed team of producers, however qualified they may be.
- Fluid Roles – produsers participate as is appropriate to their personal skills, interests, and knowledges; this changes as the produsage project proceeds.
- Unfinished Artefacts – content artefacts in produsage projects are continually under development, and therefore always unfinished; their development follows evolutionary, iterative, palimpsestic paths.
- Common Property, Individual Merit – contributors permit (non-commercial) community use, adaptation, and further development of their intellectual property, and are rewarded by the status capital they gain through this process. (Bruns, 2007, p. 4)

In short, the characteristics of (the effective use of) new digital technologies revolve around a combination of technology- and user-related factors. They all bring with them challenges for users in general, and those in educational contexts in particular, be they formal or informal. One such challenge, for example, surrounds the physicality of the devices: due to their small size the amount of data that can be displayed at any one time and the ease with which it can be manipulated is limited. They include:

flexibility and portability: digital technologies are characterised by their relatively small size which makes them readily portable and,

therefore usable anywhere anytime. Increasingly they offer connectivity and networking. Being digital they allow resources to be easily modified, presented and re-presented according to changing needs and user groups.

multifunctionality and technical convergence: mobile devices now normally bring together more than one function. Whereas only recently separate devices were needed to listen to music, look at images and watch video, maintain a calendar and contact list, view computer files created by different software packages, read e-mails, view webpages etc, these functions are now readily available at affordable prices as single small devices. This characteristic includes availability on demand as well as the creation of content 'on the fly', i.e. in real time.

multimodality: digital technologies allow content to be presented using a diverse range of systems of representation and a combination of different semiotic means of meaning-making. Digital video, for example, allows learners to create representations of themselves and the way they see and interact with the world, for example in the form of narratives or documentaries that are not based on traditional notions of textuality.

nonlinearity: hyperlinking, i.e. the ability to break up sequential ordering of information / pages / screens and allow lateral connections intra- and intertextually, between related as well as unrelated documents / artefacts, allows for unprecedented levels of interconnectedness and possible synergies.

interactivity and communicative potential: mobile devices allow for new forms of creative relations between people on the basis of reciprocity and negotiation, in writing and in speech, in real time (synchronously)

or delayed (asynchronously). Exchanges can be recorded, stored and analysed post hoc; overcoming the ephemerality hitherto of spoken interaction. Communication between a number of interlocutors can occur concurrently and multi-directionally, with different conversational fragments being interwoven.

There are larger level social consequences. Digital technologies and their affordance have a significant socio-cultural impact which we want to allude to by raising some questions even if we do not provide answers to them here. In particular, the question needs asking to what extent they can, or already have, become a prosthesis for some users and what their impact is on notions of the self and society. To what extent do, can and should they govern the way in which we perceive and apperceive the world around us? What is the impact of the (seeming) fracturing of the self into multiple identities as well as the membership of a wide range of user groups and communities of practice? How important for notions of society is the lack of shared cultural experiences as a consequence of a move away from a centrally determined broadcast content and media of transmission and the move towards a 'distributed' culture and a model of knowledge assembly? What of the increased fragmentation of mainstream culture into scenes, and the sub-cultures of life styles, each with their own practices? Or what of the individualisation of social and cultural experiences on the basis of the principles of bricolage?

Here we mention just two such issues:

(meta)collaboration: closely related to the communicative potential of digital technologies is the capability of collaboration with others across traditional barriers of place, peer / age / interest / professional groups,

social strata etc. 'Meta-collaboration', understood as effective and successful membership of 'Generation C' (Bruns, 2007, p. 8), includes the knowledge when, where, and with whom (not) to collaborate and to understand its consequences. This, Bruns (2007, p. 7), points out, requires a critical stance both towards potential collaborators and their output as well as towards one's own abilities and work.

virtuality and hyper-reality: widely used metaphors in the discussion of ubiquitous technology are 'virtuality' and 'hyper-reality'; yet, their use is rarely problematised and their meanings seldom defined. A narrow dictionary definition of 'virtual' with reference to computing is 'not physically existing'; in the main, virtuality is normally used as a parallel reality to the physical world. In an interesting think-piece, McFarlane (2003) posits the following five 'rules' of virtuality:

- the uptake and use of new technologies depend crucially on local social contexts;
- the fears and risks associated with new technology are unevenly socially distributed
- virtual technology supplements rather than substitutes for real activities;
- the more virtual, the more real; and
- the more global, the more local.

In short, notions of virtual realities are problematical and can't be seen as existing divorced from the here and now. The use of digital technologies does not transport oneself into another world, rather it affects the world in which we live, work, learn, shop, seek entertainment etc. Price (2007) expresses the potential of digital technologies to link to and interact with the physical world as 'augmentation'.

Beyond the surface: 'so what *is* 'learning'?'

At the moment the list of prefixes available for the word 'learning' is a near endless one and it grows by the day: e-, m-, online-, ubiquitous-, life-long-, life-wide-, personalised-, virtual- etc. learning. The question is: why this sudden explosion of kinds of learning, what is it about? Many of the prefixes point to technology, whether as m- or as e-, as virtual- or online-. In view of the numerous characteristics discussed above, it might be good to ask whether any of these point to different kinds of learning? In the case of life-wide and lifelong learning, the prefix indicates sites and temporal extent; and with ubiquitous there seems the idea that conditions and opportunities for learning are boundless. It seems, in other words, that the issue is not a difference in kinds of learning but in conditions and environments.

Is this the case with the 'e- forms' also, in their various guises? Is there a difference in kind between *on-line* and *e-learning*? Or, a slightly different question: what exactly is 'virtual' about *virtual learning*? Are all these in fact descriptions of conditions and environments in which learning takes place, environments distinct enough to suggest a significant difference in the experience of learning, even if not a difference of kind?

One way to start may be to ask the simple question: 'so what is 'learning'? In answering, our approach is a semiotic one. That is, we see a very close connection between *meaning-making* and *learning*, in semiotic terms between the *making of signs* and the *making of concepts*. For us, both are the result of semiotic work: that is, purposive work with meaning-resources. Semiotic work produces change; change in semiotic resources produces meaning; so semiotic work produces meaning. Semiotic work changes the tools – the semiotic resources; it changes that which is worked on; and it changes the worker.

In the example below (Figures 1.1 and 1.2), we show two three-and-a-half year old girls trying their hand at writing. We think that each of the two examples is the result of semiotic work. Each is the result of an engagement with a salient aspect of the cultures of the two young writers. The contrast between the two shows that their 'writing' is a principled attempt – that is, an engagement on the basis of discernible principles – to understand the bases of the script systems of their cultures. Neither is mere scribbling, or simply incompetent imitation. In the case of 1.1 a) (some) of the principles might be: the elements of the script system are simple; they seem at times to be repeated; they are linked; they are produced in sequence; they are displayed on a line. In the case of the other, the principles might be: the elements of the script system are complex; they are not repeated, each differs from the other; they are not linked; they are produced in sequence; they are displayed on a line.

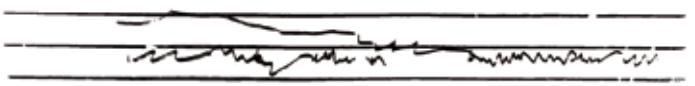


Figure 1.1: Alphabetic script

Figure 1.2: Character-based script

Our assumption is that the graphic work here represents meaning, in the way we have described it; the 'inner' resources of each of the two are changed as a result of this work (the evidence for that lies in the gradual change that can be discerned from this to the next instance, over time); the semiotic / conceptual resources of each of the makers of these signs is changed. In their work they have learned something about the script system of their culture: they have changed; and the resources they have for dealing with their cultural work also have changed.

In this view learning is change; it produces both a transformation of that which was encountered and of the learner; it is an augmentation of inner (conceptual) and outer semiotic resources.

Given our focus on conditions and environments of learning, we might ask a number of further questions, such as: *whose attention* was at issue here? That is, who decided that this should be attended to? *What* has been framed? *Who* has framed the world to be engaged with? In school, traditionally, the answer would be "well, the teacher has directed the attention of the children to this phenomenon". Out of school, the answer is "the children's own *interest* directed their attention". Teachers are likely to answer the question "what has been framed?" differently to children – in one case it would be an answer to a curricular question "what has been framed is the script system of the two cultures", "learning of writing", "a question of literacy". In the other it is a question about fun, pleasure, genuine curiosity and puzzlement. Neither of the children might be aware of adult criteria: it is quite likely that both thought they were "drawing writing". In one case power is at the base of attention and framing, in the other case it is interest and pleasure. Agency in one case is that of the two three-and-a-half year olds; in the other case agency is complex and

mediated, from curricular authority to teacher to children. Of course each has their own interpretation of their agency, and therefore each acts in distinct ways.

The question of "whose power is at issue?" seems one necessary starting point. It also provides a crucial point of 'completion', in the sense of evaluation and assessment. Where official power of curricular authority is at issue, the principles of evaluation will be those of that authority. Relative degrees of success or failure will be assessed / measured in terms of the criteria of that authority. If it is the learners' power, their own interest is the starting point, then the principles of evaluation will be those of the learner. If that which has been made/drawn/written by each of them satisfies them, then their aim has been achieved. Official pedagogy (and its deeply entrenched common-sense derivatives) might not recognise that learning has taken place here: it is unlikely to have apt principles of recognition.

Here is one crucial point of attention for a general account of learning: the frame of institutional pedagogy is neither necessary nor necessarily most efficacious for learning. Institutional pedagogy has its special and important frames and contents, and principles of recognition of learning – or at least of behaviours which might be efficient in simulating what is expected as learning. In all learning these are the central issues: whose agenda is at work, with what power, with what principles of recognition of learning. How is that agenda presented and is it accepted or recognised by those who are potential learners? As 'learning' escapes the frames of institutional pedagogy – a matter in which the e-technologies are deeply implicated – these are questions of increasing importance.

We might note, in passing, that our assessment of the children's writing had been on the basis of *their* attention, *their* framing; and that our assessment of their learning had focused on the principles which seemed at work in their engagement with the world.

The questions of "what is to be learned", "whose framing?", "whose power?" will increasingly come to the fore. The forces of the market push in the direction of individual agency in the choice of commodities – pedagogic or other. The current trend toward 'personalised learning' is of course just one further response to that. We might note, simply in passing, that some of the inherent facilities / affordances of the e-technologies entirely support and sustain and even accelerate this trend.

Contemporary environments of learning and the dilemma of the school

We might also note in passing that three questions might be useful to pose, in relation to current interests in learning: "what stays?", "what changes?" and "why?".

The dilemma for the school arises out of specific mixes of the factors we have so far mentioned. They are culture, technology, environments and (conceptions of) learning. Culture cannot be thought about other than in the presence of power, that is, in social environments. What society expects of 'its' education system of course shapes what 'the school' can and must do – at the moment at least, though that, as we pointed out is changing. If the school has had the task of putting forward certain forms of knowledge and kinds of value, as the servant of the state and its economy, then there is now a clear disjunction between school and state, state and market, and market and school. No new accommodation is as

yet in sight. The state pursues policies to favour the neo-liberal market, which pushes the school beyond its control. At the same time the state attempts to use the school – as one of the remaining instruments under its control, to promulgate traditional values – in relation to nationality/ culture/ ethnicity/ ethics. The school has lost its two major supports: the unquestioned support of the state, and the promise of the reward of a (relatively) secure place in the productive economy.

All the time, digital technologies, which dominate the cultural and economic domain, urgently suggest the same potential for action as those of the market. If technologies are – in the end – culturally shaped tools to manage the world, then there is a close homology at the moment between the facilities offered by these technologies and the promises of the market. Dominant models of learning are provided by the seductive model of the freedom of the consumer in the market – unfettered up to the moment of truth at the checkout of the super-market. Yet there is also truth in the model, for those at least who are in possession of the necessary wherewithal at the checkout. The two lies of the model – one, the harsh reality of the checkout and the other, the less obtrusive reality of the near invisible limitations of the offer of commodities in the supermarket – "you may have everything you may wish for – from the things we make available to you" – do not deny or undercut agency: they simply confine it. If consumption is identity, then you may become any identity that combinations of the resources of the supermarket allow (of course constrained one more time by 'fashion', the naturalisation of convention). And if consumption is learning then you may, as learner, engage with everything available to you *here*.

What this model does not supply are 'navigational aids', that is, resources for making sense of this world of choice. What the model also does not

supply is *knowledge*: it supplies 'stuff', which an individual assembles in relation to their interests. This adds another point, the final one that we wish to make at this time, to notions of learning, and environments of learning and their effects. In the not-so-distant past the school had provided a curriculum which was much more than a set of things to learn, but was a set of tools which had utility in relation to the problems encountered in the social and economic world. It provided a curriculum of knowledge and of skills – that is, of tools for dealing with problems in a known world. As the world around the school has changed, so this curriculum has lost its utility: the world to which the school could provide answers is a world with different demands.

Learning and technologies of text-making

Where before 'learning' had as one of its meanings 'the acquisition of knowledge relevant to issues encountered in the world', now the individual is asked to shape *their* knowledge out of *their* own sense of their world:

> Information is material which is selected by individuals to be transformed by them into knowledge to solve a problem in their life-world. (Böck, 2004)

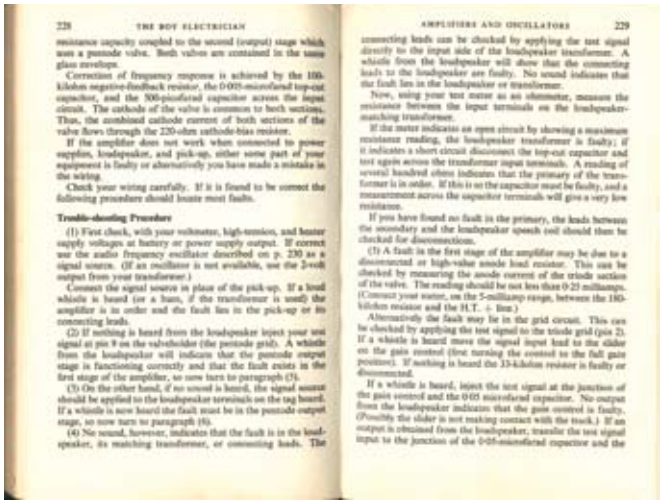
The demand made of individuals in the market-dominated society is nothing short of that of developing a new habitus of learning. What it amounts to is constantly to see the life-world of the individual framed both as challenge and as an environment and a potential resource for learning. In the article from which we have taken the quote just above, the author speaks of a fundamental change in what she calls 'information habitus', that is, from a habitus where the individual could rely on 'authorities' of

the relevant kind to bring information and knowledge to them (what she terms '*Bring-schuld*', that is, the authority had the responsibility to bring knowledge to the individual), to one in which the individual is now responsible for obtaining and shaping that knowledge for themselves (what she terms '*Hol-schuld*', that is, an obligation resting with the individual to obtain information / knowledge for themselves). Her concepts are based on an extensive and detailed ethnographic account of a geographically marginal community in Upper Austria, where she found a distinct difference in terms of this habitus. Importantly, the difference was not so much one that could readily be described in larger level terms such as class or *generation*, rather these were *dispositional* differences which could only be tracked through micro-historical accounts of the individuals concerned.

These differences are apparent in forms of texts and in modes of text-production, themselves related to the factors so far mentioned, though also, importantly, to technologies of text-making and to technologies of (text) dissemination.

The point can best be made through examples. Figures 1.3 and 1.4 show book pages from a book first published in 1926, *The Boy Electrician,* and one from the early 2000s (a Dorling Kindersley book, *Encyclopedia of Science*, Finch et al., 2006) respectively, that is, a change in the form and meaning of pages over a period of eighty years, in which one settled form of representation has been definitively overtaken by a new, deeply different one. It is also the period during which the social and economic changes we have been describing have been taking place.

There are two points that we wish to make in relation to these texts: one is around the relation of *author and reader*, and the other is around the



228 THE BOY ELECTRICIAN

resistance capacity coupled to the second (output) stage which uses a pentode valve. Both valves are contained in the same glass envelope.

Correction of frequency response is achieved by the 100-kilohm negative-feedback resistor, the 0·005-microfarad top-cut capacitor, and the 500-picofarad capacitor across the input circuit. The cathode of the valve is common to both sections. Thus, the combined cathode current of both sections of the valve flows through the 220-ohm cathode-bias resistor.

If the amplifier does not work when connected to power supplies, loudspeaker, and pick-up, either some part of your equipment is faulty or alternatively you have made a mistake in the wiring.

Check your wiring carefully. If it is found to be correct the following procedure should locate most faults.

Trouble-shooting Procedure

(1) First check, with your voltmeter, high-tension, and heater supply voltages at battery or power supply output. If correct use the audio frequency oscillator described on p. 230 as a signal source. (If an oscillator is not available, use the 2-volt output from your transformer.)

Connect the signal source in place of the pick-up. If a loud whistle is heard (or a hum, if the transformer is used) the amplifier is in order and the fault lies in the pick-up or its connecting leads.

(2) If nothing is heard from the loudspeaker inject your test signal at pin 8 on the valveholder (the pentode grid). A whistle from the loudspeaker will indicate that the pentode output stage is functioning correctly and that the fault exists in the first stage of the amplifier, so now turn to paragraph (3).

(3) On the other hand, if no sound is heard, the signal source should be applied to the loudspeaker terminals on the tag board. If a whistle is now heard the fault must be in the pentode-output stage, so now turn to paragraph (4).

(4) No sound, however, indicates that the fault is in the loudspeaker, its matching transformer, or connecting leads. The

AMPLIFIERS AND OSCILLATORS 229

connecting leads can be checked by applying the test signal directly to the input side of the loudspeaker transformer. A whistle from the loudspeaker will show that the connecting leads to the loudspeaker are faulty. No sound indicates that the fault lies in the loudspeaker or transformer.

Now, using your test meter as an ohmmeter, measure the resistance between the input terminals on the loudspeaker-matching transformer.

If the meter indicates an open circuit by showing a maximum resistance reading, the loudspeaker transformer is faulty; if it indicates a short circuit disconnect the top-cut capacitor and test again across the transformer input terminals. A reading of several hundred ohms indicates that the primary of the transformer is in order. If this is so the capacitor must be faulty, and a measurement across the capacitor terminals will give a very low resistance.

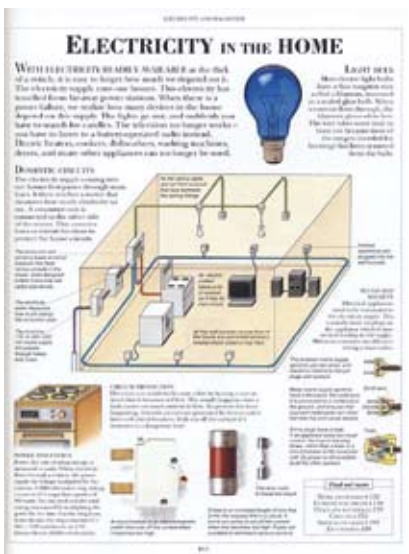
If you have found no fault in the primary, the leads between the secondary and the loudspeaker speech coil should then be checked for disconnections.

(3) A fault in the first stage of the amplifier may be due to a disconnected or high-value anode load resistor. This can be checked by measuring the anode current of the triode section of the valve. The reading should be not less than 0·25 milliamps. (Connect your meter, on the 5-milliamp range, between the 180-kilohm resistor and the H.T. + line.)

Alternatively the fault may be in the grid circuit. This can be checked by applying the test signal to the triode grid (pin 2). If a whistle is heard move the signal input lead to the slider on the gain control (first turning the control to the full gain position). If nothing is heard the 33-kilohm resistor is faulty or disconnected.

If a whistle is heard, inject the test signal at the junction of the gain control and the 0·05 microfarad capacitor. No output from the loudspeaker indicates that the gain control is faulty. (Possibly the slider is not making contact with the track.) If an output is obtained from the loudspeaker, transfer the test signal input to the junction of the 0·05-microfarad capacitor and the

Figure 1.3: The boy electrician



ELECTRICITY IN THE HOME

Figure 1.4: Encyclopedia of Science

issue of *medium* and *'site of display'*. Other factors – such as the shifts over the more recent decade in use of image and writing – have a fundamental effect, though we will not discuss that here. In the first example we have a clear example of '*Bring-schuld*': the author has assembled 'knowledge' about electricity, which will be interesting and above all helpful to young boys in experimenting with the kinds of things they make.

That is the author's task; the reader's task is to follow the order of the author's setting out of this knowledge. *Order* – as *reading path* – is designed into the text: the order of reading, from line, to syntax, to paragraph, to chapter. *Reading against* the order designed into the text is not possible, unless one has no interest in understanding the text the author produced. The issue of *'site of display'* does not seem to be an issue; though when we turn to the Dorling Kindersley book it becomes clear that display affects content. With the book from the 1920s, it is the other way around: content determines length of chapter, as well as the distribution of images within the written text. The profound change illustrated here, in the Dorling Kindersley text, is that of a change in order and in *who determines order*. Here the reading path is not firmly fixed, indeed really not fixed at all. It is the reader's interest which determines the order in which the page will be engaged with, 'read'. In effect, readers design their own ordering of the page; and to the extent that readers' interests differ, the page offers the potential of different distinct 'designs' – e.g. writing first, image second; or, large image first, smaller images second; or etc.

What we have here is a transition from a stable, settled world of knowledge produced by authority / authors, to a world of instability, flux,

of knowledge produced by the individual in her or his life-world, out of resources available to her or him, and in relation to both needs and interests that come from the reader's life-world.

From the perspective of 'mobility' we might say that the former world was *im*mobile – at least relatively speaking – while the present world has become highly mobile. Here *mobility* resides in respect to *who* produces knowledge and *how*. The move from *reading* to *design* is a move from a world in which the text is an authoritative source of knowledge to one in which the text is treated as a *resource*, available for the reader's production of knowledge.

From one perspective, a text had traditionally been a settled and coherent projection / account of knowledge about a framed aspect of the world, produced by the figure of the author. Contemporary forms of text, by contrast, are dynamic, fluid, and above all, *contingent*; they are ever more frequently multiply authored, with 'shared' / distributed power and consequently *provisional*. In their form they realise contemporary forms of social organisation: of *distributed* resources, *distributed* information, *distributed* power, *distributed* across life-worlds organised as life-style. The new social arrangements find their realisation in new genres we mentioned above: blogs, wikis, and so on. A world of stability has given way to a world of fluidity; a world of the power of the author has given way to a world of collaborative text-making; and a world of canonicity – whether of knowledge or of text – has given way to a world of provisionality.

That is the larger environment in which we think the issue of *mobility* has to be considered.

'*Mobile* learning' as an example of digital learning: hunting -isms

Our discussion so far has in part been an attempt to show that *mobility* is a feature of the contemporary social, political, economic, political and *technological* world. It is by no means a feature of the latter alone; and in our view it would lead to an entirely misleading analysis of the effects of technology to think otherwise. Younger readers of printed texts treat them as resources: they take to themselves the right to act in a highly mobile fashion in relation to them – and that applies not only to the Dorling Kindersley texts, but for them, to all texts. So several questions pose themselves around *mobility*: 'who is mobile?' and 'what is mobile?' If we do not see the widespread mobility everywhere, we will certainly misdiagnose mobility in relation to digital media.

In 'mobile learning' we have, first of all, individuals who have the new habitus of learning (never mind the existence of devices which had provided relative mobility for learning – in museums etc) which we have described above. A part of the development of that habitus is that those who 'have' it are accustomed to immediate access to the world (to be) framed and that it should be ubiquitously available. *Ubiquitous* access to resources for learning assumes an attitude to the world where all of the world is always already curricularised, everywhere. The habitus has made and then left the individual constantly mobile – which does not refer, necessarily, to a physical mobility at all but to a constant expectancy, a state of *contingency*, of *incompletion*, of moving toward completion, of waiting to be met and 'made full'. The answer to 'who is mobile?' is therefore 'everyone who inhabits the new habitus'. Given the new learning habitus, the answer to 'what is mobile?' is then 'all the world'. All the world has become the curriculum; the world itself

has become curricularised. The habitus of the individual for whom all the world is always already seen as a curriculum, becomes shaped by that experience and expectation: always expecting and ready to be a 'learner'.

The development of devices for 'mobile learning' relies on the existence of a habitus of mobility, provisionality, fluidity, etc. That which is 'mobile' is *not* knowledge or information, but is the individual's habitus: whether I am out in the countryside, in my bed, or in a classroom is, relatively speaking, beside the point. What is **not** beside the point is the ability to bring things into conjunction which might previously have been relatively difficult to join. An instance of this might be data-logging. I take a device with me somewhere. On the device forms of information can be recorded (or it may be (pre-) specialised to the recording / coding of information). I record the information in the manner enabled by the device. The site where I have gone has been turned from 'a field' or 'a meadow' into a science classroom. I have taken my (budding) habitus as scientist into the field together with a device that conveniently enables me to 'log' information. When I left the school to go to the meadow or when I return to school, say, I have in fact not left a site of learning: I have turned the environment in which I am, whatever it may be and wherever I may be, into a site of learning.

We might leave the issue there, except for one thing: to return briefly to the questions of attention, framing, engagement and of assessment. While in principle all the world may be becoming curricularised, the environments of learning will still vary from time to time, depending on the individual, their position, etc. And so the environments of / for learning will vary: from those where power is still exercised in traditional

ways to those where the learner has power to decide (and the responsibility for the effect of the decision); where framings of the world are determined by others or by oneself; curricula set by others for their purposes, and forms of assessment determined by the power of others or by the individual. For the time being, there will be a 'mixed economy' of pedagogy and learning.

A few (and troubling) questions

Given the wider and dominant social conditions, digital technologies have the potential to place me, as learner, at the centre of the world. One might ask 'what gain?' and equally one might ask 'what loss?' In the societies which we have known, and which seem to be involved in a relentless process of deconstruction, a common curriculum provided one major resource for community – in part what we have described as the educational project of the nation state. When all those who attended school had access to the same knowledge then even those who rejected it in any one of many different ways had been through a process of engagement and rejection: the curriculum had provided a common agenda of knowledge, values, skills, dispositions: the essential resources of 'community'. Personalised learning, with a personalised curriculum, can, in that context be seen as the end-point of the neo-liberal project of the destruction of community. Of course it can also be seen as the triumph of individuality. The question is: 'what place for community?'

We might also ask about the effect on individual habitus of a curricularised world, a world seen in terms of occasions and resources for learning. Where are the sites of difference, from where entirely different perspectives open up? Where are the opportunities for (seeming) down-time? And where are the times for reflection? In the world of insistently urgent

choice of a pedagogic market, where is the time to opt out? In a period of increasing speed where is the time for slowness?

We might, in that context, wish to argue for a concern with rhythm, an alternation of pace, the slow and the speeded up, and each for its purpose. We definitely need to ask whether the task for us is that of adaptation of ourselves to technologies (including the social technologies we described earlier) or whether the urgent task is a careful consideration of the utility in a wide range of ways of our adoption of technologies for considered purposes. In the period of speed, we might wish to make a plea in praise of slowness.

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Endnote:

This chapter was first published in an earlier version in Hug, T. (ed) (2007) *Didactics of microlearning: concepts, discourses, and examples*. Münster: Waxmann and is included here with kind permission.

Chapter 2
Ubiquitous computing: digital augmentation and learning

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Mobile and digital technologies can be used to enhance learning experiences in a number of different ways. Several research projects have demonstrated how technology can be used to augment everyday interaction with the world, and illustrate ways in which they can be used to enhance learning experiences in different contexts (e.g. informal and formal learning, classroom, museum or field trip based). Learning theories offer compelling rationales for the value of digital augmentation for learning, and although studies suggest ways in which digitally augmented experiences can support certain kinds of interaction, little is yet known about the specific impact on learning itself, both in terms of learning outcomes and the particular processes of learning that they can support effectively. This raises a number of questions for further research as well as some significant research issues for education, and particularly in relation to technology innovation.
This chapter presents an overview of digital augmentation, illustrating its use for learning with examples from research, outlines some underlying motivations for its use in learning, and finally introduces some recommendations for future research.

Introduction

The term 'mobile learning' is frequently used to refer to the use of handheld technologies enabling the learner to be 'on the move', providing anytime

anywhere access for learning. We can make a distinction between desktop computing and mobile computing at a very general level of description, in that 'mobile' technologies provide the potential to be used away from a fixed location. This distinction is based on wireless connectivity and the location of the computing power, which need not be confined to the desktop, but can be embedded in various handheld devices as well as in everyday objects and the environment itself. However, by shifting the locus of computation into the physical environments in which we live and interact (Ishii and Ullmar, 1997), mobile and pervasive technologies also provide the opportunity to enhance and support learning in more ways than the 'anywhere, anytime' conception. One significant feature is the facility to digitally augment the physical world in various ways, by linking digital information with physical artefacts or the environment. For example, embedded sensor technology in the environment can trigger contextually relevant information that is not otherwise available in the physical world. Or learner's information and data can be dynamically integrated over time and space, facilitating new forms of collaborative learning as well as broadening and connecting students' understandings and reflections both in the physical world and in classroom settings. Augmentation can take on many forms, for example by using different representational media, by linking relevant information both digital and physical through different modes of access, and by providing the facility to record (through computer logging), re-use or re-represent data in the classroom, e.g. in the form of integrated visualisations. Augmentation can be based on abstract concepts or on enhancing key components of the environment or on objects that are particularly relevant to the task in hand and/or the context in which the user is engaging. The links between information and artefact or environment can be based on various parameters that can be programmed into the environment.

Digital augmentation: examples from research

An increasing number of research projects using wireless and sensor technologies include various forms of digital augmentation. This section describes examples of research of augmented environments, which for the purposes of description can be seen to fall into three broad categories: digitally augmented physical objects in the form of tangibles; digitally augmented indoor environments, e.g. classrooms or museums; and digitally augmented outdoor environments, e.g. in the form of field trips.

Digital augmentation: Tangibles

Tangible technologies, in the form of physical artefacts embedded with wireless, sensor and actuator technologies (integrated electronic and mechanical devices), can be coupled with digital information, exploiting familiarity of interaction with the everyday objects and at the same time enabling access to different information or representation of concepts than is normally available in the immediate physical environment. A number of research projects have designed and developed tangible artefacts that focus on different aspects of learning activity, for example, narrative (Ananny and Cassell, 2001), hands on learning and construction (Zuckerman, 2006; Raffle et al., 2006), and pattern based interaction (Yonemoto et al., 2006).

TellTale (Ananny and Cassell, 2001) is a tangible system that allows young children to practise literacy skills through oral language, in the form of a toy caterpillar, comprising a number of modular segments, each of which allows a short sound recording to be made and which can be rearranged in any order (see Figure 2.1). Children use the recording facility of TellTale as a tool to create short oral stories. Two aspects of TellTale's design support reflection by the children on the storytelling activity. Firstly, the

Figure 2.1: TellTale system

Figure 2.2: Topobo construction

Figure 2.3: Flow Blocks (courtesy of http://creativecommons.org/licenses/by-nc/2.0/)

system allows children to record their composition in an external medium. Making digital recordings facilitates the separation of language from the context in which it is created (Marshall et al., 2004), the ability to think about language removed from context being an important predictor of later literacy (Cassell, 2002). Secondly, TellTale embodies the segmented and linear structure of traditional narrative. Focusing on the structural elements of the toy's design provides children with a model of narrative to explore. A comparison of the stories produced by children with segmented and non-segmented versions of the caterpillar showed that children playing with the segmented version produced longer and more cohesive stories with more traditional story endings compared with children playing with the non-segmented version (Cassell, 2002).

Topobo (Raffle et al., 2004) is a tangible system that aims to support children in understanding the physical principles of kinematics, and enable them to explore concepts such as balance, leverage and centre of mass. A series of computationally embedded blocks can be constructed to model dynamic systems through their ability to record and play back motion (see Figure 2.2). The learner can create movement of the constructed object by physically manipulating a specific motion, which is recorded by embedded computer chips and replayed as a physical simulation. Evaluation suggests that topobo is valuable in facilitating children's expression of concepts of movement and co-ordination, and in supporting children's conception of the effects of e.g. balance and torque on motion systems. Interaction with topobo can be extended using 'backpacks', which enable recorded topobo movements to be modulated. The three different modes (local, global and distributed) enable children to explore the effect of local-global interactions through iterative interaction (Raffle et al., 2006).

Flow Blocks (Zuckerman et al., 2006) are computationally embedded blocks with magnetic connectors that, when joined together, create a flow of light signals through the blocks (see Figure 2.3). Flow Blocks are designed to support children's exploration of concepts such as counting, probability, looping and bending (Zuckerman et al., 2005). Initial studies showed how learners moved from structural focus to a behavioural focus, i.e., focusing on the behaviour of the lights rather than the structure of the blocks. Studies also showed that behaviour was influenced by the particular blocks given, suggesting the potential for particular design configurations

to support cognition, through forms of cognitive constraint (cf. Zhang and Norman, 1994).

Although the application of tangible computing in various contexts has been clearly demonstrated, this remains a nascent research area particularly with respect to understanding of the specific value of digital augmentation with physical objects in supporting learning. Primarily studies indicate that tangible technologies are successful in fostering engagement, motivation and encourage explorative activity. However, little is known about the links between these concepts, which are clearly important, but not sufficient, for learning, and the specific learning benefits. Further research is needed to empirically establish the particular learning outcomes and particular kinds of learning that tangible mediated interaction engenders (Marshall, 2007).

Digitally augmented environments

There are a number of ways that different kinds of digital information can be presented in a physical environment, for example, visually through the use of handheld devices (e.g. PDAs) or on large screen displays; aurally (e.g. via speakers) or on handheld devices; or using purpose built devices (e.g. the ambient horn, Randell et al., 2004). Information can be accessed or delivered in different ways, for example, information can be intentionally requested or obtained by the learner, or it can be serendipitously 'pinged' by using embedded sensor technology, or be pre-programmed to elicit information according to various conditions in the learning environment (Rogers et al., 2004).

Indoor environments

A number of research projects have investigated the design and

development of combing digital technologies and physical experience in indoor settings, from museums to classrooms. Several focus on supporting collaborative interaction and learning. For example, as part of the SHAPE project non-traditional computing is used to simulate an archaeology dig (Hall et al., 2002). Here the aim is to enhance children's collaborative learning in museums, through supporting sensorial experience and capturing embodied knowledge. The Hunting of the Snark project was designed to support children collaboratively interacting in a mixed reality adventure game, where they could explore, interact and collaborate with various technologies in order to find out about an elusive creature called the Snark. One example of digital augmentation here was a jacket embedded with accelerometers that were linked to different digital effects according to the physical movement of the person wearing the jacket. Here the link is to a visual display, but others have used audio information to enhance interaction in e.g. content recommendations for learners visiting a museum or other place of interest for a second time can be shaped by their activities from a previous visit (e.g. Lonsdale et al., 2003).

One emerging concept of digitally augmented classroom environments is that of 'embedded phenomena' (Moher et al., 2005). Here digital augmentation is designed to enable learners to experience various scientific phenomena in the classroom. An interesting illustrative example is RoomQuake (Moher et al., 2005) – a classroom embedded with a combination of sensor technologies and physical artefacts used to simulate scientific earthquakes. Pocket PCs provided dynamic readings of the simulated earthquakes, which students had to then re-represent as physical models using the physical artefacts (see Figure 2.4). Students monitor the state of the simulation through distributed media positioned

Figure 2.4: RoomQuake, simulated earthquake

Figure 2.5: Trilaterations

around the room collecting evidence to solve problems or answer questions related to the phenomena.

Collectively students took readings and watched simulations on the Pocket PCs, and determined the location of the epicentre by constructing mathematical trilaterations using the string, based on the data from the readings (see Figure 2.5). Styrofoam balls were hung at identified epicentre locations, at differing heights, depending on the magnitude of each epicentre.

RoomQuake shows how digital and physical worlds can be combined to enable students to 'step in and step out', and switch between experience, abstraction, and reflection (Ackermann, 1996; Marshall, Price and Rogers, 2003).

> Such an approach provides a very different model of computer-based learning to that of the individual child interacting with educational software running on a desktop machine. In particular, it shows how it is possible to engage large groups of children in [...] ways that are radically different from the more 'passive' models of computer-based interaction (Rogers and Price, 2006).

What is additionally interesting is the 'persistent' concept in this model of augmented learning, where the phenomena run over a matter of weeks or months, and where the activity is related to but asynchronous with the regular flow of instruction in the classroom. This illustrates opportunities for rethinking models of instruction and classroom practice.

Outdoor environments

A number of projects have also explored the use of mobile and sensor technologies for learning in a range of outdoor contexts. Some in the form of field trips e.g. Tangible flags (Chipman et al., 2006), a system for tagging information both physically and digitally, that allows access to digital information attached to the location of specific flags for children learning in outdoor spaces. Several focus on data logging e.g. SENSE (Stanton-Fraser et al., 2005) aimed to support collaborative environmental science learning through providing digital technologies that enabled collection and re-representation of combinations of contextual and domain relevant data. Others have focused more on exploring the potential of digital overlay of physical environments where there is little or no direct correspondence with the particular physical environment and the learning domain e.g. Savannah (Facer et al., 2004). Projects have explored the potential of digital augmentation for supporting learning in domains such as history as well as in science learning contexts (e.g. Mobile Bristol; Stanton et al., 2005).

One illustrative example of a digitally augmented outdoor physical environment is the Ambient Wood project (e.g. Rogers et al., 2004; Price et al., 2003a) where a woodland was digitally augmented to

support pupils aged 11–12 learning about habitat distributions and inter-dependencies. The aim was to enhance the physical experience of exploration and discovery in the wood through access to contextually relevant information not normally available to the naked ear or eye. This was achieved in a number of ways: a probe device (light/moisture) enabled children to collect real time measurements of light and moisture in the woodland, with readings shown on the PDA as dynamic visualisations in relative rather than numerical measurements (see Figure 2.6); a horn device that was linked to sensors placed in the woodland, and generated sounds according to the children's location (see Figure 2.7). Sounds represented invisible processes that were relevant to the learning domain e.g. root uptake (Randell et al., 2004), and were designed to stimulate reflection about relevant 'invisible processes'; walkie-talkies enabled collaboration with a remote facilitator, whose role also included sending relevant information to the PDA in the form of images (Price et al., 2003a). All data was logged and recorded and could be re-accessed in the field and in the classroom through using the PDA and a large screen display (Harris et al., 2004). Collectively, studies suggest that digital augmentations helped students make explicit links

Figure 2.6: The Ambient Wood

Figure 2.7: Sounds on the horn

between the physical environment and relevant processes within the learning domain (Rogers et al., 2004), encouraged reflection and discussion, and promoted independent activity, peer and facilitator collaboration and reflection.

Implications for learning

The examples presented here offer insight into new learning experiences or environments that can be developed for a broad range of both informal and formal learning contexts. They illustrate the potential for changes in the way that learning and education can be conceptualised and the way we might think about the structure of learning and instruction. The potential of flexibly combining technology with the physical world for learning is considerable. At a very basic general level digital augmentation can be used to attract attention at appropriate points in the learning task, or to things that might otherwise go unnoticed. In addition, theories of learning and cognition offer a compelling rationale for the value of digital augmentation for learning.

Experiential and discovery learning (Bruner, 1973) may be supported in new ways by combining real-world physical interaction with digital representation. For example, by linking action to contextually relevant or associated information in the form of digital representations (e.g. Rogers et al., 2004; Facer et al., 2004), or by providing digitally activated experiences of scientific phenomena not normally encountered in everyday situations (e.g. Moher et al., 2005), where learners experience phenomena and explore concepts and relationships through combined physical and digital artefacts. Learning through 'hands-on' activity or

through construction activities (Papert, 1980) can be supported in new ways by, for example, combining objects with digital representations of effects or consequences of action with artefacts (e.g. Resnick, 1996; Price and Rogers, 2004; Raffle et al., 2004). In accordance with external cognition digital augmentation provides new kinds or use of external representations that make explicit information that is not normally available in the physical world, potentially supporting learning through computational offloading (Larkin and Simon, 1987). For example, by making the invisible visible or inaudible audible, through linking physical phenomena to related abstract concepts with digital representations (e.g. Rogers and Price, 2006). Collaborative learning (Pea, 1994) can be facilitated in new ways through flexible use of technology both locally and at a distance. For example, RAFT project and supporting multiple forms of collaboration simultaneously (e.g. Price et al., 2003a). In addition, wireless digital technologies provide the facility to support particular aspects of the learning process, for example, provision of contextually relevant information should assist learners to interpret and transform information (Schomberg, 1986), and understand content in context and create personal meaning (Peterson et al., 1996). Furthermore, the facility to record and re-use information that has been collated during a learning task should offer the opportunity to facilitate re-representation and reorganisation process (Levene and Peterson, 2002) important for effective learning.

However, studies of these learning experiences show how highly motivating and engaging digitally augmented learning activities can be, and some begin to make reference to the nature of interaction and ways in which they might support particular kinds of learning activity, such as, collaboration or reflection. In particular a recurring theme is the concept of stepping in and stepping out of learning experiences that is engendered through an

iterative cycle of embodied and abstracted interaction (e.g. Marshall et al., 2003; Moher et al., 2005; Raffle et al., 2006). Some studies have begun to identify ways in which interaction might be mediated by the representation and tangible device, for example, ambiguity of representation promoting reflection through discussion (Randell et al., 2004), and unexpected or unfamiliar representation events attracting attention and promoting reflection (Price et al., 2003). However, there are few, if any studies that focus in detail on learning itself and the cognitive impact of digital augmentation. Yet more work is required to verify initial findings and establish a better understanding of the particular value for learning, and the particular domains or learning contexts that are most effectively supported.

Research future directions and challenges

The potential for mobile and ubiquitous technologies to offer opportunities for new ways of learning have clearly been demonstrated, but currently there is little theoretical work looking specifically at the role of digital augmentation for learning. In particular, research needs to start to reach beyond concepts of fun and engagement, by looking more at specific learning benefits and at the effects of engaging in digitally augmented environments over time. We understand little about the underlying mechanisms of how digital augmentation actually works for learning. One critical area for research is gaining a better understanding of the impact of digital technologies on cognition, providing a clearer picture of where it works, how and why. For example, how do new ways of linking representation and context shape the way that learners think, or influence their interpretation of events or representation, the kinds of meanings that they construct and their understanding of the

learning domain? What kinds of knowledge construction does digital augmentation support?

A further important area for research is to understand better the kinds of learning tasks, domains or activities it most benefits. So far studies suggest that digital augmentation can promote reflection and collaboration, but research needs to look in more detail at the kind of reflective and collaborative activity promoted, and where this is most beneficial for learning in the learning domain and task. Furthermore, we need to understand whether and how digital augmentation and/or the technology influence learners' interaction with activities and learning context. For example, some studies show that using handhelds detracts from the ongoing activity of interacting with an exhibit or the environment (e.g. Gay et al., 2002; Hsi, 2002). Key questions include whether or not learners focus on the technology itself rather than the learning domain or environment and when this matters. Or, indeed, whether learners focus on the activity of using the technology and devices e.g. using mobile phones or making film using video recorders rather than the information they are working with. What is the role of this activity in mediating learning? Is there a difference in this level of focus depending on the kind of technology? For example, digitally embedded physical objects are not so obviously 'technology', so does this make a difference? We also need to understand whether these issues are related to novelty, and whether interaction and effect change over time.

Research more broadly into the impact on education and structure of teaching and learning is wanting. For example, the potential for integrating formal and informal learning, bridging the gap between school contexts and outside, and understanding the impact of technology in facilitating the concept of

distributed teaching and learning i.e., through paradigms such as embedded phenomena, which offer a more radical model for teaching and learning.

Research challenges

A number of research challenges arise from such questions, many of which stem from the rapid advances in technology and continual change and development in computer technology, including improved networking and more robust applications. Research into interaction, learning and cognition suffer from issues of novelty. The majority of studies demonstrate the highly engaging and motivating nature of the learning experiences. This is not surprising given the novelty of these experiences for learners, especially within traditional school settings and culture. Early days in this research field mean that novelty value cannot easily be factored out of such findings, and more extensive longitudinal studies are required to establish the sustainability of digitally augmented environments on motivation and engagement.

However, longitudinal studies themselves are challenging, being difficult to realise. One reason is again because of the rapidly changing technology environment, making it impractical for educational environments to invest heavily in new technologies. Extensive deployment and implementation is, therefore, scarce if even in existence. In addition, integrating new technologies, particularly if it means new teaching practice, is an extensive research area in itself. This means there is no reliable test bed for researching either extensively or longitudinally. Consequently large numbers of disparate case studies emerge, making coherence of findings problematic.

What is needed is a more systematic breakdown of the unique features of mobile technologies with studies focusing on particular aspects

enabling integration of findings. Another approach might be to identify key themes where ubiquitous computing appears to have an impact on learning (e.g. Rogers and Price, 2006). From the literature we identified four key themes: integrating knowledge, constructing knowledge, collaborative learning, and interaction and control, and outline different design challenges, which can be used as a basis for investigating specific learning benefits in more detail.

Conclusion

This paper has illustrated how digital augmentation can be combined with mobile technologies to be integrated into various kinds of learning experiences in different contexts. Research to date clearly demonstrates how this technology 'works' in learning contexts and provides new opportunities both for learner interaction and activity, and for structuring teaching and learning. More specific research focusing on the cognitive impact of such new ways of interacting, learning and teaching will provide a better understanding of when, where and how digital augmentation is useful in promoting effective learning, and where it is not. This is crucial in establishing how mobile and ubiquitous computing can genuinely support learning and is not just seen as a panacea for current educational concerns.

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Chapter 3
Generating learning contexts with mobile devices

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This chapter examines the following question: how should learning activities using mobile technologies be designed to support innovative educational practice? (Milrad, 2006). We propose that learner generated context (CX) and not 'merely' the generation of content is a more generic way to conceptualise pedagogically effective ways to design learning activities that embed digital interactions. We present a case study that examines learners' appropriation of new mobile devices. HE students were given an assignment task which requires them not only to gather data in the form of video clips and photos, but also to answer certain questions (i.e. fill knowledge gaps) that were posed by a so-called events checklist (a mobile learning object). Each student was loaned a Nokia N91 phone to help with the assignment. We used a questionnaire to gather data after the assignment had been completed. The results indicate that the students were very task focused and that the N91s acted as motivation to achieve high grades; the free phone calls enhanced team communication; 73% of the learners thought it was extremely important to be able to learn at any time and in any place; 64% of the learners thought that the events checklist was helpful; and 74% of the learners were positive about the university contacting them via mobile phone for learning purposes. The paper concludes by drawing out the main issues raised by the case study.

Cook et al. Generating learning contexts with mobile devices
In: Pachler, N (ed) (2007) Mobile learning: towards a research agenda.
London: WLE Centre, IoE

Introduction

This chapter addresses the following theme: how should learning activities using mobile technologies be designed to support innovative educational practice? An increasing body of research is confirming that learners are naturally adept at embracing new technologies, particularly for maintaining social networks. For example, a recent Demos publication called '*Their Space*' (Green and Hannon, 2007, p.10) researched children and young peoples' digital interactions that are part of everyday life and reported:

> The baseline finding from our research was that the use of digital technology has been completely normalised by this generation, and it is now fully integrated into their daily lives … Almost all are now also involved in creative production….

Whilst acknowledging that learners are increasingly using digital interactions as a key part of their social networking, we suggest that not enough is known about how to effectively design learning activities that are pedagogically effective at embedding mobile technologies, particularly in post-compulsory education. Specifically, we suggest that there is a need for answers to this question in a diverse set of contexts: how do we balance digital interactions like those used in social networking with authentic learning tasks? Of course, 'digital interactions' means more than mobile device use; and could include messaging, email, chat rooms, online SIGs, etc. Furthermore, the above quote from Green and Hannon (2007) also highlights a view of citizens as 'content producers'. This is part of an explosion of activity in the area of user-generated content:

> User-generated content (UGC) refers to various kinds of media content that is produced or primarily influenced by end-users … These include digital video, blogging, podcasting, mobile phone photography and wikis … Prominent examples of websites based on user-generated content include Friends Reunited, YouTube, MySpace and Facebook. (Wikipedia, 2006)

But is there a direct relationship between 'creative production' (i.e. user-generated content) and learning? Undoubtedly this may be true in certain disciplines like music, media studies etc. but this link may become tenuous in other areas. However, tapping into the self-motivation of the 'user-generated content' phenomenon could potentially have a positive impact on education. Furthermore, failing to explore how more formal educational institutions can cope with the more informal communicative approaches to digital interactions that new generations of learners seemingly possess could lead to a schism if not planned for. Consequently, we have proposed that learner generated context (CX) and not 'merely' the generation of content is a more generic way to conceptualise pedagogically effective ways to design learning activities that embed digital interactions. Indeed, we propose that a productive pedagogical vision is one that views the cultural emergence of Generation CX in terms of what Bakardjieva (2005, p. 34) calls "technology-in-use-in-social-situations", and what we are terming 'learner generated contexts' (Cook, 2007a; Cook 2007b).

In her book '*Internet Society*', Bakardjieva (2005) looks at the everyday use of the Internet. She presents a theoretical framework which combines concepts from several schools of thought (social constructivism, critical theory, cultural studies and phenomenological sociology) in an attempt to overcome some of the limitations of these perspectives. Bakardjieva (2005, p. 34) characterises her approach as "technology-in-use-in-social-

situations", or technology extended to include the acts of use in social situations. This is where a user enacts or invents 'use genres', i.e. they mobilise available cultural tools to respond to a social situation.

Our earlier work (Cook et al., 2006) provides some useful baseline data of students at London Met (the institution involved in the study described below). A mobile phone survey of Business Studies students (117) found that 61% thought it to be extremely useful to be able to learn at any time and place; surprisingly 51% of the students answered positively about the university contacting them via their own mobile for learning purposes; only 23% thought 'it would be a negative aspect'. Furthermore, our work seems to indicate that learners place a high priority on learning any time and place and are receptive to using m-learning on their own phones. Text messages containing 'learning hints' were used in our work to help create learning contexts. These included reminders for seminars, course-work deadlines and pointers to online learning resources that could help learners; these were well received by the learners.

In order to reify our perspective, this research has adopted the goal of investigating how the use of mobile devices in post-compulsory education contexts can provide integration between these areas: (i) learners' informal/private 'space', and (ii) learners' formal education. Space here means a learner's mobile device and the social networking that surrounds it. In particular, we are interested in exploring the contexts for the appropriation of new mobile communications and content generation devices by self-motivated learners. Provisionally, we define a 'mobile learner generated context' as being conducted by a learner or learners who: (i) are using mobile devices to communicate or individually reflect,

(ii) perform learning activities whenever it is appropriate and wherever it is appropriate to them, and (iii) in the course of a dialogue with another person or interaction with multimedia resources, raise questions that create a context. When an answer to this context-based question is generated this can give rise to knowledge. In the next section we present a study that investigated the above goal.

Case study

We wished to examine learners' appropriation of new mobile devices because we felt that this would provide a pedagogically effective basis for the design of learning activities that embed mobile devices. As we could not guarantee that all our students would have a high-end mobile device, we took the decision to loan mobile phones to users (learners and tutor). These 'near future phones' were essentially smart phones (Nokia N91) which possessed the necessary features for users to generate content. A study was set up that aimed at identifying and documenting the possibilities for mobile learning in terms of these questions: was there an appropriation of the smart phones (which represent new communications devices) by motivated learners? How different was the students' use of the smart phones compared to how they use their own phones? Was there evidence of mobile learner generated contexts? Indeed, we predicted the following: that users of the near future mobile phones would actively discover the relevance of mobile learning to their own context; and that users would actively initiate mobile device-based practices that designers and promoters of these technologies have not been able to imagine. The module and task were chosen carefully in consultation with experienced colleagues in order to investigate the question and

predictions given above. In the end the smart phones from the university service provider had the added advantage of providing free calls and texting to users of the same network.

2.1 The case study context

Our students visit an 'event' as part of an MA module called 'Events and Live Media Industries'. This is a taught module that makes use of a blended approach that included lectures, seminars and an online learning object called 'Imagineering' (a method used to inspire business operations) plus a series of assignments. In one assignment, the context of this case study, students have to work in groups to prepare for a multimedia presentation (worth 20% of the overall grade for the module; there was also 80% for a written assignment). Each student was loaned a smart phone to help with the assignment. They were also given access to MediaBoard, an online multimedia message board, to help them to share their ideas for the assignment and collate their multimedia assets (photos, audio and video files). Contributions to MediaBoard can be made from a mobile phone (SMS, MMS, email) or a PC (email, direct input and upload). Working in groups of 2 to 4 students choose one event (e.g. The Wine Show held at The Business Design Centre) that was to take to place in London between October and November 2006. Working in one of the four groups, students were required to undertake and present such tasks as the following (taken from the assignment schedule): identify the background data to describe the event and the current marketing initiatives of the event – verbally and pictorially; identify background data to describe the event's market (its audiences and their demographics etc), product, competition and distribution; identify, from your own perspective, or from the representative of the company, the strengths, weaknesses, opportunities and threats facing the event and its parent company etc. Marks worth up to 20% of the overall grade of a student's written assessment were also built into the assignment for students to upload their content to MediaBoard, and for discussing on MediaBoard their strategies for using this content in the presentation.

In order to prepare the students for the visit, in week 2 the team (the authors of this paper) met with the 10 students to hand out the smart phones (Figure 3.1), to explain how best to use them, to demonstrate MediaBoard and give out MediaBoard login codes for each team. Note that two latecomers to the module were given an induction in week 4. In addition, each phone came pre-loaded with a simple mobile learning object called 'events checklist'; a screen from this is shown in Figure 3.2. Figure 3.3 is a screen shot of MediaBoard displaying some of the images uploaded by a particular student group, in addition to text correspondence between group members. Thus the assignment task required the students not only to gather data in the form of video clips and photos, but also to answer certain questions (i.e. fill knowledge gaps) that were posed by the events checklist. Students were encouraged to personalise the phones, for example students were encouraged to keep music on their phones. The only thing we asked them not to do, was make personal phone calls. During the course of six weeks that the students and tutor were loaned the phones, the tutor and research team would text brief messages to the students. At the end of the trial all phones were returned. For ethical reasons it was explained to the students that the data gathered in our research would be reported anonymously. All participants signed a consent form.

The module consisted of 12 female students, all of whom were from overseas. Ten were students on the MA Events Marketing Management

Figure 3.1: Students at the induction session

Figure 3.3: mediaBoard

Figure 3.2: N91 with mobile learning object 'events checklist' loaded

programme and two were from other MA programmes who had elected to study this module. All of the students were from overseas, including Italy, Greece, Thailand, Malta, Venezuela, and Belgium. The reason for the whole cohort being female is not clear. The intake for the Spring Semester (February 2007) for this module was 10 students, nine of which were female; and again, they were nearly all from overseas. So why mostly female? The module tutor (the third author) has speculated that perhaps 'early adopters' on new MA programmes like this one are female. One reason for them all being international students may be because of the profile of London Metropolitan University; it ranks as London's largest unitary university with over 34,000 students, including

almost 7,000 international students from 155 different countries. In 2003/04, London Met was ranked the most popular university in London for international students, and the third most popular in the UK.

2.2 Questionnaire results

We used one questionnaire issued after the presentations in week 9 to gather data (one student did not respond). There were 28 questions in total and so below we present only the results that relate to the above research questions.

2.3 Discussion

We will now discuss our results in terms of our three research questions. The first research question asked: was there an appropriation of the smart phones by motivated learners? Table 3.1 indicates that the students were highly motivated to carry out the assignment. Table 3.2 attempts to probe the appropriation issue by asking: "What did you think about being given a mobile phone to use for this assignment?" Four respondents use the word "cool" in their answers. We take this to indicate that the 'coolness factor' can act as self-motivation along the path to appropriation of the device in users' practice. Learner 2 acknowledges that it was "convenient for communicating with my team", but then the same could be said of any normal mobile phone. However, as learners 6, 7 and 10 also point out, the free phone calls probably reduced barriers to team work. Indeed, learner 4 also mentions that it is a good device for communication, but learner 3 adds that it is more responsibility (this could act as a barrier to appropriation). If such an approach were to be scaled up across the university sector then maybe free phone calls to co-learners could be negotiated with service providers, thus enhancing communication in team work.

Highly motivated	1	2	3	4	**Not motivated**
% respondents	60	40	0	0	

Table 3.1: How would you rate your motivation towards carrying out this assignment?

1. COOL! [Has drawn smiley faces in the O's in 'Cool']
2. I really liked the idea, thought it was fascinating, could have been a bit of hassle at times to carry around because it was so big, but it was very convenient for communicating with my team.
3. Very privileged and more responsibility!!
4. Really cool because it's an added opportunity to communicate and has very useful features for the event.
5. It's more convenient when collect the data.
6. It was cool because we could communicate with other at no cost!
7. It's very cool tools and I'm quite impressed that u gave us trial this method for learning for free (even temporary). I so proud to show my friend that I got a new phone which supported from my course.
8. It's nice
9. Great!
10. Great opportunity … and free.
11. I think if the use is required they should be provided.

Table 3.2: What did you think about being given a mobile phone to use for this assignment?

1. My mobile does not have all of these features.
2. Yes and no. Yes because your own mobile phone you have on you all the time and frequently check, however, the cost of the given phone was free and it had many extra features that helped us at the event, such as the videos and pictures.
3. Yes, because I am familiar with my own function on my phone.
4. Maybe because I know it better and so it's simple, but that means less photo/video and less communication.
5. Sometime I prefer to use my own mobile because I don't like carry 2 mobiles when I out of home.
6. actually used it a lot more than the one given because I knew how to operate it, I am familiar with it and it is easier to carry on functions.
7. Yes because the other friend always leave the mobile phone that you gave at home, not keep with them all the time.
8. No, because this phone we could use for free.
9. Easier and instant.
10. No, the phone you provided us was very powerful.
11. We only used our own mobiles because we missed most of the briefing, hence it was quicker and less complicated to use our own phones.

Table 3.3: Would you have preferred to use your own mobile phone?

Extremely important	1	2	3	4	5	Not at all important
% respondents	73	0	18	9	0	

Table 3.4: How much is the ability to learn at any time and in any place important to you?

The second research question (How different was the students' use of the smart phones compared to how they use their own phones?) is also related to the first research question. Table 3.3 (Would you have preferred to use your own mobile phone?) shows some interesting responses, with learners fully aware that if they were to use their own phones, this could lead to "less photo/video and less communication" (learner 4); and learner 10 pointing out that "the phone you provided us was very powerful!" However, several learners express a preference for their own phones. And this is the problem with a trial such as this, lending for a short period can mean that learners may not wish to invest the time needed to appropriate the new devices. However, Table 3.4 provides an emphatic answer to the question, "How much is the ability to learn at any time and in any place important to you?" 73% of learners thought this was extremely important. This is higher than the 61% positive response to the same question obtained in an earlier study (see introduction).

Our third research question ran as follows: Was there evidence of mobile learner generated contexts? Table 3.5 shows responses to the question, "What is your opinion of the Event Visit Checklist on the phone?" It shows that those who used the checklist (just over half the respondents)

found it very useful. Student 3 provided very positive remarks: "It was very very useful at the event, again no need to carry our notes, just use the phone." Student 1 also indicated that the resource was being used and hence potentially raising context-based questions: "Very helpful at the event day! We went through it on the spot!" Table 3.6 shows that 64% of the learners responded positively (combined score for 1 and 2) to the question "The Event Visit Checklist on the phone was helpful". Only 18% strongly disagreed. We take this as a positive sign and indicative that learning objects like this could be used to facilitate mobile learner generated contexts.

Table 3.7 is slightly worrying. We received a negative response to the question "How useful would it be to access learning materials via your mobile?" Only 36% of learners were generally positive towards this question. This could be due to the nature of the task, which focused on the event, team work, content generation and presentation – not about learning from a resource on your mobile phone on your own. For them the phones were helpful for communicating and gathering data. Table 3.8, (responses to question 'What was the phone most useful for?) supports this assertion. For example, learner 2's response was "If the phones were on and we all had them, communicating was extremely useful, as well as pictures and videos taken at the event." So yes, the students were very task focused and, again, there are clear signs of the smart phones being appropriated for the team-based learning task.

Table 3.9 allows us to finish on another positive note. In answer to the question "How would you view the university contacting you via your mobile for learning purposes?" 82% of learners were positive, with no students thinking it would be a negative aspect.

1	Very helpful at the event day! We went through it on the spot!
2	Very helpful.
3	It was very very useful at the event, again no need to carry our notes, just use the phone.
4	We didn't use it.
5	I don't use it.
6	I didn't use it.
7	It's good that I no need to bring all the document to the events so I can check through mobile phone.
8	I didn't look at it. It was easier to use the booklet.
9	Good reminder.
10	Very helpful.
11	Haven't used it.

Table 3.5: What is your opinion of the Event Visit Checklist on the phone?

Strongly agree	**1**	**2**	**3**	**4**	**Strongly disagree**
% respondents	27	37	18	18	

Table 3.6: The Event Visit Checklist on the phone was helpful

Extremely useful	**1**	**2**	**3**	**4**	**5**	**Not at all useful**
% respondents	9	27	55	9	0	

Table 3.7: How useful would it be to access learning materials via your mobile?

1	Pictures and videos. They were really clear!
2	If the phones were on and we all had them, communicating was extremely useful, as well as pictures and videos taken at the event.
3	Calling the others on the course, photos and video features and also listen to music.
4	Communicate with the others.
5	Keep touch with friend, sent message.
6	Text messaging and videos.
7	Record video and take a picture.
8	Calling each other.
9	Communicating.
10	Taking pictures, videos, sounds.
11	[did not respond]

Table 3.8: What was the phone most useful for?

It would be a positive aspect	**1**	**2**	**3**	**4**	**5**	**It would be a negative aspect**
% respondents	64	18	18	0	0	

Table 3.9: How would you view the university contacting you via your mobile for learning purposes?

Indeed, this seems to support our prediction, made above, that "users of near future mobile phones actively discover the relevance of mobile learning to their own context." This is a marked improvement on earlier work (see introduction) which obtained these responses to the same question: 51% of the students answered positively about the university contacting them via their own mobile for learning purposes; only 23% thought 'it would be a negative aspect'. More work is needed to examine our second prediction, i.e. that "Users were actively initiating mobile device-based practices that designers and promoters of these technologies have not been able to imagine." However, we would suggest that mobile learner generated contexts appeared to be taking place in our studies and we believe such a practice has not been envisioned by designers of the technology.

From a module leader's perspective (the third author), 'Generation CX' and mobile learning were highly successful in bringing about learning outcomes. This was perhaps because the use of the technology 'pushed' the students into content 'delivery' by providing the tools for the data collection process. The use of the cultural tools (mobile phones) within a multi-cultural context was also considered useful for supporting teaching and learning to an international audience with varying language abilities and cultural perspectives. The smart phones provided an ideal, and level, platform for the delivery of a single 'language of technology', by promoting a form of 'technological expression'. This correlation between a singular language and the role of technology in the provision of the data to support the multimedia presentation element of the assessment resulted in 83% of students gaining a merit grade of 65% or above; with no Fail marks. This success can be compared to a further written element of the assignment that required critical discussion of theoretical concepts

within the Marketing discipline, which resulted in a 33% failure for this element of the assessment, with only 8% (1 student) gaining a grade of 65% and above. It could, therefore, be suggested that mobile learning technology supports equality within the diversity of abilities resulting from the 'massification' of higher education. These (tutor) perspectives are also an indicator that the student group appropriated the device in that there is suggestive evidence that the mobile devices acted as motivation to achieve high grades for the presentation. As we have said, the cohort consisted of 12 students, who formed 4 groups. The group presentations given by 10 of the students all gained a merit grade of 60–69%, being 83% of the cohort. These students represented 3 out of the 4 groups.

All of these students were present at the m-learning introductory session to the use of their mobile phone, and they all interacted with MediaBoard to a level that achieved them a distinction grade of 70% and above. These students gained the benefit of mobile phone use for 7 weeks. The students within the 4th group achieved a lower Pass mark of 52% for their presentation. They did not attend the m-learning introductory session, and received their mobile phone later in week 4. Evidence of interaction with their mobile phones to support their presentation within MediaBoard was extremely limited, and resulted in a failing grade of 13%; and anecdotally, the collegiality within the group was poor. Follow-up work is probing the whole issue of appropriation with a grounded study of semi-structured interviews conducted with the four teams.

Conclusions

The following issues arise relating to the first question in the Discussion section 'Was there an appropriation of the smart phones by motivated students?' Firstly, students were not using their own phones, which may mean that they will have a different approach to the chosen model, especially as they were loaned explicitly for the assignment. This may have the effect of making them feel that they had to use them. However, without their use they would not have the tools to take their media assets and communicate freely. When it came to the presentations, most groups had successfully generated their own content and this gave a strong sense of presence and location. Indeed, there were clear indicators that the N91s acted as motivation to achieve high grades. Another key issue is the difference in approach by the two latecomers. These students did not use the smart phone and scored poorly in the assignment. We would have liked to explore this issue further, but we only have a questionnaire from one of them. Finally, we feel that another issue worth exploring, which is related to the points raised above, pertains to students' use of their own phones vs. the university phone. This was necessary because, as we have noted, the phone had all the features required for the assignment and free communication. Whilst it is true that the loaned phones introduce an additional learning curve, our results have shown that the state-of-the-art technology can engage and motivate.

Acknowledgements

We would like to thank all the students who took part in this study. The Centre of Excellence in Teaching and Learning in Reusable Learning Objects is funded by the Higher Education Funding Council for England. MediaBoard has been developed and is hosted by Tribal Education.

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Chapter 4
'Get real!' – reviewing the design of a mobile learning game

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As usage of mobile phones increases dramatically world wide and with mobile games among the most popular applications, their potential to support learning is explored. The 3-year project mobile Game-Based Learning (mGBL) is supported by the European Commission (EC) to design new learning game models for the young adult market. Our aim is to support development of decision-making skills for dealing with crisis situations – a priority concern of the EC. Now well into the second half of the project, we have prototyped three game models informed by social-constructivist theory, which is learner-centred. One of these is 'Get real!': a multi-player game that uses the full functionality of the web-enabled camera phone to support both co-operative and collaborative learning and recognition-primed and creative decision-making. The prototype has been iteratively developed in a programme of field research that included an education industry workshop at early design stage. This chapter highlights concerns that were expressed during the workshop with aspects of the game design and reports the subsequent changes we have made. The result: a true game that can be integrated into a taught programme to engage students in inquiry-based learning.

Mitchell, A 'Get real!' reviewing the design of a mobile learning game
In: Pachler, N (ed) (2007) Mobile learning: towards a research agenda.
London: WLE Centre, IoE

Introduction

> The mobile revolution is finally here. Wherever one looks, the evidence of mobile penetration and adoption is irrefutable ... No demographic is immune from this phenomenon. (Wagner, 2005)

With the continuing expansion of broadband wireless networks and with mobile phone operators cutting call charges, global mobile phone use is set to pass 3.25 billion in 2007 – around half the world's population. User-centred teaching means acknowledging this trend and widening the delivery options available to students, hence the emergence of a new paradigm for learning, m-learning, i.e. learning mediated through mobile technologies. The scope for m-learning widens as mobile applications initially offered as expensive business solutions or as entertainment are increasingly included as 'standard' within mobile contract packages. Among the most popular applications are mobile games (Wagner, 2005). The sector is expanding rapidly: the latest mobile devices have higher definition colour screens, enhanced memory and functionality, which makes mobile gaming more viable and appealing. Development costs are also lower for mobile games than for games on 'traditional' platforms. The mobile Game-Based Learning project (mGBL) contributes new learning models to this market.

mGBL is a 3-year project that began in October 2005 and is supported by the European Commission (EC) Information Society Technologies (IST) programme within the Sixth Framework. Eleven educational and commercial organisations form the project consortium, from Austria, Croatia, Italy, Slovenia and the UK. Our aim is to design engaging mobile learning games that can support young adults in developing skills for

decision-making in crisis situations – a priority concern of the EC. The nub of the problem is that someone with little knowledge may well be decisive in an emergency and communicate decisions effectively but may base decisions on false criteria, whereas someone who does have knowledge may nevertheless fail where skills for creative decision-making are called for but are lacking. In an increasingly uncertain world, the need to support creative decision-making is important (Senge, 1990).

In a crisis there is no time for lengthy deliberation or the kinds of techniques used in business and management, for example 'SWOT' analyses, a method attributed to Humphrey (e.g. by Wikipedia) for analysing Strengths, Weaknesses, Opportunities, Threats in respect of a desired objective or strategy. People need to make fast decisions – and with no time to compare options some may rely on trial and error, whereas those who are experienced leaders use recognition-primed decision-making (Klein, 1998), i.e. a blend of intuition and analysis: 'arriving at feasible courses of action followed by conscious and deliberate review of the courses of action' (Wikipedia). According to Argyris and Schön (see Dick and Dalmau, 2000), simple detection and correction of error is 'single-loop learning'. However, to arrive at new solutions, the ability to reflect in and on action is needed, to identify and correct error in ways that may involve modification not just of processes but also of underpinning norms and objectives ('double loop learning'). Whichever approach they take, decision-makers also need personal awareness and sensitivity to others. Supporting development of this range of decision-making skills is difficult in classroom and traditional e-learning environments: in the classroom issues may be too personally experienced, while arguably traditional e-learning environments may support cognitive learning but do not easily support socio-affective learning (Hillier et al., 2005).

mGBL bases on the recognition (e.g. Mitchell, 2004) that games designed for mobile phones have considerable potential for encouraging both cognitive and socio-affective learning in young adults. This is in line with a growing body of research (e.g. Fabricatore, 2000; Prensky, 2001; Pillay, 2003; Wu et al., 2004; Mitchell and Savill-Smith, 2004; Ellis et al., 2006) that acknowledges the pedagogical role of fun in learning and the potential of digital games for use as educational tools, to facilitate a 'flow' (Csikszentmihalyi, 1990) experience that is a characteristic of successful learning processes. A mobile game could have the added advantage of mobilising the learner to engage in real world activity outside of the classroom, thereby supporting development of situational awareness, i.e. 'knowing what is going on so you can figure out what to do' (Adam, 1993).

Anglia Ruskin University leads the development of the learning game models for mGBL within a social-constructivist pedagogical framework. Social constructivism (Vygotsky, 1978) emphasises intrinsic learning through social interactions and interactions with tools, is learner-centred, accepts plurality of perspectives and is associated with life-long learning processes (Kolb, 1984). We understand 'game' as: 'organised play that gives us enjoyment and pleasure' (Prensky, 2001), whereby challenge is a key motivator (Fabricatore, 2000) and uncertainty a key element (Salen and Zimmerman, 2004). We understand 'mobile game' as a game delivered by 'personal and portable technologies' such as mobile phones (Naismith et al., 2004) and 'mobile learning game' as one that incorporates measurable learning outcomes, to support integration into curriculum delivery (Ellis et al., 2006). Based on this, we constructed a working definition for an mGBL game:

'An organised game with 'generic' learning outcomes, linked to decision-making in situations of uncertainty, that utilises educational affordances of the mobile phone such as 'portability, social interactivity, context sensitivity, connectivity and individuality' (Naismith et al., 2004) to engage individuals and/or groups of users in challenges relevant to their interests, knowledge and expertise (c.f. Knowles, 1990) and conducive to both adaptive learning and generative learning (c.f. Senge, 1990).'

We expect that users will want to be able to create their own games and so we are developing the models in the form of authoring templates and guidelines. To provide examples of their use, each model is implemented in at least one of the fields where the consortium has expertise: career guidance, e-commerce and e-health. The results will be made available on a website.

At the time of writing we are concluding the Elaboration phase of the project. Three game models have been developed: Game 1 is a hybrid of a Quiz and Simulation, Game 2 has been developed as a type of board game with a '2D' dimension. The development of these two models has been reported elsewhere (e.g. Mitchell et al., 2006 and 2007). Here the focus is on the development of Game 3: 'Get real!', which, as will be explained below, uses the web-enabled mobile phone to support a competition between teams of students. Game 3 design has been an iterative process of game creation, modification and analysis (c.f. Salen and Zimmerman, 2004). At an early stage we held an education industry workshop, to seek input from potential users. This chapter first outlines the initial Game 3 design, then reports the workshop and its results, highlighting concerns expressed by workshop participants and explaining modifications we made in consequence.

1 Get real!

1.1 Game rationale: bringing people together to resolve real-world issues

Forerunner for 'Get real!' was 'Baroque Blog', a game idea developed in 2005 at the Karl-Franzens University in Graz by mGBL project co-ordinators evolaris. This game concept sees teams of students competing with each other to identify buildings with Baroque characteristics, using the mobile camera phone to read 'tags' on buildings and send back information to a central server.

From this starting point, we sought to develop a user-centred mobile game model that would support development of both recognition-primed (Klein, 1998) and creative (Senge, 1990) decision-making skills, with learners investigating issues in real world scenarios. The mGBL game 'Get real!' therefore uses the web-enabled mobile camera phone as a flexible tool for use in real-world problem-finding and problem-solving. Very briefly, it supports a competition between teams of young adult learners who are using the phone to communicate with each other and with the game system as they seek to:

- identify a real-world critical situation relevant to their area of study;
- propose and critique possible solutions.

Teams have to do this as quickly and as well as possible.

1.2 First ideas and theoretical underpinnings

From the outset we were mindful of Prensky's (2001) advice; identifying reflection as a 'disappearing skill', he advocates providing players with opportunities for reflection on multiple levels to support integration of the new experience into their understanding, a view that is shared by others (e.g. Stretch, 2000). Accordingly, in designing mGBL Game 3, we set out to support development of adaptive learning and generative learning skills (c.f. Senge, 1990) by providing opportunities for single loop and double loop learning (Argyris & Schön, 1978, see Dick & Dalmau, 2000).

As an overarching theoretical framework, experiential learning theory (Kolb, 1984) was therefore useful. As Kohonen (2001) explains, it invites conscious attention to the importance of the learner's subjective experiences, attitudes and feelings about their own learning, by including reflective observation as one of four key stages of a cycle of experiential learning. The Kolbian cycle is illustrated in Figure 4.1 below:

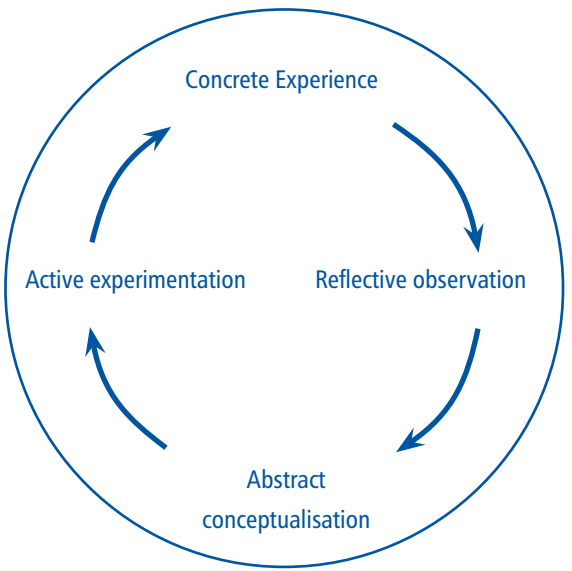

Figure 4.1: Kolb's learning cycle (Kolb, 1984: 42)

Furthermore, Kolb's theory applies to all learners but primarily concerns adults and is therefore of added relevance to mGBL.

Race (1994) redefines the Kolbian cycle as: 'wanting, doing, feedback, digesting' and takes issue with the idea of 'going round in circles', wondering where to start on the cycle. He suggests these phases should overlap, mirroring 'the simultaneous simplicity and complexity in the ways in which people actually learn'. Taking this into account, we envisaged an mGBL prototype based on the Kolbian (1984) learning cycle but allowing leeway for key stages to overlap (c.f. Race,1994):

- Wanting (intuitive and cognitive process): learners identify and plan for learning objectives, agreeing procedures to use and assessment criteria, as well as teams and team roles (e.g. Belbin, 2003).

- Doing: competing teams implement the plans to investigate a real world scenario, identifying critical issues and possible solutions.

- Feedback: During the 'Doing' phase, participants check knowledge as needed, e.g. via a quiz component, and can also access feedback on team activity via the game system.

- Digesting: The mGBL design supports 'reflection in and on action' (Schön, 1991) in two ways:
  - During the investigation via online exchanges between team members using the mobile phone.
  - Post-investigation 'Debrief' via a mobile blog, which is used to support:

'learningful' conversations that balance inquiry and advocacy, where people expose their own thinking effectively and make that thinking open to the influence of others. (Senge, 1990: 9).

From these can emerge ideas for further action enquiry.

Figure 4.2 below provides an overview of the envisaged approach.

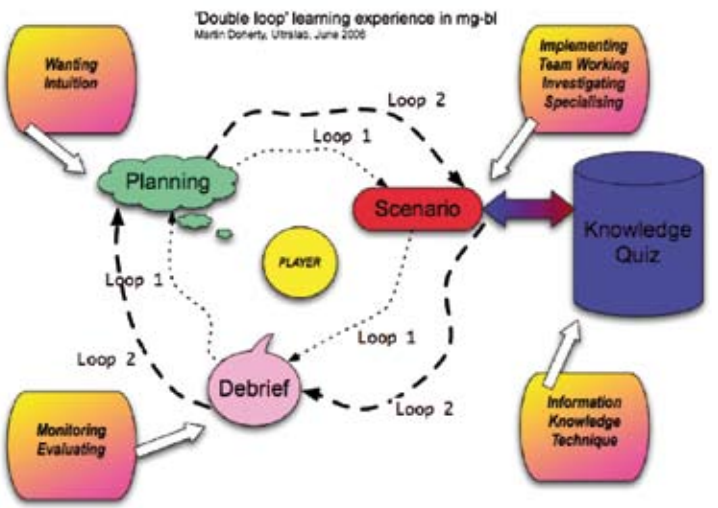

Figure 4.2: Early draft concept: mGBL learning experience
Martin Doherty, Ultralab, 2006

1.3 Fleshing out the concept

We began to develop the game in more detail as follows:

'Wanting' – in-class game preparation:

A class of learners selects a real-world topic for investigation that is relevant to their course of study. They agree learning objectives, criteria for evaluating achievement, game rules, points allocation, etc. and then form into a minimum of two teams that will compete with each other. Each team decides which role/s will be played by individuals in the ensuing 'Doing' phase; Belbin's (2003) management team roles can provide a starting point:

- Plant: a creative 'ideas person'. Less good at communicating or managing detail.
- Co-ordinator: a good team leader, co-ordinating work and facilitating discussions.
- Evaluator: a 'critic' who seeks to evaluate objectively.
- Implementer: a 'doer'. A reliable person who actions ideas.
- Finisher: a conscientious person who pays attention to detail and completes the job.
- Investigator: a 'networker' and 'detective', who identifies information and resources.
- Shaper: a 'driver' who keeps the project moving.
- Teamworker: a 'diplomat' who helps keep the team working effectively.
- Specialist: team 'expert' who provides specialist knowledge to the team.

Prior to game start, learners download specially-authored mGBL Quiz components, which they can use in-game to check relevant knowledge. However, they are made aware that use of such components would cost valuable time and hence might adversely affect game score.

'Doing' – real-world investigation

Team members use the web-enabled camera phone as a 'conversation mindtool' to share their investigation findings and thoughts via text, multimedia and voice:

> Conversation mindtools allow students to converse with their peers and with experts to get information and solve problems in groups. (Jonassen et al., 1998).

There are two 'Doing' stages:

- Problem-finding:
  Teams split up into smaller groups and travel to a number of agreed sites. Here they deploy knowledge and expertise to identify a real-world problem in the pre-selected topic area. The team co-ordinator sends this decision to the game system, which notifies all players via text that the particular problem situation has been identified, prohibiting its use by any other team.
- Solution-finding:
  Teams consider the identified problem and identify a feasible solution as quickly as possible (recognition-primed decision-making, c.f. Klein, 1998). The co-ordinator sends a short description of the solution to the team blog.

'Feedback'

A variety of 'Feedback' is accessible in the 'Doing' phase via the mobile phone, i.e.:

- quiz results;
- text messages from the game system concerning the progress of others;
- current game score, as maintained by the system;

- the exchange of resources and ideas between team members.

'Debrief':

In this activity students use team blogs to demonstrate awareness and appraisal of the following:

- efficient deployment of procedures by their own and their rival team ('single loop reflection', Argyris, 1976);
- the underpinning norms governing their own choices ('double loop reflection', Argyris, 1976).

'Debrief' blogs are monitored by the teacher, who considers the quality and relevance of input (by teams and individuals) and uploads points to individual and team profiles on the system. Here as in the 'Doing' phase there is a time limit but pressure is not so great – in order to encourage quality outcomes this part of the game may take several days.

On the one hand, this format facilitates a co-operative learning approach (c.f. Small, 2000), as participants have agreed on game rules and intended outcomes. They have also agreed on a strict time limit – teams have to move fast – all part of the challenge. On the other hand, the format offers scope for collaborative learning: students can be encouraged to look collectively at issues from a number of different angles (c.f. de Bono, 1967), whereby the focus is on generating ideas for creative problem-solving not on reaching consensus (c.f. Senge, 1990).

Supporting lifelong learning objectives

Our theory-based design identifies 'generic' learning objectives mapped against Bloom's revised taxonomy of learning objectives (Anderson and Krathwohl, 2001):

- creating: generating new ways of resolving critical situations;
- evaluating: hypothesising, judging, justifying decisions;
- analysing: organising, interrogating, finding;
- applying: using agreed procedures;
- understanding: summarising, explaining;
- remembering: recalling information, recognising, retrieving.

This design was intended to support integration of the game into delivery of graduate learning programmes, for example it could be used in relation to a number of Anglia Ruskin University's Generic Graduate Learning Outcomes:

- show flexible and creative approaches to problem solving;
- communicate clearly and appropriately, demonstrating a sense of audience;
- manage information effectively in a range of media;
- act in an ethical manner;
- produce output which is literate, numerate and coherent (in whatever form is appropriate).

So far, so good, perhaps – but were we expecting too much? Could all this actually work within the 'Magic Circle' (c.f. Salen and Zimmerman, 2004) of a game? We next convened an education industry workshop to critique the emerging design.

2. The education industry workshop

2.1 Context and scope

This workshop was the third in a series of similar workshop initiatives in the mGBL project, designed to afford opportunities for professionals in the education industry, including teachers and researchers interested in m-learning and in m-learning games, to enhance their understandings and expertise in the field. The main goal of our workshop was to review the emergent mGBL pedagogical framework from education industry perspectives, providing timely feedback to designers.

2.2 Location and participants

The workshop took place on 14 September 2006 in Chelmsford, Essex, a convenient location not far from London and easily reached by rail and air. It was held by Ultralab, a former learning technology research centre at Anglia Ruskin University. There were 21 workshop participants in all, representatives from the education industry, including teachers and teacher advisers, heads of school/departments, researchers, doctoral students, invited experts in the field of game-based learning and a representative from the mobile phone industry. Countries represented were: Croatia, Ireland, Norway, UK. The session was streamed to support those who were unable to attend the workshop.

2.3 Workshop task

The workshop was introduced with an overview of the mGBL project. Participants were then invited to consider the proposed pedagogical framework of the mGBL game. This activity took the form of a game: delegates grouped around the table formed themselves into groups

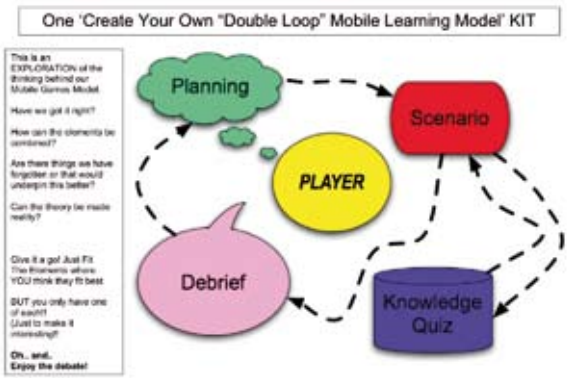

Figure 4.3; Workshop task: Martin Doherty, Ultralab, September 2006

of four or five. Each group received a 'game board' with explanatory notes (Figure 4.3 above).

Groups also received sets of 'cards' (see Figures 4.4 – 4.7). Teams were then invited to position the card elements in appropriate places on the board.

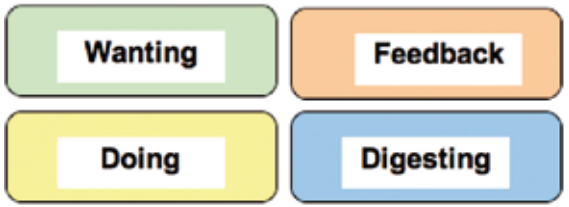

Figure 4.4: Workshop cards: Kolbian (1984) learning phases

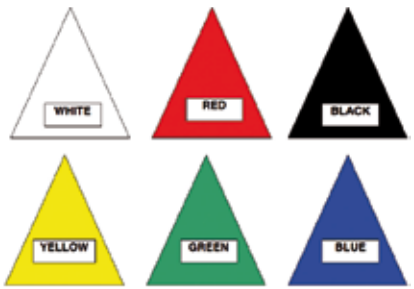

Figure 4.5: Workshop cards: de Bono's (1967) 'hats'

Figure 4.6 Workshop cards: Player Profile

Figure 4.7: Workshop cards: Belbin's (2003) team roles

2.4 Engagement and outcomes

Groups worked hard on the task (see example group in Figure 4.8), which many found challenging, if not perplexing. The discussions were intense and opinion on the emergent design was mixed.

Following group work, there was a session sharing findings where a diagram illustrating a possible solution (Figure 4.9) was collated using an interactive whiteboard.As can be seen, the result is far from ideal as a 'template' for creating a game!

Although there had been endorsement of the overall pedagogical framework, notably the 'double loop' (Argyris, 1976) approach,

Figure 4.8: Example group at work

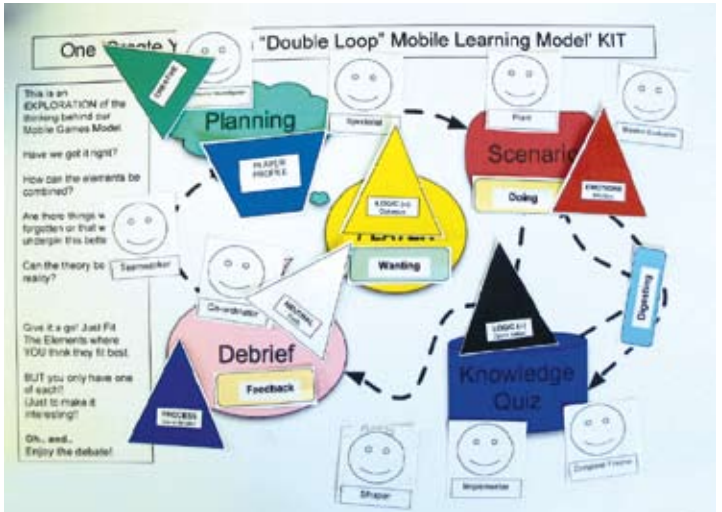

Figure 4.9: Outcome of mGBL workshop discussions, Ultralab, 13/09/06

the general consensus was that the concern with theory 'gets in the way' and that the focus should instead be on designing a fun game. It was time for us to 'Get real!' ourselves!

Delegates wanted to continue the discussions post workshop and were offered the opportunity of participation in a research community supported by the mGBL website to revisit the design. The outcome is reported below.

3. Simplifying the design

Taking on board the workshop findings, we drastically simplified the game design, now restricted to one single phase of 'Doing' with 'Feedback':

- each student sends an SMS to the game system to register for the game and team membership;
- the teacher starts the game, sending an SMS 'Opportunity alarm' to the students, requiring them to find and analyse a critical situation related to the area of study. This must be achieved within an agreed time frame;
- competing in teams, students use the web-enabled camera as a 'conversation mindtool' (Jonassen et al., 1998) to support their investigation – e.g. as a starting point they will need to agree team roles and approach;
- as soon as a team has identified a critical situation and formulated a description the team leader sends an 'Opportunity MMS' to a mobile blog that is accessible by all and where the system awards points for speed of task completion;
- still working in teams and communicating via their phones, students then propose a solution on the blog: 'Solution MMS'. Again, there is an agreed time limit;
- the teacher assesses all contributions in respect of intended learning outcomes and on the blog allocates points to individuals and teams.

This basic design is intended to afford flexibility in accommodating different implementations and theories as needed. The basic use case depicted in Figure 4.10 shows the 'Back-end' system that supports an mGBL 'Get real! Digital Economy' draft implementation. The 'Digital economy' version was developed in the winter semester 2006/07 at the Karl-Franzens University in Graz with students enrolled on the 'Principles of Digital Economy' and 'Modelling of Business Models and Digital Economy' courses and their teachers.

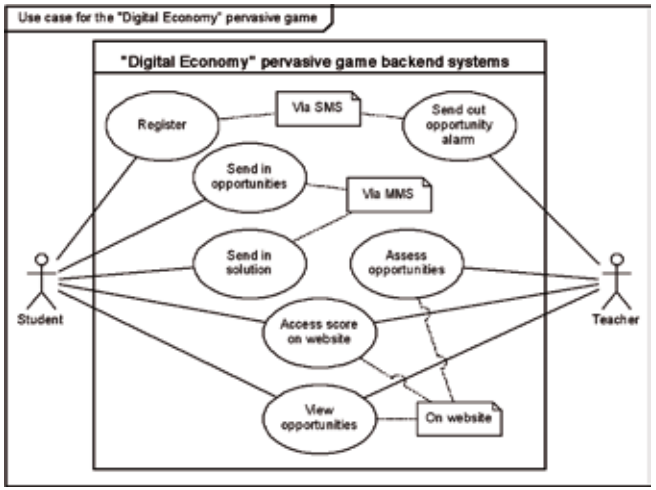

Figure 4.10: Example 'Get real!' use case, evolaris, 2007.

4. In conclusion

The mGBL prototype 'Get real!' has been developed as a 'pervasive' game, i.e. it is a multi-user mobile game that uses mobile technologies to bridge virtual world with real world activities (c.f. Benford et al., 2005).

It is a true game:

- The player struggles to meet challenges in an uncertain situation (c.f. Fabricatore, 2000, Prensky, 2001, Salen and Zimmerman, 2004), using the phone to co-operate and collaborate with others in identifying critical issues and proposing solutions (c.f. Senge, 1990, Small, 2000).
- The activity takes place in a context directly relevant to their course of study (c.f. Knowles, 1990).
- Feedback takes various forms (c.f. Race,1994, Prensky, 2001): system

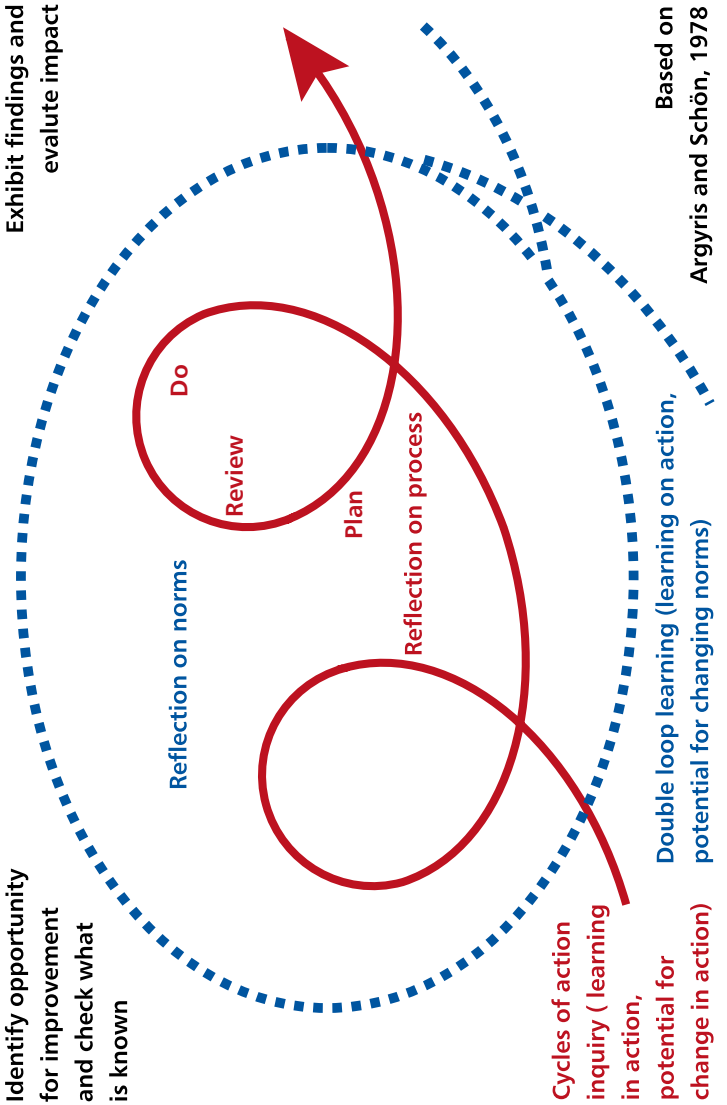

Figure 4.11: Inquiry-based learning: Richard Millwood, Ultralab 2006

score, based on time taken, and teacher feedback, geared to generic learning objectives (Anderson and Krathwohl, 2001) and any specific intended learning outcomes that the teacher may negotiate with the students. There is also the option of supporting peer feedback in an in-game blog discussion.

It is, we feel, fit for purpose: an exciting game that 'mobilises' the learner and engages them in recognition-primed (Klein, 1998) and creative (Senge, 1990) decision-making. Essentially, this is inquiry-based learning (see Figure 4.11).

A set of teacher notes supports integration of the game into curriculum 'delivery'. These offer guidelines on game preparation ('Wanting' phase) as well as ideas for a 'Debrief' (Digesting) phase for encouraging 'single loop' and 'double loop' reflection on decision-making processes and procedures that the students used and the underpinning norms – and also on the likely outcomes of their decisions, including longer term outcomes (Senge, 1990). As students are engaged pre-game in planning their investigation and post-game in reflective processes this will encourage them to take responsibility for conducting and evaluating their own learning in co-operation and collaboration with others, i.e. become autonomous learners (c.f. Kohonen, 2001).

We are encouraged by the reported success of a similar project at the University of Chile, which developed interactive mobile games to support the development of decision-making skills, albeit in a simulated situation: science students were asked to solve a core problem (Sanchez et al., 2006). After preparatory in-class activities led by the teacher, students quickly mastered the technology and successfully engaged themselves in

the problem-solving task, without further support from the teacher. However as we gear up to the mGBL user trials in September 2007, we wonder what will be the testers' experiences, practices and learning outcomes in respect of our own game? Will the overall design enable transformative play (Salen and Zimmerman, 2004), i.e. will the in-game and post-game learning opportunities effectively support co-operative and collaborative learning and double loop reflection? Crucially, will it be fun to play?

Acknowledgement:

The contribution is gratefully acknowledged of mGBL project co-ordinators evolaris Privatstiftung, Graz in developing and trialling forerunners of the mGBL game.

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Chapter 5

M-learning and media use in everyday life: towards a theoretical framework

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What is the educational impact when students of Primary School age and above readily have mobile phones and MP3-players at their personal disposal? Do their patterns of use of these media follow those of the computer and the internet? Or is there a difference? Is there anything new?

The last decade or so has seen significant innovation in everyday life brought about by the computer and the internet. These media have impacted on the school, and they have motivated some educational practitioners and theorists to explore and theorise the role of the computer and the internet for teaching and learning in formal as well as informal settings.

It was in response to first attempts at integrating these media in curricular activities that a wider educational discussion on mobile phones and MP3 players began. It started with concerns about violent images on mobile phones and found expression in their ban in schools in order to avoid any potential distraction from teaching and learning. This knee-jerk reaction can be seen as an unsurprising reaction of the school to exploiting the educational potential of the entertainment dimension of mass communication.

Bachmair, B M-learning and media use in everyday life
In: Pachler, N (ed) (2007) Mobile learning: towards a research agenda.
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1. Elaborating an educational frame for mobile devices on the basis of the dynamic of media in everyday life

Mobile devices have reached the school and the institutionalised cultural sphere of learning. They follow the rules of the development of mass communication, which is not per se interested in or orientated towards school, curricula or education. School initially built 'lines of defence' against the everyday life functions of the new media, exemplified in the mobile phone; however, in the meantime deliberate efforts are being made to 'domesticate' mobile media devices and their applications for educational purposes. A comparison with the way pictures, film and video were integrated into school curricula is instructive here. Only computers and the internet do not fit the usual pattern of acquisition by schools. One might argue that this is due to the fact that the school was asked by policy makers to encourage their introduction into the everyday life of young people in order to ensure familiarity with and competence in computer and internet 'literacy'. Computers and the internet were seen as tools for modernising industrial societies and for enhancing productivity and economic growth. It seemed that they might also function as an opportunity for bringing about school development by linking the school to the world of work, economy and technology.
If one looks back at the history of the integration of the technological media into school curricula, from photography or film to TV and video, and recently the MP3-player, podcasts or the mobile phone, there have always been some early adopters investigating the possibilities for teaching and learning on the basis of the use of these media by students in their leisure time. In a later phase, the media use in students' leisure time became the object for critical and/or creative media education.

Additionally, curricular functions were defined for these media.

With mobile devices we find ourselves once again in the cultural situation of a wave of new media 'splashing at the school gates'. Once again, the school – as institution – tries to react educationally to the outcomes of developments in the mass media and mass communication.

At the moment, apart from simplistic and naive approaches, one can also find initial interesting results from their practical and theoretical application in the field of education. For example, Kristóf Nyíri (2002) quite early on drafted a broad cultural framework paper entitled 'Towards a philosophy of m-learning'. In this he identified issues such as "ubiquitous communication", "school and society", "social construction of childhood", "text and picture". Patten et al., (2006) in turn put forward a helpful curricular approach to the recent debate on innovative models for learning. They proposed a design for m-learning on the basis of "collaborative, contextual and constructionist learning theories" (p. 295) and defined the following roles for handheld devices in "existing learning scenarios" (pp. 296 ff.):

- **administrative:** e.g. calendar or organiser on the students' mobile phone;
- **referential:** to store, access and annotate documents; information management and content delivery;
- **interactive:** e.g. a user responds to a task or receives feedback; "drill and test" with multiple choice style quizzes; to create own simple animation;
- **microworld:** allows learners "to construct … own knowledge through experimentation in constrained models of real world domains" (p. 298), e.g. exploring simple geometric concepts within the context of a billiards game;

- **data collection:** to record data and information and create learning experiences that would not otherwise be feasible or uproblematic; e.g. note taking, "on-the-spot" analysis, recording of images or sound for observations and reflection;
- **location awareness:** to "contextualise learning activities by enabling the learners to interact appropriately with their environment" (p. 299); e.g. museum guides;
- **collaborative:** to share knowledge and create a learning environment "inspired by collaborative learning principles" (p. 299); e.g. using learning platforms.

For practical examples, see Seipold, 2007.

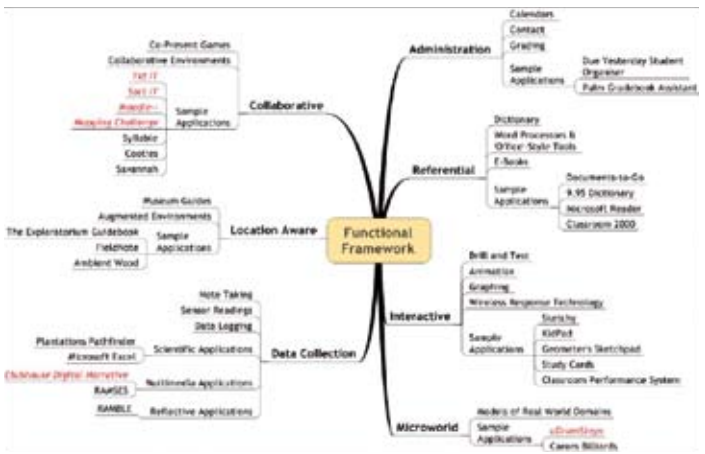


Figure 5.1: Curricular functions of mobile devices: Patten et al's Functional Framework (2006, p. 296)

This curricular approach is an attempt to rethink current principles of meaningful and situated teaching and learning ("collaborative, constructionist, contextual", Patten et. al. 2006, p. 294) in relation to mobile devices from *simple* ("administration", e.g. calendar) to *complex* ("location aware", collaborative, situational, motivated).

Even without a detailed discussion of this framework, it can be noted that it comprises functions of the three poles of any formal learning: "teacher", "student", and "content". In the traditional German curricular and didactic debate these three poles are considered as a triangle to which all curricular decisions have to refer. It would be interesting and helpful to use this didactic triangle to develop the framework above into a multi-dimensional model for the curricular application of mobile devices, alas lack of space does not permit this here.

Mike Sharples (2005) focuses his curricular frame on a discourse model of learning, which he derives from Diana Laurillard (2002; see also Chapter 6). It describes "the process of coming to know through conversation". Mobile devices receive their learning potential by virtue of the fact that students have (a) to understand and decide on their learning discourse in school and (b) to "interpret the forms of representation" of the object which have to be learned in the process of acquisition.

Everyday life and mass communication as frame of reference

There remains an essential deficit in approaches to developing a curricular frame for mobile devices. Theoretical approaches for the integration of mobile devices into the school curriculum tend not to consider the conditions of media use in everyday life. But everyday life is the determinant space for the use of mobile devices in relation to

which the school is purely reactive and over which it has no influence. More recent mobile media such as mobile phones with cameras, video capability, texting and big storage capacity for music, LCD displays etc all follow the dynamic of mass communication. From this perspective, a first question can be asked: which functions of mobile devices have the capacity to link the uses of mobile media across the frames of school and of everyday life? One can assume that challenging curricular options derive from three functions in everyday life:

- entertainment (e.g. ring tones, games, podcasts),
- interaction (e.g. calling, texting, blogs) and
- recording functions (e.g. photos).

Patten et al.'s (2006) "functional framework" for mobile devices defines a set of curricular uses; further functions become visible, embedded into the genres of entertainment. In the fast growing mobile market new genres emerge continuously. The data from mass communication research itself offers first impressions such as ring tones as a new, pervasive *m-genre*. So far ring tones have not appeared as an essential part of the school curriculum; they are, however, a mass phenomenon offering potential for composing short sound sequences and evaluation. What do the data from mass communication research on the content for mobile phones reveal? The data on applications sold in the category "mobile entertainment" indicate that in 2004 61% of users in the sample downloaded music and ring tones, 23% games and 12% logos and pictures. More recent data would probably show a significant increase in mailbox messages as well as background pictures, screensavers and videos (in 2004 = 3%) (Source: Goldhammer and Lessig, 2006: 7).

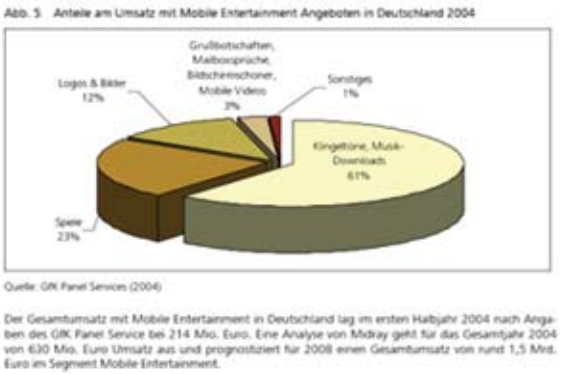


Figure 5.2: Mobile phone genres in percentages of turnover in the first half of 2004 in Germany (Source: GFK Panel Services in Goldhammer and Lessig, 2006, p.7)

The discursive background of the above three main media functions in everyday life – entertainment, interaction and recording – opens the way for adding or re-interpreting discursive models of teaching and learning, such as Laurillard's conversational framework (2002 and Chapter 6 in this publication). Students describe and act on the basis of representational schemes, e.g. they "demonstrate understanding of models and problem solutions" and "act to build models and solve problems". They work by interacting with "why" and "how" "questions and responses".

But one has to accept that the school has lost the power to define in its way and for its purposes, the representational schemas to which students respond and in which they produce. It can be assumed that successful students are able to act and produce in different signifying worlds, the world of school and the world of everyday life with its entertainment, interaction and recording. The school has lost its power to set these

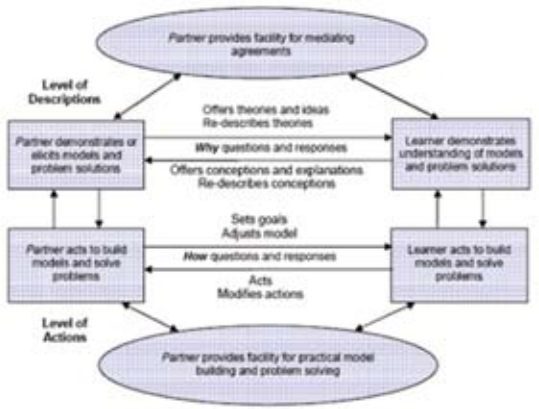


Figure 5.3: Discursive models of teaching and learning: Diana Laurillard's Conversational Framework (2002) (Source: Sharples 2005, p. 4)

frames in relation to the group of so-called "at-risk learners", that is, between a fifth and a quarter of the entire student population. While they can be successful in the everyday life world of entertainment, interaction and recording, they fail within the representational schemes of school.

In order to understand the new cultural dynamic it is helpful to know more about the three main functions of mobile devices in everyday life: entertainment, interaction, recording. These functions are developing within the features of mass communication, which – among other things – are characterised by time budgets for media consumption and patterns of media use. In the following, some selected research results are reported in an attempt to add to Nyríri's cultural frame the perspective of everyday life building on the cultural tradition of Alfred Schütz' explication of everyday life in industrial societies from the 1930s.

Longer term trends in developments of media technology

It might be instructive to have a closer look at the cultural trends within which mobile devices emerge. In the main there are three trends:

a) increase in availability and usability, which at this point in time means: individual portability, minimal size and integration into network structures such as the internet;

b) decrease in physical size of devices, which goes hand in hand with a change in traditional functions within a system structure, e.g. the convergence of the typewriter with the TV and the telephone. The typewriter was complemented by a screen, telephone talk within a cable network; it, in turn, was expanded by computers and now by radio (e.g. ring tones) and TV programmes;

c) integration of technological and cultural innovations and their logic in everyday life. If a medium is part of everyday life, it is shaped by and shapes the structures of everyday life, e.g. the time structure of a day or of the week. In Germany, for example, 89% of 12 to 18 year old boys own a mobile phone; for girls the figure is 94%; 80% of boys and 77% of girls of this age group own an MP3-player (Source: Feierabend and Rathgeb, 2006). These data indicate almost full saturation, close to that of TV and radio.

On the basis of these three assumptions, as well as the degree of saturation noted above, one can conclude that the mobile phone, handhelds, MP3-players or similar devices and their related genres will develop within the already existing patterns of media use. As a prerequisite for successful teaching and learning, the integration of mobile devices into the school

curriculum has to follow the conditions of media use in everyday life. The question arises as to the basis of the assertion that the school curriculum has to respond to the condition of media and their use in everyday life. The modern school came into being with the (medium of the) book. The developmental logic of the technological media derives from entertainment, leisure time and consumption as part of everyday life which seem to have few structural correlations with institutionalised learning. Pragmatic education approaches tried to reconcile school and the outside world, for example, through educational visits, learning on field trips or using museums as learning sites. But today the media, especially TV, deliver a wealth of learning opportunities such as "Who wants to be a millionaire?" where the format for assessment is the format of multiple choice questions. Such programmes find a broad and enthusiastic audience, even though the results of the Programme for International Student Assessment (PISA) reveal that a part of a fifth up to a fourth of the 15-year-olds in Germany are not able to read, to write (or to calculate) in a modern sense of literacy.

In this respect, two different and complex tasks need to be accomplished in order to be able to identify features of media use in everyday life with relevance for m-learning:

1) What knowledge about media development, media use and everyday life is available and can be extracted from these data to predict the potential for the use of mobile devices in schools?
   (The main purpose of this chapter is to report some selected results from German research. However, as there exist only a limited number of practical projects in this field at the time of writing, I can only offer an outline overview of the possible impact on curricular functions).

2) In our culture, with its enormous pressure for individualisation, different media are subject to different patterns of activities for TV, internet and digital games. Research results display complex features of activities which might be thought to have likely correlations with learning patterns. Such discussion of patterns of activity in respect of media which is supported by empirical research could lead to alignments with learning styles. This issue should be put on the agenda of the curricular discourse about m-learning.

2. Mass communication research and media in everyday life: report and discussion of empirical data from Germany

This chapter assumes that German data are relevant in identifying conditions of media use in other industrialised countries. At the very least, they can be used to support the search for similar or different results in other countries.

In Germany, there are two longitudinal studies in mass communication; one from 1964, on the media use of audiences over 14 years-of-age (see Reitze and Ridder, 2006; Fritz and Kingler, 2006; van Eimeren and Ridder, 2005). The second, which been carried out since 1998 (see Feierabend and Rathgeb, 2006), is on media for children and young people.

Longitudinal projects help reveal patterns such as the reach of the media to specific age-groups, affiliation with audience groups, the image of media and their function as information resource. Reach is defined here

as the index of the relevance of a medium within the media-set. It represents how many out of 100 persons are reached by the media of television, radio or newspaper.

The following short report on media trends begins with the issue of time structures and goes on to discuss specifically the media set and the preferences of the 12–19 age group. Additionally, the preferences of trendsetters are considered.

2.1 Basic time structure of everyday life (Fritz and Klingler 2006, p. 223)

Let us start with a brief scenario of mobile devices: the German public radio and TV channel WDR offers a wide range of podcasts with popular short films such as "How to measure the width of a river". The mathematics or geography teacher might suggest to their class that as homework they should watch this short film. It could serve as a motivation for them to engage with some basic features of problem solving. Another use – with low input requirements in terms of time could be a time planner and homework organiser (see Patten et al. 2006, p.297). Or, the A-level teacher of literature gives his students access to the recent work of Orhan Pamuk, the Nobel Prize winner in literature in 2006 from Turkey. He has found an audio book of a book by the author. Apart from homework, the 2.30-minutes-long film "How to measure the width of a river" could also be used at the beginning of a lesson. What other time slots are available during the day? The audio book is 155 minutes long. Could the teacher motivate his students to listen to Orhan Pamuk on their way to and from school? Students normally don't have such long journeys to school. Younger pupils tend to travel to school on foot and they have to concentrate on the traffic and should not be distracted by

listening to podcasts. When is there time for exposure to this MP3-file?

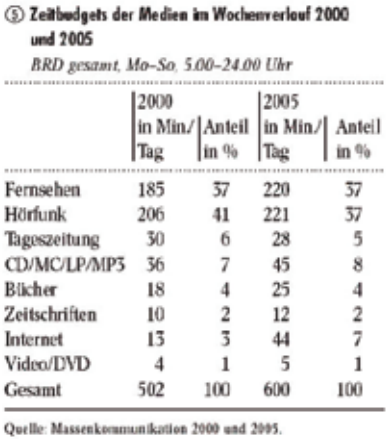
Data from Germany reveal the following time structure of a week:

- recuperation: Monday – Sunday = 30%; Mon – Fri = 28% (sleeping, eating, health care etc.)
- productivity: Monday – Sunday = 31%; Mon – Fri = 35% (e.g. working, driving to the office)
- leisure time: Monday – Sunday = 39%; Mon – Fri = 37%

There is, therefore, a quite clear time structure, which roughly divides time available each week into three thirds. Normally, people use MP3-players and their mobile phone within the time for regeneration or during leisure time. During this time, mobile learning has to compete with all other MP3-genres. The alternative is to replace activities within the time available for production; for pupils that means the time for school and homework. Perhaps the A-level student is motivated enough to accept Orhan Pamuk as part of her leisure time. The work by Orhan Pamuk is quite an exciting listening experience, which can successfully compete with other leisure time programmes. The WDR-podcast on measuring the width of a river is part of a well know children's TV programme. It fits easily in the motivation phase of a lesson.

Changing time budgets for media use (see: Fritz and Klingler 2006, p. 226)

The time available for listening to MP3 files and using mobile phones could be limited to the time budget available during school time. Teachers need to consider what potential curricular options can be derived from the entertaining (ring tones, games), interactive (calling, text) and recording (photos) functions of everyday life. Of course, different school systems



⑤ Zeitbudgets der Medien im Wochenverlauf 2000 und 2005

BRD gesamt, Mo–So, 5.00–24.00 Uhr

	2000 in Min./ Tag	Anteil in %	2005 in Min./ Tag	Anteil in %
Fernsehen	185	37	220	37
Hörfunk	206	41	221	37
Tageszeitung	30	6	28	5
CD/MC/LP/MP3	36	7	45	8
Bücher	18	4	25	4
Zeitschriften	10	2	12	2
Internet	13	3	44	7
Video/DVD	4	1	5	1
Gesamt	502	100	600	100

Quelle: Massenkommunikation 2000 und 2005.

Figure 5.4: Weekly time budget for media use 2000 to 2005
(Source: Fritz and Klingler 2006, p. 226)

cover and structure the school day differently. But an intended media use has to take into account the necessary increase of the time budget for media consumption.

Between 2000 and 2005, media use per day increased by 100 minutes. When one compares the statistics for 1980 and 2005, the over-14-year-olds almost doubled their media time from 346 minutes in 1980 up to 600 minutes per day in 2005. This increase occurred mainly in leisure time and production time. The doubling of the amount of media time indicates, as well a generational shift in the everyday life patterns, a high competition between media and their genres although competition between media is not the adequate description, because media fit in their specific time and patterns of use (Fritz and Klingler, 2006, p. 227):

Radio = throughout the day

TV = late afternoon and evening

Newspaper = morning

Internet = whole day.

There are quite specific time patterns for media use. These patterns are more or less known: TV is watched more in leisure time; radio is more closely related to production time etc. The culturally newer MP3-player and other mobile devices fit into these patterns or compete with them, e.g. podcasts replace the broadcast radio. At the moment one can observe an increase in the daily time for production and leisure activities but without a dramatic change of the existing relations between regeneration, production and leisure time. Fritz and Klingler (2006, p. 229) note almost no change in the time budget for media use for the phase of regeneration (in 2000 = 74 min. / in 2005 = 81 min.). But in the area of production the time for media expanded 35 minutes daily from the year 2000 with 140 minutes to 175 minutes in 2005. A bigger daily increase of 42 minutes occurred in leisure time: year 2000 = 258 min / year 2005 = 300 min.

If one considers the fact that the daily time budget is limited to 24 hours, then the addition of media time in the region of half an hour up to three quarters of an hour per day is rather significant, particularly in terms of defining what is important and what can be replaced etc. Furthermore, one can expect that mobile communication will cover the whole day and not only leisure time and time for regeneration.

If the school intends to widen the participation of at-risk learners such as boys from immigrant families and from families with a relative distance to formal education (see e.g. Deutsches PISA Konsortium, 2001, pp. 399 ff.), then the media preferences within the cultural background of these

groups have to be taken seriously. To find and interpret relevant research result should, therefore, be on the agenda of the discussion about the role and use of digital technologies in education.

2.2 Media set of the 12- to 19-year-olds

The results of a recent German longitudinal study on young people and media (Feierabend and Rathgeb, 2006) make it obvious that mobile phones, CD-players and radio are fully or almost completely integrated in everyday life. MP3-devices are quite close to this stage.

TV is integrated into family life, but not as an object of un-negotiated disposition for young people. In Germany, parents are still the gatekeepers and hesitate to put a TV set into the children's bedroom. In respect of the availability of computers there is a discrepancy of 18% between

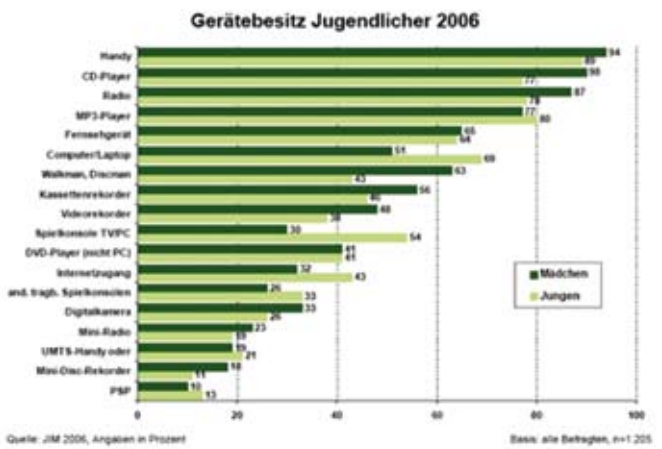


Figure 5.5: Possession of media devices by young people (Source: Feierabend and Rathgeb, 2006, p. 10 (JIM 2006))

boys and girls. Just half of the girls have a computer at their disposal, although nearly all families with children (98%) own one or more. But 69% of the boys are PC owners.

What are the main trends?

Everyday and non-linear media

The mobile phone is definitely part of everyday life for 12 – 19-year-olds. As such, mobile phones are subject to the structures of everyday life, which are taken for granted and usually not reflected on any more. But the media technology of everyday life influences and changes the structure of everyday life and the relation to the media set. The ongoing change is significant. With MP3 and CD players young people can be independent from traditional providers such as broadcasters, channels etc. The availability of MP3-players in families and for the young is three times higher than 4 years ago. In 2003, 28% of German households with children and 14% of young people owned an MP3-player, in 2006 the figure had risen to 87% of households and 79% of young people had an MP3-device. One has to take into account that MP3-devices are not part of the traditional structure of mass communication, which was based on the broadcasting of programmes in a linear manner. The significant increase of MP3-devices leads to non-linear media use, which is becoming the norm. For a short period this development opens up a generational gap in respect of the preferred use of the media. The parental generation grew up with linear media use within a system defined by broadcasting.

The discourse model governing teaching and learning discussed briefly above (Sharples, 2005; Laurillard, 2002 and Chapter 6) is still based on personal interaction which is typical for the school as an institution: learners are asking, explaining, defining despite the fact that mass

communication influences the way we engage with and learn from and about the world. Suffice it to mention three features here:

- learning in everyday life is an integral part of entertainment;
- the individualised and personal framing of the world; and
- there increasingly exists a range of different acquisition patterns rather than objectively, extraneously given approaches to generally relevant topics.

In light of these assumptions, non-linear media use, such as podcasts, enhances entertainment, which is the typical cultural frame of learner groups outside school. As a frame of reference, the curriculum loses power. Some groups of learners do not align their personal patterns of acquisition with the preferred patterns of school learning, for example "to demonstrate understanding of models and problem solutions" (see Laurillard, 2002 and elsewhere in this publication).

Gender bias

Gender bias in relation to the media set is normal. Relative to boys, girls have more CD-players, radio, audio cassette recorders, video recorders and digital cameras. Boys possess more computers / laptops, digital game consoles and have more internet access. Teaching and learning based around mobile devices has to be aware of this gender bias.

Social bias

A remarkable proportion of children and young people still has reduced access to individually programmable (= non-linear) and mobile media devices. There is also a social class bias which tends to lead to the exclusion of children and young people from social groups with low

Figure 5.6: Possession of media devices by young people in Germany relative to school types (Source: Feierabend and Rathgeb 2006, p. 11 (JIM 2006))

Note: The German school system is divided into three hierarchically – and socially – discriminated types of school: Hauptschule = school type with a high proportion of children from working class and migration families; Realschule = school type with orientation to administrative professions; Gymnasium = school type which opens the way to university.

Figure 5.7: Frequency of media use during leisure time by girls and boys (daily/more than once per week) (Source: Feierabend and Rathgeb 2006, p. 12 (JIM 2006))

income and distance to school-based education. In the short term, this social bias could influence efforts to widen participation in education supported by the mobile phone and MP3-players.

2.3 Media preferences during leisure time

Leisure time competes with time for regeneration and for production. As noted above, in Germany each of these three time allocations covers more or less a third. In Germany the term 'competition' seems an appropriate description of the relationship between the three allocations because the children and young people spend in the main only around half a day at school. After school, they are expected to do their homework but the division of the available time between homework and leisure activities is left to families and young people. Also, the German concept of school and education separates learning and entertainment, although the media offer a lot of knowledge-based programmes within entertainment formats such as game shows. At present, the media preferences within leisure time still show a preponderance for TV. There is also a quite remarkable gender difference which applies particularly to the internet and digital games consoles. More girls prefer music CDs and radio, more boys MP3s, computers and the internet. Games on consoles are definitely the domain of boys (boys = 32%, girls = 6%). If the 2.30 min podcast "How to measure the width of a river" or the 2:30 hours Orhan Pamuk audio book is to be used outside the school this competition for time has to be considered carefully, as do the different media priorities of boys and girls.

2.4 Genre, content, program(me)s

It is useful to combine the rather divergent concepts of genre, content and program(me)s because new media also establish new 'content'.

Figure 5.8: Contacts and communication with friends (Source: Feierabend and Rathgeb, 2006, p. 14 (JIM 2006))

At this quite early stage of the development of the mobile phone into the leading medium of everyday life, it is possible to keep the terminology ambivalent. But one development was to be expected: the transformation of this technology from portable telephone to a 'full medium' was publicly discussed in relation to violent content. Looking back, when video first impacted on everyday life, this media innovation was scorned publicly for its harmful content. Traditionally, harmful content has been society's mechanism for becoming aware of a new medium. In Germany in 2005, the recording or photographing of violent performances in school playgrounds was a big issue ('happy slapping'), which indicates the awareness of self produced content alongside the traditional functionality of making calls. The sound genre "ring tones" was considered to be harmful for children and young people in terms of their being duped by advertising. In the dynamic of multi-media convergence, the advertisements for ring tones led to 'hits' like the *Crazy Frog*.

The semiotic use of the concept genre stresses social functions. Therefore, a descriptive view of social activities negotiated via the mobile phone is worthwhile in order to identify specific genres within the range of modes afforded by the mobile phone of supporting and enhancing social contacts. In relation to the use of the mobile phone for contacting friends and peers, the German data suggests that it is still only one mode of interaction alongside others. Just as with TV, the mobile phone is mainly integrated into interaction within peer group and friends. 92% of young people see each other daily or several times per week. However, to get in touch with friends 71% of girls and 62% of boys use texting and MMS. 42% of girls and 49% of boys use mobile phones to call their friends. One can consider the present 73% of landline use as an area for considerable growth for mobile phones.

Radio and the MP3-player: from a linear to a non-linear medium

The MP3-player, either as integrated part of the mobile phone or as separate mobile device, connects the mobile with traditional media content, which is produced within an editorial context. Radio, the traditional linear medium, increasingly delivers programme offerings via the internet to MP3-players and is on its way to adopting non-linear media structures. To compare the traditional editorial media of sound programmes, i.e. radio broadcasts, with the MP3-player highlights a change in cultural tends from linear to non-linear mass communication. On the one hand, the MP3-player carries the content of the radio, on the other, it disrupts the linearity of producing, delivering and using the medium. The MP3-player does not need an editorial structure of the kind needed by the traditional radio, which pushes defined programme elements within a given time structure to the audience. A user has simply to decide if s/he wants to listen or switch off/tune into another station. By contrast to such a *push* strategy,

the user of a MP3-player *pulls* his/her preferred programme from a programme storage, supported by software such as iTunes, from a website and listens within his or her personal time structure.

94% of the 12- to 18-year-olds use MP3-players to listen to music. But their radio preferences include news, comedy, information on regional events, coverage of regional relevance, sport (note the gender differences discussed above), concerts etc., and information with relevance to internet or computer games.

But the data from 2004 presented earlier shows that the mobile phone re-shapes traditional genres (c.f. ring tones), but also invites young people to download traditional material. All together *sound* comprises 61% of the content on mobile phones, followed by games (23%), logos and pictures

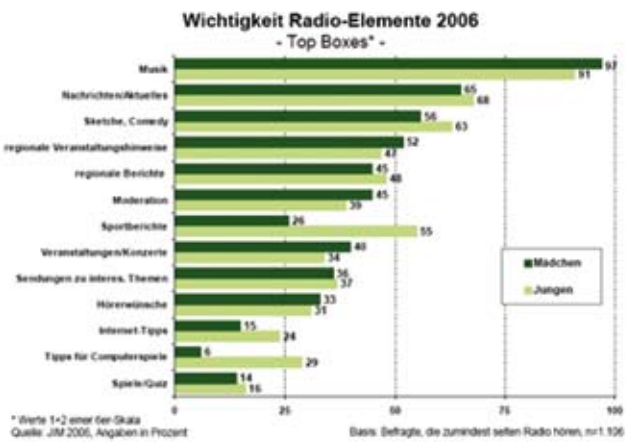


Figure 5.9: Relevance of radio offerings (Source: Feierabend and Rathgeb 2006, p.30 (JIM 2006))

(12%), and 3% mailbox messages, background images and screensavers and downloaded videos etc.

Music

97% of girls and 91% of boys listen to music on the radio, and 65% of girls and 68% of boys listen to news and information on current issues. Information on local issues and offers are used by almost half of the young people surveyed. It can, therefore, be argued that such content on mobile devices would be positively received by students given its relevance for everyday life.

In terms of school-based instruction, it seems rather straightforward to introduce into the curriculum the genres relating to information on general and regional issues. Rather more difficult, it seems, is the use of music genres for instructional purposes. It is argued here that creative ideas are needed how to 'curricularise' the genre preferences from everyday life in relation to mobile devices, or at least to bring them into a meaningful and supportive relationship with school-based teaching and learning. If the mobile phone is not just for motivation and updating the curriculum with the latest entertainment technology, the curricular functions delineated by Patten et al. (2006, pp.294, 297 ff.) have to be addressed, i.e. administrative, referential, interactive, microworld, data collection, location aware and collaborative. A brief look at the media of everyday life reveals some provisional ideas. Given the focus of this chapter, i.e. to explore media use in everyday life as an important basis for curricularising mobile devices, the following examples are deliberately taken from everyday life.

Example: Favourite music as genre for mobiles

In Bonn, 6000 owners of mobile phones downloaded Beethoven's 'Ode an die Freude' as a ring tone. They performed Beethoven's ring tone to blackbirds with the intention of getting male blackbirds to learn to whistle the tune. Teaching blackbirds to whistle a melody works on the biological assumption that male blackbirds compete with possible rivals by answering their 'call signs'. The context of this project was established by an artist, probably to enhance an impression of the overwhelming repetition of classic melodies within spaces of consumption.

Using the curricular categories of Patten et al. (2006, p.299) this project with a music genre realises the categories "location aware", "collaborative" and to some extent also "microworld".

- **collaborative:** the experiment is organised as social project, which affords, as a first step, opportunities for small talk within a town and, after the project is completed, for follow-on discussion outside the context of the project.

- **location aware:** the 6000 inhabitants of Bonn are encouraged to analyse the marketing function of classical music and its trivialisation within shopping site and as ring tones. Additionally, their world is considered as living space for birds. Curious behaviour of animals and the trivialisation of classical music occur in their own world, which is usually taken for granted and not reflected on.

- **microworld:** aspects of structure and function of the world as well as the biological basis of the whistling of birds become known. Blackbirds do not learn a melody because they like a melody or they

like to repeat it. Male blackbirds just whistle a ring tone because they understand it as unfriendly signal from an intruding competitor. A blackbird uses the '*Ode to Joy*' as sign against an intruder.

Example: Social analysis with camera phones and MMS

The German women's magazine *Brigitte** offered its female readers a test on the attractiveness of men and how to begin a friendship. It is a psychological test of the typology of female identity. A female reader is invited to choose one of five pictures of men. The pictures are printed above an elaborate text on the social psychology of the initial phase of relationship and the role personality features play. One has to select one out of five images of men, i.e. take with one's mobile a picture of one's favourite man depicted on pages 146–149 of the magazine. The reader is invited to send their chosen picture, using the subject line 'MAN', by mobile phone (via MMS) to a psychologist who answers by SMS and interprets the chosen type. (see *Brigitte* 13/2007, p.150)

From a learning perspective, this procedure is similar to using the camera phone function on a visit to a museum (see Patten et al., 2006, pp.299 f.: "location aware", "collaborative"), which is by now a common proposal for 'creative' use of media in learning sites outside the school. When students walk through a museum they have to identify and compare pictures in order to find features within the picture. Before taking a photo they have to make a decision on the basis of features identified in the picture. Afterwards, and supported by the teacher, the students reflect on the features, mainly by talking on a higher level of reflection.

* Brigitte, Hamburg 2007, No. 13, June 6th 2007, pp.157, 145–151: Die Gesetze des Kennenlernens (The laws of getting to know one another)

Usually a further level of reflection is reached by means of reading more theoretical documents and writing an essay. The magazine *Brigitte* offers the pictures within the frame of a quite theoretical article on the beginning of personal relationships. However, in contrast to school, it does not ask the reader to write a short essay but to take a photo. Of course, to write an essay would not be acceptable in an entertainment context. Therefore, the essay is replaced by the photo, which is to be sent to the magazine. There are, however, significant differences in taking a picture and writing an essay. This example reveals differences in the mode of reflection in school and entertainment. The essay necessarily requires higher order thinking, the former does not. One can just take a picture based on very little reflectivity. Nevertheless, this 'task design' gives the reader the option of identifying a feature within a picture through the eye of a camera. On the basis of an anonymous interaction with the psychologist, the reader receives feedback via the mobile phone's text function.

This example reveals curricular application in the context of the conversation model. One could also identify learning outcomes in relation to the levels of literacy required by the test of the "Programme for International Student Assessment" (Deutsches PISA-Konsortium, 2001, p. 89). Readers of the magazine *Brigitte* engaging with the 'task' are asked to identify features within a text (pictures plus written text). PISA identifies three dimensions of literacy: a) to identify information, b) to interpret a text and c) to reflect and evaluate. A participant in the womens' magazine's test has to work on all three dimensions, which is possible only by using two application of the mobile phone: taking a photo and texting.

2.5 Media trendsetter

In 2005, the German longitudinal study for media use (Reitze and Ridder,

2006, pp. 178–199) asked 6% of the population with the highest score in media use and media equipment to learn from them about trends. With reference to m-learning, the trends underline the transformation of mass communication away from the linear broadcasting model towards non-linear media use. Furthermore, media trendsetters show a rather remarkable preference for genres relating to socially relevant issues.

Trend towards non-linear media use

Trendsetter own and use media outside the traditional broadcasting system which provides programmes in a linear way. Within linear mass communication, media such as TV channels push programme to the audience. In a non-linear medium, the audience is able to control and determine the media flow by pulling programme elements. Digital video recorders and MP3-players support a non-linear media flow and the pulling of programmes on demand. In 2005, media trendsetters used digital video recordings twice as frequently and MP3-players almost three times more often compared with other audience groups (Reitze and Ridder 2006, p.185):

Digital video recording:
average media user = 17,1% / media trendsetter = 45,2%
MP3-player, iPod:
average media user = 26,2% / media trendsetter = 75,1%

Agenda setting

Which are currently the most relevant societal issues? The following issues are important for trendsetters (Reitze and Ridder, 2006, p. 189):

Social Policy (Gesellschaftspolitik/Soziales)	79%
Economy, jobs, profession (Wirtschaft/ Arbeitsmarkt/Beruf)	68%
Politics (politische Themen)	62%
Technological, scientific development (technologisch/ wissenschaftlicher Fortschritt)	45%
New media, communication (neue Medien/ Kommunikation)	38%
Environment (Umweltprobleme)	33%
Energy (Energie)	28%
Poverty in the 3rd world (Armut in der 3. Welt)	15%
Human relations (menschliches Miteinander)	10%

Figure 5.10: Extract from the list of the important issues for media trend setters (Source: Reitze and Ridder, 2006, p. 189)

It is surprising that the media issues, which trendsetters are concerned with, do have a positive correlation with the typical and traditional school agenda. The question that remains unanswered is what this implies for attempts at widening the participation of at-risk learners in the school, because learners at risk do not belong to the group of media trendsetters.

3. A short overview of complex patterns of activities related to media

The ongoing process of individualisation and social fragmentation is negotiated and enforced by the media of everyday life. In this dynamic, media are cultural objects among various commodities with relevance to everyday life. They function as symbolic material within a standardised offer, which is open for consumption within, and for building personal life worlds. The shift from mass communication based on linear to

non-linear principles fits into the process of individualisation which enables, or may enable, students to construct their own knowledge. It is argued here that m-learning correlates with constructivist curricular approaches to innovating a static model of school instruction. These constructivist curricular approaches correlate with the personalised construction of life worlds, which have become taken for granted.

Personal life worlds include the individualisation of collective risks (see Giddens 1991, pp. 109 ff.) and a self-referential frame of personalised experiences of reality (see Schulze 1992, pp. 34 ff.). These two impacts of personalised life worlds have found their way into school in the form of constructivist curricular approaches. In view of these developments, the educational dimension of the introduction of mobile devices in formal learning has to be considered critically between the poles of enhancing meaningful and situated learning (constructivist learning) and of individualising cultural and social risks by personalised and self-referential experiences.

As well as the necessary theoretical consideration, data on media consumption are discussed below. M-learning is framed by features of the socio-cultural milieus and already habitualised patterns of media use.

In addition, a very short summary of the results on TV and internet will be given in this section.

3.1 Media preferences of socio-cultural milieus

In the first instance, milieus can be identified as socio-cultural frames for the identification of media patterns. The milieu-related organisation of our society has emerged during the past two decades. Following the cultural

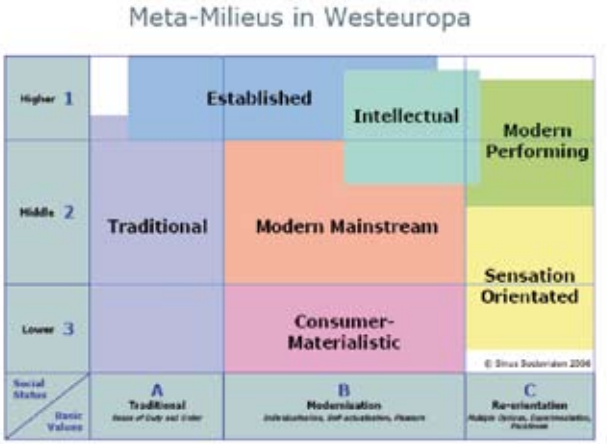


Figure 5.11: Social Milieus in Western Europe (Source: Sinus Sociovision®, 2007)

Figure 5.12: Style of living rooms – milieu 'modern performer' (Source: Sinus-Milieus®, 2001, p. 10)

Figure 5.13: Style of living rooms – milieu 'traditionalists' (Source: Sinus-Milieus® 2001, p. 12)

sociology of Anthony Giddens (1991) or Gerhard Schulze (1992), and looking at the results of the respective empirical research, it can be noted that industrialised European societies are segmented into the following milieus. Their construction follows two dimensions (Source: Sinus-Milieus®, 2001, p. 5):

a) Social Status: high, middle, lower; and
b) Basic Values: traditional (sense of duty and order), modernisation (individualisation, self-actualisation, pleasure), re-orientation (multi options, experimentation, paradoxes).

The above-mentioned media trendsetter belong to the higher scorers on the dimension *Basic Values* and *Social Status* (see Figure 5.11). Probably they are part of the milieu *Modern Performing* or of the *Modern Mainstream* as well as of the milieu *Consumer-Materialistics.*

The spatial personal environment, that is the living room or the bedroom, of the milieu *Modern Performer* is likely to be similar to the one depicted in Figure 5.12. The media trendsetters usually do not belong to a tradition-oriented milieu living in rooms like the example in Figure 5.13.

If a teacher invites students to use mobile devices in a constructivist learning environment, the *value orientation* of the *Modern Performers* are closer to such a project than young people from a traditional cultural environment. Certain projects will require quite a strong motivation for students from a traditional background with higher or lower social status and income. But it is rather likely that the traditionally orientated groups appreciate mobile calendars or organiser ("administrative function", Patten et al., 2006, p. 296), dictionaries ("referential function" Patten et al., 2006, p. 296) or the basic learning input like *drill and test* ("interactive function, Patten et al., 2006, p. 296). These kinds of learning tools are accepted by milieus with a more traditional orientation. One can assume that the three different "basic values" map onto different preferences in respect to school, teaching and learning. They are: "A: Traditional, sense of duty and order", "B: Modernisation, individualisation, self-actualisation, pleasure" and "'C: Re-orientation, multiple options, experimentation, paradoxes" (see Figure 5.11). A traditional values orientation can be seen to go hand in hand with traditional methods of schooling.

Also, genre preferences are pre-structured by the social milieu.
For example, the podcast with the short video "How to measure the width of a river" belongs to a well know children's TV series "Die Sendung mit der Maus". Children from innovative milieus with higher social status are more likely to watch this series, but children with a traditional orientation prefer information programmes. By looking at the socio-cultural milieus of the pupils, a teacher can tailor specific inputs to activate specific media habits and media preferences for m-learning.

3.2. Activity patterns within the media set and family life of children

Within the context of the cultural transformation of mass communication from linear to non-linear dispositional modes, and the relevance of cultural practices in terms of the segmentation of society, children are acquiring specific patterns of activities by using certain media sets in their family life. The children's TV channel SuperRTL investigated these patterns at the end of 1990s and the beginning of the year 2000 (2000 & 2002), when TV was still the dominant medium of the media set of children.

The research project focused on four kinds of patterns:

a) activity patterns in leisure time: different levels of activity and external orientation; level of activities: low / high,
b) patterns of emotions and feelings;
c) patterns of social and self experiences;
d) patterns of the social and organised worlds of children;
e) parental style of education.

The activity patterns range from casual watching of TV to complex patterns of integration of TV programmes into mundane and individual action patterns with different levels of activity and external orientation, as well as "emotional patterns".

a) Activity patterns of children in leisure time (SuperRTL 2000, pp. 58 ff.)

There are two main dimensions of activities:

- orientation towards the outer world or to the inner world;
- level of activities.

Identified activity patterns

- the "passive children" with few of their own activities, however with a great deal of action-rich television consumption (22% of children);
- the "play-children" with many toys and fairy tales (22% of children);
- the "intellectuals" who concentrate on "more knowledge, in order to receive an achievement-orientated advantage"

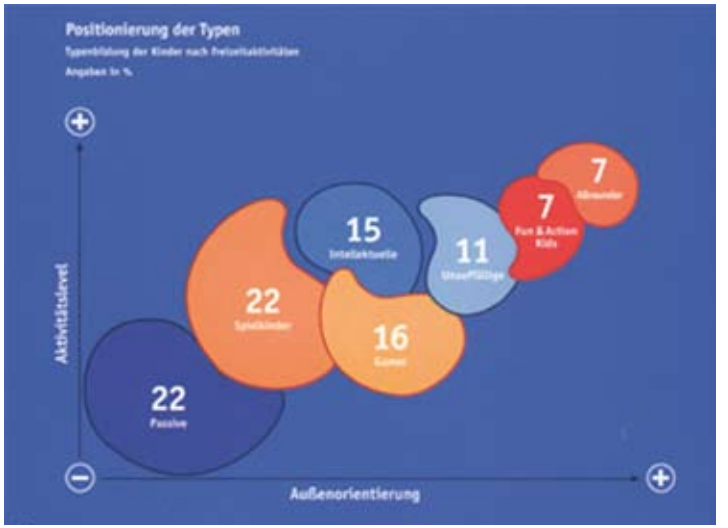


Figure 5.14: Children's activity patterns in leisure time (Source: SuperRTL 2000, p. 60)

(15% of children);
- the "game players" with their plethora of "games, fun, and excitement" (16% of children);
- the "unnoticables" with their love for animals and openness to new things (11% of children);
- "fun and action kids" who are "young, dynamic, and rarely alone" (7% of children); and
- the "allrounders" with a "need for leadership" and "corners and edges" (7% of children).

The keywords from marketing such as play-children or fun and action kids are rather superficial but indicate the differences between groups of children in- and outside a classroom. If mobile devices are to be integrated

into learning activities, teachers need to re-think these different patterns of activities on different levels and in relation to different orientations to the inner or outside world of children.

These activity patterns map onto patterns of emotions and feelings and patterns of social and self experiences, which regulate the integration of media use in everyday life.

b) Media/TV are elements in patterns of emotions

- boredom;
- relaxation;
- regulation through anger;
- mood of sadness;
- mood of separation and retreat; and
- getting comfort.

c) Patterns of social and personal experiences

The dimensions of these patterns are:

- comfort and attention in the family;
- self-determined retreat;
- friends;
- excitement and surprise;
- learning and desire for knowledge;
- curiosity for others;
- retreat, disinterest and boredom and
- dramatic search for suspense.

d) Modes of organising children's worlds

There are other patterns which regulate the social worlds of children

especially in the way parents organise family life and educate their child or children (Source: SuperRTL 2002, pp. 74 ff.).

Clusters of educative styles of parents inclusive of TV

A) Over-educative and regulative style	
• controller	7%
• (over)protective	16%
• contradictory	11%
B) Engaged and communicative style	
• open minded	17%
• generous, liberal	18%
(C) Distant	
• weak orientation towards family	12%
• indifferent	19%

Figure 5.15: Educative style of parents (Source: SuperRTL, 2002, p. 74)

The 35% of children (see Figure 5.15: section B) who benefit from an engaged and communicative style of education are likely to respond positively to teachers offering the use of mobile phones and application such as camera phones for *collaborative* investigations of *real world domains* such as the museum or to work within the *microworld* of models offered by mobile devices (see Patten at al. 2006, p. 296). This group of children is familiar with working autonomously which is essential for successful constructivist learning. These positive experiences are also important for collaborative investigations of real world domains or creative use of the small world of mobile games etc. (microworld). But there is also

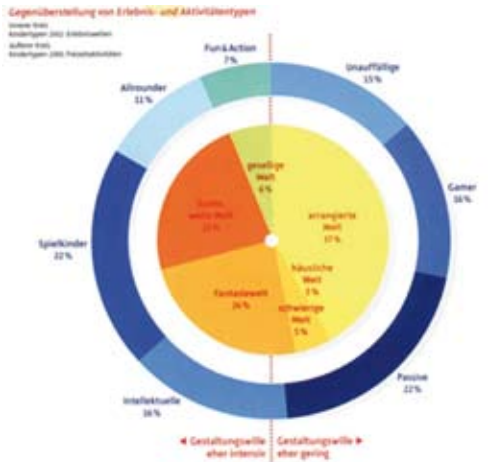


Figure 5.16: Correspondences between activity styles of the children (outer circle), the organisation of their everyday life world (inner circle) and the children's capability in relation to formation and organisation (left sphere: more intensive, to the right: limited) (Source: SuperRTL, 2002, p. 77)

a large proportion of students who expect clear regulations (23% with controlling and overprotective parents; see section A of Figure 5.15) or who do not have positive experiences in terms of support from their parents.

In Germany, 37% of children live in an *organised world*, 23% in an *open-minded* world, 24% in a *world of fantasies*. But 5% of children live in a world which can be described as challenging. Correlating the activity styles of children with the mode of organising the worlds children live in, one can see differences in the way or degree to which children can contribute to or influence and form their world. It can be assumed that the ability to influence and form their own world to a greater or lesser degree correlates closely with learning modes. Almost half the children

expect a low degree of opportunity for forming, influencing and creating. They probably lack experiences which they could use as positive learning frames for creative media use.

These children need positive experiences in school through meaningful and constructivist learning. Their organisation of everyday life suggests starting with calendars and organisers (Patten et al., 2006: administrative function), drill and test-software (Patten et al., 2006: interactive function), or dictionaries (Patten et al., 2006: referential function).

3.3 Typology for TV and internet use

Empirical data concerning activity and engagement patterns within the media set as well as the educational dispositions within families can help to identify at-risk learners and their ways of coping with everyday life as a prerequisite for curricular organisation and learning. Also, the research on typologies of media users affords relevant information on media habits which have the potential to support successful m-learning even for at-risk learners.

German public broadcasting developed user typologies for TV and the internet. Dehm and Storll (2003) identified the following five factors of involvement with TV and also with the internet:

1) emotions (e.g. to have fun, to laugh, to relax);
2) orientation (e.g. input for reflection, something for learning);
3) balance, compensation (e.g. distraction from everyday life problems);
4) diversion, to pass the time (e.g. meaningful use of time, habit); and
5) social experience (e.g. to have the feeling to belong to, to participate to the life of others).

On the basis of these five factors of involvement with TV, Dehm, Storll and Beeske (2004, pp. 217 ff.) found seven distinct profiles of TV viewing:

1) involved enthusiasm	11%
2) emotionally involved connoisseurship	15%
3) knowledge acquisition with pleasure	16%
4) habitualised orientation seeking	12%
5) habitualised participation	21%
6) undemanding coping with stress	14%
7) sceptical distance	10%

These seven types of TV viewers are now using mobile phones and MP3-players. Usually teachers do not have much of an idea which profile of TV viewing is associated with a successful or a weak student. As schools move towards the integration of mobile technologies, these issues and considerations are increasingly coming to the fore.

In addition, internet users can be described by the five factors of media involvement: emotions, orientation, balance and compensation, diversion (to pass the time), social experience. On the basis of these five factors, four distinct types of internet user were identified (Dehm, Storll and Beeske 2006, p. 96):

• hedonistic participation	18%
• habitualised surfer for knowledge acquisition	31%
• curious surfer seeking compensation	26%
• browser	25%.

Again, the question arises whether and how students combine their internet habits with the curricular offer of mobile devices.

4. A provisional summary: m-learning and media in everyday life

The data, patterns and typologies reported here provide the basis for media-related resources and conditions from everyday life for m-learning. School education – in the German tradition: didactics – can still be seen to be characterised by a notion of autonomy which excludes relevant media resources from everyday life and does not tend to refer to them explicitly in the planning of teaching and learning.

In the following an attempt is made to extract from the various data sources presented above some provisional features which seem particularly pertinent for m-learning.

Time

- Increase of daily media use of approximately 100 minutes leads to high competition between media within leisure time and production time. It is necessary to conceive of genres of m-learning which fit into leisure time or regeneration time. M-learning genres in the form of games should be seen in conjunction with the mobile phone.

Genres

- Trend setters prefer socially intelligent and valid genres.
- New genres are emerging in and for everyday life, which also widen the possibility for formal education.

- In line with changes in mass communication, mobile devices are affording non-linear systems of dissemination. Therefore, schools need a specific awareness in relation to archiving.

Social status and socio-cultural milieus: expected biases

- Trendsetters prefer non-linear media. One can expect barriers in m-learning for children from traditional milieus and from milieus with a lower social status.
- TV will continue to be the main medium for social groups and milieus with lesser orientation to and flexibility for innovation, also for milieus with a lower social status. This will influence daily time structures and genre experiences.
- Elements of children's TV programmes with a focus on information could serve as an introduction to complex forms of m-learning for milieus with a less strongly developed orientation towards modernisation and with lower social status.

Consumerism and the life world of young people*

- Young people's life worlds are an amalgamation of typical issues of youth, peer groups and commodities.
- For the older age group the mobile phone is more important, and the relevance of TV and printed material like magazines decreases.

**The "Bravo Faktor Jugend 6. Lebenswelten und Konsum" investigated the relation of young people (12 – 18 years) to 5 areas of consumption: fashion and clothing, shoes, softdrinks, mobile phone, provider for mobile networks. Bravo Faktor Jugend 6. Lebenswelten und Konsum. Bauer Media AG. October 2002. http://www.bauermedia.com*

Patterns of children's media and family world

- Almost half the children do not live in a life world which enhances experiences to form, to influence and to create. These children need positive experiences in the school with meaningful and constructivist learning activities. The organisation of their everyday lives suggests beginning with calendars and organisers (Patten et al., 2006: administrative function), drill and test-software (Patten et al., 2006: interactive function), or dictionaries (Patten et al., 2006: referential function).

- At-risk learners need sensitive support to use mobile devices for formative and creative activities outside their expectation of educational needs and pursuits.

TV and internet typologies

- Three of the five factors of TV and internet use in everyday life could be helpful as a guide for planning m-learning activities: emotions, orientation, social experience. These three factors of users' involvement in TV and the internet can also direct the involvement with m-learning.
- Acquired internet habits seem to be supportive of school and m-learning: 'hedonistic participation' (18%); habitualised surfers, who are searching for knowledge (31%); curious surfers, who are seeking compensation (26%); surfers who are looking with distance for information (25%).

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Chapter 6
Pedagogical forms for mobile learning: framing research questions

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Introduction

The mobility of digital technologies creates intriguing opportunities for new forms of learning because they change the nature of the physical relations between teachers, learners, and the objects of learning. Even the traditions of distance learning cannot offer the flexibility of these new kinds of interaction, so the rise of interest in 'm-learning' is understandable. The process begins, inevitably, as a technology solution devised for other requirements, in search of a problem it can solve in education. The history of technology in education has repeated this process so many times, with less than optimal effects for education, that educators need a means by which education holds the reins of the investigation, stating our requirements, and using these to evaluate each new technology, on our terms. Otherwise, we fail to optimise its value by underestimating what it might do, and by over-adapting education to accommodate to what it offers.

Stating our requirements of technology is a complex task. I have attempted to encapsulate them in the form of a framework against which new technology could be judged and used according to how it supports the different aspects of the learning process. This framework, published as the 'Conversational Framework' can now also be used to test what this new technology of m-learning contributes to the learning process.

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However, setting the one against the other also provides an opportunity to critique the original Framework – to what extent does it succeed in capturing all the requirements of the learning process enriched as it now is by these new forms of learning? Is it powerful enough to provide a challenge to the new technology opportunities by generating new proposals for their use? And does mobile learning suggest new ways of developing the Conversational Framework? This chapter explores both questions.

What do mobile technologies contribute?

This section sets out to clarify what is critically different about mobile technologies, in order to then analyse the forms of pedagogy that are relevant.

What characteristics are intrinsic to mobile technologies?

In defining the pedagogies for mobile learning, it is important to be clear about what exactly m-learning contributes that is new and different from previous technologies of learning. Characterisations such as the following probably fail to capture it because they are also true for too many other technologies:

> Enable knowledge building by learners in different contexts.
> Enable learners to construct understandings.
> Mobile technology often changes the pattern of learning/work activity.
> The context of mobile learning is about more than time and space.
> (Winters, 2007)

And if we tried to characterise mobile technologies as mediating tools in the learning process, addressing:

- the learner and their personal relationships (peer groups, teachers, etc.),
- what the learner is learning (topic, relationship to prior experience, etc.), and
- where and when learners are learning,

then it is unlikely that we could easily differentiate m-learning from any other form of distance learning. All these definitions would have been familiar to a learning technologist twenty years ago. The current wikipedia definition, for example, recognises its closeness to e-learning and distance education, but locates its distinctiveness in "its focus on learning across contexts with mobile devices" – it could be a book on a bus, although a much wider range of possibilities are proposed. Clearly there is still work to be done in characterising the critical factors that make it distinctive.

Other proposals for what is critical were shared at the WLE Symposium on M-Learning in February 2007, and these were more successful. John Cook suggested that 'learner-generated contexts' in mobile learning provide a more generic description of the value of digital technologies than the more common idea of 'user-generated content' in social software. Sara Price suggested that the key difference is digital representation of physical objects that are in the same location as the learner (Price, 2007). One such example is being able to augment physical objects with digital projection of e.g. shadows on a building, or to build knowledge of dynamic systems through mapping learners' actions in the real world with an inspectable digital representation. At the M-Learning Symposium, Niall Winters suggested that we have to address three mobilities in m-learning – learners, technology objects, and information – and the objects can be differentiated by being in:

- regional space – 3-dimensional physical space;

- network space – the social space of participants and technologies; or
- fluid space – learners, relations, and the object of learning.

The object therefore has to adapt to the context in which it is placed, i.e. variable in regional and network space, and fixed in fluid space. Both proposals capture something more than the flexibility, social relations, constructivism, and varying contexts characterised above, which are shared with many other learning technologies. The emphasis here is more on the nature of the physical environment in which the learner is placed, and hence the 'digitally-facilitated site-specific' learning experience that is now possible with mobile technologies, that was not possible with a desktop and landline. We will therefore find the critical pedagogical contribution made by m-learning in that inelegant description of its particular learning context.

Another promising aspect is that motivation has become a focus for what m-learning offers that is different. It is clear that learners working with m-learning enjoy the process, and in a different way than, say, interactive gaming technologies. In particular, the affective forms of motivation afforded by aspects of m-learning are characterised as:

- control (over goals);
- ownership;
- fun;
- communication;
- learning-in-context;
- continuity between contexts.

(Jones, Issroff et al., 2007; Sharples, 2007)

At the M-Learning Symposium, the point was reinforced by Geoff Stead, who argued that m-learning is important for access, personalisation, engagement and inclusion, control over learning, ownership, and the ability to demand things, i.e. meeting the rights of the learner.

Features like control, ownership, and communication with peers all can contribute to suggest why m-learning might be 'fun'. 'Learning-in-context' and 'continuity between contexts' are also aspects of ownership and control which explain why these properties might make learning easier and more effective.

How do mobile technologies support learning?

The intrinsic nature of mobile technologies is to offer digitally-facilitated site-specific learning, which is motivating because of the degree of ownership and control. What does this mean for what learners actually do?

The presenters at a 2006 Kaleidoscope Convergence Workshop on CSCL (Computer-Supported Collaborative Learning), entitled 'Inquiry Learning and Mobile Learning' collectively offered a wide range of learning activities that could be supported through mobile digital tools and environments:

- exploring – real physical environments linked to digital guides;
- investigating – real physical environments linked to digital guides;
- discussing – with peers, synchronously or asynchronously, audio or text;
- recording, capturing data – sounds, images, videos, text, locations;
- building, making, modelling – using captured data and digital tools;
- sharing – captured data, digital products of building and modelling;
- testing – the products built, against others' products, others' comments, or real physical environments;
- adapting – the products developed, in light of feedback from tests

or comments; and
- reflecting – guided by digital collaborative software, using shared products, test results, and comments.

All these activities are possible in other forms of e-learning, but what may be critical to m-learning is the way they are integrated, to bring the best possible support to the learning process. To test this idea, we now turn to the next section which looks at the pedagogical challenges to m-learning, testing it against the requirements of the optimal learning process.

What are the pedagogical challenges relevant to m-learning?

The point of turning to new technologies is to find the pedagogies that promote higher quality learning of a more durable kind than traditional methods. By trying to understand what it takes to learn complex ideas or high level skills, we can develop the pedagogical forms that are most likely to elicit the cognitive activities learners need to carry out if they are to achieve the intended learning outcomes. Using this analysis we would then be able to evaluate the characteristics of m-learning defined in the previous section.

What does it take to learn (formal learning)?

What is learning? Conventionally, in formal learning, it is the transformation of what is encountered in the teaching, to augment the learner's conceptual resources. The teaching creates a constructed environment, classroom, blackboard, pencil and paper with lines, and a curriculum focus.

The Conversational Framework was developed by analysing the findings from research on student learning, and using these to generate the

requirements of the teacher who is responsible for designing the learning process for their students (Laurillard, 2002). It is therefore common to all forms of learning, conventional, distance, digital, blended, as it is derived from research on 'what it takes to learn', and takes what is common from a range of different kinds of study.

The form of the Framework defines a dialogic process between 'teacher' and 'student' on two levels, the discursive level, where the focus is theory, concepts, description-building, and the experiential level, where the focus is on practice, activity, procedure-building. Both levels are interactive, but at the discursive level the interaction will take a communicative form – the teacher describes, i.e. the teacher decides what is to be 'framed' (Kress & Pachler, 2007), the student asks questions, the teacher elaborates, the student states their own idea or articulation of the concept (i.e. their conceptual resources are 'augmented' in Kress and Pachler's sense). At the experiential level, the interaction is adaptive, where the student is acting within some practical environment to achieve a goal, and experiences the results of their actions as changes in that environment, enabling them to see how to improve their action. The interaction at the experiential level benefits from the student adapting their actions in the light of the theoretical discussion. The interaction at the discursive level benefits from the students' reflection on their experiences. Similarly, the teacher's construction of a suitable learning environment benefits if it is adapted to their students' needs, and their explanations at the discursive level will benefit from reflecting on their students' performance at the experiential level. The whole process is the same for every teacher-student pair, but also links students with each other, by the same interaction type of communication at the discursive level.
At the experiential level, the feedback between peers takes the form of shared comparisons of their outputs from actions on the environment.

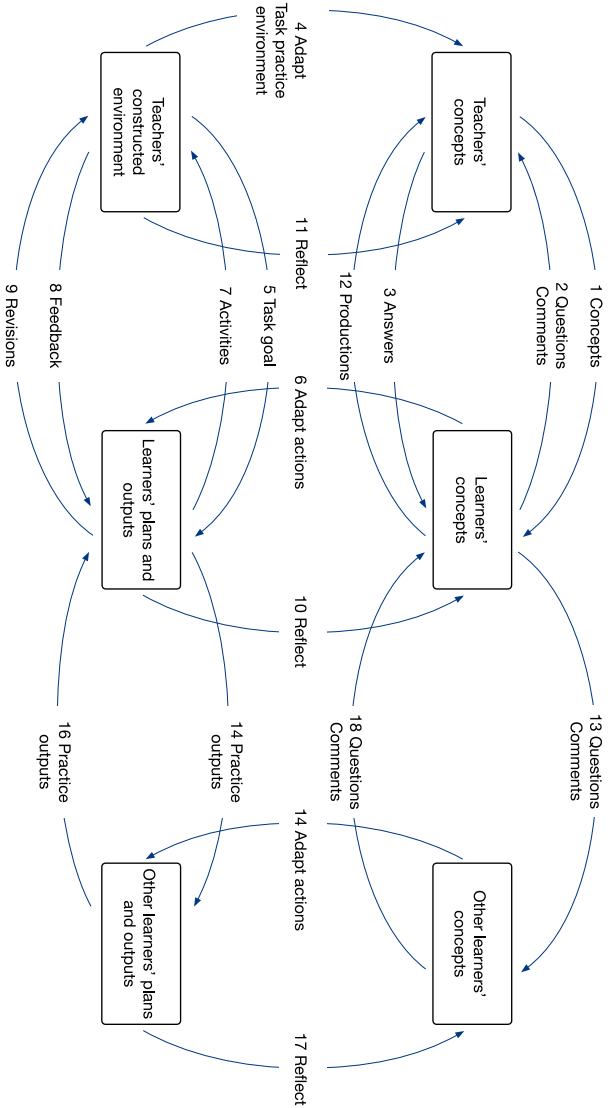

Figure 6.1: The Conversational Framework for supporting the formal learning process

The symmetry and continual iteration of all these relationships is illustrated in Figure 6.1 (redrawn from Laurillard, 2002). The diagram shows the minimal interactions between the teacher and learners that would constitute a completely supported learning process.

The Conversational Framework is designed to describe the minimal requirements for supporting learning in formal education. It can be interpreted as saying that, on the basis of a range of findings from research on student learning, if the learning outcome is understanding, or mastery, the teaching methods should be able to motivate the learner to go through all these different cognitive activities. In that sense it should be able to act as a framework for designing the learning process.
For example, it claims that

- learners may be motivated to think about the theory if they have to use it in order to act in the environment to achieve the task goal;
- their motivation to practise repeated actions will be higher if the feedback on their action is intrinsic, i.e. showing the result of their action in such a way that it is clear how to improve it;
- they will be motivated more to reflect on that experience if they are required to produce some version of their own idea to the teacher at the discursive level – this would traditionally be an essay, or a report, or a model, depending on the discipline.

Similarly, for peer collaboration it claims that

- learners will be motivated to improve their practice if they can share their outputs with peers;
- and will be motivated to improve their practice and augment their conceptual understanding if they can reflect on their experience by discussing their outputs with peers.

So each of the activities within the Conversational Framework plays its part in motivating other activities, creating a continual iterative flow of attending, questioning, adapting, experimenting, analysing, sharing, commenting, reflecting, articulating … all the forms of active learning that research tells us count as what it takes to learn. The learners may take themselves around these iterative loops, and good learners do, given the means to do it, but poor, or unmotivated learners need the teacher to construct their learning environment in such a way that they can scarcely avoid being active learners. This is one reason why we look to digital technologies to support learning – they can provide both communication and experiential environments in support of the learning process. But they do not necessarily do it. Sadly, few educational applications of technology go beyond the provision of access to ideas, which does not mark them out from books.

So the Conversational Framework provides a way of checking that a teaching design motivates what it takes for students to learn, and in particular, provides a way of analysing what each teaching method and each new technological tool brings to the learning process by asking the same question of both: how much of the Framework does it support? Lecture notes on the web, digital libraries, and podcasts provide exactly the same value as lectures in this analysis. By contrast, the supervised workshop for student groups provides the most complete coverage of the Framework – discussion, practice, feedback, sharing of outputs, articulation of a final product – and the right combination of new technologies, such as a collaborative modeling environment, would provide the same value as the traditional workshop.

One argument for m-learning proposed at the m-learning Symposium by Alice Mitchell suggested that it can provide games to support decision-

making skills in professional contexts, or provide tools to make games. She based her theoretical argument on Kolb's 'learning cycle' which rehearses the student in double-loop learning – introduction, action, feedback, digest. The Kolb cycle covers the parts of the Conversational Framework that express the teacher's description of ideas or theory ('introduction'), the learner's action (action to achieve the task goal), intrinsic feedback from the environment ('feedback') and reflection on the experience ('digest'). In fact, it is possible to show that m-learning covers more than that, in the ways it is normally implemented.

We can understand this best by setting exemplars of m-learning designs against the pedagogical requirements defined by the Conversational Framework. Instead of the flow of activity around the cycles illustrated in the diagram, we can also express these in the following questions, for ease of analysis, where numbers refer to the labels of activities in Figure 6.1.

Does the m-learning design motivate students to:

a access the theory, ideas or concepts (activity 1)?
b ask questions of (i) the teacher, or (ii) their peers (2, 13, 18)?
c offer their own ideas to (i) the teacher, or (ii) their peers (2, 13, 18)?
d use their understanding to achieve the task goal by adapting their actions (5, 6, 7)?
e repeat practice, using feedback that enables them to improve performance (8, 9)?
f share their practice outputs with peers, for comparison and comment (14, 16)?
g reflect on the experience of the goal-action-feedback cycle (10)?
h debate their ideas with other learners (13, 18)?

i reflect on their experience, by presenting their own ideas, reports, designs (productions) to peers (17, 18)?
j reflect on their experience, by presenting their ideas, reports, designs (productions) to their teachers (12)?

Consider as an exemplar a learning design that uses mobile technologies to support learners in developing an understanding of the thesis in an art exhibition. A typical learning design might be as follows:

- teacher introduces the work of the artists; provides extracts of the catalogue linked to key paintings for students to read in advance; answers questions (1, 2, 3);
- teacher provides a guide for students to work in pairs in the gallery, guiding them through the key paintings and the relations between them, including instructions to take notes to bring back to class (4, 5);
- students work in pairs in the gallery, using the guide, making notes, with the teacher moving between them (5, 6, 7, 11);
- in the next class discussion, students are asked to report on what they noticed and the notes they took (1, 2, 3, 10, 12);
- the teacher ends the discussion by summarising their comments in terms of the intended thesis (1).

This covers a good proportion of the activities, assuming that each stage is well designed. For example, the students will succeed in adapting their initial ideas to the task requirements if the guide assists them to do that, e.g. by setting a challenging goal, such as to look for ways in which the style of one artist resembles another, and contrasts with a third for a similar subject, and reminding them of the principles they discussed in class that differentiate schools of painting. If, on the other hand, the guide simply said 'look at paintings X and Y and make notes on how they are similar',

this much less challenging task does not require them to reflect back on their theoretical concepts to adapt them to the task in hand. It is the integration of the linked activities that builds the learner's motivation on any one activity.

It could be argued that there is an opportunity for students to share their 'practice outputs' in the form of the notes they take. But there is no special motivation to do this. As long as they make notes (7) to bring to the class, that is all that is required. Sharing ideas and outputs may happen, but it is not facilitated.

By contrast, a typical m-learning activity could build in more opportunities for digitally-facilitated site-specific activities, and for ownership and control over what the learners do (shown in italics):

- teacher introduces the work of the artists; provides extracts of the catalogue linked to key paintings for students to read in advance *and download to their mobile devices*; answers questions (1, 2, 3);
- teacher provides a guide for students to work in pairs in the gallery *with digital codes for each painting (see Price, this volume on "tangible flags")*, guiding them through the key paintings and the relations between them, including instructions to *identify features in particular paintings, upload their answers and check against the teacher's model answer, set quiz questions to challenge other pairs, answer challenges from other pairs, record these and their observations on each painting, uploading these to a shared website*, and take notes to bring back to class (4, 5,);
- students work in pairs in the gallery, using the guide, making notes, *checking their observations against the teacher's, setting and answering challenges with other students, recording and uploading their ideas and observations*, with the teacher moving between them (5, 6, 7, 8, 11, 13,

14, 15, 16, 17, 18);

- in the next class discussion, students are asked to report on what they noticed and the notes they took, *using the whiteboard to display their records and notes from the gallery, e.g. the "MediaBoard"* (Cook, Bradley et al., 2007) (1, 2, 3, 10, 12, *13, 14, 16, 17, 18*);
- the teacher ends the discussion by summarising their comments in terms of the intended thesis, *by means of an edited version of the students' outputs collected in the form of a collaborative digital catalogue of the exhibition, and made available on the school website* (1, *12*).

This analysis shows how much richer the m-learning experience can be, as interpreted through the Conversational Framework, primarily because the mobile devices *digitally facilitate* the link between students and data while they are in the *site-specific* practice environment. The digital facilitation provided by the teacher is to set up motivating collaborative and competitive transactions between the students, motivated also by the prospect of contributing to a product at the end of the process. In the earlier version the learning design ends with the teacher's summary – the ideas owned once again by the teacher, for all that the summary may refer to the points made by the students. The m-learning design can display the students' contributions at the end – they maintain ownership. It would be possible to achieve the non-digital equivalent of this learning design, but it would be hard to manage, and paper technology does not facilitate the process.

The only part of the Framework not covered by this learning design is the 'revisions' activity (9). This is because there is only 'extrinsic' feedback on the students' actions. The former design achieves no feedback – students make notes to address the task goal, but have no way of knowing if these

are good, or appropriate. With the more specific task set in the m-learning design – to identify certain features in a painting – the teacher can make the model answer available on a website, so that when the student uploads their answer it is revealed and they can compare it with their own. This is 'extrinsic' feedback, showing they are right or wrong, but not motivating any revision of their action. By contrast, 'intrinsic' feedback would show them the result of their action in such a way that they could see how to revise and improve it, thereby motivating the revision activity (9). However, if the m-learning design asked the learner to, say, identify the item in a painting that symbolises 'wisdom', and they see the model answer as different from their own, this would help them identify the concept in a different painting. It would act as 'intrinsic' feedback if there are further similar questions, thereby prompting improved practice. It is the kind of tuition that a teacher can provide on an individual basis, but is very hard to do with a class. Providing feedback is one way in which m-learning can improve the quality of the learning experience. Using the Conversational Framework to check the design might also challenge it to set up the task in a way that provides also intrinsic feedback, thereby promoting practice and improvement.

The Conversational Framework can therefore provide a powerful way of critiquing both traditional and digital learning designs, illustrating in a reasonably formal way why digital forms offer a better integrated, and more motivating learning environment. By using the findings on research in student learning to generate a set of requirements for teaching, it shows what it takes to support learning, in formal education. In particular, it takes us beyond the typical endorsement of a technology resource, the 'you can…' approach to design, which offers the user a wide range of options and opportunities. Instead, it proposes the 'try this…' approach,

which provides a default pathway through the environment, engaging the student explicitly in tasks that elicit the kind of cognitive activity it takes to learn that idea, concept or skill. In the former design approach, the learner 'can' engage with difficult ideas in a variety of ways, but may not. Without guidance and motivation they may choose to take a cognitively easier pathway, thereby failing to engage properly with difficult or complex ideas. The Conversation Framework shows that it is not sufficient for the teacher just to 'tell' the story of their subject in book or lecture. To support the learning process fully, they have to engage the learner in all the types of activity it proposes.

The analysis also enables us to (a) critique how m-learning operates and what more an m-learning design needs to complete the coverage of the Framework, and (b) critique the extent to which the Framework fully expresses the richness of the learning experiences supported. This is the focus for the next section.

What does it take to learn (informal learning)?

The move to mobile learning has opened up the opportunity for learning to be digitally-facilitated in any location, whether defined as a learning environment or not. The m-learning research community is therefore also interested in 'informal learning'. The most obvious contrast with formal learning is the absence of a teacher. The absence of which means there is no defined curriculum, externally-defined learning goals, formative and summative assessment, and or formal task structures. There is no longer a 'teacher constructed environment' in which the learner is operating, but the more uncertain context of the real world. Learning may still take place, of course, but no part of the learning process is driven by 'the teacher', or anything representing them.

Taking account of this, the Conversational Framework describing informal learning is therefore simpler, as in Figure 6.2. The diagram shows the minimal interactions between the learner and their world, and with other learners that would constitute an optimally productive informal learning process. In the absence of the teacher, the learner defines their own task goal, and other learners and the world of experience act as arbiters of the learner's actions and productions.

This raises the question of the extent to which the 'continuity between contexts' feature of m-learning, can provide continuity between formal and informal learning contexts. The idea of a 'learner-generated context' is an important one for giving learners a sense of ownership and control over their learning, but formal and informal learning involve very different 'contexts' for learning. Learners have to be aware of the difference. If, for example, they treat a formal learning context as if it were informal, and set about acting on their own task goal, and interpreting feedback in those terms, they may well learn something, but not necessarily what the teacher designed, so their 'production' may not be valued. It is the distinction John Cook made at the Symposium between the informal/private space "where there is no right answer" and the formal space where there usually is. In the informal context, in the absence of a teacher, learners have to set their own task goal, generated from their world experience, or what Kress and Pachler refer to as the learners' "own interest" which directs their attention, rather than an externally defined problem (Kress & Pachler, 2007). They may find it difficult to set a task goal that is appropriate for the site specific environment and their ability to act on it, in which case participating in a social learning environment may be of considerable help, either in proposing more realistic goals, or by sharing model outputs.

This interpretation characterises informal learning as being entirely in the hands of the learner, not guided by anyone and certainly not educators – they are not there, and that is what I see as the defining difference between the two forms of learning. Curators are present in a museum or art gallery, guides in an exhibition space, as are many others with a story to tell in informal contexts – authors, journalists, programme-makers, film-makers, parents, friends, colleagues, bosses – but although the opportunity to learn from others is always present in informal learning contexts, they have no authority over the learner, no power, and no sanctions. So the learner can ignore, use, or contradict them at will. This makes their motivation in such contexts entirely governed by their peers or social group, and by the behaviour of the world, in terms of their task goals and feedback. In a formal learning context the key agents are teachers, educators, facilitators, advisers as well as learners. In the informal context the only key agents are the learners themselves and the 'others' they choose to act as agents in defining the focus of interest, the task goals, and the feedback.

The Conversational Framework suggests that maintaining contact and sharing outputs with other learners would give a more optimal learning experience in an informal context, just as in the formal context. The two contexts are generated and negotiated in very different ways, however, and even the consistency of tool (mobile phone or pda) does not assure continuity. In this volume, John Cook and others demonstrate a form of continuity between contexts in his example of a 'learner-generated context' (Cook, Bradley et al., 2007), but in fact his pedagogical design took care to construct the learner's experience of the remote context, as well as providing formal assessment of their activities, and the opportunity for social construction of their knowledge in a shared uploading environment,

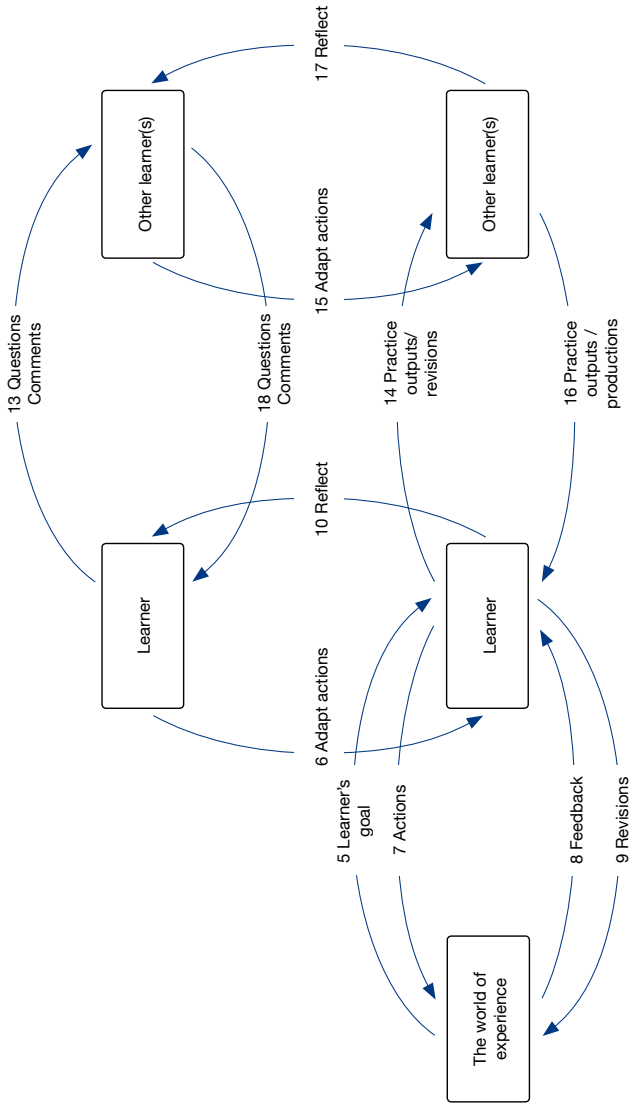

Figure 6.2: The Conversational Framework for supporting the informal learning process

together with a very clear formal assessment judgment of their attainment of the intended learning outcomes. It was a very supportive learning design, which covered a good proportion of the Framework. The virtue of the m-learning environment here was precisely that it supported the formal learning process by maintaining continuity between the teacher-directed f2f context and the learner's remote peer learning context. In that sense, the 'continuity between contexts' is demonstrated. But this cannot be interpreted as meaning that m-learning necessarily provides continuity between formal and informal learning environments, where in the latter the learner is wholly self- and peer-directed. This will only be assured when the pedagogic design facilitates that continuity, as in John Cook's example.

The Conversational Framework can also be used to propose improvements to design. It is very difficult to achieve intrinsic feedback for informal learning, or learning in an environment that is ungoverned by the teacher, such as an exhibition space. To achieve meaningful feedback that shows the learner how to improve their action and attain the task goal, the teacher has to set up the kind of task for which the learner will reliably find intrinsic feedback in that environment. The example of finding the representation of 'wisdom' in a painting, discussed above, would not be so easily translated to an exhibition space about which the teacher has little advance information, and feedback from the real world would be too uncertain. To meet this requirement of the Conversational Framework, the teacher would have to set a task goal similar to a research project, such as 'test your hypothesis of the relationship between the characteristics of the event and the characteristics of the company running it', so that the collection of data would enable the students to refine their hypotheses. The MediaBoard would then elicit different hypotheses and evidence

for a later collaborative debriefing. Designing the m-learning activity to meet the Conversational Framework requirements in this way then helps to generate a more focused and hopefully more productive learning experience.

What are the research challenges for m-learning?

The preceding sections have interpreted the opportunities offered by m-learning in terms of the Conversational Framework, in order to test the extent to which m-learning can and does achieve good pedagogic support for the learning process. The analysis has certainly shown the importance of unpacking the form of 'the teacher's constructed environment', and in that sense challenges the Conversational Framework as a simple expression of how the teacher can support what it takes to learn. M-learning, being the digital support of adaptive, investigative, communicative, collaborative, and productive learning activities in remote locations, proposes a wide variety of environments in which the teacher can operate. One research question might be, therefore, 'how do we characterise and represent the different forms of the teacher's constructed environment that best support learning'? This is a question for learning in general and for the development of pedagogic theories such as the Conversational Framework.

The Framework also provides a challenge to the design of m-learning, as we have seen. It requires a quite rigorous approach to working out how to support all the component learning activities, in remote locations, with learners guided only by the tasks set, the information available online, the characteristics of the world they are in, and peer support. It is worthwhile to develop these detailed pedagogic forms for two reasons: (i) it is more likely that learners will succeed in engaging with the richness of the

m-learning environment, and (ii) it will help to develop the specific pedagogies of m-learning in a way that can be built upon and shared with other teachers. From this analysis, two important research questions for m-learning could therefore be expressed as:

> What are the pedagogic forms specific to m-learning that both fully support the learning process and exploit the richness of the remote environment?
>
> What are the best ways for teachers to construct different kinds of remote environment in support of the learning process?

M-learning technologies offer exciting new opportunities for teachers to place learners in challenging active learning environments, making their own contributions, sharing ideas, exploring, investigating, experimenting, discussing, but they cannot be left unguided and unsupported. To get the best from the experience the complexity of the learning design must be rich enough to match those rich opportunities. This chapter proposes a way in which teachers can plan for optimal learning designs that fully exploit mobile technologies.

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Dr Diana Laurillard is Professor of Learning with Digital Technologies at the London Knowledge Lab, Institute of Education. She was previously Head of the e-Learning Strategy Unit at the UK Government's Department for Education and Skills, and on the Visiting Committee on IT at Harvard University. Prior to that, she was Pro-Vice-Chancellor for learning technologies and teaching at the Open University. Her research is the substance of her book *Rethinking University Teaching: A conversational framework for the effective use of learning technology*. She is currently on the Boards of the Observatory for Borderless HE, the Centre for Applied Research in Educational Technologies at the University of Cambridge, and the UNESCO Institute for IT in Education in Moscow, and is an external examiner at the University of Oxford.

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A linguist with expertise in French and German, Alice first developed her career as a Manager of Language Departments and Language Centres in Secondary, Further and Higher Education, both in Germany and in the UK. Her early experience also includes seven years with the Ministry of Defence as a Burnham Lecturer followed by a year at executive level in SME and blue-chip companies while on sabbatical in Australia.

In 1991, Alice joined Anglia Ruskin University (then Anglia Polytechnic) to set up and lead the Anglia Language Centre. In 1994 she transferred to Ultralab, a learning technology research centre at the University, to take up a role as Editor of the Apple European Education website and to lead the development of standards-based learning and teaching materials for web delivery. She went on to instigate and lead several funded R&D projects for the education and business sectors, including Anglia Ruskin's role in the first m-learning project that was supported by the EU (http://www.m-learning.org). In January 2007 she joined Inspire, Anglia Ruskin's Centre for Learning and Teaching. She currently leads the innovation of game-based learning models in the pan-European project mobile Game-Based Learning (http://www.mg-bl.com), which is supported by the EU under 6th Framework, Priority 2, IST.

Alice is in demand as researcher, consultant and conference speaker, delivering presentations and keynotes at national and international level. Her publications cover a broad spectrum and include language teaching books, e-learning packages, academic papers and externally commissioned reports relating to cultural-linguistic learning, game-based learning, e-learning and e-assessment. Since May 2007 she is visiting professor for m-learning at the University of Rijeka, Croatia.

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