ARTICLE

Sustainability for Innovative Education – The Case of Mobile Learning

Ben Bachmair* and Norbert Pachler*

The successful introduction of mobile learning into education is arguably premised on sustainability in the sense of an ability to maintain innovation over time and to become embedded into mainstream practice. This paper argues that such an endeavour requires a discursive approach, decoupling sustainability from the notion of unambiguity tendentiously inherent in technological paradigms. Learning with mobile devices is an educational response to societal transformation characterized among other things by the detraditionalization of established modes of media and communication in everyday life. Detraditionalization can be seen to refer to the process of breaking down, or challenging, traditional social structures but also encompasses rather more fundamental transformations in the spheres of politics, the economy and culture. In this paper, with particular but not exclusive reference to education, we focus on the tension between established institutions, systems, regulations and practices on the one hand, and emerging forms of teaching and learning afforded by new media and technology on the other. Delimitation (Beck and Lau, 2004), a central conceptual perspective discussed in this paper, can be viewed as one consequence of detraditionalization, namely the blurring of previously rigid boundaries (e.g. those pertaining to social class or political certainties). An important conceptual frame for this paper is the mobile complex (Pachler, Bachmair and Cook, 2010), which shapes mobile learning and results from the delimitation of structures, agency and practices. In turn delimitation does not lead to new, transformed but stable features; instead it is characterised by provisionality. Provisionality is an important aspect of the continuous process of detraditionalization, where stable practices, norms and social structures are replaced by perpetually fluid and transient ones. The key issue under consideration here, therefore, is the interdependence of mobile learning and sustainability within societal structures, agency and cultural practices. The paper proposes some operational tools for the discussion and consideration of sustainability of mobile learning under the specific societal conditions of the mobile complex, i.e. the 'new normal' of provisionality.

Introduction: mobile learning and cultural development

Mobile devices and services are a result of, and contribute to the blurring of structures, processes, practices and boundaries of mass communication, everyday life learning and teaching. The blurring of boundaries, among other things, between linear media such as television, Internet platforms and mobile devices; between professional media production and user-generated content by mobile device users; between ubiquity of mobile contexts and institutional learning spaces: all are processes of delimitation which are the defining *leitmotif* of ongoing cultural transformation. The concept of detraditionalization in the form of delimitation is a sociological approach to explaining the dramatic changes in modern society towards what has been called *second modernity* (Lash, Giddens and Beck,

1994; Beck, Bonss and Lau, 2003; Beck and Lau, 2004). The terms *detraditionalization* and *delimitation* connect the educational discussion with that of the field of cultural sociology. They allow us to understand the socio-cultural frame governing:

· recent changes in relation to the agency of learners;
· old and new structures of learning and associated trends and conflicts concerning learning innovations; and
· familiar and new practices of learning and practices of media use.

The term detraditionalization focuses on the tensions inherent in traditional forms of social structures and social practices of learning as well as of media. From a historical point of view, the process of cultural, social and societal transformation is always accompanied by a conflict of interests with attendant gains and losses. Currently ongoing transformations, what we call detraditionalization, are breaking up established traditions with a

* UCL Institute of Education, University College London, GB
  bachmair.augsburg@t-online.de, n.pachler@ioe.ac.uk

significant impact. Globalization is one example. As can be seen below, this paper seeks to explain the process of detraditionalization of learning and media by means of a triangular model which describes the interrelationship of structures, agency and cultural practices.

A specific feature of the ongoing transformation processes of detraditionalization is *delimitation*, the blurring of well-known boundaries. *Delimitation* is a term coined by the sociologist Ulrich Beck (Beck and Lau, 2004); it is a translation of the German term *Entgrenzung*. Delimitation seems to be not just a transitional phenomenon of detraditionalization, but a permanent feature. The streams of migration across the world are one visible part of it. Migration is blurring not only national but also cultural boundaries, e.g. of religious hegemony. Further examples of delimitation are: formal learning in school during childhood amalgamates with lifelong informal learning. Professional media services such as television and newspapers exist side-by-side and convergent with user-generated media platforms such as YouTube. Facebook permeates the borders between private and public. Smartphones guarantee ubiquity: always and everywhere. Education discusses seamless learning. Increased individualization, inter alia through mobile digital devices, changes the way meaning is generated. The notion of meaning making links to the field of social semiotics which contributes a further dominant societal and cultural feature to the discussion of delimitation, namely provisionality:

> Contemporary social conditions in Anglophone and Western European societies are markedly different to those of some four decades ago. Stability – even though that had only ever been relative – has given way to instability; homogeneity has given way to often radical diversity; permanence has given way to provisionality, a condition in which crucial characteristics of the environments of communication may vary from one moment to the next. (Kress, 2010a, p. 171)

Provisionality also characterises emerging new forms of learning and teaching to which mobile learning belongs. Provisionality seeks to capture the outcomes of the ongoing cultural and societal detraditionalization. Despite our desire for stability, we live within a mobile world which – rather than featuring permanence, continuity and stability – is characterised by provisionality and fragmentation and requires individualised risk-taking and meaning making. As a consequence, ambiguity linked to complex variables shapes the modern world. Provisionality requires us to understand sustainability as a fluid notion that does not lend itself to precise measurement but one to be explored through objectified procedures and tools. And it is such tools we critically discuss later in this paper.

The provisional character of sustainability has become visible in the many different definitions of the term reported, for example, by Scott (2002). In its attempt to deal with this kind of semiotic arbitrariness, the World Commission on Environment and Development (Brundtland Commission, 1987) defined sustainability as

development. Sustainability as a process cannot resolve the underlying provisionality but needs to deal with it systemically. Nevertheless, sustainability as a concept needs to be concretised and situated within a theoretical and conceptual frame. The frame that we propose here stems from an ecology of cultural resources which views mobile devices as cultural products and mobile learning as related processes. Mobile devices and mobile learning can be understood with reference to what we call *the mobile complex*. To explore this mobile complex, and the idea of sustainability of learning in it, we discuss sustainability with reference to a triangular structuration model here based on, and expanding Giddens (1984), namely the interrelationship of agency, the human capacity of acting on the world, within societal and cultural structures. We widen this frame by adding cultural practices as a third category.

Although sustainability is a relational category, we deem it legitimate and necessary to view it as maintenance of stability, to make innovative procedures operational, and to generalise implementation procedures. How can we combine this practical requirement for stability with its relational and provisional character? The proposals of Scott (2002) as well as Ng & Nicholas (2013), who put forward a discourse process model, are helpful in specifying, and working towards sustainability in mobile learning by way of, and within conversational, discursive processes. Our intention here is to contribute to a better understanding of sustainability through a conversational, discursive perspective by offering a set of tools supporting and enabling a systematic engagement with perpetual change. These tools link to our analysis of the mobile complex and of learning by means of a triangular structuration model.

Part 1: Beyond the status quo of mobile learning: a discursive approach to sustainability

Mobile learning is in the process of moving into a new phase as a result of the acceptance of tablet devices in schools. Also, a growing number of practical experiences with mobile devices are becoming available as a result of their increased use in formal education. At this transitional point we turn our attention in this paper from *planning* to *embedding* mobile learning in educational practices and routines. The challenge is to move from single, isolated instances of mobile device use or mobile learning projects to the integration and use of mobile devices systematically in(to) the complexity of learning in educational institutions and in life courses. Part of this complexity is a view of learning as a cultural resource in an economically driven society as well as mobile devices as cultural resources of everyday life.

Viewing mobile devices as cultural resources, we address here the concept of sustainability from an ecological perspective. The category of sustainability is traditionally rooted in a discussion of the exploitation of nature as an economic resource. Sustainability has been, and continues to be, a central economic category, e.g. in relation to the appropriation of energy or natural resources. For Scott (2002) the term sustainability is

problematic as it is used very widely. Dobson (1996) reports over 300 definitions "with some, at least, being used as competing rhetorical currencies in a market for whose worldviews will best save the planet." (Scott, 2002, p. 1). Scott underlines "a clear distinction in meanings with sustainability as a goal and sustainable development as a process". According to the Brundtland Commission (1987, p. 17) sustainable development spans from the here and now to the future.

Within this tradition of defining sustainability as a process, we focus on a discursive, conversational approach (see e.g. Pask, 1976; Laurillard, 2002) to make sustainability tangible in the context of mobile learning. We follow Ng & Nicholas' (2012, p. 669) 'person-centred sustainable model for mobile learning' but with an orientation towards mobile devices and mobile learning as cultural resources. Although we are clear that we need a process-orientated concept of sustainability, we must not neglect the outcomes of mobile device use in terms of teaching and learning. In other words, the effects, implications and social costs of mobile learning are all relevant. The cultural impact of mobile devices might also be summarized in terms of sustainability: what will the implications of an increase in mobile device ubiquity be on formal learning, on how we organize work and how we deal with the need for perpetual contingency?

A discursive, conversational approach to cultural resources and their ecology

The concept of sustainability has entered educational discourse, certainly in discussions about technology-enhanced learning. This makes eminent sense in the context of a perspective of mobile devices and mobile learning as cultural resources. The notion of sustainability has reached education not only in an ecological sense but also in terms of a cultural interpretation in relation to resources for learning as well as learning and knowledge as resource (see Bachmair, Pachler and Cook, 2009; 2014; Cook, Pachler and Bachmair, 2011; Pachler, Bachmair and Cook 2010, pp. 155ff). In the same way we know that the sustainable use of energy or natural resources sits ill at ease with arbitrary exploitation, we must be mindful that the implementation of mobile cultural products can impact negatively on, and disrupt exiting learning cultures. This raises the question how to innovate at scale without the risk of exploitation and negative impact on existing learning cultures.

In 2002, Scott outlined the impact of the term sustainability on education. Just as in environmental debates, there are 'multiple perspectives' and 'differing prognoses' (Scott, 2002, p. 4) in education. One has to examine "the way different groups view and use ideas about sustainability in order to focus on widely different learning and/or on social goals". And, one has to explore "different ideas about whether social and ecological unsustainability can be cured by contemporary society, or rectified by means of appropriate learning." This approach to sustainability in education challenges stability, operational procedures and the broader implementation of technology in teaching and learning.

Following a similar line of argumentation, Ng & Nicholas (2013) designed a complex 'person-centred sustainable model for mobile learning', which focuses on discursive processes in learning and teaching and the interplay of teachers, students, parents, technical support, leadership and management, the wider community as well as mobile devices and their peripherals (see Ng & Nicholas 2013, p. 669).

We believe that 'multiple perspectives' (Scott, 2002) are also constitutive of basic educational terms such as 'literacy' (Bachmair and Pachler, 2014). We recognise that it goes against epistemological convention to give up conceptual explicitness and definitional clarity and accept discursive ambiguity. However, the ongoing process of detraditionalization – we posit – leads to an increased provisionality of central terms. Ambiguity, caused by provisionality, cannot be *repaired* but must be integrated into conversational, discursive, analytically interpretative processes within emerging frameworks. We propose a wider framework with two focal points. One concentrates on the function of mobile devices as cultural products, the other, the societal focus, results from the situadedness of mobile devices within a *mobile complex*. This epistemological task reaches beyond practices of developing intelligent and responsible innovative educational practices. Nevertheless, there is a necessity to concretise tasks around stability, operational procedures and broader implementation.

Promoting innovation: stability and operational procedures

At one level, the concept and practice of sustainability in mobile learning is aimed at the ability to maintain innovative processes over time and to embed them in the mainstream which requires stability and continuity. How to achieve this for learning under the condition of mobility, e.g. with mobile devices which reach from everyday life into school? For example, one strategy for achieving sustainability in mobile learning is the development and collection of scenarios (see also Friedrich et al., 2011 and 2012; Strasser, 2012; Thissen, 2013; Pérez, 2013).

We can learn how to develop sustainable procedures from the implementation of previous generations of technology. For example, Cuban (2001) analyzed the steps of integrating computers into schools as 'levels of technology integration' with reference to earlier work by Ringstaff et al. (1997, pp. 4–5):

- Entry: Teachers are beginner users of computers.
- Adoption: Teachers tend to take more traditional approaches to instruction but do provide some explanation on how to use computers.
- Adaptation: Traditional approaches to instruction prevail but some class time is allowed for students to use computers for homework and daily class work.
- Appropriation: Teachers integrate technology regularly into the curriculum.
- Invention: Teachers find new ways to connect students and use project-based and interdisciplinary approaches to instruction. (Lomicka, 2003, p. 43)

This list of implementation steps operationalizes one aspect of achieving sustainability. Cuban's work suggests a tendency of implementation peaking at the level of adoption (Cuban, 2001, p. 55). Viewed from this perspective, a relevant criterion for, and factor of achieving sustainability is teachers' competence to deal with innovations and to integrate them into school.

More recently, Puentedura (http://www.hippasus.com/rrpweblog/archives/2013/04/26/SAMRBeyondTheBasics.pdf) developed the so-called SAMR model of Substitution, Augmentation, Modification and Redefinition, which identified the two incremental spheres of enhancement (substitution, augmentation) and transformation (modification, redefinition) and is finding traction in the blogosphere. In this linear model, technology performs a number of possible functions from acting as a substitute for existing practices without fundamental change, through functional improvement to task redesign and the creation of new tasks.

There are a number of mobile learning projects offering a range of recommendations and typologies. Drawing upon research across a number of early mobile learning projects, Roschelle and Pea (2002) suggest the following application affordances on the basis of the wireless internet learning devices (WILD) project:

· augmenting physical space,
· leveraging topological space,
· aggregating coherently across all students,
· conducting the class,
· act becoming artefact.

The question arising from this work for our purposes is to what extent such frameworks and typologies support and help to ensure sustainability. We do not set out to provide empirical support for such frameworks and typologies here. Instead, we endeavour to show that a hermeneutic and heuristic approach is an appropriate and legitimate way of approaching the question of sustainability and the implementation of mobile devices in the cultural field of learning. Heuristics is normally understood as experience-based processes of discovery supported by simple models, rules or methods, a kind of intelligent approximation. Hermeneutics, broadly speaking, refers to an interpretative paradigm. We posit that a list of focal points can be helpful in validating mobile learning within critical discursive processes embedded in a coherent conceptual frame. As noted earlier, we see our line of argumentation supported by processes of provisionality and the ongoing delimitation of society and culture.

Mobile learning proponents tend to be interested in stability, operational procedures and broad implementation; consequently these are recurring themes in current debates about mobile learning. Impact and efficacy are currently frequently measured in the context of small scale, one-off projects which tend not to lend themselves to be replicated for a number of reasons such as lack of funding, obsolescence of technology etc. One hallmark of sustainability, we argue, has to be the embedding of innovation in mainstream curriculum design and teaching and

learning processes. Of course, there are different ways of emphasising stability, operational procedures and broad implementation: more technocratic approaches, which view learning in terms of measurable outcomes with a focus on attainment gains. There are also other, more socially orientated ones, which anchor innovation to an ecology paradigm around cultural resources and practices. It is in the tradition of the latter that we frame the implementation of mobile devices and services here (see Pachler, Bachmair and Cook, 2010, pp. 25ff., Pachler, 2010; Bachmair, Pachler and Cook, 2014).

Part 2: Sustainability of learning under the condition of *delimitation* and within the mobile complex

For us, a key question is how these endeavours of achieving sustainability relate to the societal processes in which mobile devices have emerged within a mobile complex. Can we just pursue the path of updating technology-enhanced learning? The trend of technology-enhanced learning was, and is, to enrich the established functions and procedures of teaching and learning through established or new media and technology. But the ongoing cultural transformations and fragmentation arguably require a new paradigm or new paradigms. Our proposal to view them as cultural resources for learning, and to view learning as meaning making represents such a new paradigm.

The issues of delimitation and provisionality

In his paper on sustainability and mobile learning, Traxler (2010) outlines features of a societal, cultural approach with the following key notions: 'jobs, the economy' (p. 59); 'space, place and time' (p. 60); 'community and discourses' (p. 61); 'knowledge and learning' (p. 62); and the '*epistemological revolution*' (p. 63). Traxler (2010, p. 63) emphasises the re-configuration of "time, space, place, identity" and how this challenges existing practices. This argumentation aligns with our view of provisionality as a main feature of delimitation and detraditionalization. If basic categories such as time and space as well as central social categories are becoming unstable, then we cannot be content with merely adjusting technology-enhanced learning to mobile devices, or with adjusting mobile devices to technology-enhanced learning. The task is to find an adequate explanatory and analytical frame for the emerging societal and cultural situation characterised by delimitation of learning, teaching and a culture of learning driven by the following main features:

· detraditionalization of institutionalized learning and teaching in the context of a developing 'creative knowledge society';
· learning in provisional and learner-generated contexts;
· the dynamic of the mobile complex and its effects on teaching and learning.

From the perspective of Kress' theory of multimodality (2010b), mobile devices can be viewed as a new and provisional cultural resource for representation. Their

provisionality results from their basic affordance of contributing to meaning making in individualized contexts. The cultural frame for the 'mobile' mediation of meaning making relates to ubiquity and a consumptive disposition towards commodities, services, sites etc. Despite all the differences, there is a constitutive communality between acting in everyday life and learning in school: both depend on cultural resources for meaning making. In our conceptual frame of the mobile complex, spatial frames have become situational and contextual frames for meaning making and differ with regard to some essential features.

For Traxler, the change of a traditional definition of space is in the foreground of ubiquitous mobile devices:

> Mobile devices demolish the need to tie particular activities to particular places or particular times. They reconfigure relationships between public and private spaces, and the ways in which these relationships are penetrated by virtual spaces. Virtual communities and discussions were previously mediated by static networked PCs in dedicated times, places and spaces. Now, mobiles propel these communities and discussions into physical public and private spaces, forcing changes and adjustments to all three as we learn to manage a more fluid environment. (Traxler, 2010, p. 59)

Following this line of argumentation, we propose the consideration of the affiliation of mobile devices to *contexts* as a successor to a traditional definition of space in, and in relation to which humans act.

Epistemological challenges of cultural and societal developments

Considering contexts is, in itself, insufficient. Contexts, we argue, belong to a mobile complex. From this follow two challenges: a social and an epistemological one. The social challenge is that mobile devices have emerged within a clear social delimitation of media, mass communication and learning. We cannot rely on familiar structures and their evaluation. Therefore, we have to understand these developments with reference to the logic of delimitation. What follows from such a perspective? For us, it is the adoption of a hermeneutic path of interpretation and the finding of conceptual frames which refer to individual, social and cultural processes.

After more than a decade of practical and theoretical work (e.g. Roschelle and Pea, 2002; Luckin et al., 2005; Pachler et al., 2010; Sharples, 2007; Sharples et al., 2007; Taxler, 2010) we know a lot about mobile learning. The existence and pervasiveness of contingency appears as provisionality (Kress, 2010) and results from the ongoing process of delimitation (Beck, Bonss and Lau, 2003; Beck and Lau, 2004). It, in turn, leads to a mobile complex, which consists of specific structures, agency and cultural practices (see Pachler, Bachmair and Cook, 2010, pp. 3ff.). The structures, agency and cultural practices of the mobile complex are in perpetual flux. From the conceptual perspective of 'second modernity' or 'reflexive modernity' (Lash, Giddens and Beck, 1994; Beck, Bonss and Lau, 2003; Beck and Lau, 2004; Beck and Grande, 2010;), *perpetual flux* can be characterised by the term *Entgrenzung* (delimitation, boundary blurring), i.e. the removal of systemic demarcations. This boundary blurring or, in terms of Giddens' structuration theory (1984), 'delimitation', is part of a new constellation of mass communication as well as of learning. If we describe the system in which mobile learning works as a mobile complex, we imply a high level of complexity in which 'sustainability' as an evaluative category has to deliver relevant knowledge about the practices of mobile learning.

The triangular structuration model for analyzing the societal complexes of mobility and learning (see Figure 1)

The conceptualisation at the meta-level of an educational frame of what mobile learning can be is based on the interrelationship of structures, agency (see Giddens, 1984) and cultural practices (see the theory of practice e.g. of Lefebvre, 1977 and Wenger, 1998, p. 5 and, in media and cultural studies, Hall, 1997, p. 36). The first chapter of Giddens' structuration theory (1984, pp. 1–40) of the sociology of the constitution of a society offers a model for the interrelationship of social structures and the agency of people, who act on different levels of consciousness within structures and on transforming structures. The "stratification model
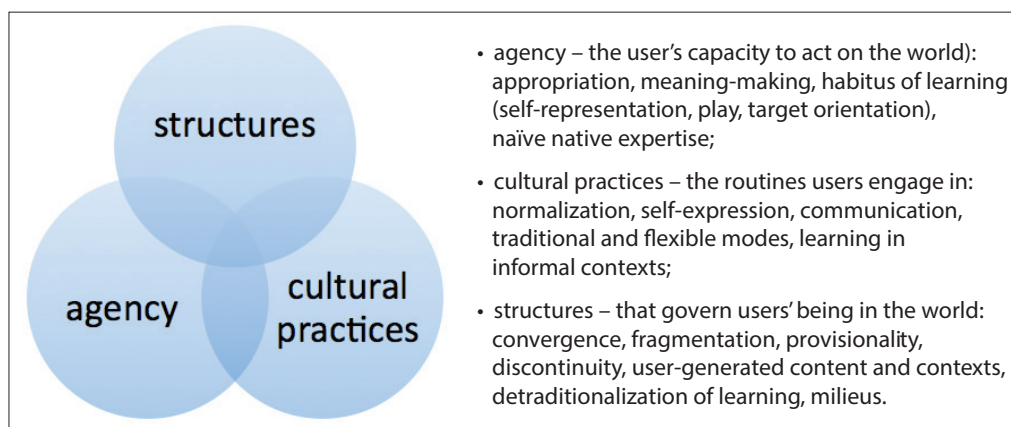

- agency – the user's capacity to act on the world): appropriation, meaning-making, habitus of learning (self-representation, play, target orientation), naïve native expertise;

- cultural practices – the routines users engage in: normalization, self-expression, communication, traditional and flexible modes, learning in informal contexts;

- structures – that govern users' being in the world: convergence, fragmentation, provisionality, discontinuity, user-generated content and contexts, detraditionalization of learning, milieus.

Figure 1: Triangular structuration model (Based on: Pachler, Bachmair and Cook, 2010).

of the action . . . involves treating the reflexive monitoring, rationalization and motivation of action as embedded sets of processes" (Giddens, 1984, p. 3). Broadly speaking, agency is the reflexive monitoring capacity in the continuous process of action (p. 9) which happens within structures ("rules and resources", p. 25) within a system ("reproduced relations between actors or collectives, organized as regular social practices", p. 25) and its "conditions governing the continuity or transmutation of structures" (p. 25). The "conditions governing the continuity or transmutation of structures, and therefore the reproduction of the social systems" is covered by the term of structuration.

We uncouple the cultural practices of media use and of learning from structure and agency, because – we believe – they provide a specific view of learning. The theoretical outline relates to a specific perspective on practices in everyday life, namely that of French critical theory of practices (Lefebvre, 1977). The focus on cultural practices has the specific analytical value of identifying the constraints of, and opportunities afforded by everyday life and institutions for learning.

Part 3: An analysis of sustainability of learning with reference to the mobile complex through conversational, discursive processes

As a result of arguments presented in the previous two sections, we posit that the sustainability of mobile learning innovations emerges from conversational, discursive processes. If we accept provisionality as a basic feature of the delimitation of society and culture, we should adopt the position of Scott (2002, p. 4), mentioned earlier, of 'multiple perspectives' and 'differing prognoses'. But we cannot succeed without objectified tools and operational implementation procedures. The contradiction of objectified tools and provisionality cannot be overcome. Therefore, a hermeneutical, conversation-based approach seems to us to be the logical solution.

In the following, we present some possible tools in support of such a conversational approach based on our conceptual frame of the mobile complex. In Ng & Nicholas' (2013, p. 669) model of conversational processes, sustainability concentrates on the agents of these conversations (management, teachers, parents, students) but also refers to tools such as 'formal/informal' learning. This section of our paper summarizes the major features of structures, agency and cultural practices of the triangular structuration model.

Key questions to be explored are how valid such a summary is and how reliable the proposed tools are. The familiar criteria for evidence-based research, namely validity and reliability, apply. But, there are no stable external reference points outside the conversational, discursive process to which validity and reliability could be connected. Validity and reliability, therefore, need to be embedded in the process.

Dominant features of mobile learning – some keywords and tools

In line with the hermeneutical, conversation-based approach outlined above, and using the triangular structuration model, we propose some keywords and tools to frame the

discussion of sustainability. They are intended to serve as reference points for an analysis within a discursive engagement with pertinent issues and not as prescriptive procedures.

Structures
Detraditionalization and fragmentation

· Detraditionalization through globalisation and an increase of individualisation through mobility and convergence; the risk of decision making and dealing with risk taking is transferred to individuals.
· Fragmentation of society linked to lifestyle according to the variables of socio-economic status and orientation towards modernization.

Lifestyle fragmentation becomes overt in values but also in one's habitus of learning (see e.g. Kress and Pachler, 2007). Learning contains a social risk which leads e.g. to NEETs, young people not in education, employment or training, often belonging to the 'Precarious milieu' or to the 'Escapist milieu' of the Sinus-Milieu model. These milieus have a clear orientation towards mobile devices as cultural products. However, the powerful agents in schools – management, teachers and education-aware parents – usually do not belong to milieus with a strong value orientation towards 'modernisation & individualisation' and 're-orientation' (see Sinus-Milieus in Germany 2010) for which mobile devices are essential. On the contrary, they tend to promote the book as traditional cultural product for education. Systematic lifestyle investigations such as the Sinus-Milieu model are more or less unknown in educational design research (see Rummler, 2012) or in the research of sustainability, although they focus on people involved in mobile learning in the process of cultural transition.

Tool 1: Milieus of central European societies with specific reference to Germany (Source: Sinus Sociovision GmbH 2010, http://www.sinus-institut.de/en/solutions/sinus-milieus.html)
The Sinus-Milieus comprise two variables. One variable is socio-economic status, which depends mainly on income and formal education. It is categorized in terms of familiar social class stratification: lower/middle/higher. The second variable represents value orientation in respect of social changes with the following main categories: "tradition"/"modernisation and individualisation"/ "re-orientation". For example, members of the milieu valuing "re-orientation" tend to contribute actively to social changes by seeking to "overcome limitations" and "focus on new syntheses". Teachers may be described as belonging to the milieus of the "new middle class", the "adaptive pragmatist" or the "socio-ecological milieu". These milieus are characterized by Sinus Sociovision GmbH as follows:

"*New Middle Class milieu:* The modern mainstream with the will to achieve and adapt: general proponents of the social order; striving to become established at a professional and social level, seeking to lead a secure and harmonious existence."
"*Adaptive Pragmatist milieu:* The ambitious young core of society with a markedly pragmatic

outlook on life and sense of expedience: success oriented and prepared to compromise, hedonistic and conventional, flexible and security oriented."
"***Socio-ecological milieu:*** Idealistic, discerning consumers with normative notions of the 'right' way to live: pronounced ecological and social conscience; globalization sceptics, standard bearers of political correctness and diversity."

These three milieus arguably do not actively seek to integrate mobile innovation from mass media and the media into curricula.

Mobility
· Diversification of mobile devices;
· Use of apps for connecting mobile devices to institutions, services, resources, repositories and activities;
· From linear media production and media use to user-generated content and contexts.

User-generated contexts are normally removed from traditional educational thinking, because contexts for learning tend to be standardized by the school system. Our definition of context is as follows: a context is a frame under construction for optional combinations of actions, representational resources including media and literacy, virtual and local sites or social sites such as socio-cultural milieus (see also Bachmair and Pachler, 2014). In accordance with the provisionality of a culture in the process of detraditionalization, Dourish (2004, p. 5) explains context as a "*relational property*" which is "*defined dynamically*" and operationalizes the following four feature elements.

Tool 2: Dourish's model, which describes four feature elements of user-generated contexts (Dourish, 2004)
· "*contextuality is a relational property* that holds between objects or activities"
· "*the scope of contextual features is defined dynamically*".
· "context is particular to each occasion of activity or action. *Context is an occasioned property*"
· "context and content" are not two "separable entities". (p. 5)

Learning
· Detraditionalization and increased flexibility of contexts and frames of activity leading to fragmented meaning making;
· The school loses the power to define teaching and learning;
· Neo-liberal models of teaching and learning lead to de-schooling (see as example http://www.sbw.edu/index.php/idea-home/);
· The school as a knowledge production organization at the expense of other functions and tasks such as social integration.

The model of neoliberal transformation, the commodification of education and learning within the logic of a market economy, was described in Ritzer's cultural analysis (1993) with reference to developments in the domain of fast food as "McDonaldization". Certain strands of mobile learning can be seen to be influenced by this logic.

Tool 3: Ritzer's (1993) features of McDonaldization
· Efficiency: the optimal way to go from being hungry to being satisfied;
· Calculability: to transform food, production and consumers into being measured: e.g. making food units;
· Predictability: management of offer and consumption of units of food;
· *Control*: working people and consumers are subdued to these processes e.g. by pre-organised choice, going through channels, levels or screens.
· "The irrationality of rationality" (pp. 121ff).

These five categories of commercialisation of work also exert pressure on mobile learning, for example in the case of micro-learning or the use of technology for purposes of neo-liberal transformation of the school by setting up specific designs for learning.

Agency
Mobility
· user-generated content and context

Learning
· learning as an individualized social risk, at-risk learners (NEETs);
· learning in informal contexts and lifelong learning;
· provisionality of meaning making as a basic feature of learning;
· new modes of habitus and habitus of learning linked to social milieus and attendant lifestyles.

Tool 4: pedagogy of inclusion
Böck (2010) summarizes the discussion about *at-risk learners and mobile learning* under the heading of inclusion as follows:

· *Making learners mobile* so that they are able to expand their horizons;
· Engaging learners on their own terms and addressing them as people who are *already learners and as knowledge makers*;
· According them *full recognition* in their position and achievements in their lives; as well as of their position as learners and makers of knowledge. (p. 32)

These points also touch on key issues about changing agency and work in a culture of delimitation.

Cultural practices
The concept of cultural practices covers a wide range of practices of learning. With the emphasis on the changing *world* of learning or, more precisely, on the changing interrelationship of structures, agency and practices

of representation and learning, we consider persistent and innovative forms. Institutionalized forms of learning in the school system tend to be steady as a result of their institutionalized character which guarantees stability. As already noted above, structural changes in the field around the school lead also to a detraditionalization and increase in flexibility of learning with individualized mobility and mobile representation. Forms of mobile learning are closer to innovative and informal versions of learning and more remote from institutionally stable ones. Consequently, the affordances of mobile devices for established forms of school-based learning are different, e.g. tablets are closer to books and desktop computers; this we consider to be an important reason for them being accepted for teacher-guided instruction much more readily than mobile phones. For teacher-guided instruction the smartphone – with its origin in everyday life – is viewed as rather disruptive of established school-based learning, especially as it is linked to a new habitus of learning. The variability in the breadth of persistence and innovation is accompanied by more conservative or more innovative attitudes of the key agents of the school system or other sites of learning. At the time of writing a conservative attitude with a strong focus on exam preparation linked to an emphasis on performance in national and international league tables tends to characterise school systems around the world. This is not necessarily the case in vocational education with its greater proximity to employers and industry and attendant underpinnings.

If we try to operationalize learning practices with the help of mobile devices and corresponding structures we need to acknowledge seminal analyses of the existing school system. Hattie (2003; 2008) offers a data-driven analysis with a rather conservative outlook. Alternatively, there are more innovative approaches to changing education and related learning and teaching practices including educational design research.

Of course there are significant implications for the sustainability of mobile learning. From a conservative perspective, mobile devices and services are per se disruptive because of their origin in everyday life, their closeness to the delimitation of established institutionalized approaches to teaching and learning or for supporting changes to established habitus forms of learning. Whilst outcome-based approaches linked to standardized testing cannot be ignored, they have to be critically discussed.

Mobility
· Ubiquitous integration of mobiles and their applications into everyday life.

Learning
· Trend towards designing learning and teaching as individualized, flexible learning options which correlate with the affordances of mobile devices but also support learning as part of development within the life course.
· Informal learning strategies which are enhanced by formal learning institutions. Essential for informal

learning is the media environment of everyday life, which – for children and young people – tends to be based on mobile devices such as mobile phones, smartphones and tablets as interfaces for the internet with its social network(ing) sites, repositories and (online) games.
· Situated learning which re-frames the role of the teacher (Lave and Wenger, 1991).
· Collaborative knowledge building (Scardamelia and Bereiter, 1999).
· Context-aware learning (Yang, Okamoto and Tseng, 2008).
· Learning as conversation (Laurillard, 2002; 2007) which focuses on personal meaning making of the world.

Tool 5: Pedagogical focal points for designing mobile learning
The pedagogical focal points react to these innovative trends and represent educational and didactic options within the breadth of available mobile applications. They have been tested in a German school project for mobile learning (Bachmair, 2011; Bachmair, Pachler and Cook, 2011)

1. To integrate informal learning by means of the mobile device;
2. To set up episodes of situated learning by means of the mobile device;
3. To generate learning and media contexts by means of the mobile device;
4. To set up conversational bridges by means of the mobile device;
5. To support students as experts of their everyday life within the school by means of the mobile device;
6. To set up responsive contexts of development and learning by means of the mobile device.

Tool 6: Innovative educational design: Mor's (2013) design model for mobile learning scenarios
Learning scenarios are an arrangement of media, facilitators/teachers, students/learners and situations which serve as meaningful curricular units in the wider context of instruction/teaching/learning/instructional processes. What is 'meaningful' depends on the situation, context and actors. Mor's cyclical model combines the conversational model of sustainability (see Ng & Nicholas, 2013) with hermeneutic procedures. Scenarios are not organized as an action plan within a curriculum to which a teacher or facilitator reacts. They work as representation of processes on which the planning, realisation and evaluation of teaching and learning builds. Interpretation of educational practices is communicatively combined with research and theory. The cycles propose, and make visible, analytical and empirical activities which are objictied by "design narratives" with the focus on interpretations leading to "exemplars of practice". Mor emphasises that design narratives are "engendered" "collaborative reflection among practitioners by

structured processes of sharing stories of successful practice" (http://de.slideshare.net/yish/design-narratives). Design patterns are "situated abstractions of design narratives" (Mor, 2013, p. 5) and orientated towards research and theory. They summarize activities of evaluation and focus on analysis and theory. Design patterns are "elements of a scientific discourse" which lead "from narratives to patterns, and mechanisms established for validating them" (Mor, 2013, p. 2).

Design Scenarios objectify designers' intention within a frame of empirical evidence and theoretical substantiation. They "articulate a thick description of a design challenge in a realistic context, and harness existing design knowledge and theoretical frameworks to propose a viable solution to this challenge" (Mor, 2013, p. 7). They function like a conversational bridge to an interpretative application in practice of education.

Tool 7: Hattie's evaluative summary of the variables of students' achievement within the established learning practices in schools
Hattie, an Australian educationist at the University of Melbourne, carried out a "synthesis of over 800 meta-analyses relating to achievement" (Hattie, 2003; 2008). He found the following "major sources of variance in students' achievement" (Hattie, 2003, pp. 1–3):

· Students: "about 50% of variance". "High correlation between ability and achievement";
· Home: 5–10 % of the variance. The "major effects of the home are already accounted for by the attributes of the students".
· Schools: 5–10 % of the variance;
· Principals: "are mainly accounted for in the variance attributed to schools".
· Peer effect: 5–10 % of the variance.
· Teachers: "who account for about 30% of the variance".

Tool 8: a critical cultural theory of learning environments
In the context of the OECD-project "innovative learning environments", Schrittesser (2012) summarized the main features of such environments as being:

· orientation of the school culture towards the school's cultural and social environment (Ausrichtung der "Schulkultur" auf den "Schulstandort").
· professional standards of teachers ("Professionalität der Lehrenden").
· participatory elements in teaching and learning ("partizipative Moment von Unterricht").
· feedback to students about their attainment as a reflexive element of learning ("Rückmeldeverfahren zum Lern- und Leistungsstandard der Lernenden" als "reflexives Moment von Lernen").
· dealing with diversity ("Heterogenität und Diversität").
· political participation ("politische Teilhabe in der Demokratie"). (p. 51)

We have presented above, albeit rather briefly, eight possible tools which we consider supportive of an analytical engagement with the issue of sustainability of learning with and through mobile devices as cultural resources. The range and diversity of tools presented recognises the multiplicity of perspectives on sustainability of learning in the specialist literature as well as the provisionality and transience inherent in the phenomena under consideration. The multiplicity of tools presented also mirrors the lack of definability of static operational procedures for defining or measuring sustainability of learning with and through mobile devices. The tools are discursive and conversational in that they offer different lenses through which to explore and discuss learning with and through mobile devices and in that they seek to engender debate about learning with and through mobile devices from different perspectives.

In summary, the tools we proposed for consideration and their keys are:

Tool 1. Sinus-Milieus: help us recognise milieu-related differences in dispositions towards learning with and through mobile devices;

Tool 2. Dourish's model of user-generated contexts: allows us to understand that context is an interactional phenomenon;

Tool 3. Ritzer's notion of McDonaldization: explains the commodification of education;

Tool 4. Böck's pedagogy of inclusion: stresses the importance of engaging learners on their terms and as risk-takers and knowledge makers;

Tool 5. The London Mobile Learning Group's pedagogical focal points: identify key features of designing mobile learning in formal educational contexts;

Tool 6. Mor's innovative educational design: identifies the usefulness of design patterns and scenarios in orchestrating mobile learning;

Tool 7. Hattie's variables of student achievement: enable an evidence-informed discussion of the efficacy of established learning practices in schools; and

Tool 8. Schrittesser's features of innovative learning environments: offer a starting point to analyse schools as learning communities.

Our invitation to mobile learning researchers and practitioners is to use one or more of these tools, depending on the specifics of the particular activity or project, to consider issues of sustainability.

Conclusion
We began our approach to sustainability for the field of mobile learning with the assumption that mobile learning results from a societal and cultural change characterised by a blurring of boundaries. This leads to a provisionality of central activities and concepts which includes sustainability of innovations and their implementation in the cultural practice of learning. As Scott (2002, p. 4) outlined, we have to deal with "multiple perspectives" and "differing prognoses". Additionally we see a solution in making sustainability concrete with reference to the proposal of the Brundtland Commission (1987) to

understand sustainability as development (p. 17). In this line of argumentation, we take up the proposal by Ng & Nicholas (2013) for a conversational procedure to attain sustainability for mobile learning. But the drive behind sustainability remains to maintain innovative processes, to achieve stability by working within operational procedures, to generalise implementation beyond single instances of mobile learning interventions. Therefore, we concentrated here on practical tools. The validity and reliability of the proposed tools cannot be tested in general terms, only through concrete conversational processes, for example by analysing a specific mobile scenario in a defined context.

A critical look at the proposed tools for operationalizing sustainability raises a range of questions: why these tools and not others? Why so many? Why so few? Are they empirically validated or do they remain conceptual? The proposed tools result from conversations within the London Mobile Learning Group and its research endeavours around a critical educational theory and practice of mobile learning. Viewed within in the hermeneutic principle, this paper hopes to give rise to a new round of conversations to explore the value of the proposed tools critically.

Competing Interests
The authors declare that they have no competing interests.

References

Bachmair, B 2011 Ein didaktisches Design für das Handy: Episoden situierten Lernens mit dem Handy im lehrergeleiteten Unterricht. In: Friedrich, K, Bachmair, B & Risch, M (Eds.) *Mobiles Lernen mit dem Handy. Herausforderungen und Chancen für den Unterricht.* Beltz Verlag: Weinheim/Basel, 171–174.

Bachmair, B and **Pachler, N** 2014 Framing ubiquitous mobility educationally: mobile devices and context-aware learning. In: Wong, L H, Specht, M and Milrad, M (Eds.) *Seamless learning in the age of mobile connectivity.* New York: Springer.

Bachmair, B, Pachler, N and **Cook, J** 2009 Mobile phones as cultural resources for learning: an analysis of educational structures, mobile expertise and emerging cultural practices. In *Medienpädagogik.* Available at: http://www.medienpaed.com/2009/bachmair0903.pdf.

Bachmair, B, Pachler, N and **Cook, J** 2011 *Parameters and focal points for planning and evaluation of mobile learning.* Available at: http://www.londonmobile-learning.net/downloads/Parameter_flyer.pdf.

Bachmair, B, Pachler, N and **Cook, J** 2014 Kulturökologie, Medien und Mediennutzung. In: Tillmann, A, Fleischer, S & Hugger, K-U (Hrsg.) *Handbuch: Kinder und Medien.* VS Verlag, 137–151. DOI: http://dx.doi.org/10.1007/978-3-531-18997-0_10

Beck, U, Bonss, W and **Lau, C** 2003 *The Theory of Reflexive Modernization*: Problematic, Hypotheses and Research Programme. *Theory,* Culture & Society, 20(2): 1–33. DOI: http://dx.doi.org/10.1177/0263276403020002001

Beck, U and **Grande, E** 2010 Varieties of second modernity: the cosmopolitan turn in social and political theory and research. *The British Journal of Sociology,* 61(3): 409–443. DOI: http://dx.doi.org/10.1111/j.1468-4446.2010.01320.x. PMid: 20857607.

Beck, U and **Lau, C** (Hrsg.) 2004 *Entgrenzung und Entscheidung: Was ist neu an der Theorie reflexiver Modernisierung?* Frankfurt: Suhrkamp.

Böck, M 2010 Mobile learning, digital literacies, information habitus and at-risk social groups. *International Journal of Mobile and Blended Learning,* 2(3), 30–41. DOI: http://dx.doi.org/10.4018/jmbl.2010070103

Brundtland Commission 1987 *Report of the World Commission on Environment and Development: Our Common Future.* Available at: http://www.un-documents.net/wced-ocf.htm.

Cook, J, Pachler, N and **Bachmair, B** 2011 Ubiquitous mobility with mobile phones: a cultural ecology for mobile learning. *E-learning and Digital Media. Special Issue – Media: digital, ecological, epistemological,* 8(3): 181–196. DOI: http://dx.doi.org/10.2304/elea.2011.8.3.181

Cuban, L 2001 *Oversold and underused: computers in the classroom.* Cambridge, MA: Harvard University Press.

Dobson, A 1996 Environmental sustainabilities: an analysis and a typology. *Environmental Politics,* 5(3): 401–428. DOI: http://dx.doi.org/10.1080/09644019608414280

Dourish, P 2004 What we talk about when we talk about context. *Personal and Ubiquitous Computing,* 8(1): 19–30. Also available at: http://www.ics.uci.edu/~jpd/publications/2004/PUC2004-context.pdf. DOI: http://dx.doi.org/10.1007/s00779-003-0253-8

Friedrich, K, Bachmair, B and **Risch, M** 2011 *Mobiles Lernen mit dem Handy. Herausforderungen und Chancen für den Unterricht.* Beltz Verlag: Weinheim, Basel.

Friedrich, K, Ranieri, M, Pachler, N and **de Theux, P** (eds.) 2012 *The "My Mobile" Handbook. Guidelines and scenarios for mobile learning in adult education.* Available at: http://mymobile-project.eu/IMG/pdf/Handbook_web.pdf.

Giddens, A 1984 *The constitution of society: outline of the theory of struct*uration. Berkley and Los Angeles: University of California Press.

Hall, S (ed.) 1997 *Representation. Cultural representations and signifying practices.* London: Sage.

Hattie, J 2003 *Teachers make a difference. What is the research evidence?* University of Auckland. Australian Council for Educational Research, Copyright Professional Learning and Leadership Development, NSW DET. Available at: http://www.acer.edu.au/documents/RC2003_Hattie_TeachersMakeADifference.pdf.

Hattie, J 2008 *Visible learning: a synthesis of over 800 meta-analyses relating to achievement.* London: Routledge.

Kress, G 2010a Learning and Environments of Learning in Conditions of Provisionality. In: Bachmair, B (Hrsg.) *Medienbildung in neuen Kulturräumen. Die deutschsprachige und britische Diskussion.* Wiesbaden: VS Verlag für Sozialwissenschaften, 171–182.

DOI: http://dx.doi.org/10.1007/978-3-531-92133-4_12. PMid: 20180716; PMCid: PMC2852152.

Kress, G 2010b *Multimodality. A social semiotic approach to contemporary communication.* London: Routledge.

Kress, G and **Pachler, N** 2007 Thinking about the 'm' in m-learning. In: Pachler, N. (Ed.) *Mobile learning – towards a research agenda*, Occasional Papers in Work-based Learning. London: WLE Centre. Vol. 1, pp. 7–32. Available at: http://www.researchgate.net/publication/233981184_Thinking_about_the_%27m%27_in_m-learning.

Lash, S, Giddens, A and **Beck, U** 1994 *Reflexive modernization: politics, tradition and aesthetics in the modern social order.* Cambridge: Polity Press. PMCid: PMC1566771.

Laurillard, D 2002 *Rethinking university teaching: a conversational framework for the effective use of learning technologies.* London: Routledge. DOI: http://dx.doi.org/10.4324/9780203304846

Laurillard, D 2007 Pedagogical forms of mobile learning: framing research questions. In: Pachler, N (Ed.) *Mobile learning: towards a research agenda.* WLE Centre, Institute of Education, London, pp. 153–176. Available at: https://www.researchgate.net/publication/259405349_Mobile_learning_towards_a_research_agenda.

Lave, J and **Wenger, E** 1991 *Situated learning: legitimate peripheral participation.* Cambridge: Cambridge University Press. DOI: http://dx.doi.org/10.1017/CBO9780511815355

Lefebvre, H 1977 *Das Alltagsleben in der modernen Welt.* Frankfurt/M.: Suhrkamp.

Lomicka, L 2003 Review of Oversold and Underused: Computers in the Classroom. *Language Learning & Technology,* 7(3): pp. 42–45. Available at: http://llt.msu.edu/vol7num3/pdf/review4.pdf.

Luckin, R, du Boulay, B, Smith, H, Underwood, J, Fitzpatrick, G, Holmberg, J, Kerawalla, L, Tunley, H, Brewster, D and **Pearce, D** 2005 Using mobile technology to create flexible learning contexts. *Journal of Interactive Media in Education,* (22). Available at: http://www-jime.open.ac.uk/jime/article/viewFile/2005-22/300. DOI: http://dx.doi.org/10.5334/2005-22

Mor, Y 2013 SNaP! Re-using, sharing and communicating designs and design knowledge using Scenarios, Narratives and Patterns. In: Luckin, R, Goodyear, P, Grabowski, B, Puntambekar, S, Winters, N and Underwood, J (Eds.) *Handbook of Design in Educational Technology,* Routledge, 189–200. Available at: http://oro.open.ac.uk/33861/1/SNaP-ORO.pdf.

Ng, W and **Nicholas, H** 2013 A framework for sustainable mobile learning in schools. *British Journal of Educational Technology,* 44(5), 695–715. DOI: http://dx.doi.org/10.1111/j.1467-8535.2012.01359.x

Pachler, N 2010 The Socio-Cultural Ecological Approach to Mobile Learning: An Overview. In: Bachmair, B (Hg.) *Medienbildung in neuen Kulturräumen. Die deutschsprachige und britische Diskussion.* Wiesbaden

VS Verlag für Sozialwissenschaften, 153–167. DOI: http://dx.doi.org/10.1007/978-3-531-92133-4_11

Pachler, N, Bachmair, B and **Cook, J** 2010 *Mobile Learning: Structures, Agency, Practices.* New York: Springer. DOI: http://dx.doi.org/10.1007/978-1-4419-0585-7

Pask, G 1976 *Conversation Theory: Applications in Education and Epistemology.* Amsterdam, Oxford New York: Elsevier.

Pérez, L 2013 *Mobile Learning for all. Supporting accessibility with the iPad.* Corwin / Sage: Thousand Oaks.'

Ringstaff, C, Sandholtz, J and **Dwyer, D** 1997 *Trading Places: When Teachers Utilize Student Expertise in Technology-Intensive Classrooms.* Apple Classrooms of Tomorrow Research. Report Number 15. Available at: http://www.apple.com/nl/images/pdf/acotlibrary/rpt15.pdf.

Ritzer, G 1993 *The McDonaldization of society.* Pine Forge Press / Sage. Newbury Park, California.

Roschelle, J and **Pea, R** 2002 A walk on the WILD side: how wireless handhelds may change computer-supported collaborative learning. *International Journal of Cognition and Technology,* 1(1): 145–168. DOI: http://dx.doi.org/10.1075/ijct.1.1.09ros

Rummler, K 2012 *Medienbildungschancen von Risikolernern. Analyse der Nutzung mobile und vernetzter Technologien durch männliche jugendliche Risikolerner und die in den Nutzungsmustern angelegten Chancen für Medienbildung.* (Dissertation). Universität Kassel. Available at: http://www.risikolerner.de.

Scardamalia, M and **Bereiter, C** 1999 Schools as knowledge building organizations. In: Keating, D & Hertzman, C (Eds.), *Today's children, tomorrow's society: the developmental health and wealth of nations.* New York: Guilford, 274–289.

Schrittesser, I 2012 Lernen pädagogisch gewendet. Annäherungsversuche mit Nebenwirkungen. In: Schrittesser, I, Fraundorfer, A & Krainz-Dürr, M (Hg.) *Innovative Learning Environments: Fallstudien zu pädagogischen Innovationsprozessen,* 25–57. Wien: facultas. wuv.

Scott, W 2002 *Sustainability and learning: what role for the curriculum?* Inaugural professorial lecture given on April 25. Council for Environmental Education in association with the Centre for Research in Education and the Environment, University of Bath. Available at: http://www.bath.ac.uk/cree/resources/scott.pdf

Sharples, M (ed.) 2007 *Big issues in mobile learning: report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.* LSRI, University of Nottingham. Available at: http://matchsz.inf.elte.hu/tt/docs/Sharples-20062.pdf.

Sharples, M, Taylor, J and **Vavoula, G** 2007 A theory of learning for the mobile age. In Andrews, R & Haythornthwaite, C (Eds.) *The Sage Handbook of E-learning Research.* London: Sage, 221–247.

Sinus Sociovision GmbH 2010 *Sinus-Milieus in Germany 2010.* Available at: http://www.sinus-institut.de/en/solutions/sinus-milieus.html.

Strasser, T 2012 *Mind the app! Inspiring internet tools and activities to engage your students.* Helbling Languages: Rum.

Thissen, F 2013 *Mobiles Lernen in der Schule.* Available at: http://www.frank-thissen.de/ibook_gut.pdf.

Traxler, J 2010 Sustaining mobile learning and its institutions. *International Journal of Mobile and Blended Learning,* 2(4): 58–65. DOI: http://dx.doi.org/10.4018/jmbl.2010100105

Wenger, E 1998 *Communities of practice. Learning, meaning, and identity.* Cambridge: Cambridge University Press. DOI: http://dx.doi.org/10.1017/CBO9780511803932

Yang, S, Okamoto, T and **Tseng, S-S** 2008 Context-aware and ubiquitous learning. *Educational Technology & Society,* 11(2): 1–2.