

## Learning Competences in Open Mobile Environments: A Comparative Analysis Between Formal and Non-Formal Spaces

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### Abstract

As a result of the increasing use of mobile devices in education, new approaches to define the learning competences in the field of digitally mediated learning have emerged. This paper examines these approaches, using data obtained from empirical research with a group of Spanish university students. The analysis is focused on the experiences of students in the use of mobile devices in both formal and open-informal educational contexts. The theoretical framework of the study is based on the ecological focus applied to explanatory models of digital literacy. As a result of the data it is possible to study this framework in depth, taking into account the theories defending an open view of digital literacy. The study may be of interest to instructional designers and researchers in the fields of open educational resources and technologies applied to education in open contexts.

**Keywords:** affordances; digital competences; mobile devices; open educational environments; socio-cultural ecology; user-generated contexts

### Approach and objectives of the study

The use of mobile devices in educational settings presents the following aspects of scope for designing learning practices:

- (1) The formative skills of the classroom are extended to other scenarios that are open and delocalised. Mobile learning may take place as part of the student's normal routine, but this is not the only place.
- (2) The aspect of educational ubiquity and the capacity for learning to take place in any context are introduced. To the extent that mobile devices enable learning environments to be extended to other contexts, teaching becomes ubiquitous, since it is possible to learn in, through and from any of the different surroundings that form part of student life.
- (3) There is a specific typology for mediation tools. Mediation takes place through interfaces with a particular configuration and functionality, such as touch screens, video viewers and headphones.

In view of these aspects, and others directly linked to mobile learning, it is perhaps appropriate to examine the competences and skills required for undertaking educational processes with these devices. The research that defines this study sets out to respond to the needs that arise from the growing use of mobile devices in education, considered in terms of educational competences and contextualised in higher education and open educational resources and spaces<sup>1</sup>. In that sense, the main objectives of the study are:

- (1) To identify skills linked to the use of mobile technologies and how they affect competences associated with future jobs.
- (2) To define new forms and practices for acquiring knowledge, skills and competences.

- (3) To analyse the changes associated with the role played by those taking part in learning processes through mobile technologies.
- (4) To determine the role of mediation technologies in the transformation and support of creative and innovative learning.
- (5) To define the changes and challenges for assessing, certifying and accrediting competences in ubiquitous learning scenarios.

Specifically, the objectives 1 and 2 of the investigation are discussed below. To do this, the schemes that contain skills related to the use of mobile devices in learning situations are analyzed. And also how these schemes evolve when learning situations in the classroom are discussed, along with other non-formal educational situations.

### **The state of the question: competences within the framework of digital literacy**

The ecological approach to the field of educational technology considers that pedagogies and technologies combine to form certain types of behaviours. This approach avoids the emergence of deterministic visions surrounding technologies and enriches the analysis of educational practices that include the use of digital systems. When these practices are mediated by mobile devices, it is appropriate to consider the affordances made possible by these devices for their users. Digital technologies in general and digital devices in particular have many components that enable the spread of social practices and the generation of new forms of learning. It is also appropriate not to consider these affordances in a vacuum but as elements dependent on the context (Belshaw, 2012), a key aspect in the study of educational phenomena that take place in open spaces.

These principles are taken into account in this research, which aims to establish an interpretative framework from which to consider the operational elements examined in this study. Also the analysis of existing literature on digital competences, which shows the diversity of concepts with relation to the researchers' disciplines and the various projects in which digital competence models have been developed, is taken into account. Thus, concepts like computer literacy, ICT literacy, information literacy, media literacy and web literacy appear, each with its own particular significance but at the same time with common meeting points.

Of all the proposals analysed, the one with the greatest regulatory component is based on the conceptual frameworks developed by Bawden (2008), Martin & Grudziecki (2006) and Van Deursen (2010), upon which Ala-Mutka (2011) proposes a Digital Skill Model based on the knowledge structure, skills and attitudes set out in the European Qualifications Framework. The Ala-Mutka model contains a matrix that includes the following elements (figure 1):

- (1) *Instrumental skills and knowledge*. Divided into two blocks: operational and media related.
- (2) *Advanced skills and knowledge*. These define the main aspects that have to be learnt to apply to digital settings, mostly in networked environments, and are grouped as follows: Communication and Collaboration, Information Management, Learning and Problem-solving, and Significant Participation.
- (3) *Attitudes for the application of these skills and knowledge*. Because of their transversal nature, subjecting them to any sort of regulation is complicated.

The analytical frameworks on which competence assessment and certification are based are generally far removed from ecological models, which mainly take into account socio-cultural variables. The variety of factors characteristic of any open approach to society does not match the aims associated with experimental models, which focus largely on operational aspects and control. If the complexity of competence assessment in open scenarios is to be included, it is essential to

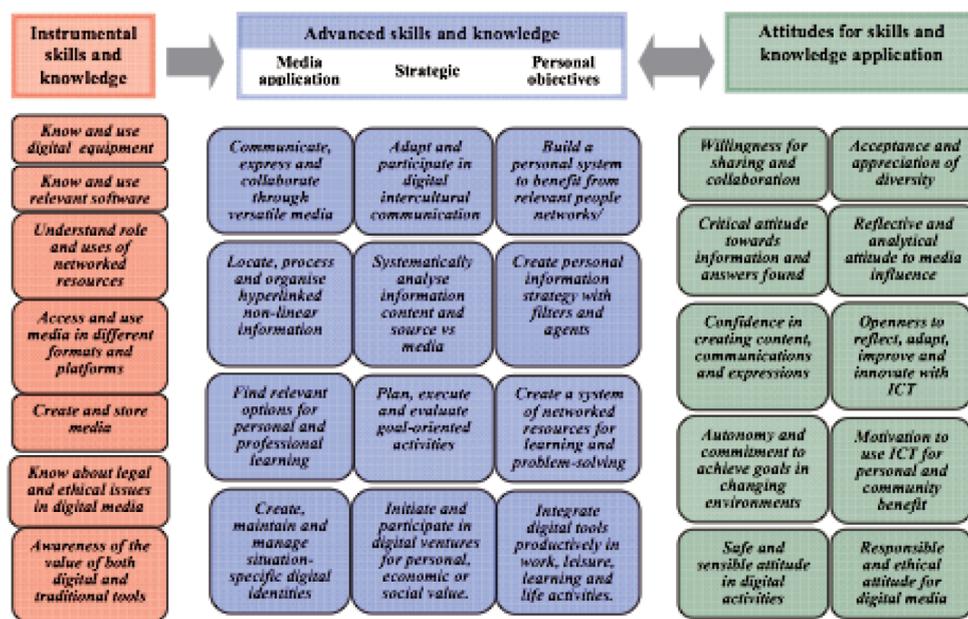


Figure 1: Structural elements of Ala-Mutka model (Ala-Mutka, 2011: p. 47): Knowledge, skills and attitude items contributing to Digital Competence

resort to aspects that are difficult to index, such as those related to participation in communities of practice, the quality of interpersonal relationships or peer-to-peer recognition (Schmidt, Geith, Håklev & Thierstein, 2009).

In this respect, the reference framework for this study has also taken into consideration work done by the Mozilla Foundation (VVAA, 2013b) supporting the development of an open schema that, at the same time, includes an operational definition of competences involved in the Literacy Web. The task undertaken by Mozilla is based on a philosophy of learning through practice. Together with proposals derived from academic studies, its model has taken into account the practical action of user groups following a crowdsourcing strategy. This has enabled the creation of a *de facto* standard that has been tested in parallel with its conceptual development.

The Mozilla schema for web competence differentiates between *skills* (a controlled activity that an individual learns to carry out) and *competences* (a collection of skills with a predefined purpose; in this context, competences are packages of skills) and proposes a simple model based on three core concepts. Each concept has a series of competences that are subdivided into skills (Belshaw & Casilli, 2013):

- (1) Exploration.
- (2) Construction.
- (3) Connection.

It is this last approach which has been used by this research as a reference framework, in such a way that mobile competences are seen as a part or subset of other areas that contribute to information literacy, such as digital literacy, media literacy, web literacy, computational thinking and information technology. Variables of a contextual nature have been taken into account in its construction and interpretation, which allows its development to be related to the environmental and behavioural ecology of the subjects (Rheingold, 2012; Davidson, 2011).

## Conceptual bases: mobile competences from socio-cultural ecology

Digital competences have a superficial component. Students are increasingly becoming more familiar with technologies and able to cope in a context characterised by information overload. For them, all information has an equivalent value in that what they are seeking is not accurate data but communication with each other. The very nature of the Internet encourages comparisons between a multitude of different sources of information, individually incomplete and collectively inconsistent. This encourages a type of learning based on searching, consulting and synthesis, rather than on the assimilation of a single source of “validated” knowledge, such as that obtained from books, the television or a lecturer giving a conference (McLester, 2007). Within this vast area of digitally mediated learning, mobile technologies are characterised by their capacity to generate highly interconnected educational environments. Learning everywhere is equivalent to some form of simple mobile learning, for example, through environments that can be accessed in different contexts and situations (Marin & Mohan, 2009; Kukulska-hulme, 2009; Liu, & Hwang, 2010; Hwang, Kuo, Yin & Chuang, 2010; Liaw, Hatala & Huang, 2010; VVAA, 2013a). In order to guarantee ubiquitous learning it is essential to integrate a series of mobile technologies around scenarios of convergence, since these technologies increase the educational possibilities of virtual environments in conventional learning. In this respect, the educational experience can be enriched through connecting with people in a known geographical location, information from other equipment and traceability data on the student’s activity. Knowing how to integrate their use is fundamental to the consideration of any mobile competence framework.

In order to analyse these elements, this study opts for the conceptual framework of socio-cultural ecology (Pachler, Bachmair & Cook, 2010). In accordance with this approach, learning through mobile devices is governed by a triangular relationship between cultural practices, social structures and the actions of students in the educational process:

- (1) *Cultural practices*: Mobile devices are increasingly used for social interaction, communication and exchange. Learning is seen as the creation of meaning that is situated culturally both inside and outside educational institutions, at the same time that the mass media have attained cultural significance in everyday life.
- (2) *Structures*: Students form part of a new social stratification in which the individualisation of mobile mass media and a complex and abundant technological infrastructure lead to learning being governed by the curricular frameworks of educational institutions with specific approaches towards the use of new cultural spaces as learning resources. Within this framework, spaces for open educational practice, especially the open spaces of the Internet, provide a natural field for mobile learning to develop.
- (3) *Student action*: Increasingly, subjects are immersed in a new learning habitat in which the worlds they live in are configured as potential means and resources for learning. In such a learning context experiences are assigned individually in relation to the actions the subject is capable of undertaking, whether in his or her daily life or as part of standardised study plans.

Together with the ecology defined by these three components, another important feature, which requires pedagogical answers, is the predominance of what is known as user-generated contexts. As users participate actively by creating their own ways of generating content, learning contexts are also circumscribed by the ambit of the individual. This results in the emergence of new relationships between the context and the execution of mobile communication practices managed entirely by the user. Mobile devices make it possible to produce not only content but also context. In the case of education, they enable the student to develop a new relationship with space (the outside world) and place (the immediate socio-cultural surroundings). Likewise, mobile connection changes

the sequence of traditional communication between educational agents. Students are now producers of content and as such form part of a burst of activity in the content area generated by other users, including teachers.

Finally, the appropriation of technology is a core element for guaranteeing the quality of technologically mediated learning. Technological appropriation is obtained through the processes that accompany personal practices with mobile devices, of which the main ones are: interaction, assimilation and accommodation, and change (Pachler, Cook & Bachmair, 2010).

Accordingly, in the research approach applied, media convergence around mobile devices, together with the association of cultural structures characteristic of their respective environments and habitats, are considered to generate modes of individualised appropriation in the form of learning contexts. Spaces created in this way can differentiate everyday life activities into individually defined contexts and at the same time bridge different and divergent cultural practices, such as entertainment and academic learning. In such a scenario, socio-techno-cultural evolution tends to generate situations in which there is no need to differentiate between media for learning inside and outside formal educational settings.

### **Empirical approach and data analysis**

The design of the research focuses on the objective of empirically validating the conceptual approach of the project and the principal aspects that have been described in the previous sections. In the absence of a deep analysis of the compiled information and its cross-referencing with the information coming from the entire study, this section introduces the most notable empirical evidence following the implementation of the principal instruments and that is related to the theoretical perspective.

The method utilized in the first phase of the research (January-February 2013) consisted of a case study carried out with a group of university students. The group was composed of 40 students who studied two undergraduate degree subjects in Communication Sciences (students from the Complutense University of Madrid, Spain) and Social Education (students from UNED—Distance Education University of Spain). This group was then split into five focus groups. Discussion subjects centred on the use of mobile technologies by the students, with the aim of obtaining conclusions on utility and creating knowledge with which to construct the scope of the survey.

Once the principal aspects were explored, progress continued in the second phase of the study (April-October 2013) to make the research representative, for which the sample was expanded to a total of 650 students (students from the following universities in Spain: Granada University, Oviedo University, Vigo University, Complutense University of Madrid and UNED) with the same characteristics as the first pilot group. A survey based on a questionnaire was then used on this sample. The operative variables of the questionnaire derived from the contrast between the theoretical-conceptual aspects of the study and the analysis of the information obtained in the focus groups. The resulting questionnaire consists of 20 items, divided into six aspects:

1. Profile data.
2. Devices and uses.
3. Devices, frequency and use.
4. Devices, functions and applications.
5. Devices, competences and learning.
6. Satisfaction with achievements.

Shown here are the results of a first analysis of disaggregated data obtained in the focus groups. A simple method of qualitative content analysis based on an inductive process was applied. It was

**Table 1: Competences acquired with the use of mobile devices in the classroom (formal environment). Selection of valid data**

Competences	Code	% Codes	Cases	% CASES
<i>Instrumental skills &amp; knowledge</i>				
Know & use mobile devices	18	20,0%	29	24,4%
Know & use software-apps	16	17,8%	25	21,0%
Access & use media in different formats	20	22,2%	28	23,5%
Create information	13	14,4%	19	16,0%
<i>Advanced skills &amp; knowledge</i>				
Adapt & participate in digital communication	5	5,6%	3	2,5%
Locate, process and organize hyperlinked non-linear information	4	4,4%	4	3,4%
Create personal information strategy	3	3,3%	2	1,7%
Plan, execute and evaluate goal-oriented activities	3	3,3%	3	2,5%
Plan, execute and evaluate goal-oriented activities	5	5,6%	4	3,4%
Integrate digital tools productively in work, leisure, learning and life activities	3	3,3%	2	1,7%

developed in two stages: first the texts generated in the focus groups were coded, and then these codes were associated with the concepts of the theoretical model used in the research. The codes represent the major units of meaning generated in the discourse of the participants in the focus groups.

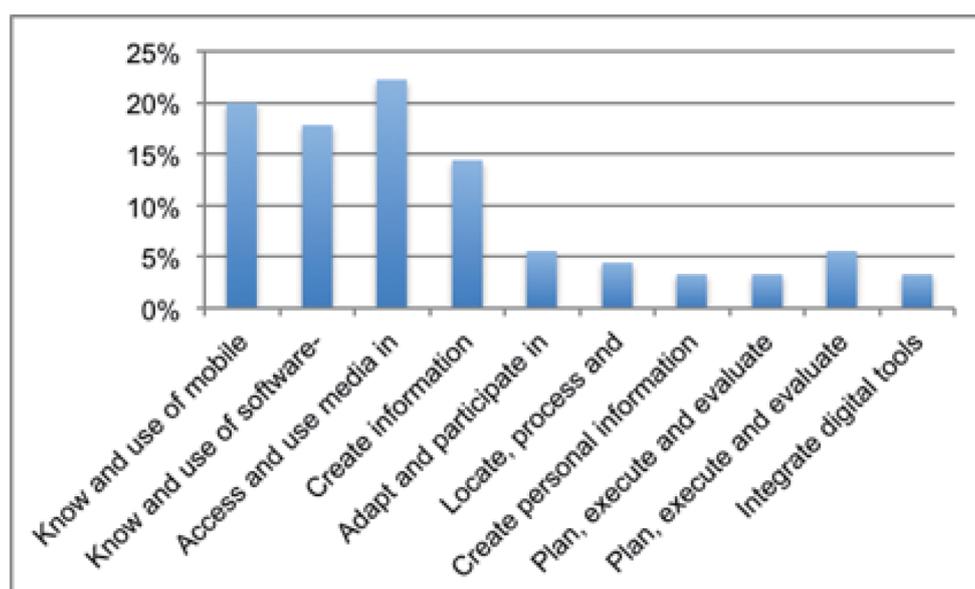
In tables 1 and 2, the “Competences” column shows a selection of competences that are relevant to this case. These skills are part of the ecological approach used in the theoretical framework of the study. The “Code” column shows the number of codes in the focus group discussions related to each competency. The number of codes that appears is a variable data, depending on how often participants have referred to each unit of meaning in their conversations going within focus groups. That is, the number of occurrences codes is not related to the number of people involved, but how many times these people have referred to content relevant to the investigation. The “% Codes” column shows the percentage represented by the presence of these codes in the total set of codes generated in the focus groups conversations. The “Cases” column shows how many cases of people named these codes in their conversation. And the “% Cases” column shows the percentage of cases of total people named codes.

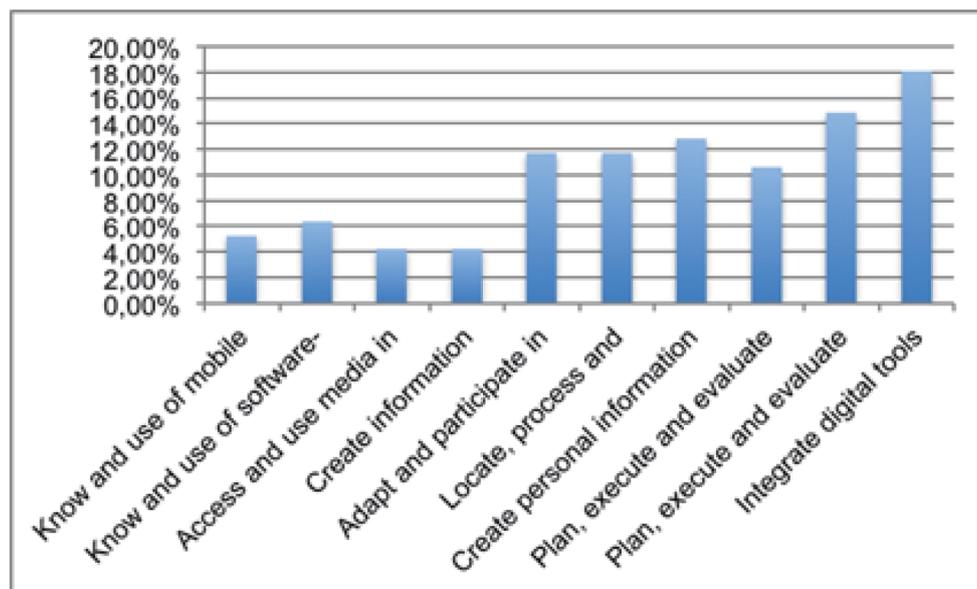
In a first phase (tables 1 and 2, figures 2 and 3), the analysis suggests a dual typology of social practices, which changes depending on whether the mobile technologies are used in formal educational environments (in the classroom) or informal environments (outside the classroom). For their part, the digital competences related to mobility are consistent with the ecological focus. A common set of practices that form part of information literacy (similar to those of the Ala-Mutka model, 2011) are validated, but they show great variability when the contextual variables (inside/ outside the classroom) are considered.

**Table 2: Competences acquired with the use of mobile devices outside of the classroom (informal environment). Selection of valid data**

Competences	Code	% Codes	Cases	% CASES
<i>Instrumental skills &amp; knowledge</i>				
Know & use mobile devices	5	5,3%	2	1,5%
Know & use software-apps	6	6,4%	3	2,3%
Access & use media in different formats	4	4,2%	2	1,5%
Create information	4	4,2%	2	1,5%
<i>Advanced skills &amp; knowledge</i>				
Adapt & participate in digital communication	11	11,7%	12	9,3%
Locate, process and organize hyperlinked non-linear information	11	11,7%	14	10,8%
Create personal information strategy	12	12,8%	20	15,6%
Plan, execute and evaluate goal-oriented activities	10	10,6%	18	13,9%
Plan, execute and evaluate goal-oriented activities	14	14,9%	26	20,2%
Integrate digital tools productively in work, leisure, learning and life activities	17	18,1%	30	23,3%

In subsequent analyses it's hoped to determine what type of competences are involved in both scenarios, although the first results show that the competences developed in open educational practice environments are more related to advanced skills and knowledge, the area of communication and collaboration, problem-solving and significant participation (table 2 and figure 3). In the

**Figure 2: Competences acquired with the use of mobile devices in the classroom (formal environment). Selection of valid data**



**Figure 3: Competences acquired with the use of mobile devices outside of the classroom (informal environment). Selection of valid data**

formal scenarios, the most developed skills are those related to instrumental knowledge in the operational area and to managing devices (table 1 and figure 2).

Specifically, these findings could help to improve learning methods in the classroom environment where mobile devices are used as a learning tool. The same can also be applied regarding to more precise knowledge of assessing, certifying and accrediting competences in ubiquitous learning scenarios. As well as the contrast of the data on the types of competences and further research can contribute to strengthen the validity of the learning obtained in open environments through mobile devices. It is expected the development of studies to improve the integration between the two types of learning environments where mobile devices are used, formal and non-formal environments.

## Conclusions and discussion

Research in the world of learning competences with mobile devices is usually considered in a way that is differentiated in regard to the skills framework that makes up digital literacy. In this article, a more transversal delimitation is advocated, where mobile competences form part of a continuum in which other forms of literacy, such as information, media, web, etc., also form part. At the same time, the competences derived from literacy in these diverse areas can be studied in a more integrated manner if they are considered with a focus on social practices mediated by digital technology, and by paying attention to contextual variables that may affect how they are put into practice in different environments. As such, the differentiating element between certain competences and others isn't so much the mediating device that acts as an interface between learning and the rest of the educational agents/resources, but rather specific practices that are carried out in specific environments.

Research has been presented in this article that takes into consideration these conceptual principles and applies them to the case of educational practices mediated by mobile devices.

According to the objectives of this study, the article concludes that the data are consistent with the conceptual framework of social and cultural ecology. In the absence of further analysis,

the research found that the use made by students of their mobile devices during the study in open contexts is similar to how they use them in their daily practices, and these practices can be interpreted as learning processes. These learning processes take place in situations of everyday social practice mediated by digital technologies. So it is possible to understand that both -the ecology and the social context- are crucial to generate that kind of learning. This conclusion is appropriate from the results of this first phase of research. In addition, it is also consistent with the finding that there are differences between the competences that learners put into practice when they do educational assignments using mobile devices in open and closed environments.

Discussion related to these topics could include the need to construct competence analysis frameworks starting from the specific practices of the learners and contextualized in specific environments, whether they be physical, digitally mediated or a hybrid. It may also be useful to talk about the open character of the competence schemas, allowing the integration of diverse visions throughout the process until they become a *de facto* standard. Lastly, it may be of interest connecting the study on mobile competences with approaches searching for digital literacy models, given that both perspectives are looking for evidence to improve educational practices. And, from an eminently instrumental viewpoint, what can be confirmed is a tendency wherein mobile devices act as the principal intermediary between the learner and open educational resources.

## Note

- <sup>1</sup> Research Project “Aprendizaje ubicuo con dispositivos móviles. Elaboración y desarrollo de un mapa de competencias en educación superior” (“*Ubiquitous Learning with Mobile Devices. The production and development of a map of competences in higher education*”) (ref.: EDU 2010-17420), National Programme of Fundamental Research Projects of the Spanish Ministry of Economy and Competitiveness.

## References

- Ala-Mutka, K. (2011). *Mapping Digital Competence: Towards a Conceptual Understanding*. JRC 67075—Joint Research Centre—Institute for Prospective Technological Studies. Retrieved from [http://ftp.jrc.es/EURdoc/JRC67075\\_TN.pdf](http://ftp.jrc.es/EURdoc/JRC67075_TN.pdf)
- Bawden, D. (2008). Origins and Concepts of Digital Literacy. In C. Lankshear & M. Knobel (Eds.), *Digital Literacies: Concepts, Policies & Practices* (pp. 17–32). New York: Peter Lang.
- Belshaw, D. (2012, October 18). Some Thoughts on iPads and One-to-One Initiatives. *Digital Media Learning Central Blog*. Retrieved from <http://dmlcentral.net/blog/doug-belshaw/some-thoughts-ipads-and-one-one-initiatives>
- Belshaw, D. & Casilli, C. (2013). *Mozilla Web Literacy Standard*. Retrieved from <https://wiki.mozilla.org/Learning/WebLiteracyStandard>
- Davidson, C. N. (2011). *Now You See It: How Technology and Brain Science Will Transform Schools and Business for the 21st Century*. London: Viking Books.
- Hwang, G. J., Kuo, F. R., Yin, P. Y. & Chuang, K. H. (2010). A Heuristic Algorithm for planning personalized learning paths for context-aware ubiquitous learning. *Computers & Education*, 54(2), 404–415. <http://dx.doi.org/10.1016/j.compedu.2009.08.024>
- Kukulska-hulme, A. (2009). Will mobile learning change language learning? *ReCALL*, 21(2).
- Liaw, S. S., Hatala, M. & Huang, H. M. (2010). Investigating acceptance toward mobile learning to assist individual knowledge management: Based on activity theory approach. *Computers & Education*, 54(2), 446–454. <http://dx.doi.org/10.1016/j.compedu.2009.08.029>
- Liu, G. Z. & Hwang, G. J. (2010). A key step to understanding paradigm shifts in e-learning: towards context-aware ubiquitous learning. *British Journal of Educational Technology*, 41(2), E1–E9. <http://dx.doi.org/10.1111/j.1467-8535.2009.00976.x>

- Marin, D. & Mohan, P. (2009). Personalisation in mobile learning. *International Journal of Mobile Learning and Organisation*, 3(1), 25–43. <http://dx.doi.org/10.1504/IJMLO.2009.023051>
- Martin, A. & Grudziecki, J. (2006). DigEuLit: Concepts and Tools for Digital Literacy Development. ITALICS:Innovations. *Teaching & Learning in Information & Computer Sciences*, 5(4) 246–264.
- McLester, S. (2007). Technology Literacy and the MySpace Generation: They're Not Asking Permission. *Technology & Learning*, 27, 16–22.
- Pachler, N., Bachmair, B. & Cook, J. (2010). *Mobile learning: structures, agency, practices*. New York: Springer.
- Pachler, N., Cook, J. & Bachmair, B. (2010). Appropriation of mobile cultural resources for learning. *International Journal of Mobile and Blended Learning*, 2(1), 1–21. <http://dx.doi.org/10.4018/jmbl.2010010101>
- Rheingold, H. (2012). *Net Smart: How to Thrive Online*. Cambridge, MA: MIT Press.
- Schmidt, J. P, Geith, Ch., Håklev, S. & Thierstein, J. (2009). Peer-To-Peer Recognition of Learning in Open Education. *The International Review of Research in Open and Distance Learning*, 10(5). Retrieved from <http://www.irrodl.org/index.php/irrodl/article/view/641/1389>
- Van Deursen, A. J. (2010). *Internet Skills. Vital assets in an information society*. University of Twente. Retrieved from <http://doc.utwente.nl/75133/>
- VVAA. (2013a). *Mobile Education—Lessons from 35 Education Experts on Improving Learning with Mobile Technology*. Studio B Productions, Inc. Retrieved from [http://www.slideshare.net/DavidRogelberg/mobile-education-27782655?utm\\_content=buffere096f&utm\\_source=buffer&utm\\_medium=twitter&utm\\_campaign=Buffer](http://www.slideshare.net/DavidRogelberg/mobile-education-27782655?utm_content=buffere096f&utm_source=buffer&utm_medium=twitter&utm_campaign=Buffer)
- VVAA. (2013b). *Web Literacies white paper*, Working Document v0.8. Mozilla Foundation. Retrieved from <http://bit.ly/weblit08>