Journal of Literacy and Technology

Special Edition: Personal Learning Environments: Current Research and Emerging Practice

Contents

Editorial for the Special Issue on Personal Learning Environments ........................................ 2
Learner Control in Personal Learning Environments: A Cross-Cultural Study ...................... 14
A Pedagogy-driven Framework for Integrating Web 2.0 tools into Educational Practices and Building Personal Learning Environments ................................................................. 54
The Problem of Learner Control in Networked Personal Learning Environments ............. 80
A Concept to Bridge Personal Learning Environments: Including a Generic Bookmarking Tool into a Social Learning Management Systems .......................................................... 111
Interaction and Reflection with Quantified Self and Gamification: an Experimental Study. 136
The Mobile as an ad hoc PLE: Learning Serendipitously in Urban Contexts ................... 157
An Exploratory Study of the Personal Learning Environments of Security and Investigation Professionals ...................................................................................................................... 171
Connected Older Adults: Conceptualising their Digital Participation .................................. 200
Innovation, Knowledge and Sustainability with PLEs: an Empirical Analysis from SAPO Campus Schools Pilots ........................................................................................................ 215
Analysis of the Future Professionals' PLEs as Lifelong Learning Basic Skill: Presenting the CAPPLE Project .............................................................................................................. 247
Editorial for the Special Issue on Personal Learning Environments

Guest editor:
Ilona Buchem, Beuth University of Applied Science Berlin, Germany
buchem@beuth-hochschule.de

Introduction

Personal Learning Environment (PLE) is an approach in Technology-Enhanced Learning (TEL) based on the principles of learner autonomy, ownership and empowerment. PLEs are integrated, individual environments for learning which include specific technologies, methods, tools, contents, communities and services constituting complex learning infrastructures enhancing new educational practices and at the same time emerging from these new practices. This represents a shift away from the traditional model of technology-enhanced learning based on knowledge transfer towards a model based on knowledge construction. In PLEs learning happens by drawing connections from a growing and diverse pool of online and offline resources to plan, organise, create, network, engage and reflect in permeable spaces.

The articles presented in this Special Issue are selected best research papers submitted for The Personal Learning Environment Conference 2013, which took place at Beuth University of Applied Sciences in Berlin, Germany together with a parallel event at Monash University in Melbourne, Australia. The PLE Conference - http://pleconf.org - is an international, scientific event which intends to create a space for researchers and practitioners in which exchange ideas, case studies and research related to the design, development and implementation of Personal Learning Environments (PLEs). The PLE Conference takes place annually, each time in a different city. The first event was held in Barcelona, Spain in 2010,
the second one in Southampton, UK in 2011, the third one in Aveiro, Portugal in 2012
together with a parallel event and Melbourne, Australia, the fourth one in Berlin and

**Articles in this Special Issue**

The Special Issue includes ten selected articles presenting current research on
Personal Learning Environments. All ten articles provide unique perspectives and insights
into Personal Learning Environments. The different focal points of the ten articles represent
the diversity of gateways used to approach the concept of Personal Learning Environments
in specific contexts, including education, work and leisure.

“Learner Control in Personal Learning Environments: A Cross-Cultural
Study” (pp. 14 - 53), by Ilona Buchem, Gemma Tur Ferrer and Tobias Hölterhof,
describes the results of an international, cross-cultural study exploring the role of ownership
and control in Personal Learning Environments and possible differences in perception of
control and ownership by higher education students from different national and academic
cultures. The study, rooted in the theory of psychological ownership, was conducted in 2013
at three different universities in Germany and Spain. The study is based on the assumption
that a learning environment becomes a Personal Learning Environment when the learner
feels the owner and in control of this environment. The article explores ownership and
control in context of ePortfolio practice and provides a contribution to the investigation of
the impact of PLE practice on learning. The results of the study indicate that differences in
perception of ownership and control may be attributed both to cultural factors and
instructional designs. An interesting result of the study is a disjunction between instructional
designs aimed at activating students by means of compulsory assignments and students'
perception of their learning environments as Personal Learning Environments. The results
of the study indicate that freedom of choice (e.g. objectives, tools), flexibility (e.g. planning) and transparency (e.g. personal data) may positively contribute to the perception of a learning environment as a Personal Learning Environments and may be beneficial to the overall learning effect, including interest-orientation, engagement and creativity. The authors argue that promoting ownership and learner control of the entire learning environment, including its components and processes, should be considered the key element of PLE design and PLE practice.

“A pedagogy-driven framework for integrating Web 2.0 tools into educational practices and building personal learning environments” (pp. 54 - 79), by Ebrahim Rahimi, Jan van den Berg and Wim Veen, proposes a conceptual framework for designing Web 2.0 based PLE activities. The authors adopt a constructivist approach to developing and deploying PLEs and pledge for enhancing student control to support personal development and learning by building Personal Learning Environments. The emphasis is on facilitating student control through student-centric instructional approaches. The framework consists of four main elements, i.e. student control model, learning potential of Web 2.0 tools and services, project-based teaching approach, and technology-enhanced learning activities. The framework defines how to design PLE activities by considering the interaction of the three elements - Web 2.0 technologies, student control and teaching practices. The framework aims at providing teachers with opportunities to acquire a deeper understanding and knowledge about students' learning processes as means to improving and enriching own educational practices. The article argues that student control may be best promoted by defining and granting active roles to students in technology-enhanced learning environments as these roles are necessary for developing competencies needed to deal with the challenges of the knowledge society.
“The problem of Learner Control in Networked Personal Learning Environments” (pp. 80-111), by Paul Bouchard, investigates the notions of learner agency and learner control in view of networked learning. The article argues for a need for further research that takes into account the key features of Personal Learning Environments, namely learner control, self-directed learning and the distribution of power in networked-based communication systems. The article emphasises that the very option to initiate and pursue learning is the first area of learner control and it precedes other stages of knowledge building. The author points out that this conative dimension of learner control is contingent on psychological and contextual variables such as readiness and incentive. The learning process is considered to be a result of many decisions and choices. Hence, the second area of learner-control is defined as the ability to influence the procedures of the learning process itself. The article argues that in complex networked learning environments, learners must be able to devise ways to reduce own vulnerability as learners and to build the capacity for creative interactions that are necessary for structuring a new understanding of the world. The article provides interesting points of reference for the conceptualisation of a research framework on networked Personal Learning Environments.

“A concept to bridge Personal Learning Environments: Including a generic bookmarking tool into a social Learning Management Systems” (pp. 111 - 135), by Tobias Hoelterhof and Richard Heinen, investigates the ability to connect learners' Personal Learning Environments by a central, permeable Social Learning Management System (SLMS). The relevance of this conceptual idea is explored within the context of higher education based on the example of social bookmarking tools as elements of PLEs. The concept of bridging PLEs is based upon the metaphoric idea of bridges in social network analyses. It refers to interface bridging between bookmarking tools as an element
of the learners' PLE and the institutional SLMS realised as a “social hub”. The article reports on use cases and survey results on the uses of the bookmarking tool “Edutags” as a component of the Social Learning Management System “Online Campus Next Generation” based on Drupal. Connecting multiple tools from different environments is discussed in view of a non-dominant and inconsistent design of an LMS. The article argues for the design of Learning Management Systems as permeable, social systems including the need of rich metadata enabling personalisation. The article further discusses theoretical questions concerning the relation between personal and social, institutional and private, as well as consistent and heterogeneous elements of Personal Learning Environments.

“Interaction and Reflection with Quantified Self and Gamification: an Experimental Study” (pp. 136–157) by Benedikt S. Morschheuser, Verónica Rivera-Pelayo, Athanasios Mazarakis and Valentin Zacharias, reports on the research conducted to explore the impact of gamification on enhancing motivation of students to use Personal Learning Environments in context of higher education. The research presented was an experiment with the Live-Interest-Meter (LIM), a Quantified Self (QS) application which allows capturing, sharing and visualizing several types of feedback with the aim of improving the learning experience during and after lectures. The results of the experiment indicate that perceived fun induced by gamification design may have positive effects on the motivation to use services such as LIM which may be used by students as elements of their Personal Learning Environments. Based on these results the authors argue that gamification may be an appropriate enabler to engaging learners in using quantified self-approaches as parts of their PLEs for improving their learning experiences.

“The mobile as an ad hoc PLE: Learning serendipitously in urban contexts” by Ruthi Aladjem and Rafi Nachmias (pp. 157-170) reflects on the potential of mobile
devices used in urban contexts for constructing ad hoc PLEs through consolidating discrete learning events into coherent learning experiences. The starting point is the consideration of the city or urban space as an exploration ground with endless learning opportunities, related to such aspects as local language, history, architecture, art and culture. The authors define PLEs as an approach to the use of technologies including all the different tools used in everyday life for learning. The article reports on the results from a pilot study of informal serendipitous learning events in urban settings mediated by mobile technologies, including location-based applications such as Google Maps, TripAdvisor, Foursquare and Facebook. The research questions focus on the ways in which mobile tools and applications are being used in order to construct knowledge in urban settings. Based on the analysis of learning interactions three specific issues are addressed in the paper. These are availability (e.g. information, connectivity), social interaction (e.g. social support, sharing opportunities) and awareness (e.g. affecting others). The authors argue that these three aspects, i.e. availability, social interaction and awareness, support the construction of ad hoc PLEs by selecting and utilizing dynamic components based upon contextual needs and preferences. The article concludes that mobile devices may encourage learners to explore and utilize opportunities for learning in the city, by fostering serendipitous learning in ad hoc PLEs.

“An exploratory study of the personal learning environments of security and investigation professionals” by Antony E. Ratcliffe (pp. 171 - 199) describes and discusses how security management and investigation professionals use Personal Learning Environments for work-related learning and continuing professional development. The article is based on an exploratory study with 67 security management and investigation professionals in 17 countries. The results of the study indicate that although these professionals participate in online discussions, access networks and resources, their
collaborative activities in online spaces remain limited for reasons of security, privacy, authenticity of information and employer restriction concerns. The author points out that collaboration in work-based contexts tends to takes place in private settings with the more traditional technologies of telephone and e-mail. An interesting result from the study is that security professionals express reluctance and caution when sharing in online spaces, taking on a rather consumer-oriented approach, acting as consumers rather than creators of information. It seems that Personal Learning Environments constructed by these professionals (any maybe others as well) lack some of the key characteristics of participatory environments. The author argues that the observed consumer-orientation might be to a certain extend attributed to many security professionals being in the early stage of legitimate peripheral participation, which may lead to greater participation as knowledge and comfort in the use of new tools and practices increase. The article concludes with a recommendation for enhanced digital literacy practices and case studies of successful collaborative efforts as a means to encourage other professionals to participate in knowledge sharing as part of their PLEs, connecting PLEs with careers and professional activities.

“Connected Older Adults: Conceptualising their Digital Participation” by Linda De George-Walker and Mark A. Tyler titled (pp. 200 - 214) explores the experience of the digital divide among older adults, including such issues as digital anxiety, and proposes a model for conceptualising older adults’ digital participation. The proposed model integrates self-efficacy theory, digital competence and the Personal Learning Environments approach. The aim of the model is to signpost paths towards enhanced digital participation of older adults based on developing digital self-efficacy. The authors emphasise the potential of digital technologies for improving opportunities for older adults to socialise, access services and learning, thus improving the quality of life, especially in
relation to health and wellbeing. The authors define PLEs as “fluid and relational learning contexts in which individuals are both autonomous and interconnected”, and argue that PLEs offer an opportunity to a more comprehensive conceptualisation of individual and social aspects of digital self-efficacy and digital participation of older adults. The article concludes with some relevant points on current and future research in this area, focusing on examining how digital self-efficacy of older adults (both users and non-users) may be improved by engaging in PLE practice. This includes, among others, an investigation of mastery experiences related to previous success with digital technologies.

“Innovation, Knowledge and Sustainability with PLEs: An empirical analysis from SAPO Campus school pilots” by Carlos Santos, Luis Pedro and Fatima Pais (pp. 215 - 264) reports on the SAPO Campus Schools project developed by the University of Aveiro and SAPO. The project aims at promoting disruptive innovation in schools by encouraging openness, collaboration, content production and sharing. The focus is on an empirical study of use cases of SAPO Campus Schools (SCS) platform, a Web 2.0 platform designed for schools (K1 through K12). The design of this platform combines the principle of personalisation, aimed at enabling users to construct their own PLEs, and the principle of institutionalization, aimed at enhancing the commitment of schools to promote the formal and institutional adoption of SCS. The authors argue that combination of these two principles - institutionalization and personalization – may help provide learner with the possibility of building and customizing their own PLEs, while at the same time extending the range of learning activities in schools. The article analyses preliminary data gathered from a group of pilot schools that have institutionally adopted SCS. The study builds on the theory of knowledge creation as a process of promoting innovation. The use cases described in the article reveal that platforms such as SCS can act as catalysts for change by promoting
new practices in educational institutions, such as engaging in open discussions, building learning networks or creating content.

“Analysis of The Future Professionals' PLEs as Lifelong Learning Basic Skill: Presenting the CAPPLE Project” by Paz Prendes and Linda Castañeda (pp. 216 - 248), provides an insight into the CAPPLE Project, a research project focused on the exploration and understanding of Personal Learning Environments by future Spanish professionals. This multidisciplinary project focuses on modelling PLEs and creating a tool for analyzing and diagramming PLEs as the next step in PLE research. The research question addressed in this article is related to strategies that students use to organize their PLEs, including strategies induced by formal learning. The description and analysis of the current PLEs of future professionals aims at exploring the contribution of transversal learning to PLE practice with the view of improving the processes of creation, management and enrichment of PLEs. The authors emphasise the need for further discussion on institutional contributions to PLEs both in context of vocational training and formal education.

Conclusion and Outlook

The ten articles included in this Special Issue provide rich and valuable theoretical and empirical insights into Personal Learning Environments. The meta-analysis of the selected ten articles reveals three main issues related to Personal Learning Environments. These issues can be described with the following three keywords: PLE control, PLE diversity and PLE contexts. All three issues are explained in more detail below.

- **PLE control:** The first key issue arising from the papers in this Special Issue is the importance of learner control and a need for a new conceptual framing of learner control and ownership in relation to Personal Learning Environments. The first three articles explicitly address both issues. Both learner control and ownership in
PLEs gain a new dimension when compared to earlier approaches to technology-enhanced learning. Learner control is no longer only about manipulation and customization of pre-defined options but encompasses a range of autonomous decisions starting with the intention and decision to use technologies to learn, through a free choice of services and tools, to the ultimate decision of abandoning or even destroying an own PLE. Also the issue of ownership, especially psychological ownership as described in “Learner Control in Personal Learning Environments: A Cross-Cultural Study,” become crucial when it comes to taking responsibility for learning as well as for a genuine and sustainable engagement in PLE practice. Framing both aspects - control and ownership – seems necessary to guide further PLE design and practice targeted towards the enhancement of autonomy and freedom of choice, especially in formal settings, including schools (e.g. “Innovation, Knowledge and Sustainability with PLEs: An empirical analysis from SAPO Campus school pilots”), higher education (e.g. “Learner Control in Personal Learning Environments: A Cross-Cultural Study”) and vocational training (e.g. “Analysis of The Future Professionals' PLEs as Lifelong Learning Basic Skill: Presenting The CAPPLE Project”). Furthermore, contributions to this special issue indicate that both control and ownership of the learning environment are the key defining characteristics of Personal Learning Environments, revealing what “personal” in PLE may really mean.

- **PLE diversity:** The second issue emerging from the meta-analysis is the diversity of PLE users and the diversity of PLE forms. “Learner Control in Personal Learning Environments: A Cross-Cultural Study” points towards cultural differences when it comes to PLE practice. These differences may be related both
to national and discipline cultures. “An exploratory study of the personal learning environments of security and investigation professionals” and “Connected Older Adults: Conceptualising their Digital Participation” address further dimensions of diversity of PLE users, i.e. age and occupation. While “Connected Older Adults: Conceptualising their Digital Participation” reveals some possible barriers of PLE adoption by older adult learners, such as digital anxiety and lack of digital self-efficacy, “An exploratory study of the personal learning environments of security and investigation professionals” points to some important concerns of professionals engaging in PLE practice in work-based settings, including security, privacy, authenticity of information and employer restrictions, possibly preventing more open and participatory forms of PLE practice. In the current stage of PLE research the diversity of PLE users has not yet been systematically explored and may become an important area of further research, design and development of Personal Learning Environments. Another dimension of PLE diversity are the diverse PLE forms, including ePortfolio-oriented PLEs (“Learner Control in Personal Learning Environments: A Cross-Cultural Study”), bridging PLEs with institutional platforms such as Social Learning Management Systems (“A concept to bridge Personal Learning Environments: Including a generic bookmarking tool into a social Learning Management Systems”), gamified PLEs (“Interaction and Reflection with Quantified Self and Gamification: an Experimental Study”), ad-hoc PLEs mediated by mobile technologies (“The mobile as an ad hoc PLE: Learning serendipitously in urban contexts”) or Web 2.0 based PLEs such as SAPO Campus Schools (“Innovation, Knowledge and Sustainability with PLEs: An empirical analysis from SAPO Campus school pilots”). This diversity shows
yet again that there no single PLE design and that new designs are emerging
together with the rise of new media (e.g. mobile media) and new approaches (e.g.
gamification).

- **PLE context:** The papers in this issue describe PLE research and practice in
  various contexts. While higher education context is still dominating, new contexts
  for PLEs are emerging, for example professional and work-based learning (“An
  exploratory study of the personal learning environments of security and
  investigation professionals”), vocational training (“Analysis of The Future
  Professionals' PLEs as Lifelong Learning Basic Skill: Presenting The CAPPLE
  Project”), schools (“Innovation, Knowledge and Sustainability with PLEs: An
  empirical analysis from SAPO Campus school pilots”), informal learning
  (“Connected Older Adults: Conceptualising their Digital Participation”) or even
  city as an urban learning context (“The mobile as an ad hoc PLE: Learning
  serendipitously in urban contexts”). The descriptions of PLE research and practice
  in these different contexts show that different PLE approaches may be emerging
  naturally and/or are necessary in terms of design and development depending on
  the characteristics of the context. Context-sensitive R&D may be another important
  direction for PLE research. In the future it will become crucial to develop a better
  understanding of the contextual requirements and facets of PLEs.
Learner Control in Personal Learning Environments: A Cross-Cultural Study

Ilona Buchem, Ph.D.  
Professor in Residence for Digital Media and Diversity  
Beuth University of Applied Sciences Berlin  
E-mail: buchem@beuth-hochschule.de

Gemma Tur, Ph.D.  
School of Education Coordinator  
Associate Lecturer in Early Childhood Education  
Primary Education and the Master’s Degree in Teacher Training. Educational Technology Group (GTE).  
Department of Applied Pedagogy and Educational Psychology  
University of the Balearic Islands  
E-mail: gemma.tur@uib.es

Tobias Höelterhof, Ph.D.  
Scientific Assistant with the Chair of Media Didactics and Knowledge Management – Learning Lab,  
University of Duisburg  
E-mail: tobias.hoelterhof@uni-duisburg-essen.de
Abstract

Changing power relations and the shift in control have been some of the key issues driving the discussion in Technology-Enhanced Learning (TEL) in the last years. As opposed to deterministic approaches to designing learning, such as the system approach in instructional design, emancipatory approaches, such as Personal Learning Environments (PLE), emphasizes the *shift of control and ownership* from the educator or the designer to the learner, bestowing decision making and choice upon the learner, not only in terms of choosing the content or the sequence of learning steps, but first and foremost the choice of the learning tools and the use of these tools to support one’s own learning, including co-creation of learning content and fostering of Personal Learning Networks (PLN). In this paper we describe the results of an international, cross-cultural study exploring the role of ownership and control in Personal Learning Environments. Our study is rooted in the theory of psychological ownership and utilizes research instruments developed in the predecessor study by Buchem (2012). The study was conducted in winter and spring 2013 at three different universities in Germany and Spain including students from six different courses, i.e. three courses in media sociology in Germany, two online master programs in educational media and educational leadership in Germany and a teacher education program in Spain. An online survey was used to collect data in two languages - German and Catalan. Following the concept of ownership proposed by Buchem (2012), the study is based on the assumption that a learning environment becomes a Personal Learning Environment when the learner (subjectively) feels the owner this environment and perceives herself/himself to able to exercise control over this environment. The study presented in this paper aims at advancing our understanding of the role of psychological ownership in context of PLE, especially in relation to *learner control*. This paper specifically explores ownership and control in context
of ePortfolio practice. Finally, this article provides a contribution to methods of measuring the impact of PLEs.

**Introduction**

Personal Learning Environments (PLE) is an approach to using technology for learning, focusing on self-directed and self-regulated uses of tools and resources by the learner (Buchem, Attwell and Torres, 2011). It is capturing the *personal activity*, or how the learner uses technology to support own learning, rather than developing *personalised platforms*, that lies at the heart of the PLE research. The first survey about the role of ownership and control in context of Personal Learning Environments was conducted in 2012 at two universities in Germany (Buchem, 2012). This study was rooted in the theory of psychological ownership by Pierce, Kostova and Dirks (2001, 2003) and reported on empirical findings from an online survey and analysis of educational practice, exploring multiple relationships between ownership, control and learning in context of technology-enhanced learning environments created in the process of creating ePortfolios. The results of the study indicated that control of *intangible elements* of a learning environment, such as control of content or personal data, is more strongly related to the feeling of ownership of this learning environment than is the control of *tangible elements*, such as technical tools (e.g. Web 2.0 services). The underlying assumption was that not every learning environment - not matter how personalized - automatically becomes a PLE, but that it is the perception of the individual learner that makes a learning environment to a PLE. Further, the hypothesis is that this perception depends on whether the learner develops a feeling of ownership and control of the learning environment. More specifically, it was argued that the perception of a learning environment as a PLE is related to the feeling of ownership of
intangible elements rather than tangible ones (Buchem, 2012. The results of the study indicated that learners perceive a learning environment as a PLE even if they do not have the full control of all elements of this environment and do not in fact own them. For example, Web 2.0 services do not belong to the learner in terms of legal or intellectual proprietorship, and yet learners may feel in control when using them. The follow-up research presented in this paper further explores the role of psychological ownership and learner control in PLEs from a cross-cultural perspective.

Theoretical Background

Learner control has been one of the key research interests in the field of technology-enhanced learning. In the early years, learner control was analyzed mainly within technology-enhanced instructional delivery systems, such as computer-assisted learning programs including intelligent tutoring systems. Recently, the socio-constructivist paradigm in technology-enhanced learning and the emergence of Personal Learning Environments have introduced new lines of research in the area of learner control.

Research on learner control in 1980s and 1990s was to a wide extent embedded in the instructional design paradigm. This prescriptive approach to learner control focused on control as a choice of a pre-defined set of elements, including learning paths (e.g. lesson branching) and learning materials (e.g. examples and exercises) in computer-supported settings. Later, in web-based settings, new types of learner control have been explored, including informational control enabled by hypertext and hypermedia systems (Wilson and Jonassen, 10989; Lin and Hsieh, 2001). Within the instructional design framework learner control has been pre-programmed by the
designer and conceptualized as choices provided within computer-delivered instruction, for example in form of control of sequence (i.e. control of sequencing of topics or exercises), control of level, (i.e. control of the difficulty level or degree of difficulty within a learning sequence), control of pacing (i.e. control of speed of presentation of learning content), control of display (i.e. control of viewing materials from a selection including examples, exercises or quizzes), control of support (i.e. control of using system advice such as recommendation on learning materials) (cf. Merrill, 1983; Laurillard, 1987; Milheim and Martin, 1991; Chung and Reigeluth, 1992). A number of authors including Buchem, Attwell and Torres (2011) have argued that this type of conceptualization of learner control allows for system adaptivity and individual customization but not for a genuine co-/design of a learning environment by the learner.

More recently research on learner control in context of PLE has moved beyond computer assisted programs, intelligent tutoring systems and learning management systems towards authentic learning contexts mediated by technology in which the learner may have a greater control of either tangible or intangible elements of a learning environment (Buchem, 2012). Buchem, Attwell and Torres (2011) carried out an extensive literature review on Personal Learning Environments and showed that learner control in context of PLEs has been conceptualised broader in relation to different dimensions of learner activity. Based on the activity theory framework (extended triangle) these authors analysed learner control in PLEs in five dimensions: objectives, tools, rules, community and tasks.
The results of the grounded theory analysis pointed towards a multi-dimensional notion of learner control in PLEs, which goes beyond the previous conceptualizations of learner control in terms of scope (Table 1).

Table 1. Dimensions of learner control in PLEs (Buchem, Attwell and Torres (2011, p. 10-11).

<table>
<thead>
<tr>
<th>Dimensions of learner control</th>
<th>Examples of learner activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Control of objectives</td>
<td>The learner (subject) can:</td>
</tr>
<tr>
<td></td>
<td>• Determine learning goals and outcomes</td>
</tr>
<tr>
<td></td>
<td>• Manage data, services, resources, content</td>
</tr>
<tr>
<td></td>
<td>• Use scaffolding and guidance</td>
</tr>
<tr>
<td>B. Control of tools</td>
<td>The learner (subject) can:</td>
</tr>
<tr>
<td></td>
<td>• Select and use tools according to own needs</td>
</tr>
<tr>
<td></td>
<td>• Reuse and remix content</td>
</tr>
<tr>
<td></td>
<td>• Aggregate and configure tools based on own preferences</td>
</tr>
<tr>
<td>C. Control of rules</td>
<td>The subject can:</td>
</tr>
<tr>
<td></td>
<td>• Configure the environment according to own preferences</td>
</tr>
<tr>
<td></td>
<td>• Negotiate rules of communication and collaboration with teachers, peers, communities</td>
</tr>
<tr>
<td></td>
<td>• Negotiate intellectual property rights</td>
</tr>
<tr>
<td>D. Control of social base</td>
<td>The learner (subject) can:</td>
</tr>
<tr>
<td></td>
<td>• Choose with whom to communicate</td>
</tr>
<tr>
<td></td>
<td>• Choose who can communicate with him/her</td>
</tr>
<tr>
<td></td>
<td>• Initiate discussions and collaborations</td>
</tr>
<tr>
<td>E. Control of tasks</td>
<td>The learner (subject) can:</td>
</tr>
<tr>
<td></td>
<td>• Specify own needs (e.g. user profile)</td>
</tr>
<tr>
<td></td>
<td>• Self-monitor own progress</td>
</tr>
<tr>
<td></td>
<td>• Adjust performance based on (peer) feedback</td>
</tr>
</tbody>
</table>
The examples of learner control in Table 1 indicate that the concept of learner control in PLEs envisages learner control far beyond skipping forwards and backwards as part of a pre-programmed sequencing strategy or choosing between viewing examples or consulting a glossary as part of a display strategy. The notion of learner control in the PLE approach goes as far as allowing learners to determine their own learning goals, selecting and aggregating a wide range of available (not necessarily pre-selected) tools, negotiating rules, initiating (and not only engaging in) discussions and collaborations and adjusting learning based on self-monitoring the learning progress (versus automated recommendations). In comparison to earlier instructional principles of learner control, the PLE approach resembles more of an activity of “building a house” rather than “furnishing a house”. Thus, while instructional design approaches have focused on micro-level strategies of learner control within a pre-determined system (manipulation of small instructional elements), the PLE approach has focused on meta-level strategies of learner control within an open system (management of the entire learning process) with learner control being inherent to the construction of PLEs.

Learner control is related to the concept of ownership, and both concepts are related to the notion of “agency” in terms of the human capacity to make choices and to impose those choices on the world (Buchem, Attwell and Torres, 2011). Ownership has been considered as a critical issue for learning. Allowing learners to own their learning process means to allow learners to engage with the process itself, which is a crucial factor for the effectiveness of the learning process (Biggs and Tang, 2011). In context of technology-enhanced learning, a number of approaches consider ownership as a crucial concept for learning. For example, the “folio thinking” approach to ePortfolio practice has emphasised the role of ownership of ePortfolio for ensuring the use of ePortfolio as
a basic learning strategy, integrated into all educational activities and sustainable in the lifetime (Cousin, 2006; Joyes, Gray and Harnell Young, 2009; Chen, 2009; Chen & Light, 2010; Shepherd and Skarbut, 2011). In this research context, the relationship between control, motivation and ownership have been considered to be mutually supportive. For example, the study by Shroff, Trent and Ng (2013) rooted in the Milner-Bolotin's (2001) framework of ownership, showed that students and teachers considered the feeling of control as vital for the ownership of ePortfolio. As Barrett and Wilkerson (2004) argue, the greater the control of students over their ePortfolio, the more intrinsic motivation towards learning they develop.

![Learner Ownership and Control of Electronic Portfolio Development](image)

**Figure 1. Learner ownership and control of ePortfolio (Barrett & Wilkerson, 2004)**
However, the varying forms and degrees of ownership have been seldom differentiated both in literature related to PLEs and ePortfolios as well as in publications addressing the ownership of learning in general. Also, there has been little clarity about what type of ownership and control (e.g., technical, legal, psychological, social) and over what elements (e.g., goals, information, services) may be effective for learning. As Buchem, Attwell and Torres (2011) point out, it is possible to conceive of ownership of learning from various perspectives, e.g., in a technical sense (e.g., the learner is technically responsible for aggregating and configuring services), legal sense (e.g., the data and content legally belong to the learner) or psychological sense (e.g., the learner feels an owner of the learning environment). As the study by Buchem (2012) indicated, it is also possible that the learner can “control” the environment (e.g., select sources of information, reuse and remix content) without actually “owning” all its constituting parts. In the context of ePortfolios, Attwell (2005, 2007) highlighted some important issues related to ownership by distinguishing different agents owning different ePortfolio processes (Attwell, 2012). Attwell focused on the ownership of different processes related to learning and pointed out that in educational settings different ePortfolio processes are owned by different agents. For example, reflecting is “owned” by the learner (the learner controls this process), assessment is “owned” both by the learner and external agents whilst accreditation is “owned” only by external agents, such as educational institutions.
However, ownership in context of PLE comprises both processes and elements of learning, such as digital tools used to construct a PLE. Nowadays, the nature of the relationships brought about by social networks, as well as the shift of the external world's learning agents, has highlighted the importance of the control of intangible elements of learning including personal data in order to improve the sense of ownership (cf. Attwell, 2012). This is the central point of interest explored by Buchem (2012) and in this paper.

To explore the relation between ownership and control one can refer to philosophical investigations about ownership in general and self-ownership in particular (e.g. Dan-Cohen, 1992; Brown, 1993). For example, the concept of self-ownership, which is related to the individual autonomy (Pateman, 2002), can be defined as a psychological condition of a person (disposition), which is expressed in actions and in the general attitude towards oneself and the world (Dworkin, 1988). Personal
“autonomy” in the sense of self-governance or self-rule (“autos” meaning self and “nomos” meaning rule), involves choosing, defining, being able to make preferences and take decisions (Dworkin, 1988). As such the notions of personal ownership and personal autonomy are closely linked to the notion of control. Learner autonomy regarded as learner's psychological relation to the process of learning (Little, 1991), is also closely linked to taking responsibility for one's learning. Autonomous learners are capable of independently setting learning goals, choosing learning materials and methods, making choices in organizing learning and defining criteria for evaluation (Knowles, 1975, 1980). Owning a learning environment is to some extent similar to owning physical objects such as books or digital devices. In context of PLEs, ownership is rooted in a learner-controlled use of technology, especially the ability to create, design, and operate an environment according to personal preferences (Buchem, Attwell and Torres, 2011; Buchem, 2012). According to moral and philosophical investigations about ownership, the dependency between the learner and the environment can be characterized as “control ownership”, whereas “control” may be used to refer to the ability of a person to be the final arbiter of what is to be done with an object (Christman 1994, p. 128). In this sense to own a learning environment means to be able to use, control, modify or even destroy it in an independent way without the consent of others. Ownership in terms of control means a private use of an object. In addition the common meaning of ownership also implies the ability to sell or gain income from ones property. Thus ownership and control are part of individual autonomy (Christman 1994, p. 167). This is yet to emphasize that the concept of learner control pertinent to the concept of PLEs radically differs from previous conceptualizations of learner control in technology-based learning. In the PLE sense of
learner control, the learner can build, use, change, adjust, abandon, lend, cede or even destroy a learning environment or its parts without the consent of a teacher or another external agent.

**Research design**

The study presented in this paper is guided by the following research questions:

*How are control and ownership of learning environments perceived by learners from different national and academic cultures and how do these perceptions impact learning?*

The conceptual model applied in the present research study used the Antecedents-Consequences Model (ACM) proposed by Buchem (2012). Based on theoretical underpinning of psychological ownership, the underlying assumption of the ACM is that psychological ownership is influenced by a number of factors (antecedents, such as students' perceived control of different elements of a learning environment) and leads to certain outcomes (consequences, such as level of engagement, creativity and productive uses of media). Based on the results of the first study, it was expected that a learning environment is perceived as a PLE if learners develop a feeling of ownership towards the elements of this environment. The present study encompassed three main groups of variables, i.e. (a) perceived control as a factor influencing psychological ownership (Antecedents), (b) the measure of psychological ownership itself, and (c) learning effects (Consequences) resulting from ownership (Figure 3).
Figure 3. The Antecedents-Consequences-Model (ACM) of the study.

The study incorporated the concept of psychological ownership by Pierce et al. (2001) applied in the study by Buchem (2012). According to this model, ownership comprises five dimensions, i.e. (1) sense of responsibility, (2) sense of self-identity, (3) sense of accountability, (4) sense of self-efficacy, and (5) sense of belongingness. Sense of responsibility is related to protecting and enhancing the object of possession, which may include improvement, control and limiting access to others. Sense of identity is viewed as part of the self-concept and is established, maintained, reproduced and transformed through interactions with tangible and intangible objects of possession. Sense of accountability can be defined as an expectation to hold others accountable and to be held accountable for what happens to and with objects of possession. Sense of self-efficacy is based on the concept developed by Bandura (1997) and describes the belief in one's ability to reach goals, master difficult situations and succeed in relation to both tangible and intangible objects of possession. Sense of belongingness relates the
feeling of attachment to places, objects and people (Pierce et al., 2001; Avey et al., 2009).

**Research method**

The present study is an extension of an earlier study by Buchem (2012), which was conducted at two universities in Germany with 50 students from three different university courses and disciplines. An online survey including three scales, i.e. psychological ownership scale, control scale and learning effects scale, was applied to collect data. The present study revised and adjusted the three scales from the study by Buchem (2012) based on reliability measures from the first study and on feedback from experts in the PLE community. The current study was conducted with a wider and more diverse group of learners in terms of age, language, cultural background and the area of study. Given the international study sample, the survey was created in two language versions (English and Catalan) and conducted using online tools LimeSurvey and Google Forms. The research applied quantitative and qualitative methods to triangulate conclusions. Quantitative data was analysed with SPSS and R software. Qualitative data obtained by means of open questions in the survey was analysed and discussed with students in respective courses.

Despite different educational contexts of learners participating in the study, all students in the sample used Web 2.0 tools to construct their PLEs as part of ePortfolio practice in university course. Students from all courses used different Web 2.0 tools to support and document their learning during one semester. Following the idea formulated by Conole and Alevizou (2010) about the need for systematical integration of the social web in higher education, Web 2.0 tools were introduced as instruments for
learning, knowledge construction and collaboration. The study sample included 76 students from the following courses:

(1) General Studies Program at Beuth University of Applied Sciences Berlin

(Germany): The general studies program (Studium Generale) at Beuth University is an open, university-wide program aiming at academic and career development of students from all accredited programs. Students who participated in the study were enrolled in two courses in media sociology, i.e. “Web 2.0 and the Society” and “Mobile Web and the Society”. The sample for this research study included 45 bachelor and master students from various programs including economics, computer sciences, engineering and media design. Both courses integrate the concept of PLEs and ePortfolios into their coursework. ePortfolios are primarily used to support research-based learning as students work in small groups on own research projects throughout the semester. The aim is to foster the use of digital media to create own PLE beyond the requirements of the course. Students in the course “Web 2.0 and the Society” created their ePortfolios combining different Web 2.0 tools, such as Wordpress, Tumblr, Twitter, Flickr, Storify, Prezi, ScoopIt and SlideShare. Students in the course “Mobile Web and the Society” used Mahara as a main hub in which different artefacts and media (e.g. YouTube videos, RSS feeds) were mashed and aggregated to create ePortfolios.

(2) Teacher Education Programme at the University of the Balearic Islands (Spain):

This program integrates the concept of PLEs and ePortfolios into coursework. ePortfolios are created by students using Web 2.0 tools, in this way extending their PLEs. The aim is to develop a positive attitude towards using technology in education. The study sample comprised of 24 student teachers consisting of first and second-year
students who study to become Infant Education Teachers. Student teachers at the local branch in Ibiza of the Balearic Islands University create and maintain their ePortfolios throughout their stay at the university. In this way students document their learning and identity development as Infant Education teachers as well as use ICT for learning during their education as teachers so that the experience is consistent enough to use ICT as future teachers. The project has run since 2009/2010 and its evolution has been positive (Tur, 2011; Tur and Urbina, 2012a and 2012b; Tur, 2013). The ePortfolio project is based on three approaches by Barrett, (2009, 2010, 2011), Cambridge (2009, 2010) and Zubizarreta (2009). First, based on Barrett’s work, students build their ePortfolio in three main steps: students create artefacts, document learning in a chronological order and finally present their ePortfolios. Second, based on Cambridge’s work, ePortfolios are used to foster the development of students’ networked selves and symphonic selves which are closely related to Barrett’s three steps. Third, based on Zubizarreta, students collaborate and reflect while documenting their learning.

(3) Online Master Programs at the University Duisburg-Essen (Germany): The master programs “Educational Media” and “Educational Leadership” are designed as part time study and blended learning with one or two on-campus events per semester. The programs count around 100 participants per semester and are held in German language. Participants mainly come from Germany and German speaking countries. The sample from these courses comprised of 7 students from different courses. These courses integrate the concept of PLEs into their coursework. New students are introduced to the learning systems and become acquainted with a personal weblog. According to the concept of a “social hub”, the social learning management system of the study program focuses on connecting students' PLEs (Hölterhof, Nattland & Kerres 2012). A basic set
of tools is offered by the system for learners including a collaborative synchronous text editing tool, an internal personal weblog, a poll tool, a messaging system. In discovering the potential of Web 2.0 for collaboration and synchronous communication, students can choose an internal weblog managed by the learning system or an external weblog hosted on the web. Weblogs are used as tools to express the learning process which corresponds with the ePortfolio approach. As part of ePortfolio students form groups and cooperate to work on assignments. Students are given assignments for blogging, reflecting and discussions in their weblogs. Using weblogs is required in order to be permitted to the examination at the end of the course.

Research results

The study comprised a cross-cultural sample of 76 students from three different universities and courses as described in the previous section (i.e. “Berlin sample”, “Ibiza sample” and “Duisburg sample”). Descriptive statistics related to these samples are summarized in Table 2.

Table 2: Descriptive statistics of the study sample, n = 76

<table>
<thead>
<tr>
<th>Language</th>
<th>Berlin (Germany)</th>
<th>Ibiza (Spain)</th>
<th>Duisburg (Germany)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study area</td>
<td>General Studies</td>
<td>Teacher Education</td>
<td>Online Master</td>
</tr>
<tr>
<td>Sample size</td>
<td>45 students</td>
<td>24 students</td>
<td>7 students</td>
</tr>
</tbody>
</table>
Below the results of several statistical tests are summarized following the key research question: *How are control and ownership of learning environments perceived by learners from different national and academic cultures and how do these perceptions impact learning?*

**(A) Psychological ownership:** These five dimensions of psychological ownership, i.e. sense of responsibility, sense of self-identity, sense of accountability, sense of self-efficacy, and sense of belongingness, were measured across the three samples based on the scale with five items rated on the Likert scale from 1 (fully agree) to 5 (fully disagree). Thus the lower the values, the more positive the result. Table 3 summarizes statistical results for ownership scale.

Table 3: Statistics of psychological ownership (m = mean, sd = standard deviation), n = 76. *Likert scale 1-5: 1 = fully agree, 5 = fully disagree*

<table>
<thead>
<tr>
<th></th>
<th>Berlin</th>
<th>Ibiza</th>
<th>Duisburg</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 45</td>
<td>n = 24</td>
<td>n = 7</td>
<td>n = 76</td>
</tr>
<tr>
<td>1.1 Sense of responsibility</td>
<td>m = 1.78</td>
<td>m = 2.29</td>
<td>m = 2.14</td>
<td>m = 1.97</td>
</tr>
<tr>
<td>sa = .95</td>
<td>sa = .91</td>
<td>sa = .90</td>
<td>sa = .90</td>
<td>sa = .95</td>
</tr>
<tr>
<td>1.2 Sense of self-identity</td>
<td>m = 2.41</td>
<td>m = 1.83</td>
<td>m = 2.71</td>
<td>m = 2.29</td>
</tr>
<tr>
<td>sa = .99</td>
<td>sa = .96</td>
<td>sa = .96</td>
<td>sa = .96</td>
<td>sa = 1.02</td>
</tr>
<tr>
<td>1.3 Sense of accountability</td>
<td>m = 2.36</td>
<td>m = 1.92</td>
<td>m = 2.86</td>
<td>m = 2.26</td>
</tr>
<tr>
<td>sa = .80</td>
<td>sa = 1.02</td>
<td>sa = .69</td>
<td>sa = .90</td>
<td></td>
</tr>
<tr>
<td>1.4 Sense of</td>
<td>m = 2.23</td>
<td>m = 1.75</td>
<td>m = 3.29</td>
<td>m = 2.28</td>
</tr>
</tbody>
</table>
As Table 3 shows, the lowest (most positive) values across all five items measuring the five dimensions of psychological ownership were reached by the Ibiza sample with m = 2.03 and the lowest standard deviation of sd = .92. This means that Ibisan students developed the strongest feeling of ownership of their learning environments. In general, students in all three samples developed a sound sense of ownership towards their learning environment with the m = 2.23 and sd = 0.99. These results may indicate that students perceived their ePortfolio based learning environment as their PLE, for example students felt responsible for it, could identify with it, felt accountable for and attached to the learning environment they created. Yet, the cut-off point for a learning environment becoming a PLE to the individual learner is not straightforward. Further studies should investigate the relationship between the ownership values and PLE in more detail. As far as results for single dimensions are concerned, the lowest (most positive) values across all three samples were reached for dimension “sense of responsibility” with the m = 1.97 and sd = .95. In this respect, most positive values
were reached for Berlin students with \( m = 1.78 \) and \( sd = .95 \), meaning that students in Berlin felt more responsible for their learning environment than students in other two samples. Since the sense of responsibility (item 1.1) towards the learning environment was the most salient dimension of psychological ownership in all three samples, especially in Berlin sample, a possible interpretation is that ePortfolio practice promotes the responsibility of own learning, independent from the national or academic culture. It is also interesting to highlight the fact that the lowest values related to accountability (item 1.3) are achieved by Ibiza students, who are assessed to 50% based on their ePortfolio performance. Further research should further investigate the question raised by this result: Is there a relationship between type of assessment (e.g. ePortfolio) and ownership, especially the sense of accountability?

(B) Learner control: The theory of psychological ownership by Pierce et al. (2001, 2003) defines control as one of the three key mechanisms (besides engagement and identity) through which psychological ownership develops. The overall aim of ePortfolio work in the courses participating in the study was to enhance learner control in the sense of the PLE concept of learner control. However, the intended design may be realised otherwise in situ or perceived differently by students. Therefore, it was not the “designed control” but “perceived control” that was measured to explore students' perceptions. The concept of perceived control was defined to encompass seven dimensions of control with items derived from the research by Buchem, Attwell and Torres (2011) and applied in the first study by Buchem (2012). These seven dimensions were: (1) control of technology, (2) control of objectives, (3) control of content, (4) control of planning, (5) control of design, (6) control of access rights, and (7) control of
personal data. Altogether 7 items were applied to measure perceived control. Table 4 summarises the values for perceived learner control across the three samples.

Table 4: Statistics of perceived learner control (m = Mean, sd = Standard Deviation), n = 76; Likert scale 1-5: 1 = fully agree, 5 = fully disagree

<table>
<thead>
<tr>
<th></th>
<th>Berlin</th>
<th>Ibiza</th>
<th>Duisburg</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>45</td>
<td>24</td>
<td>7</td>
<td>76</td>
</tr>
<tr>
<td><strong>2.1 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>technology</td>
<td>m = 2.2</td>
<td>m = 2.63</td>
<td>m = 3.57</td>
<td>m = 2.46</td>
</tr>
<tr>
<td></td>
<td>sd = 1.1</td>
<td>sd = .77</td>
<td>sd = 1.4</td>
<td>sd = 1.1</td>
</tr>
<tr>
<td><strong>2.2 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>objectives</td>
<td>m = 2.47</td>
<td>m = 2.5</td>
<td>m = 2.86</td>
<td>m = 2.51</td>
</tr>
<tr>
<td></td>
<td>sd = 1.06</td>
<td>sd = .88</td>
<td>sd = 1.46</td>
<td>sd = 1.04</td>
</tr>
<tr>
<td><strong>2.3 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>content</td>
<td>m = 2.36</td>
<td>m = 2.42</td>
<td>m = 1.71</td>
<td>m = 2.41</td>
</tr>
<tr>
<td></td>
<td>sd = 1.13</td>
<td>sd = .78</td>
<td>sd = 1.89</td>
<td>sd = 1.11</td>
</tr>
<tr>
<td><strong>2.4 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>planning</td>
<td>m = 1.78</td>
<td>m = 2.67</td>
<td>m = 2.14</td>
<td>m = 2.09</td>
</tr>
<tr>
<td></td>
<td>sd = .93</td>
<td>sd = 1.13</td>
<td>sd = 1.95</td>
<td>sd = 1.17</td>
</tr>
<tr>
<td><strong>2.5 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>design</td>
<td>m = 2.33</td>
<td>m = 1.88</td>
<td>m = 3.86</td>
<td>m = 2.33</td>
</tr>
<tr>
<td></td>
<td>sd = 1.13</td>
<td>sd = 1.33</td>
<td>sd = 1.21</td>
<td>sd = 1.3</td>
</tr>
<tr>
<td><strong>2.6 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>access right</td>
<td>m = 2.16</td>
<td>m = 2.88</td>
<td>m = 2.71</td>
<td>m = 2.53</td>
</tr>
<tr>
<td></td>
<td>sd = 1.21</td>
<td>sd = 1.3</td>
<td>sd = 1.6</td>
<td>sd = 1.35</td>
</tr>
<tr>
<td><strong>2.7 Control of</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>m = 2.49</td>
<td>m = 2.42</td>
<td>m = 3.43</td>
<td>m = 2.55</td>
</tr>
</tbody>
</table>
As Table 4 shows, the lowest (most positive) values across the seven dimensions of perceived learner control were reached by the Berlin sample with the average value of \( m = 2.25 \). This results raises the question why Berlin students felt more in control of their learning environments than students in other samples? It seems that differences in instructional design are a more plausible explanation than cultural differences.

Differences in perception of control can be further explored in specific dimensions. For example, students in Berlin felt strongly in control of planning (item 2.4), while students in Ibiza felt strongly in control of design (item 2.5) and students in Duisburg felt strongly in control of content (item 2.3). These differences may be related to different instructional designs in respective courses. For example, it may be that students in Berlin were given more freedom to plan while students in Ibiza were given more freedom to design. These also could be cultural differences related to educational principles of course instructors. At the same time the values of perceived control in terms of visual and structural design (item 2.5) are in general negative for the Duisburg sample. The reason may be that students used tools embedded in the learning management system that allowed for only little customisation of the look and feel.

Furthermore, the blog functionality used by students in Duisburg was for technical
reasons readable by all other students in the study program, which may explain
negative values of perceived control of access rights and data privacy (items 2.6 and
2.7) in the Duisburg sample. These results compared to positive values of ownership
may indicate that although students in Duisburg felt the owners of their learning
environments, there were technological limitations which negatively effected the
perception of control. However, the ex ante examination of the relationship between
different instructional designs and different perceptions of control has certain limits as
freedom to make choices which educators grant to students is to a large extent
determined in context. Granting control is a negotiation process and takes place in
interaction between instructors and students. Further studies could therefore apply other
methodologies, such as interactional analysis, to determine the degrees of freedom
granted to students in practice and compare these with measures of perceived control.
Nevertheless, the differences in perceived control could be attributed to cultural
differences, especially related to discipline cultures. A possible explanation is that
students of technical disciplines in Berlin attached more value to control of planing
(item 2.4), while students of pedagogy in Ibiza attached more value to control of design
(item 2.5). These hypotheses should be tested in further studies, as the implications of
cross-cultural differences are relevant for culture-sensitive designs of learning
environments. Since perceived control related to planning was the most salient
dimension of learner control among all students in the all three samples, control of
planning seems to be an important design feature independent of national or discipline
culture. The negative values, however, were reached for control of objectives, control of
access rights and control of personal data. In general, these results can be understood
both in terms of instructional designs and cultural differences, such as learner control
versus institutional control. As learning objectives may have been imposed and perceived as compulsory by students, further research on PLE designs in formal education should attempt to explore new ways of establishing learning objectives with students. It should be explored further, if institutional control related to learning objectives is meaningful in context of PLEs at all and how a balance between educational objectives and learner autonomy could be reached.

Further, negative results were reached for perceived control of personal data. This again may be the result of institutional applications of technology which from students’ perspective lack flexibility and transparency. However, it could also be a cultural issue, especially in terms of data privacy concerns in the academic culture. Further research on PLE designs should try to improve perceived learner control in relation to personal data.

The comparison of results in Tables 3 and 4 reveals some interesting findings of possible relationships between perceived control and ownership. First, students in Duisburg achieved most positive results in control of content (item 2.3) and at the same time most negative results in the feeling of responsibility (item 1.1). This may mean that being able to control the content has no significant effect on the feeling of responsibility. The correlation analysis seems to support this interpretation. At the same time, there is a strong relation between the sense of self-efficacy (item 1.4) and the control of personal data (item 2.7) in the Duisburg sample (r = .835). However, these observations would need to be further tested, e.g. by means of regression analysis. Also students in Duisburg did not achieve any significant values in any item related to psychological ownership despite – or perhaps because of - the fact that ePortfolio
assignments were compulsory. Further research should try to understand how compulsory tasks in context of PLEs affect learner control and ownership. Second, findings reveal that students in Berlin obtained most positive values in control of planning (item 2.4) and at the same time most positive values in the sense of responsibility (item 1.1). Further research should investigate how perceived control of planning affects the sense of responsibility. Third, students from Ibiza achieved the most positive values in control of design (item 2.5) of their ePortfolio and at the same time the most positive values in the sense of self-identity (item 1.2). The correlation analysis confirms this relationship, $r = .425$. This may mean that Ibiza students focused on designing the representations of their identity in their ePortfolio practice. Further research should explore the role of perceived control of design on the sense of self-identity and the PLE becoming a part of the self-concept.

(C) Cross-cultural differences: Beyond descriptive statistics and correlation analysis, t test for independent means were computed to compare parameter values of the three key variable sets, i.e. learner control, psychological ownership and learning effects, across the three samples representing different cultures in terms of fields of study and nationality. Altogether nine t tests were calculated for pairs of independent samples and the significance assessed at the .05 level. The results of the t tests are summarized in Table 5.

Table 5: T test results (m = mean, df = degree of freedom, p = probability), n = 76

<table>
<thead>
<tr>
<th>Learner</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin (m = 2.25) &amp; Duisburg (m = 3.18): $t = -3.2174$, df = 50, p &lt; .05**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Berlin (m = 2.25) &amp; Ibiza (m = 2.48): $t = -1.4716$, df = 67, $p &gt; .05$*</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Psychological ownership</td>
<td>Berlin (m = 2.21) &amp; Duisburg (m = 2.97): $t = -2.9571$, df = 50, $p &lt; .05$**</td>
</tr>
<tr>
<td></td>
<td>Duisburg (m = 2.97) &amp; Ibiza (m = 2.03): $t = 3.3174$, df = 29, $p &lt; .05$**</td>
</tr>
<tr>
<td>Learning effects</td>
<td>Berlin (m = 2.99) and Duisburg (m = 3.30): $t = -0.9281$, df = 50, $p &gt; .05$*</td>
</tr>
<tr>
<td></td>
<td>Duisburg (m = 3.30) &amp; Ibiza (m = 2.26): $t = 4.0787$, df = 29, $p &lt; .05$**</td>
</tr>
</tbody>
</table>

* $p > .05$ = non significant

** $p < .05$ = significant

Results in table 5 indicate that there was no significant difference in how students in Berlin and Ibiza perceived learner control and psychological ownership. This may indicate that instructional designs in Berlin and Ibiza did not differ in a significant way. However, due to significant differences in perceived control and ownership in the Duisburg sample, instructional design in Duisburg was explored in more detail. In fact, instructional design in Duisburg was different as most students could not freely choose a tool to create their ePortfolios but had to use a blogging tool embedded in the learning management system. The t-tests also reveal significant differences in learning effects of students in Berlin and Duisburg compared to students in Ibiza. Possible predictors are explored in the section below.
D) Learning effects: The Antecedents-Consequences-Model of the study considers learning effect as a consequence of ownership and control. This is based on the assumption that the sense of ownership and perceived learner control influence how students engage and develop their learning environments. Learning effects in the study were explored using a measure with six dimensions: (1) time invested (students willingly invested time in learning), (2) student engagement (students did more than was required by the teacher), (3) student creativity (students tried something new), (4) interest orientation (students followed their interests), (5) self-direction (students felt they were learning for themselves), (6) intrinsic motivation (learning was more important than grades), (7) social learning (students collaborated to learn), (8) future use (students expect to create a similar learning environment in the future), (9) continued use (students expect to continue to use their learning environment after the course), (10) transfer (students expect to transfer the PLE idea to other areas), and (11) transformation (PLE practice changed the way students learn). Since psychological ownership and control have been viewed as positive resources for impacting attitudes, e.g. higher commitment, responsibility (Avey, et al., 2009; Priece et al., 2001, 2003; Van Dyne & Priece, 2004), it was expected that both ownership and control had a positive impact on the learning effects. Learning effect statistics are summarised in Table 8.

Table 8: Statistics of learning effects (m = mean, sd = standard deviation), n = 76; Likert scale 1-5: 1 = fully agree, 5 = fully disagree

<table>
<thead>
<tr>
<th>Learning effects</th>
<th>Berlin</th>
<th>Ibiza</th>
<th>Duisburg</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 45</td>
<td>n = 24</td>
<td>n = 7</td>
<td>n = 76</td>
</tr>
</tbody>
</table>
### Learning Effects

<table>
<thead>
<tr>
<th>Learning effects</th>
<th>Berlin</th>
<th>Ibiza</th>
<th>Duisburg</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 45)</td>
<td>(n = 24)</td>
<td>(n = 7)</td>
<td>(n = 76)</td>
</tr>
<tr>
<td>3.1 Time invested</td>
<td>(m = 2.6)</td>
<td>(m = 2.58)</td>
<td>(m = 2.86)</td>
<td>(m = 2.62),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.07)</td>
<td>(sd = .72)</td>
<td>(sd = 1.35)</td>
<td>(sd = .99)</td>
</tr>
<tr>
<td>3.2 Student engagement</td>
<td>(m = 2.78)</td>
<td>(m = 2.54)</td>
<td>(m = 3.71)</td>
<td>(m = 2.79),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.33)</td>
<td>(sd = 1.02)</td>
<td>(sd = 1.38)</td>
<td>(sd = 1.27)</td>
</tr>
<tr>
<td>3.3 Creativity</td>
<td>(m = 2.71)</td>
<td>(m = 2.08)</td>
<td>(m = 3.14)</td>
<td>(m = 2.55),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.12)</td>
<td>(sd = .78)</td>
<td>(sd = 1.21)</td>
<td>(sd = 1.08)</td>
</tr>
<tr>
<td>3.4 Interest orientation</td>
<td>(m = 2.42)</td>
<td>(m = 2.13)</td>
<td>(m = 2.71)</td>
<td>(m = 2.36),</td>
</tr>
<tr>
<td></td>
<td>(sd = .99)</td>
<td>(sd = .9)</td>
<td>(sd = 1.38)</td>
<td>(sd = 1.0)</td>
</tr>
<tr>
<td>3.5 Self-direction</td>
<td>(m = 2.71)</td>
<td>(m = 2.38)</td>
<td>(m = 3.86)</td>
<td>(m = 2.71),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.2)</td>
<td>(sd = .71)</td>
<td>(sd = 1.21)</td>
<td>(sd = 1.13)</td>
</tr>
<tr>
<td>3.6 Intrinsic motivation</td>
<td>(m = 3.29)</td>
<td>(m = 2.54)</td>
<td>(m = 4.29)</td>
<td>(m = 3.14),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.2)</td>
<td>(sd = .78)</td>
<td>(sd = .76)</td>
<td>(sd = 1.15)</td>
</tr>
<tr>
<td>3.7 Social learning</td>
<td>(m = 3.06)</td>
<td>(m = 2.46)</td>
<td>(m = 2.86)</td>
<td>(m = 2.86),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.05)</td>
<td>(sd = .78)</td>
<td>(sd = 1.21)</td>
<td>(sd = 1.02)</td>
</tr>
<tr>
<td>3.8 Future application</td>
<td>(m = 2.96)</td>
<td>(m = 1.91)</td>
<td>(m = 2.86)</td>
<td>(m = 2.62),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.20)</td>
<td>(sd = .93)</td>
<td>(sd = 1.57)</td>
<td>(sd = 1.24)</td>
</tr>
<tr>
<td>3.9 Continued</td>
<td>(m = 3.6)</td>
<td>(m = 2.33)</td>
<td>(m = 3.43)</td>
<td>(m = 3.18),</td>
</tr>
<tr>
<td></td>
<td>(sd = 1.21)</td>
<td>(sd = .96)</td>
<td>(sd = 1.13)</td>
<td>(sd = 1.26)</td>
</tr>
</tbody>
</table>
As Table 8 shows the self-assessment of learning effects in general among students from all three samples reached on average slightly higher (more negative) values (m = 2.79) than ownership (m = 2.23) and control (m = 2.43). Students in Berlin and Ibiza (compared to students in Duisburg) invested more time in the development of their learning environments, were more engaged and more creative, followed their interests more strongly and felt more strongly that they were learning for themselves. These are interesting results which may indicate that the instructional design in Duisburg, which was more compulsory and allowed for less freedom of choice, contributed to less positive learning effects. However, intrinsic motivation, social learning, future applications, continued use, learning transfer and transformation of learning as dimensions of learning effects reached positive values only in the Ibiza sample. There is a striking difference especially in the perception that ePortfolio practice transformed...
own learning (item 3.11). This indicates that the ePortfolio practice in the Ibiza sample had the deepest impact on learning as it transformed the way students learn.

In general, highest (most negative) values were reached for dimensions “continued use” (m = 3.18) and “intrinsic motivation” (m = 3.14). This means that on average students in all three samples felt it was rather unlikely they will continue to use their learning environments created during the course and that grades (extrinsic value) were no less important than learning (intrinsic value). Lowest (most positive) values were reached for dimensions “interest orientation” (m = 2.36) and “students creativity” (m = 2.55). This means that students in all three samples followed their interests and engaged in creative practice.

In order to explore the impact of perceived learner control and psychological ownership on learning effects, several statistical tests were conducted, i.e. bivariate correlations and regression analysis. The correlation analysis shows that there is an overall significant correlation between control and ownership (r = .41, p < .01) and a significant relationship between learning effects and ownership variables across all samples (r = .68, p < .01). These results can be interpreted as of validation of the Antecedents-Consequences Model applied in this study. Table 9 summarizes correlation coefficients.

Table 9: Correlation results of the Antecedents-Consequences Model

<table>
<thead>
<tr>
<th></th>
<th>Perceived control and ownership</th>
<th>Ownership and learning effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Also the results of the linear regression analysis with learning effects as dependent variable and ownership as independent variable for all samples indicate that psychological ownership is a good predictor of learning effects ($R^2 = .46$), explaining almost 50% of variance. Perceived control, on the other hand, explained under 20% of variance ($R^2 = .17$). The proposed model should however be tested in further studies with larger samples.

**Discussion**

This paper presented the concept of learner control and ownership in context of Personal Learning Environments and the results of a cross-cultural study aiming at exploring possible differences in perception of control and ownership of learning environments by learners from different national and academic cultures. The study presented in this paper also proposed a measure of “learning effects” which can be used to explore the impact of perceived control and ownership on learning. The results of the study indicate that there may be certain cultural differences in perception of control and ownership of learning environments, such as attaching more value to planning in technical academic cultures rather than to control of design as compared to other discipline cultures, including pedagogy. These differences should be, however, explored in more detail in further studies, as the implications may be important for promoting PLE design and practice by students from different academic backgrounds. However, it seems that a number of differences in perceptions of control and ownership may be best
explained by differences in instructional designs, especially in relation to how much freedom of choice and thus control is granted to students in their PLE practice in formal settings, e.g. higher education.

As the results of the study indicate, compulsory tasks and choice of media, little possibilities to adjust the look and feel of PLE tools as well as application of institutional tools such as learning management systems which from students' perspective provide little control and transparency of personal data, may have a negative impact on learning. The responses in the survey express a disjunction between the instructional design aimed at activating students for ePortfolio work by formal (compulsory) assignments and the student perception of their ePortfolio as a PLE. On the other hand, as survey responses indicate, especially control of planning and control of design have a positive impact on learning. This is reflected, among others, in willingly investing time in learning, following their interests and being creative in ePortfolio practice or even the perception that ePortfolio practice altogether transform the way they learn. Thus perceived learner control, especially control of planning and control of design (both intangible elements of Personal Learning Environments) should be considered an important element of PLE practice and PLE design.

Conclusions

This paper provides a contribution to the discussion on learner control in context of Personal Learning Environments. In line with the study by Buchem (2012), the results presented in this paper point out to the fact that perceived control of intangible elements, such as planning and design, may have more positive effects on learning than
control of tangible elements, such as technical tools. This study also reveals the impact of different PLE designs on learning.

It seems that more freedom of choice (e.g. objectives, tools) as well as flexibility (e.g. planning) and transparency (e.g. personal data) may be beneficial to learning effects. The future implication may be that learner control as postulated by the PLE approach can be advanced to the next level, at which learners are able not only to choose but also to create, for example developing the components of their PLE. This would require learners to develop new skills, such as coding, as well as technical tools to become low-threshold and user-friendly. Finally, this paper uncovers the topic of control and ownership from a cross-cultural perspective and indicates that specific elements of control may be more valued by learners from different national and academic cultures. As a recommendation for further research, future studies should also explore the possibilities of mobile technologies for enhancing perceived learner control and psychological ownership in relation to Personal Learning Environments and its impact on learning.
References


A Pedagogy-driven Framework for Integrating Web 2.0 tools into Educational Practices and Building Personal Learning Environments

Ebrahim Rahimi
PhD candidate
Delft University of technology
Netherlands
e.rahimi@tudelft.nl

Jan van den Berg
Full Professor in Cyber Security,
Delft University of technology
Netherlands
j.vandenberg@tudelft.nl

Wim Veen
Full Professor in eLearning,
Delft University of technology
Netherlands
w.veen@tudelft.nl
Abstract

While the concept of Web 2.0 based Personal Learning Environments (PLEs) has generated significant interest in educational settings, there is little consensus regarding what this concept means and how teachers and students can develop and deploy Web 2.0 based PLEs to support their teaching and learning activities. In this paper a conceptual framework for building Web 2.0 based PLEs is proposed. The framework consists of four main elements, including (i) student’s control model, (ii) learning potential of Web 2.0 tools and services, (iii) project-based teaching approach, and (iv) technology-enhanced learning activities. The main purpose of the framework is to assist teachers to design appropriate Web 2.0 based learning activities. Students then can accomplish these learning activities to develop their PLEs and complete their learning projects.

Introduction

In recent years innovations in web technologies along with the new learning requirements laid down by the knowledge society have led to the emergence of three fundamental shifts in technology enhanced learning (TEL) including: (i) a shift from a focus on content to communication, (ii) a shift from a passive to a more interactive engagement of students in the educational process, and (iii) a shift from a focus on individual learners to more socially situated learning (Conole, 2007). There is overwhelming evidence corroborating the notion that Virtual Learning Environments (VLEs), as the mainstream in TEL initiatives, despite some successes, have failed to address these shifts (Chatti, Agustiawan, Jarke, & Specht, 2010; Attwell, 2010; Downes, 2006). These systems mainly follow and support the learning from technology approach (Jonassen & Reeves, 1995) manifested in technology-push, course-centered, content-based, and teacher-driven
educational processes (Chatti et al., 2010; Attwell, 2010). As a result, the underlying assumption of these systems presumes a passive and controlled role for students in their educational practices (Dron, 2007).

Personal Learning Environments (PLEs) have been suggested as a solution for the challenges mentioned above (Attwell 2007; Downes, 2006; Valtonen et al. 2012; Dabbagh & Kitsantas, 2012). An overwhelming number of authors contended that PLEs, as rooted in socio-cultural and constructivist theories of learning and knowledge building as well as facilitated by the popularity of Web 2.0 tools and social software, have potential to support collaborative learning, communities of practice, personal development, self-directed and lifelong learning (McLoughlin & Lee, 2010; Wilson et al., 2009; Johnson & Liber, 2008; Drexler, 2010). According to Attwell (2007), PLEs are activity spaces in which students interact and communicate with each other and experts the ultimate result of which is the development of collective learning. As argued by McLoughlin & Lee (2010), the conceived goal of PLEs is to enable students, not only to consume content, but to remix, produce, and express their personal presentation of knowledge. Furthermore, it has been argued that PLEs presume and support an active role for students by placing them in the center of their learning processes, corroborating their sense of ownership of learning, and enhancing their control in educational process (Downes, 2006; Buchem, 2012).

Knowing the potential of PLEs, the question how to develop Web2.0-based PLEs in educational settings to address these challenges is posed. Indeed, while there is an increasing number of suitable Web 2.0 tools, robust theoretical-based technological and pedagogical roadmaps to build PLEs are unavailable. As a result, educators at different educational levels are forced to adapt and rethink their teaching approaches in conjunction with the advent of new web technologies and the learning requirements of the knowledge society “without a
clear roadmap for attending to students’ various needs” (Kop, 2008). Furthermore, while supporting student’s control appears to be an essential aim of PLEs (Attwell, 2007), there is little consensus regarding what this concept means and how it is to be attained by developing Web 2.0 based PLEs (Väljataga & Laanpere, 2010; Buchem, 2012).

Inspired by these observations, in this paper we develop a framework to support teachers in facilitating the main dimensions of student control by designing appropriate learning activities using the learning potential of Web 2.0 tools and services.

**Framework for developing Web 2.0 based PLEs**

Supporting the personal development of students and enhancing their control in educational process by using web technologies are the main objectives of building and deploying PLEs (Johnson & Liber, 2008; Drexler, 2010). Scardamalia and Bereiter (2006) argue that in order to help students to acquire the required skills for learning and working in the knowledge-based society, they should participate in designing and developing their learning environments. Along similar lines some authors remarked that the participation of students in designing and developing their learning environment can strengthen their control in educational process (Valjataga & Laanpere, 2010; Drexler, 2010). Applying this approach to developing and deploying PLEs requires adopting a constructivist-based *learning with technology* concept (Jonassen & Reeves, 1995). From the perspective of this concept, instead of leaving technology to the hands of instructional designers to “predefine and constrain learning process” of students, it should be given to students to use as constructing tool to support their personal development and learning by building their learning environments and expressing what they know.

In an attempt to formulate a solution to support student’s control in educational process by developing and deploying Web 2.0 PLEs, we proposed a conceptual framework shown in
Figure 1. The framework illustrates how Web 2.0 technologies, the student’s control model and the teaching process should interact with each other in order to define appropriate technology-enhanced learning activities to be accomplished by students to build and apply their PLEs. According to this framework, by facilitating the student’s control through student-centric instructional approaches (i.e. project-based learning), it is likely that students will start to engage in several learning activities by means of Web 2.0 tools. As a result, it can reveal the ways that they employ technology to manage their learning process providing the teacher with opportunities to acquire a deep understanding and knowledge about students’ learning process as a means to improve their teaching process. Moreover, the engagement of students and teachers with Web 2.0 technologies can help them to explore the affordances and learning potential of these technologies and operationalize these affordances to enrich their educational practices.

Figure 1: A conceptual framework for developing Web 2.0 PLEs

**Student control model**

Supporting students to achieve more control over their learning process and become autonomous learners is pivotal to the learner-centric learning theories such as self-regulated
and self-directed learning theories (Dabbagh & Kitsantas, 2012). Student’s control over the learning process is concerned with the degree to which the student can influence and direct her learning experiences and it relates to several aspects of the educational process, including the selection of what is learned, the pace and strategies of learning, the choices of methods and timing of assessments, and choosing learning resources such as online communities and networks, web tools, and content (Kirschner, 2002; Dron, 2007; Valjataga & Laanpere, 2010; Buchem, 2012). As stated by Kirschner (2002), strengthening of student’s control over the educational process will place the student in a “position of importance” and by giving them the feeling of more control over their learning experience, it will be more rewarding for the student. Along similar lines, Buchem (2012) demonstrated that there is a significant relationships between perceived control, sense of ownership and uses of a learning environment. Accordingly, Buchem (2012) argued that supporting student’s control opens her an opportunity to make choices during the learning activity to effect certain learning outcomes and perceive the learning activity with more personal meaning.

Figure 2 presents the suggested model to support student control in PLEs. We developed this model by adopting and appropriating the learner’s control dimensions model proposed by Garrison & Baynton (1987). According to Garrison & Baynton (1987), learner control is not achieved simply by supporting their independency. Rather than it can be attained only by establishing a dynamic balance between independence (i.e. learner’s freedom to choose what, how, when, and where to learn), power (i.e. cognitive abilities and competencies) and support (i.e. learning resources the learner needs in order to carry out the learning process and keep control over learning process) through the process of communication between teachers and students.
To support the active and constructing roles of students in PLEs, we translated power, support and independence dimensions into the active roles a student should undertake in PLE-based learning, namely knowledge producer, socializer, and decision maker, respectively. The student's control model is based on the assumption that students in order to be in control of their learning process should act as (i) knowledge producers to achieve control by acquiring relevant cognitive capabilities, (ii) socializers to keep control by learning skills needed to seek support, and (iii) decision makers to practice control through the personal endeavors to manage web technologies for enriching their learning experiences. The model also explains how to make a balance between these roles by supporting and encouraging activities for co-producing knowledge, developing personal knowledge management strategies, and developing personal learning network. Furthermore, by considering the PLE as output, not input, of the learning process, the model underscores the constructivist-based nature of the PLE-based learning.

Figure 2: The proposed model for supporting student control in Web 2.0 PLEs
Student-centric instructional approaches

To support and corroborate student control, teachers should adopt a more activity-oriented and student-centric rather than lecture-based teaching approach. Project-based learning (PBL) is an appropriate approach to support student control model. Firstly, PBL can support the knowledge producer role of students through involving them in knowledge building and higher-level cognitive activities such as engagement with more complex problems and pursuing solutions to them, asking and refining questions, collecting and analyzing data, knowledge and idea presentation, drawing conclusions, and creating artifacts (Blumenfeld et al., 1991; Chen & Chen, 2007). Secondly, through participating in designing and doing learning projects, students can acquire personal and metacognitive skills needed to improve their decision making skills such as designing plans or experiments, time and project management, making predictions, selecting appropriate content and, choosing relevant web tools (Chen & Chen, 2007). Thirdly, PBL can develop the social skills of students through collaborating with peers and experts, communicating their ideas and findings to others, improving their willingness to accept peer critiques and revise their projects, and promoting them to work collaboratively in groups to achieve the projects objectives (Blumenfeld et al., 1991; Chen & Chen, 2007). Finally, the involvement of the students in defining and completing the project “can create a sense of accomplishment and control for students which is absent in traditional classroom instruction” (Kearsley & Shneiderman, 1998).

Learning potential of Web 2.0 tools and services

Web 2.0 tools and services are receiving intense and growing interest across all sectors of the educational industry as means for facilitating the transformation of learning (Alexander, 2006; Couros, 2010; McLoughlin & Lee, 2010). These tools and services can support creative and collective contribution, knowledge producing and the development of new ideas by
students (Nelson, Angela, & Clif, 2009). Furthermore, they can provide students with “just-in-time” and “at-your-fingertips” learning opportunities in a way that typical learning management systems cannot (Dunlap & Lowenthal, 2011).

In order to investigate the ways that Web 2.0 technologies can support student control model, we need to elicit their learning potential. Due to the steadily increasing heterogeneity of Web 2.0 technologies and ambiguousness of Web 2.0 concept, it is difficult to reach consensus about the meaning, notion, and borders of Web 2.0 technologies. Hence, we need to consider the gravitational core and underlying concepts of Web 2.0 to depict a picture of their learning potential and map them to the elements of the student’s control model. Alexander (2006) enumerated the gravitational core and underlying concepts of Web 2.0 as below:

- **Social software**: a software application which provides an architecture of participation for end users to support collaboration and harnessing of collective intelligence by extending or deriving “added value” from human social behavior and interactions (O’Reilly, 2005).

- **Micro-content**: a metaphor for the nature of user-generated content in Web 2.0 including blog posts, wiki conversations, RSS feeds, podcasts, vodcasts, and tweets, compared to the page metaphor of Web 1.0.

- **Openness**: refers to the free availability of web tools and user-generated content.

- **Folksonomy**: user-generated taxonomies which are dynamic and socially or collaboratively constructed, in contrast to established, hierarchical taxonomies that are typically created by experts in a discipline or domain of study (Dabbagh & Rick, 2011).

- **Sophisticated interfaces**: refer to the drag and drop, semantic, widget-based websites created by using AJAX, XML, RSS, CSS, and mashup services (Bower, Hedberg, & Kuswara, 2010).

**The potential of Web 2.0 to support students as knowledge producers**

Web 2.0 is drawing several new perspectives to knowledge development within educational settings, which were not possible before. Firstly, as asserted by Mejias (2005), the openness nature of Web 2.0 makes it possible for social software applications to impact knowledge building process within classroom by connecting the classroom activities “to the world as a whole, not just the social part that exists online”. Indeed, by considering the knowledge building as a “civilization-wide” process, these technologies afford students to
“connect with civilization-wide knowledge building and to make their classroom work a part of it” (Scardamalia & Bereiter, 2006).

Secondly, in recent years, affected by increasing attentions towards social approaches of learning and knowledge building, a fundamental shift in technology enhanced learning from a focus on content to a focus on co-constructing knowledge and communication around the content has been emerged (Conole, 2007). Gunawardena, Lowe and Anderson (1997) illustrated five developmental stages for co-constructing knowledge in collaborative learning environments including (i) sharing and comparing of information, (ii) discovering of inconsistency among the information, (iii) negotiating the meaning and co-construction of knowledge through social negotiation, (iv) testing and modification of co-constructed knowledge, and (v) agreement and application of newly constructed knowledge and meaning. Arguably, the architecture of participation and openness aspects of Web2.0 can facilitate the communicational process and information needed to support the co-construction of knowledge by students.

Thirdly, Web 2.0 can support the appropriation of content by students. Appropriation as the “ability to meaningfully sample and remix media content” (Jenkins, 2006) makes student simultaneously as the producer and consumer of content and can be understood as a learning process in which students learn through picking several content (sampling) and putting them back together (remixing) to produce new content and knowledge objects such as ideas, discussions, conversations, comments, replies, concept maps, webpages, podcasts, wikis, and blog posts (Jenkins, 2006). Appropriation as a student-driven knowledge producing strategy is in line with the new knowledge development approaches which underscore the importance of increasing the students’ capacity to know more rather than what currently they know, through equipping them with competencies required to engage with social and technological
changes. Combining the participatory, micro-content, and openness aspects of Web 2.0 facilitates a unique sort of participatory appropriation process known as “collaborative remixability” that recombines the information and micro-content generated by students to create new content, concepts, and ideas (McLoughlin & Lee, 2010; Chen & Chen, 2007; Alexander, 2006).

Taken together, different aspects of Web 2.0 can enrich the learning experiences of students and nurture their cognitive skills by providing them opportunities to practice “learning by doing” (Brown, Collins, & Duguid, 1989), to experience “learning with technology” (Jonassen & Reeves, 1995), and construct a personal presentation of knowledge and share it with others. In addition, by involving students in active construction of knowledge, teachers can achieve a comprehensive understanding of the ways that students learn, the sorts of content and technology they use, and the patterns of interactions they establish as a means to improve their teaching practices.

**The potential of Web 2.0 to support students as socializers**

The value and real power of Web 2.0 technologies is in their sociability aspect. This sociability aspect has changed the way that “participations” spread and people behave by making it feasible to build connections and networks between them (Boyd, 2007). From a learning perspective, the sociability aspect of Web 2.0 offers students learning opportunity that is in line with their normal ways of learning and can enable them to integrate the explicit and tacit dimensions of knowledge (O’Reilly, 2005). On this basis, as stated by Dabbagh & Rick (2011), the inextricable link between “learning as a social process” and sociability aspect of Web 2.0 is transforming learning spaces, perspectives and interactions.

Web 2.0 can support the socializer role of students in three levels. Firstly, it can facilitate student-centered instruction. Indeed, Web 2.0 can trigger deep and active interactions
between teacher and students through supporting conversational interactions; social feedback; and social networks. As a result, it can improve the negotiated control between teacher and students and raise levels of students’ engagement and motivation (McLoughlin & Lee, 2010; Attwell 2007). Secondly, Web 2.0 can foster interaction and social learning between students. By getting help of social software, students can participate collaboratively with each other to the “authorship of content”, obtain support and guidance from others, work together as a learning community, and share their resources, knowledge, experiences and responsibilities (Bower et al., 2010). Social bookmarking and RSS services can provide a great way to support students to bookmark, tag, and disseminate information, people, and learning experiences. These tags then can be arranged to develop tag clouds to visualize the ways that students are working and learning (Alexander, 2006). Being able to have access to other students’ tags cloud provide the opportunity for students to see each other experiences and competencies resulting in being aware of the new streams of information, supporting vicarious and social learning and triggering students’ reflection (Dabbagh & Rick, 2011). Additionally, as pointed out by Dabbagh & Rick (2011), folksonomy as a context-based mechanism for supporting social tagging and sharing the personal experiences of people can be seen as the “language of a community to form connections” between the members of the community. In classroom settings students can use this language to communicate and support “socio-semantic networking” and create learning environment through tagging, annotating and sharing web resources and learning experiences. Thirdly, the social and openness aspects of Web 2.0 make it possible to connect students to “More Knowledgeable Others” outside of the classroom boundaries (Attwell, 2010). As claimed by Peña-López (2012), this possibility can broaden the horizon of students’ personal development by making a close link between PLEs and Zone of Proximal Development, or ZPD, (Vygotsky, 1978) concepts. According to
Peña-López (2012), PLEs could be understood both as the ZPD and the full set of More Knowledgeable Others in terms of “people of flesh and blood”, open educational resources, and all sorts of digital content. Accordingly, he contends that PLEs can extend the borders of students’ ZPD by providing them with more developmental opportunities and support.

**The potential of Web 2.0 to support students as decision makers**

As the locus of control is shifting from institutions and teachers to students, the decision making abilities of students as the core part of self-directed and self-organizing learning behaviors are gaining more attention. Web 2.0 can support the decision making role of students in three dimensions. Firstly, the abundance of Web 2.0 tools along with the intensive contact of today’s students with technology provide an unprecedented opportunity for supporting self-organizing and self-directing students to explore the web to satisfy their heterogeneous learning needs (Veen & Vrakking, 2006; Brown, 2000). According to Brown (2000), the permanent contact of today’s students with web technologies and the open nature of web, provide them with opportunity to be the discoverers and thinkers of relevant technologies and learning resources and then to be the conveyors of them to their educational settings. As a result, students are intensively showing a new behavior called bricolage, i.e. “the ability to find something - an object, tool, document, a piece of code - and to use it to build something you deem important”, which is compatible with their natural spirit of exploration (Brown, 2000). This technology-induced behavior can provide an exploratory-based learning situation which educators can use to corroborate the role of students as decision makers by prompting them to manage their learning process through designing and developing personal knowledge and technology management strategies (Rahimi, Van den Berg, & Veen, 2013a, 2013b).
Secondly, selecting the most appropriate technologies to support teaching and learning activities is becoming more and more complicated due to the growing heterogeneity of available web tools and resources (Couros, 2010). This growing heterogeneity can trigger several learning processes and corroborate the role of students as decision makers in educational process. As illustrated by Couros (2010), the heterogeneity of Web 2.0 tools and services is enforcing teachers and students to acquire new skills in order to discover learning affordances of these tools and integrate them in their educational processes. As a result, choosing what to learn, what tools to use, how to find the right tool or content, and what community to join are becoming prevalent processes in today’s learning and position decision making as an important learning skill for educators and students (Siemens, 2004). Moreover, according to O'Reilly (2005), the features and functionalities of Web 2.0 tools are considered to be in a “perpetual beta” state. On this basis, the permanent and extensive contact of students with Web 2.0 tools beside “unceasing development” of these tools can posit students as pioneer explorers of new functionalities of Web 2.0. As a result, it can change the expectations from the students and open a great opportunity for them to act as decision makers, co-designers, and partners in educational processes.

Thirdly, the sophisticated interfaces of Web 2.0 support easy development of the drag and drop, semantic, widget-based websites by using AJAX, XML, RSS, CSS, and mash-up services. As a result, students can use these technologies to manage their learning activities not only by remixing of content but also by mashing up of tools and services. This feature of Web 2.0 along with the provision of opportunity for students to make decision regarding their learning trajectory, can provide possibility for them to develop their PLEs by adding their personal choices including learning content, tools, and peers into them. Figure 3 summarizes
the learning potential of Web 2.0 and depicts a map between these potential and the elements of the student’s control model.

Figure 3: Mapping the learning potential of Web 2.0 into student control model

Technology-enhanced learning activities

To design technology-enhanced learning activities, we adopted and appropriated the Bloom’s digital taxonomy map proposed by Churches (2008). Bloom’s taxonomy (Bloom, 1956) represents the cognitive process dimensions as a continuum from lower order thinking skills to higher thinking skills being: knowledge, comprehension, application, analysis, synthesis, and evaluation. Anderson and Krathwohl (2001) revised Bloom’s taxonomy by assigning a number of sup-process to each dimension and defining creating as a new higher order thinking skill. Thus, the revised Bloom’s taxonomy has proposed a new continuum of
thinking process consisting of remembering, understanding, applying, analyzing, evaluating and creating sub-processes. Churches (2008) extended the revised Bloom’s taxonomy and proposed Bloom’s digital taxonomy map by assigning digital learning activities to these cognitive processes as below:

- **Remembering**: recognizing, listing, describing, identifying, retrieving, naming, locating, finding, bullet pointing, highlighting, bookmarking, social networking, social bookmarking, favorite-ing/local bookmarking, searching, googling.

- **Understanding**: interpreting, summarizing, inferring, paraphrasing, classifying, comparing, explaining, exemplifying, advanced searching, Boolean searching, blog journaling, twittering, categorizing and tagging, commenting, annotating, subscribing.

- **Applying**: implementing, carrying out, using, executing, running, loading, playing, operating, hacking, uploading, sharing, editing.

- Analyzing: comparing, organizing, deconstructing, attributing, outlining, finding, structuring, integrating, mashing, linking, reverse-engineering, cracking, mind-mapping, validating, tagging.

- **Evaluating**: checking, hypothesizing, critiquing, experimenting, judging, testing, detecting, monitoring, blog/vlog commenting, reviewing, posting, moderating, collaborating, networking, reflecting, (alpha & beta) testing.

- **Creating**: designing, constructing, planning, producing, inventing, devising, making, programming, filming, animating, blogging, video blogging, mixing, remixing, wiki-ing, publishing, vodcasting, podcasting, directing/producing, creating or building mash ups.
Figure 4: Mapping Bloom’s digital taxonomy into student control model

Figure 4 shows an example of mapping Bloom’s digital taxonomy into the defined roles for students in the student’s control model. Teachers can use this map to design appropriate technology-enhanced learning activities to assist and scaffold students to develop and deploy Web 2.0 based PLEs and accomplish their learning projects. According to this map, the PLE development process includes two sub-processes consisting of lower-order technology-enhanced learning activities, and higher-order technology-enhanced learning activities. To develop their PLEs students can start with accomplishing the lower-order technology-
enhanced learning activities and then continue by running the higher-order technology-enhanced learning activities.

The map can support the key elements of the student’s control model. Indeed, accomplishing learning activities such as advanced searching, tagging, blogging, twitting, mind mapping, and evaluating, remixing and appropriating of content can arguably provide students with the opportunity to acquire appropriate domain-specific knowledge, cognitive skills and competencies. During this process which can be characterized as learning by doing and content building process, it is likely that students acquire technical skills about the web tools and their learning potential which, as argued by Drexler (2010), can improve their autonomy during their learning processes. It should be noted that, to support the inherent personal development approach embedded in the PLE concept, appropriation of content should promote and facilitate a personal developmental trajectory for students. Indeed, without careful consideration of this developmental trajectory, according to Scardamalia and Bereiter (2006), any activity-based learning experiences can easily decline to a form of “shallow constructivism” or “doing for the sake of doing.” Accordingly, to avoid this drawback and to emphasize the importance of the process of content building, appropriate learning activities such as reflecting, self-evaluating, creating personal meaning from learning experiences, and evaluating the quality of online content are required. This type of learning activities can foster internal learning abilities such as self-reflecting and develop critical thinking regarding the options and range of possibilities to select and evaluate content.

The social context of learning environment can assist students to keep control by providing them learning resources and relevant support they need to overcome the difficulties faced during the learning process and assisting them to make appropriate decisions (Garrison & Baynton, 1987). In technology-based learning environments such as PLEs, there are five
sorts of interaction between the student and their social context, namely teacher-student, student-students, student-people outside of classroom, student-content, and student-interface (Moore, 1989; Hillman, Willis, & Gunawardena, 1994). The first three interactions outline the socializer role, while the last two interactions are related to the knowledge producer and decision maker roles of student, respectively. By defining the social learning activities such as social tagging, annotating, and group forming the map can assist students to learn and practice the principles of being a socializer to seek and achieve needed support to keep their control.

The map can augment the decision making role of students by allowing them to find, use, assess, and introduce relevant web tools and services. It also can corroborate the role of students in planning and designing educational practices by allowing them to explore and introduce the learning potential of web tools. It also encourages them to develop personal knowledge management strategy through tagging, categorizing, filtering and mashing up of content and services.

Requirements for implementing the model

There is a set of prerequisite conditions needed to be considered in order to implement this approach in a classroom setting. These requirements include:

- **Defining a learning project**: The learning project gives a meaning and direction to the students’ learning activities. It also defines the tangible and measureable learning objectives and expected outcomes needed by the assessment and evaluation rubric.
- **Meeting technological requirements**: i.e. providing reasonable access to Internet and required web tools, providing an initial technical platform to keep students’ PLEs together and allow them to observe each other learning experiences.
- **Providing initial support**: i.e. appropriate learning content, a list of relevant experts outside of the classroom setting to contact, guidelines to evaluate the quality and validity of online content, training students the basic functionalities of the selected web tools, defining an appropriate group working mechanism, and defining appropriate assessment and evaluation rubric.
Conclusion

This paper proposes a pedagogy-driven framework for developing Web 2.0 based PLEs in educational settings. Supporting students’ control through defining and adopting active roles in order to equip them with necessary competencies and skills needed to deal with the challenges of current knowledge intensive era is the main objective of this framework. Teachers can use this framework as a guideline to design appropriate enhanced technology-based learning activities to scaffold and assist students to develop and deploy Web 2.0 based PLEs to accomplish their learning projects. Further research is supposed to be needed to test, evaluate and improve the roadmap introduced.
References


The Problem of Learner Control in Networked Personal Learning Environments

Paul Bouchard, Ph. D.
Professor, adult education
Concordia University
1455 de Maisonneuve blvd. West
Montreal Qc
CANADA
H3G 1M8
paulbou32@gmail.com
Abstract

The purpose of this paper is to examine the ramifications of networked learning as it relates to the learners' agency in the presence of a new learning environment. Not only has learning become transformed through the use of social ICTs, the learner is now placed at the very centre of the act of learning, to the point where it is possible to question the continued role of teachers or indeed of learning institutions in general. The question of learner autonomy has been the object of empirical research from the 1970's to the present. This paper argues that there is a need for further research that takes into account the features of personal learning environments, namely learner control, self-directed learning, the distribution of power in networked-based communication systems, and some intrinsic characteristics of web-based learning that require an increased awareness on the part of the learners. One goal of this paper is to contribute to a framework for conducting such research.

Freedom to learn

With the emergence of peer-to-peer networking and many-to-many publishing, there is a renewed interest in forms of learning that are not bound by the traditional controls of educational institutions. Learning materials, tools and interactivity can now be accessed readily and freely on the web, to the point where the question appears quite unavoidable as to the continued relevancy of structured learning environments such as classrooms and programmed instructional materials in the age of social computing. The many features of what has been variously called "Web 2.0", "P2P communication", or "social networking", naturally point to an alternative to programmed instruction, namely, participation in a collectively generated learning process that is facilitated by network interactivity.
The notion of freedom from educational institutions has intrigued educators not only since the appearance of web technologies, but also for some time earlier. From Socrates’ notion of ‘self-learning’, to Illich's famous plea in 1971 for "deschooling society", and to today’s yearly proceedings of the International Symposium on Self-Directed Learning, the literature is replete with references to learner autonomy and learner self-direction, which are typically promoted as opportunities for adults to exercise their natural capacity for independent learning without the cumbersome interference of formal institutions. Here is a telling quote from Jean-Jacques Rousseau’s Émile:

"There is only one man who gets his own way – he who can get it single-handed. Therefore freedom, and not power, is the greatest good. This is my fundamental maxim ...and all the rules of education spring from it."

Rousseau, 1762: 1972, p. 48

The new web connectivity evokes a world where learners are free to seek and build knowledge unconstrained by the traditional gatekeepers, while losing nothing in the trade-off in terms of access to text, media, or people. This shift does not represent a noticeable change in the types or the quality of resources that are available for learning, any more that it can be said to provide anything different from the relation of learners with 'knowledgeable others' as a universally recognized means of learning. What is different in the networked environment is that the almost infinite range of possibilities for retrieval and interaction gives learners unprecedented control over the objects of their learning, and the means through which to achieve it. If it is to mean anything at all in the end, the notion of Personal Learning Environment (PLE) is about allowing learners to take control of their own learning.

**Learner control**
Although it might sound self-explanatory, we still might ask, what does one gain control over, after one has established control of one's learning? In other words, what are the unproductive features of pre-network types of learning that can be circumvented thanks to the newly accessible, self-determined learning environment?

The notion of self-directed learning emerged as a central area of research in the 1970’s through the 1990’s in North American literature, and subsequently receded into reduced visibility. Today however, there is a renewed interest in the concept, in the context of accessibility of knowledge for all. In the interest of continuity, it seems relevant to briefly review the main conceptual developments in research surrounding SDL. In 1967, Allen Tough, a Canadian scholar, published a condensed version of his doctoral dissertation written two years earlier, which found that almost 100% of adults experienced at least one self-directed learning episode in any given year. This publication could be said to have been the launch of the SDL revolution. The same year as Tough was preparing his thesis, however, a survey by Johnstone and Rivera (1965) pointed out that 7.9% of some 1 800 respondents in the U. S had “participated in independent study of any type” (p. 34). The discrepancy is explained by the fact that Tough admitted to have “helped” his respondents to remember learning events (“the interviewer assisted their memory”). Apparently, after being informed of some 26 different “types” of learning projects, respondents answered the question quite differently. It is evident here that the importance of SDL depends to a large extent on the definition one gives to the expression “learning event”. In reverse fashion, the notion of “learning event“ can be said to have been somewhat re-defined after the emergence of SDL as a viable representation of learning.

**SDL as process**
A few years earlier, Cyril Houle (1961) had prepared the set with his notion that not all adult learning presented a similar profile. According to Houle, adults varied in their approach to learning as being either goal-oriented (learning for a subsequent purpose), learning-oriented (deriving pleasure from simple curiosity), activity-oriented (learning as a social activity with others). However, Tough readily admitted that the only learning he considered important was determined by the benefits learners could derive from learning (goal-oriented). This has been pointed out as a weakness of Tough’s framework by critics such as Bonham (1992, pp. 48-54). But Tough remained convinced that deliberate learning should remain the central concern.

“Man (sic), according to this view, can be active, energetic, free, and aware. He often chooses his goals, direction, and behavior; he is not always pushed and pulled by his environment and by unconscious inner forces”.

Tough, 1979, p. 45

Furthermore, Tough adhered more or less stringently to a linear process of learning that is similar to other types of programmed learning. For example he described the self-directed learning project’s “stages” as being:

1. Decide on a learning goal

2. Determine a learning sequence and a learning schedule

3. Secure the physical and financial resources to pursue the learning project

4. Select a suitable place to learn
5. Select resources and materials

6. Find appropriate resource persons

7. Resolve motivation issues

8. Overcome learning difficulties

9. Minimize self-doubt

10. Set subsequent learning goals at the end of a learning sequence

It is quite evident that Tough establishes a strong parallel between the “process” of SDL and the “process” of learning-as-the-result-of-teaching, such as routinely found in formal or managed learning environments. The traditional notions of learning goal, resources, learning effort and subsequent assessment are more or less transposed from traditional pedagogy to learner-directed projects. A veritable avalanche of writings followed. The literature of that period accounts for self-directed learning episodes among various groups such as physicians (Fox & West, 1983); students (Johnstone et al., 1965); illiterate villagers (Kondani, 1982); gifted children (Okabayashi et al., 1984); inventors (Cavaliere, 1988); the elderly (Curry, 1983); immigrants (Diaz, 1988); children (Eisenman, 1988); fire-fighters (Clark, 1988); aviators (Torbert, 1988). SDL projects were described in any imaginable context involving nurses, administrators, priests, jazz musicians, etc. All of these studies used a framework similar to the one proposed by Tough, namely that self-directed learning is a process that can be accurately described and analyzed over time as a sequential series of events.

SDL as personality
During that same period, Lucy Guglielmino (1977) was working on a model of individuals’ “measurable” propensity towards self-direction in learning. After conducting a Delphi study among experts in the field (including the likes of Allen Tough, Cyril Houle and Malcolm Knowles), Guglielmino arrived at a series of characteristics that defined the self-directed learner. By emphasising the *individual* learner rather than the learning *project*, she derived a multi-dimensional model that could be assessed through the Self-directed learning Readiness Scale (SDLRS). That instrument became the standard for a large number of studies. In 1989, Csljarevic had already counted 47 major reports that used the SDLRS as their central instrument, and in 1990, Guglielmino herself estimated that the instrument had been used among 4596 subjects. In order to better understand learners, the SDLRS was used to establish correlations between readiness for self-direction and numerous other variables. For instance, Sabbaghian (1979) established a positive correlation between SDL and self-perception. Torrance and Mourad (1978) found that self-directed learners have a marked propensity for “right-hemisphere” tasks, such as creativity, analogy, and problem solving. Overall, according to Guglielmino’s view, not all persons exhibit the same predisposition for self-direction in learning, just as they differ in other psychological abilities such as creativity, problem-resolution, mathematical reasoning, etc. We could readily say that in this perspective, *all* persons are self-directed learners, although to varying degrees. The plausible corollary here is that self-directed learners are self-directed *because* of their specific personality characteristics.

This view did not persist without meeting with some controversy. For instance, Field (1989) argued rather convincingly that the SDLRS was semantically and statistically based on constructs that differed from self-direction in learning (i.e. that it actually measured disposition towards learning in general, not self-direction in particular). The American
periodical, Adult Education Quarterly, became the theatre of fierce and passionate debate. Huey Long (Guglielmino’s academic advisor at U. Georgia) accused Field’s study “nit-picking” while Guglielmino herself argued that Field’s study was “replete with errors” and McCune insisted that the Field study was based on “inadequate observations” (in Bonham, 1991). Finally, it appears that Bonham (1991) got the last word when by finally objecting to the vagueness of the concept, self-direction, in Guglielmino’s work. Nevertheless, the SDLRS is still being used today by researchers in adult education, and the notion of self-direction as a personality trait is still very much alive. For some reviews of empirical results using the SDLRS and other instruments, see Salazar et al. (2012); Delahaye et al. (2000); and McCune (1988).

**SDL as environment**

It was George Spear and Donald Mocker (1984) who introduced the notion of SDL as an environmentally-determined phenomenon. While Tough and Guglielmino had both independently confirmed that self-directed learners have the will and capacity for carrying out personal learning projects, Spear and Mocker pointed out that this was often not the case at all. Their research revealed that learners were influenced by their surrounding circumstances much more than by their “determination” or their “inner predisposition”. Indeed, respondents to Spear and Mocker’s research declared that they had not planned any specific tasks or sequence in their learning:

> “Self-directed learners, rather than pre-planning their learning projects, tend to select a course from limited alternatives which occur fortuitously in their environment.”

Spear & Mocker, 1984, p. 4
In this light, the 10 learning tasks imagined by Tough appear to be foreign to the self-directed learning projects at least when they are described by the learners themselves. Noting that in general, authors suppose that all learning projects involve a series of indispensable steps, but that learners themselves do not seem to be aware of these steps, Spear and Mocker shed some doubt on the linear character that theorists would impose on all types of learning, and particularly self-directed learning. The authors cite Kurt Lewin’s “field theory” to explain how environmental factors can influence self-directed learning episodes. Tough himself had admitted that the learning “steps” could remain outside the awareness of learners, but Spear and Mocker argue, on the contrary, that such a linear learning process can only occur within the confines of formal learning situations. Indeed, planned learning supposes that the learner already has some mastery of the contents to be learned. Furthermore, the task of planning a learning sequence is a rather specialized task for which a learner in the natural setting is not likely to be prepared. Spear and Mocker concluded that it is not reasonable to assume that self-directed learning projects can be planned in a similar way as formal learning projects.

**Personal commitment to learn**

As we can see, the notion of learner-control has been the object of some discussion in the literature, and has generally implied the possibility for individuals to exercise choices, beginning of course with the choice of whether to learn anything at all in the first place (Chu & Tsai, 2009; Long, 1993; Candy, 1991). This is best understood as the opposite of some forms of "other-directed" learning such as mandatory schooling, or of some instances of workplace learning, where people have no choice at all about whether to learn, or indeed what to learn. So, the first area where learners may exercise control over their learning (or be
inhibited from doing so) lies in their option to initiate and pursue learning, or to choose to do something else instead.

The personal commitment to learning precedes other aspects of the knowledge building process and is contingent on psychological and contextual variables such as readiness and incentive. This has been called the "conative" dimension of learner control (Ponton et al., 2005; Bouchard, 2009; Kop & Bouchard, 2011). However, even a cursory incursion into the notion of needs assessment reveals that this important step cannot be left entirely to chance, and that some measure of sophistication must be applied in order to differentiate, for instance, between "perceived" learning needs and "prescribed" needs - neither type being in itself sufficient to mandate enlightened choices - or between levels of behavioural, cognitive or attitudinal gains that are to be expected as outcomes of the learning process. Even in a "goal-free" learning environment such as advocated by Zheng (2010), it is still advisable for any self-regulated learning mechanism to remain embedded in the contingencies of real life and to include the periodic monitoring of one's progression as it relates to more holistic, non-learning aspects of individual development. The decision to learn should belong, before and above all else, to the learner. If it does not liberate us from the 'obligation' to learn, then the notion of PLE implicitly reinforces the hegemonic view of humans as permanent, de facto learners-in-deficit. This notion has been used to describe unreasonable expectations, for example by employers, that their workers be permanently engaged in a catch-up race with new and emerging knowledge.

The second area of possible learner-control lies in the ability to influence the procedures or ‘algorithms’ of the learning process itself (Kop & Bouchard, 2011). The learning process is the result of many decisions and choices, whether they are exercised by a
teacher in a traditional classroom, or by a learner in a self-directed environment. Not only are we required to decide whether to learn, and what to learn, we must also determine how the learning can unfold. Some examples of algorithmic choices that must be made include determining the pace of learning (how fast), the sequence of learning events (in what order), the goal structure, the nature and frequency of the follow-up, the overall validation process, etc. But perhaps the most important of these procedural decisions is choosing the materials that will be used for the purpose of building knowledge. Instructors and content designers normally consider this a central aspect of their job, for it is their responsibility as experts to direct students to the most appropriate text, medium or person while implicitly circumventing second-rate sources and outright charlatans. Interestingly, and central to our discussion of PLE’s and learner autonomy, selection of resources is also the area where learners in programmed environments typically exercise the least control over their learning. This aspect of learner-control is surely the one where web-based learning is likely to make the largest difference, since it provides the possibility for learners to directly access a quasi-infinite range of learning resources, including knowledgeable others. Learners are no longer dependent on institutional authorities to direct them to appropriate materials and persons, and they can search for up-to-date information on the web, as well as interact with other learners and specialists who volunteer their expertise on the network. This is truly a revolutionary aspect of web-based PLE's and the one that offers the greatest promise for an Illichian 'liberation' communities of learners. However, since the problem of monitoring the quality and relevance of resources can now occur in the absence of a content expert, this means that the learner is now in charge of this complex task. And this predicament is exacerbated by the very nature of the web, beginning with the quantum explosion in the number of accessible sources that it makes accessible.
A web of … deception?

Very early in the development of the world-wide web, critics have warned against the unreliability of information that is not subjected to the habitual processes of validation. There is still much talk about the 'Babel' of information overload on the web (Castells, 2011; Benkler, 2007), and there are lingering qualms that the spontaneous assault on the public sphere by the multitude can only lead to the dilution of defined standards of 'quality' - not to mention in more extreme cases, to suspicions of conspiracy:

"... these excesses (overabundance of information, etc.) produce a flattening of distinctions between authorized and unauthorized, official and covert, expert and amateur, true and false that seems to threaten reason, democracy, and the bounded stability of the nation."

Dean, 2000, p. 63

The fears expressed against the democratization of the web are reminiscent of the tensions between mass culture and so-called ‘high’ culture that emerged in tandem with technologies such as the newspaper, television and the radio, and which prompted one author in the 1950’s to cynically observe that, “mass culture is very, very democratic: it absolutely refuses to discriminate against, or between, anything or anybody” (MacDonald, 1957, in Strinati, 2004, p.14). Today, the limitation of the Web as an unfiltered information source cannot be shrugged off with mere caginess. One co-designer of the application Twitter, Evan Williams, readily admits that "We must absolutely find a way to reduce noise-to-signal ratio on the web", while analyst Danah Boyd, addressing the interactive web's potential for disinformation, asserts that, "We should take care to create a future that we actually want to live in" (Boyd, 2010).
The problem of ambiguous reliability is compounded by two specific properties of networks. First, the so-called ‘Power Law’ explains that the popularity (or visibility) of a URL depends basically on the number of links previously directed to it by others, regardless of its own inherent value. This mathematical occurrence knows no moral or scientific justification, and research confirms that people tend to prefer content that is popular among friends and contacts above all other criteria of credibility or quality (Pegrum, 2011; British Library, 2008; Goodfellow and Lea, 2007). This has raised concerns that some kind of ‘herd mentality’ is becoming the main determinant of hierarchy on the network. Without directly arguing that there is no merit in word-of-mouth popularization, we should at least take stock of the fact that other, more credible alternatives often take second place in social network environments, to the point that they matter very little or not at all. So, we must at the very least ask: is peer judgment a feature of an ‘ideal’ learning environment? And this is without mentioning ‘non-peers’ dislocated from the network, rendered invisible for their non-networkedness. What about them?

The second characteristic that can devalue network content is the propagation of customized search and filtering algorithms that inspired Shirky (2010) to talk of the ‘death of ontology’. Traditionally, researchers, scholars and students have depended on classification structures such as the Dewey decimal system or the Library of Congress cataloguing scheme that arrange subjects according to what they are, or more precisely, according to meanings assigned by those systems themselves. Over time, these methods have proven invaluable to locate sources in the physically defined spaces of library stacks. In the non-physically delineated environment of the web, similar divisions have been found too restrictive because they don’t allow what the web does best: to link together objects and persons that are related to each other idiosyncratically, rather than ontologically. In the network, it is not considered
helpful to impose an ‘outside’ logic to classification, so like in all things networked, the solution lies in spontaneous generation. The result has been to capitalize on individuals’ capacity to generate their own webs of links, using their own personal logic.

While some might say that unlimited links attached to unlimited content provide a flexible and intuitive way to associate ideas, it could also be argued that such a non-structure creates a vacuum which can (and will) be filled with market-generated systems that depend on criteria of their own, sometimes with contrary results. For example ‘tagging’ one’s public content allows the gregarious assembly of similar-minded taggers. Replacing taxonomy with ‘folksonomy’ seems innocuous enough and can probably be acclaimed as one of those so-called ‘liberating’ developments in web ontology. On the other hand, some practices are much less ingenuous in their purpose, such as the fast-growing industry of assigning consumer characteristics to individual users in order to ‘personalize’ their search results. There is evidence of a disturbing tendency among knowledge brokers to allocate specific algorithms to specific information depending on ‘who is asking’. Most well-known search engine designers readily admit that personalizing searches is one of their development priorities (Google News, 2008). In a somewhat frightful way, the difficult question of establishing relationships between things according to their ‘nature’ is subjected to laws of commerce even before entering the world of ideas. Again we should ask, is this an ideal feature of a learning environment?

The corollary to profiling our web searches according to our inquiry patterns is to do the opposite, i.e. to assume that everybody is searching for the same thing, regardless of goal or purpose. To illustrate this, this author once tried to reproduce a biographical search that a student did about a well-known educational theorist, but which in my opinion still lacked
some essential information. Doing my own web search, I managed to come up with about the same information as the student, which stated publications and things like ‘Dr. X is professor of adult education at University “Y”, etc., but I was never able to ascertain what I already knew as a fact: this man had died more than 12 years earlier. So, we might ask: How is important information found, but essential data concealed? In the words of Sunstein (2006),

“Why is Google so good at finding what a particular researcher wants? The answer is that it knows what most researchers want, and most people want what most people want.”

Sunstein, 2006, p. 23

The uneasy commons

In the end, and heedless to these cautionary observations, the web is destined to grow and the problem of searching it will not become any simpler (Selwyn, 2010). Ironically, we have rapidly come to a point where 'too much choice' is an impediment to learning, just like 'not-enough choice' used to be. One solution to the over-abundance of available information lies in the creation of web 'filters' that will only allow desirable information to seep into our environment. Filters vary in nature and effectiveness from sophisticated search protocols to self-proclaimed bloggers who make decisions for us about the flow of information that will ultimately reach our screen. Of course, given the monumental task of filtering the web, we will inevitably need to filter even the filters themselves in order to aggregate a manageable mass of data. The problem is, whom will we entrust our filtering to? Information filtering is reminiscent of traditional reviews of literature or annotated bibliographies that are rooted in the academic tradition, where a knowledgeable reader highlights the main points of a complex issue, thereby saving us the effort of sifting through all the materials ourselves. In
fact, a vast amount of 'aggregated' knowledge distributed on the web is quoted from the
works of professional academics, philosophers, sociologists and researchers whose credibility
is recognized through traditional, pre-internet kinds of filters – back when the cost of
publishing was a safeguard against the threat of infinite garbage. In a cyberworld filled with
dubious claims to accuracy, proven intellectuals are manifestly still considered good arbiters
for separating the believable from the bogus.

Interestingly enough however, a majority of professional academics are prevented
from contributing freely to today's flowing exchanges on the web because an important part
of their work is housed in proprietary databases. This is in direct opposition to the network
trend of the 'creative commons' where participants are invited to contribute their work
liberally without other compensation than heightened reputation or popularity. Indeed, there
is growing confidence in the literature that not-for-profit contributions to networked
knowledge represent an irreversible trend that will soon become a serious alternative to
commercially protected content (for an in-depth discussion of this issue, see Benkler, 2007).
The optimistic prediction that the networked commons will eventually counterbalance
proprietary interests has been explained in at least three ways. First, because the network
deals with digital materials that can be reproduced infinitely at no cost, there seems to be no
point in 'imposing artificial scarcity' on them in the first place (Mejias, 2009, p.7). Second,
there is a perception that an inherent set of human 'motivations' such as vanity and altruism
will continue to inspire people to contribute freely to networks (Shirky, 2008). And third, that
there are sufficient secondary economic spin-offs to be derived from web notoriety to ensure
a continued supply from web contributors. Some even predict that these ‘non-economic’
motives of contributing to open source content represent an irreversible trend.
"As the material barriers that ultimately drove much of our information environment to be funneled through the proprietary, market-based strategies are removed, these basic nonmarket, non proprietary, motivations and organizational forms should in principle become even more important to the information production system."

Benkler, 2007, p. 16

The reality however is that the jury is still out over who will win the tug-of-war for network accessibility. On the one hand, authors such as Benkler tell a story of exciting open-source economics unleashed by the new connectivity; on the other hand, Lanier (2010) warns against the proliferation of non-proprietary commodities, arguing that the checks and balances of the for-profit market (as opposed to open-source kinds of markets) are necessary in order to weed out irrelevant contributions to discourse and structure. The argument is once again, ownership versus credibility. While we sit and talk about the promises of open-source access and quietly anticipate the empowerment of the information commons, governments and global corporations are negotiating worldwide agreements designed, precisely, to thwart the expansion of access through connectivity. In her book, *Who owns academic work?*, intellectual-property lawyer Corrine McSherry (2001) summarizes the nature of the crisis brought about by the ‘liberation’ of knowledge and creativity in interactive networks:

“When documents can be copied and circulated worldwide with a few clicks of a mouse, and multiple forms of media (textual, visual, musical) can be digitized and recombined so that all traces of “originary” sources are practically dissolved, it is generally difficult to ensure that persons (both corporate and “natural”) are compensated in their investments. Hence the development of
legislation, legal doctrines and technologies designed to track and limit the circulation of digitized information and thereby to contain the “crisis”

McSherry, 2001, p. 26

Obviously, a purely commons-bound PLE is not feasible at this time, at least if it is to include access to academic writing, among other things. The struggle for control over what is and is not accessible to the commons shows no sign of slowing down in the near future. Currently, all eyes are turned to the future digitalization of existing books as it becomes evident that technology allows the storage of data in large enough quantities to imagine that all books ever written could be housed in a single database. The question is, who will ‘own’ and ‘distribute’ this data? By applying market logic to digital phenomena, we are accepting the possibility of handing over a very large chunk of our culture to some overarching corporate entities, and then buying it back from them for use in our Personal Learning Environments. Even without thinking about issues of possible corruption of access or censorship, this does not make good economic sense.

**Network snake oil**

Networks have changed our way of thinking about many things, from the workings of the globalized economy to the mathematics of human relations. Network theory is a trendy thing and it fills us with fascination at every turn. As would be expected, the world of education has been no exception and some authors have been tempted to revisit basic notions such as the nature of learning, and the nature of knowledge itself in light of recent network developments. The results are not without appeal and we can predict that after the dust settles, network learning theories will at least contribute a substantial footnote to tomorrow’s textbooks. The danger however with force-matching psychological and epistemological
explanations to fashionable network theory is that people might be misled to believe some things about learning networks and Personal Learning Environments that they simply cannot deliver. For instance, in network-based learning theory, there is a marked tendency to 'discover' futuristic learner characteristics that are either already explained by previous learning theories, or that are contrary to rational sense. Consider for example the connectivist contention that because of its networked genesis, conceptualisation can no longer be seen as the acquisition of a localized mental representation, but rather as a fluid and changing association:

“(…) the concept 'Paris' is a loose association of a whole bunch of different things, and hence the concept 'Paris' exists in no particular place in our minds, but rather, is scattered throughout our minds.”

Downes, 2010, p. 4

and further,

“(…) each person is experiencing a mental state that is at best seen as an approximation of what it is that is being said in words or experienced in nature.”

Downes, 2010, p. 9

Beyond its clear departure from medieval phrenology (the study of cranial bumps), the scatter-mind model seems to be another way of saying that concrete concepts cannot be reduced to a set of defining features (e.g. a dog has a tail and four legs), but are more usefully described as the formation of tentative "prototypes" (e.g. a dog with three legs is still a dog) which people shape and re-shape constantly, sometimes as the result of human interaction and
sometimes not. Such theories of concept formation have been around for many years, alternatively called 'prototype' or 'parallel-distributed' learning theories (Ormrod, 2008 or any standard textbook). Perhaps the novelty here resides in the fact that complex mental representations can now be referred to as 'networks' of mental activity, in the same way that the web itself has been compared to the human brain, as they are both examples of 'networks'. The isomorphic transposition of properties from one instance of network (e.g. the web) to another (the brain), replays a familiar occurrence in technological innovation – from the invention of the telegraph to the spread of personal computers – where new technologies have been the subliminal background for ‘explaining’ how the human mind works (Friesen, 2009). One day, we are wired as 2-way feedback loops, and the next our thoughts are portrayed as tentacular, self-replicating rhizomes. Here the question is, did the telegraph actually make us into unthinking behavioral machines? And will social computing make us into connected thinkers in a heretofore undiscovered way?

So this question remains, at least for the sake of a final argument on the issue: does networked learning facilitate in any way my ability to conceptualize abstract material in a more flexible, socially responsive manner, or is this ability a function of cognitive processes entirely unrelated to the particulars of my current learning (networked) 'environment'? Developmental psychologists in the past have opted for the second explanation. They have argued that all individuals undergo a series of ‘epistemic shifts’ as a result of normal cognitive development, and that the later stages of cognitive maturity are characterized by the ability to hold concepts that are fluid and changing, rather than fixed and rigid (Perry, 1970; Baxter-Magolda, 1992). In this light, to ascribe determinants of human cognitive development to some aspect of virtual connectivity is somewhat misleading.
If the network allows us to question the nature of learning, so it appears also to redefine the nature of knowing. Web theorists have hinted at a possible epistemological shift towards some unknown type of ‘networked knowledge’ (Siemens, 2008; 2006). The main feature of this ‘way of knowing’ again seems to be based on the fluid and changing nature of connected reality, simply by virtue of its being shared and inevitably confronted with the alternate views of others. Hence, knowledge is continually being re-shaped in the network:

“(…) the world of expert, clearly-defined, and well-organized knowledge formed by ancient philosophers and deciphered by subsequent thinkers, has today given way to continual flux.”

Siemens, 2008, p. 5

Furthermore, this seemingly harmless observation has led some to believe that knowledge is the network:

“(… knowledge) consists of a network of connections formed from experience and interactions with a knowing community.”

Downes, 2010, p. 1

The rise of the networked age has triggered a torrent of ideas about the features of information networks, such as: the opportunities of quasi-infinite connectivity; the 'natural' organizing principles of networks; the explosion of cost-free production and reproduction; the growing market for non-proprietary services and products; the relativization of meaning in an 'economy of attention' (Lanham, 2006; Shirky, 2010). We are witnessing a somewhat frenzied effort to characterize just about anything with the newfound properties of networks - be they mathematical, economic, social or psychological. The movement is so entrenched in our
times that it was no surprise to hear in the popular movie Avatar (2010) a bemused and
glassy-eyed Sigourney Weaver affirm: “... But don't you get it? This whole planet is a...

network”. The tendency is reminiscent of the 'theory of general systems' initiated by Von
Bertalanffy (1969) which briefly became the pet premise of the 'systems thinking' movement,
but which quickly fizzed out when, in the words of Bertalanffy himself, “disappointment of
over-extended expectations occurred” (p. 23). Of course we can look at web connectivity as a
quantum leap from previous forms of communication in its capacity to enable more
connections, faster. But the fixation of explaining too many things in terms of network theory
does a disservice to learners and to potential users of designed PLE’s, simply because it
couches the issues of access to learning in arcane and incorrect reasoning.

Conclusion

Network connectivity has given us a world of intricate, rapid re-articulations of
information and meaning, while at the same time providing us with the technical
means to actually keep up with it. By considering the network as part of our learning
environment, we realize that the so-called unlimited access to knowledge is really a
backdrop for human purpose and that it is only through the careful realization of that
purpose that we can create something of value. There is nothing inherently
deterministic in linking a quasi-infinite number of nodes within an unmonitored
network where anything can happen, and indeed it does. Connectivity not only implies
the possibility of access, it also changes the nature of our relations with ideas and
persons. We are confronted with questions about what it means to learn and to know, in
ways that are not merely hypothetical or subject to theoretical speculation, but in ways
that are very real to each of us, personally.
Scientists and thinkers in all domains have been challenged to explain the emergent relationships uncovered by connectivity. They made us question some notions that we had considered more or less self-evident in our previous, less complicated culture. But the fact is, there are no extraneous explanations for learning and knowing that are disconnected from our own, intimate selves. In the end, each of us is responsible for defining what is real, what is true, what makes sense. This is a rather profound realization that networked learning makes not only possible, but also necessary – or more precisely, unavoidable.

The intention in pointing out some contradictions and inconsistencies in network related theories is not to discredit the efforts of those who have sought light in this tunnel. Rather, it is to reinforce the notion of the epistemic self seeking equilibrium in a complex world of interconnected realities. Networked connectivity does not automatically make up new ways of learning, anymore than it automatically reveals new ways of knowing. What it does however is to force us as learners and knowledge seekers to ask what it is that we are looking for, and why. These two fundamental questions – the meaning of learning and the purpose of knowing – have been the focus of much serious effort from scholars and intellectuals throughout human history. The problem we face today is that it is no longer possible to engage in a learning journey without being required to make some judgements about these questions for ourselves. In his book *Fear of Knowledge*, Boghossian (2007) reminds us that there are different ways to test the validity of so-called ‘true’ statements and that the methods used can vary considerably in reliability and consistency. In an open environment such as the web, learners are required to make such estimates on a regular basis, and therefore are called upon to exercise some rather sophisticated judgement calls. The problem is
compounded if we consider that such judgements of validity are destined to remain forever tentative if they are to be epistemologically acceptable. According to standard texts in the philosophy of science (e.g. Cover & Curd, 1998), there is a necessary string of inference to be followed from testing the validity of an assertion to demonstrating its ‘falsifiability’. This basic epistemological ‘fact’ requires explanations too complex to be included here, which is precisely why the question is so urgent: How can learners be prepared to make such strings of inference, and make them accurately?

The exercise of learner-control requires an understanding of the processes and outcomes of the learning cycle, along with a well-articulated view of one’s own expectations in knowledge-building and connectivity. In complex networked learning environments, we must devise ways to reduce our vulnerability as learners and to build our capacity to use a wide range of communicative tools. In this way, we may develop the capacity for creative interaction that is necessary for structuring a new understanding of the world.
References


A Concept to Bridge Personal Learning Environments: Including a Generic Bookmarking Tool into a Social Learning Management Systems

Tobias Hölterhof, Dr. phil.,
Scientific Assistant with the Chair of Media Didactics and Knowledge Management
Learning Lab, University of Duisburg
tobias.hoelterhof@uni-duisburg-essen.de

Richard Heinen, M.A.,
Scientific Assistant with the Chair of Media Didactics and Knowledge Management
Learning Lab, University of Duisburg
richard.heinen@uni-duisburg-essen.de

Postal Address
Universität Duisburg Essen
Lehrstuhl für Mediendidaktik und Wissensmanagement
Forsthausweg 2 LC 022
47057 Duisburg
Abstract

This conceptual study investigates the ability to connect learners' Personal Learning Environments (PLE) by a central permeable and social Learning Management System (LMS). Within the exemplary scope of bookmarking tools as elements of learners’ PLE in Higher Education (HE), the relevance of this conceptual idea is shown with reference to the social bookmarking tool “Edutags” as well as to survey results about the heterogeneity and use cases of bookmarking tools in distance learners's PLE. As the analysis shows the issue of connecting PLEs – a metaphor which can be adopted from “bridges” in graph theory and social network analyses – refers to a non-dominant and inconsistent design of an LMS. Theoretical questions concerning the relation between personal and social, institutional and private, consistent and heterogeneous are addressed. Both Drupal (Content Management System) and OnlineCampus Next Generation (social Learning Management System) serve as a framework for interfacing PLE and LMS.

Personal Learning Environments in higher education

Offering formal online learning opportunities at universities is often dependent on institutional learning environments, frequently referred to as Learning Management System (LMS). In recent years, an increased interest has emerged in the personalization of online learning processes. Most Higher Education (HE) institutions offer online learning opportunities through LMS. However, these systems do not seem to facilitate the level of personalisation and individualisation of learning required. In this context, the main question addressed in this article is how formal learning scenarios can be designed so that the concept of a Personal Learning Environment (PLE) is fostered as well.

Regarding the scientific discussion about Personal Learning Environments it appears necessary to define PLE in more definite terms, since the spectrum of possible
understandings ranges from technological platforms to pedagogical ideas, from learning opportunities offered by institutions to informal opportunities opposing the integration in educational institutions. Our central thesis is that PLE denotes at least a theoretical concept fostering the learning environment as belonging to an individual. The relation between the individual and the environment can be characterised in terms of ownership and control (Buchem et al., 2011). In doing so, the person can own the environment in different manners. Learner can own and control the data and functions of the environment in a technological sense by deleting or expanding them. The data can also be owned by someone else while the learner is the legal owner of the functions and the data of the environment. At least the individual can feel the ownership and the control as a psychological aspect. Even though granting ownership and control to the learner may be realised by a central environment from a HE institution (Taraghi et al., 2009), the scientific discussion of PLE focuses on heterogeneous and decentralised systems, claiming the benefit from the wide range of generic tools on the web as quality, flexibility and pedagogical suitability (e.g. Weller, 2010). The focus on personalisation and the learner as a pedagogical approach leads to a technological implementation of learning environments as a framework of less dominant, open and permeable systems with an inconsistent set of tools (Wilson 2009). The inconsistency of tools means that the system is not restricted to a single tool per task, instead it is open to include multiple tools for the same purpose. This diversity of tools is considered to meet the demands of human individuality.

The personalisation of learning environments has to accompany learning as a social process. The learner is integrated in a social context that is essential for the learning process. So if one considers the heterogeneity of tools on the web as basis of a PLE, these tools usually include social aspects. A PLE is not an isolated environment. A PLE is social at least
in its different components: messaging and communication tools, collaborative editing tools, 
weblogs and sharing tools (Attwell, 2007). As the social and the personal aspects may 
represent two opposing poles of single dimension delimiting the concretion of PLE systems, 
the institutional inclusion of a platform is a second dimension that specify different kinds of 
PLE designs: a PLE can be a platform of an educational institution (e.g. Aresta 2012; Taraghi 
2009) and it can be a non-institutional personal arrangement of independent tools (e.g. 
Wilson, 2009).

From the perspective of a higher education institution these two dimensions are 
essential for designing a system for technology-enhanced learning environment. A PLE as a 
personal arrangement of generic social media tools depends on the capacity of these tools to 
manage and determine the relationships between users. For example, Google+ and the 
collaborative text editing tools Google Docs own a dedicated user management as well as the 
ote note taking app Evernote, the social media platform Facebook and the synchronous 
communication tool Skype. The learners have to connect each other on every chosen tool. 
Building a group and especially building a formal learning context is a challenge and depends 
on further arrangements of frameworks. One approach of enabling social relations in PLE is 
to avoid generic social media tools. Mash-up, gadget or widgets are developed as components 
of PLE sharing the same background structure and can be arranged in special portal sites. 
According to this approach these arrangement portals are considered as a PLE. A widget-
based PLE serves the need of personalisation by offering functional learning objects that can 
be reused, individually arranged, shared and created. An example for this approach is the 
ROLE widget store combined with GRAASP as portal (Dahrendorf 2012). The portal can be

---

1 Another approach is the PLE design language LISL, that offers the possibility to use generic social 
media tools as well but doesn’t face the mentioned problem with dedicated user management (Wild et al., 2008)
hosted by an educational institution, serve as a central platform and build a unified formal
learning context. While the widget-based approach dissolves problems caused by the
heterogeneity of tools, widgets are simple applications like to-do-lists that hardly satisfy the
needs of higher educational institutions.

Another approach is the combining of generic tools through interfaces and APIs
(Wilson 2009). While this approach usually lacks a unified platform or portal, it benefits from
the quality and richness of generic social media tools. Some standards for interoperation
between generic tools already exist: rss-feeds and atom-feeds. Others need to be developed.
An example for this kind of PLE is gRSShopper (Downes 2010).

Technology-enhanced learning in the context of higher educational institutions
somehow depends on central platforms, especially for the needs of online study programs
(Hölterhof et al., 2012). Instead of building a Learning Management System as a dominant
system and consistent set of tools (Wilson, 2009), the discussion about PLE and LMS should
consider the design of open and permeable systems including a wide (and maybe
inconsistent) range of generic tools. A strategy for integrating the demands of formal and
institutional study programs in a learner’s own Personal Learning Environment is through the
implementation of “social hubs”: a social hub connects the PLEs of different learners,
including heterogeneous collaboration and learning tools as well as different devices, with the
members of formal groups representing modules and courses of study programs (Hölterhof,
Nattland & Kerres, 2012). The strategy is based on the Social Learning Management System
(SLMS) instead of a common Learning Management System (Kerres, Hölterhof & Nattland,
2011).

The “Online Campus Next Generation” is a Social Learning Management System
used for technology-enhanced learning in the online master programs “Educational Media”
and “Educational Leadership”. The system realizes an approach of connecting generic web 2.0 tools instead of a widget-based technology. Taking this system as an example as well as the master’s program, the following investigation develops a concept on how to connect different generic tools used in learners PLE. The aforementioned aspects of heterogeneity are the first assumption for designing the concept. Accordingly, learners PLEs can contain an inconsistent set of tools, including redundancy. The second assumption concerns the understanding of PLE itself. Thus a Learning Management System for formal learning opportunities in higher education should focus on connecting the personal environments of the learners instead of offering a dominant and central TEL system. With these assumptions the interaction between PLE and LMS can complement each other. The belief, sometimes suggested in the scientific discussion, that PLEs displaces LMSs, is unsustainable from the perspective of a formal master program in higher education, because an LMS fulfils at least the function network and links the participants in a central and unified place.

**Bookmarking tools in PLE**

Bookmarking tools are created to help users to collect and structure web resources. Many of these tools use social tagging as a way to structure resources and contents. The idea of social tagging has become popular in many different web tools and is a standard tool in many social software applications (Marlow et al., 2006). Tagging means that users annotate digital objects with free chosen keywords (Golder & Huberman, 2006). Together with other tools, tags are used to describe single objects in the platform. For example in flickr tags are used to describe photos that are uploaded to the platforms. In social bookmarking platform the objects are links that refer to other websites or documents. A single learner describes an object by free chosen tags. In contrast to a hierarchically taxonomy, learners do not have to classify the object in a given set of terms. They are free to create their own system of
classification. Describing an object by using tags can be seen as part of a learning process: Learners have to think about the tags that are most appropriate to describe an object. Therefore tagging is an active part of learning. The result of this learning activity is “tag cloud”. In this cloud all tags are assembled and tags that are use more frequently are represented in a bigger scale. A tag cloud, therefore, can be regarded as a representation of a learner’s concept of the subject.

So far we have described a personal tagging tool. The social aspect occurs when different learners start to share their tags and objects – in case of a bookmarking tool their bookmarks. In common social bookmarking tools the community of people share their tags and links and, therefore, their knowledge as an informal open community. In these communities, people can also build open or closed groups and networks by building friendships or following each other. But it is important to keep in mind that in this place learning happens in an informal setting and manner. When using a social bookmarking tool, at the beginning learners can browse through the collection of resources by using the tags created by other users. While exploring the tag clouds they may pick up new tags they consider helpful for their own resources. Again the idea of the tag cloud and relevance of the tag indicated by the relative size of a word in the cloud become important support of the learning activities taking place in this bookmarking communities. For example, a learner can use tag cloud to explore the resources of a given area and may reflect and expand his or her own concept of this area and adopt certain tags to use with their own objects. A social bookmarking tool therefore is not only a tool that gives learners access to even more information, documents and resources. It also can help to build and extend knowledge by using tags. Tags can be used by learners in two ways: learners can describe objects to
elaborate their concept of the topic or they use tags of others to broaden their knowledge (Cress, Held & Kimmerle, 2012).

From the perspective of higher education learning communities in formal learning settings often share knowledge that is represented in texts that can be found on websites. They can use different tools of a LMS to do so. They can collect links in a forum or wiki - in both cases losing the benefit of tags and tag clouds. Therefore, social bookmarking tools can be useful for learning in a formal setting using an LMS. Learners can collect resources from the web together and tag them to create a common knowledge base structured by a folksonomy build from the tags they used. However, the following problem occurs: What is the appropriate tool or web service to use? Is it part of the LMS offered by the institution or do they use a generic tool specialized on the task of bookmarking? And if the decision is to use a generic tool, how can they decide what tool they are going to use? If the tool is part of the LMS, the knowledge created remains in the LMS even when students finish the course. Even if there is an export feature: during the course students would have to decide whether to use the usual tool or the course tool. Using generic tools is even worse. Students using different tools would hardly be able to know about the findings of their fellows.

Learners learn during their entire lifetime, that means learning is a life long learning process that now can be supported by social software of different types (Klamma, 2007). Therefore, learners who use the internet as a learning resource will most likely make a decision for one tool the like best regardless of the context. Learning in formal settings takes place only for a period of time. Learners come together to take a course or a seminar and then spread out again. It is not necessary that they build a community that lasts longer than the duration of the learning activity they share. For this purpose it seems to be useful to describe possibilities to bridge PLEs and LMS. In this way learners can use their usual bookmarking
tools and amount of links, knowledge and groups they collected and formed within the tool when following a formal learning course. The idea of bridging PLE and LMS considers the use of different external bookmarking tools and the linking of them together in a formal learning scenario. As a result, learners may use their PLE to organize their own learning process, to create a knowledge base and to share resources.

In a formal learning scenario learners may use their knowledge and structures to obtain new information. New items shouldn't be stored in a new and course related bookmarking system or a bookmarking system of an isolated LMS. Learners might also want to transfer new items into their own PLE. So the bridge has to serve two purposes: It has to offer an easy to use way to aggregate knowledge from a variety of bookmarking tools used in the learners PLEs (direction PLE to LMS) and a smart option for the user to integrate selected items into a PLE (direction LMS to PLE). As explained later the PLE in this case can be regarded as a bridge. Also to understand how different tools can be bridged by the use of tags we have to take a closer look at tagging as the way individual and shared knowledge is represented. When it comes to social tagging another advantage is important. Social tagging means different learners objects can be described in different dimensions. The challenge is to correctly assign the resources of different origins to the corresponding courses and formal learning groups.

Edutags: an example for a social bookmarking tool

As a result of a joined project between the University of Duisburg-Essen and DIPF, the German Institute for International Educational Research as a member of the Leibniz Association, the social bookmarking system “Edutags” has been developed (see figure 1). Among others, DIPF offers and operates the German “Eduserver”, a server dedicated to educational resources. Edutags extends this server by a community oriented bookmarking
system. With the focus on primary and secondary education, Edutags is a bookmarking tool for educators, teachers, pupil and also students to collect and classify a knowledge base of educational resources on the web. The system offers both a personal bookmarking tool combined with community and collaboration functions. The concept of Edutags is to offer teachers an easy to use system to collect, tag and share resources for daily teaching (Heinen, 2011). The service features

- an integration into all common web browsers allowing to mark and classify any web resource within the web browser,
- suggestion of classification while bookmarking a resource, based on the community,
- functions to explore and search web resources,
- management of groups and friendships, among the ability to share bookmarks,
- interoperability with mobile devices and LMS.

The social bookmarking tool was established in 2011. Until now the tool counts 1,800 active users. The database contains more than 18,000 resources collected by users and shared in around 250 groups. Given this range, Edutags is used in PLEs of several students, learners and teachers for managing and collecting private bookmarks as well as in learning groups, distance learning courses and LMS of schools and HE institutes. Further development will investigate more interoperability in Edutags especially focussing on platforms offering open educational resources (Heinen et. al., 2014).
Figure 1: The social bookmarking tool “Edutags”

**Investigating the use of bookmarking tools in distance learners' PLEs**

For the scope of bookmarking tools as a central element of a PLE, the authors conducted a study to have a closer look at the heterogeneous use of bookmarking tools of participants of distance learning courses. The survey has been distributed in the Social Learning Management System of the master programmes “Educational Leadership” and “Educational Media” of the University of Duisburg-Essen as well as to the participants of a dedicated online course concerning Open Educational Resources “COER 13”. In the online master programmes nearly 100 participants of the two programmes are familiar with Technology Enhanced Learning and distance learning scenarios. Also the participants of COER 13 are familiar with distance learning. The amount of return of the survey (n = 32) can hence serve as an exemplary basis to illustrate the concept and not to draw further conclusions. This survey focuses on the plausibility of conceptual ideas and does not predicate the use of the final implementation.

Table 1: Frequency of bookmarking tools mentioned in distance learners' PLE (n=32)
The questionnaire first suggested several bookmarking tools (e.g. Delicious, Edutags, Google Bookmarks etc. as well as the bookmarking tool of the web browser) including the possibility to freely add other tools and asked the user to choose the tools they usually employ. The question offered the possibility to choose multiple tools and 59% of the respondents chose two or more tools. The most frequently chosen tools in the sample are Edutags (marked 14 times), web browser bookmarking tools (also marked 14 times), Diigo (marked 11 times) and Delicious (marked 9 times). The second question explored the use of bookmarking tools. They may either be used in a private way to bookmark content for oneself but also in a social way. The social way includes searching in the collections of the community, assigning search results to the private collection and collecting bookmarks collaboratively in groups. Clearly the private usage is the most common use case as 75% of the respondent marked that item as “often” and 94% as at least “sometimes”. The two use cases searching and assigning results to the private collection are very similar: around 40% never used a tool that way, around 60% at least sometimes whereas searching is a little bit more common (20% “often”) compared to assigning search results to the private collection (15% “often”). Finally the collaborative use is somewhat more popular than the other two social uses. The private use can thus be
considered as the default use for bookmarking tools, although social uses showed some relevance.

Table 2: Use of bookmarking tools in distance learners' PLE (n=32)

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Private Use</th>
<th>Social Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bookmark for oneself</td>
<td>search bookmarks</td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>never</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>6%</td>
<td>37%</td>
</tr>
<tr>
<td>sometimes</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>19%</td>
<td>43%</td>
</tr>
<tr>
<td>often</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>20%</td>
</tr>
</tbody>
</table>

As the survey showed bookmarking tools are used as an element of learners PLE. Also social bookmarking is established and used. Therefore a concept of linking different bookmarking tools used by the participants of a formal learning scenario like courses of a master programme seems to be plausible and useful. One not even has to consider that distance learners already use multiple bookmarking tools and thus own expertise in using this tools as well as an amount of bookmarks stored in different systems. But also learners are at least familiar with the social usage of bookmarking tools.

**Conceptual reflections and interface design**

---

2 The survey offered the possibility to skip answers. The percentage value is calculated against the amount of answers within the use case.
This article describes the design of an interface bridging between bookmarking tools as an element of the learners PLE and the institutions SLMS realised as a “social hub”. The design focuses on an interface is to be used in higher education courses, in particular a formal online master programme. This approach is geared to the structure of a bridge in graph theory and social media analysis insofar as it takes this structure as a design model. To focus the concept the above mentioned tools and systems are used as example: “Edutags” as a social bookmarking tool as well as “Online Campus Next Generation” as Social Learning Management System. Although this study focuses on a connection of specific tools, the interface needs to be designed as an open and universal connector suitable for many bookmarking tools.

Typically a PLE is illustrated as a network graph but as a special form of network. Scott Leslie collected 78 diagrams of PLEs on his wikispace “edtechpost”. The diagrams have been created by educators, advanced learners and specialists. They have been collected from Leslies own personal network and illustrate a personal view to the subject of PLE. After four years of collecting them he posted some of his observations concerning the diagrams (Leslie, 2012). He remarked that the main metaphor used to illustrate a PLE is a network diagram, especially a hub-and-spoke network characterized by a centred hub at which all lines leaves like spokes. Not all diagrams show persons as the centre hub but also tools (like a webbrowser or a reader tool). Even if this observation is exemplary as it is based on a particular collection, one can find similar diagrams on scientific publications of PLE (e.g. Wilson, 2009). Further it corresponds to the relation between the subject and his/her PLE in terms of ownership and control (Buchem et al., 2011).
Figure 2: Diagrams illustrating PLE collected by Scott Leslie (Leslie 2012)

Compared to the structure of the internet, these observations are interesting regarding the relation between the personal and the social in PLEs: As Leslie explains: “While they [the PLE diagrams, TH] capture the individual user’s perspective of being at the ‘centre’ of their network, these are not actually accurate representations of how internet networks as a whole look” (Leslie, 2012). If one considers the internet as representing social relations between individuals, these ego-centred diagrams lack of social relations between the participants. These individual networks of tools and environments need to be connected to realise distance-learning scenarios. Of course these connections can be done within the chosen tools by agreeing upon specific tools. But an agreement like this can serve as a limitation to the own environment. If we consider the personal learning environment as a basis to lifelong learning that stays persistent over multiple qualifications, participants of distance learning opportunities may need to change well established tools of their environment.

In social network analysis it is common to identify the vertices of a graph as actors and the edges as social relations between the actors. Several kinds of social relations have been analysed that way, e.g. e-mail and forum messages sent between participants of distance
learning course (Reffay & Chanier, 2002). From a perspective that considers a PLE not to be an institutional platform but the personal environment of a learner, one can suggest that an individual can only act on behalf of its environment. The diagrams collected by Leslie (2012) illustrate the network of tools a person uses to act, receive and react on the Internet. Even e-mail and forum messages are not send by the individual directly but on behalf of web browsers and e-mail tools representing parts of the individual’s environment. Thus with regard to PLE, vertices of social graphs can be environments of tools. These tools often realise relations to other individuals like e-mails sent to others, friendships, posts to groups and bookmarks. In this way edges of a graph can be considered as one of the heterogeneous relations between the environments. This interpretation of vertices and edges of graph as personal environments and its relations to other personal environments can lead to the conceptual metaphor of bridging personal learning environments. Bridges in graph theory connect components of a graph, they are critical to the connectedness of a graph. If a bridge is removed from the graph, the resulting graph has more components than when the bridge is included (Wasserman & Faust, 1994, p 114). Bridging PLEs with respect to the mentioned conceptual metaphor means to build connections between the tools of different environments; maybe by connecting multiple tools of the same kind in the context of a distance-learning course.

Assigning items on behalf of tags

A challenge in bridging PLEs with regard to bookmarking tools is to identify the context of a bookmark resource. One has to consider that in higher education learners follow multiple courses. Thus a Social Learning Management System must be able to aggregate the bookmarks of participants of different courses. Lastly, because bookmarking tools are also used privately, a learner must be able to decide if a resource is to be assigned to a formal
learning context. An obvious way to solve that challenge is to use the tagging feature of bookmarking tools. As explained above, social bookmarking uses tags to identify resources. Because tags can be freely assigned by the learner, they can be used for different purposes. A requirement to automatically identify the formal learning context of a bookmark resource by its tags is a unique set of fixes tags used by all participants of a course to identify the context of the corresponding course. In other words, courses in a social LMS need short acronyms (Figure 3). If the acronym of a course is used by a participant as a tag for a bookmark resource, the bookmark can be assigned to the course.

Figure 3: Concept of bridging PLEs: courses within the Learning Management Systems are marked with acronyms (here: “#a” and “#b”) that matches tags used in learners PLE bookmarking tool.

A closer look on adequate interfaces to export content from bookmarking tools shows that RSS feeds are widely used for that purpose. Edutags as well as Diigo and Delicious, the three
most frequently mentioned online bookmarking tools in the survey, support RSS feeds to export bookmarks of a user. Reading and handling RSS feeds is well established in most web developing environments. But with respect to the need to include users’ tags in the RSS feed, the situation looks different. It is not sufficient to somehow include the tags in the RSS feed, the tags need to be marked up so they can be identified automatically. The specifications of RSS 2.0 provide an element that can be used to mark tags: the “category” element3. Edutags supports marking tags in that way. Diigo like Delicious do not support the category element, maybe because the feeds do not support RSS specification version 2.0. Instead the tags are included in the description element as links. Of course this way of marking tags can also be processed automatically, but the markup style misses an official standard. At least the fact that both tools, Diigo and Delicious, include the users’ tags in the description elements shows that a PLE bridge can use bookmark tags to assign bookmark resources to courses. The required data is exported by the RSS feed.

To transfer the knowledge of a single learners PLE to the group within the Social Learning Management System RSS feeds are reasonable. The learner can register the feeds of the own PLEs bookmarking tools to the LMS and as soon as the new bookmarks appears in the feed it is imported into the LMS as well and assigned to the course group according to the tag acronym. To save the benefit of the social tagging the LMS has to preserve the tags of the bookmarks and take care that the imported bookmarks within the LMS are marked with the same tags then in the generic bookmarking tool. The LMS can than build a new tag-cloud representing the knowledge of the group. This import procedure may produce duplicate bookmarks within the LMS because learners can tag the same web resource on different

3 According to RSS 2.0 Specifications: http://www.rssboard.org/rss-specification
bookmarking tools all imported to the same group in the LMS. This might be regarded as a problem, but the doublet bookmarks referring to the same web resource keep meaningful information within the LMS. They also retain the relation to the learners bookmarking system expressing that a specific resource has been bookmarked and tagged by several learners. By accepting doublets, the bridge offers the opportunities to explore more of the learners collected knowledge. In case a learner will add a resources from the LMS to his or he own PLEs bookmarking tool, this can be done in the same way other resources are added to the specific bookmarking tool: the user can use a generic javascript “bookmarklet”, an adapted toolbar for the web browser as well as other ways offered by the bookmarking system. Via RSS this adopted bookmark will be integrated in the tag cloud of the learners group if the learner specified the group acronym as a tag while assigning the resource to the own bookmark collection. In this case the interface collects the resource in the next iteration, identifies the acronym and assigns the bookmark to the corresponding learning group in the LMS. Possible new tags broaden the knowledge base of the learning community.

Implementation using the Content Management System “Drupal”

The implementation of the specified interface is planned to use the Content Management System “Drupal” as framework instead of generic Learning Management Systems like Moodle. The decision to choose Drupal rests upon the Social Learning Management System that is currently used in the online masters programmes at the University of Duisburg-Essen. The “Online Campus Next Generation” is developed with Drupal to take advantages of the numerous social media modules developed and maintained by the Drupal community. The organic groups module builds social relations between website users by forming groups. This module can be used to form courses as well as learning groups. Arranging learning content can be done by the books module featuring a hierarchical
structure of pages. Content can consist of videos, audios, pictures, texts, pdf files as well as SCORM elements. Learning assignments, student submissions and teacher feedback can be realised by the workflow module in combination with several workflow extension modules. The workflow modules allows to specify a succession of submission states like creation, editing, submitted, reviewed, finalised with corresponding fields to be activated and locked for feedback text, attachments etc. A more detailed description on how the “Online Campus Next Generation” is created on basis of the Content Management System Drupal is given in Hölterhof & Kerres (2011).

The interface to bridge bookmarking tools used in learners PLEs to a SLMS like the “Online Campus Next Generation” can use the Drupal feed module and its extension modules. This modules allows to parse RSS 2.0 feeds and import the feed items as website content by mapping item fields to internal web content. In this way the interface can be configured almost without the need of programming. However a little customisation is necessary first to extract the bookmark tags from RSS feeds that do not use the category element. In this case a parser needs to be written that matches the tags within the description section of the feed. Second assigning the imported bookmarks to the corresponding courses on behalf of the acronym is a customisation task of Drupals feed modules as well. Lastly, the issue of creating tag clouds is a standard feature and can be realised by corresponding modules without the need of programming. So, the Drupal community offers valuable modules and plugins to implement the interface, but still there is a need of customisation by programming.

Conclusion

The concept to bridge learners PLE is based upon the metaphoric idea of bridges in social network analyses. According to this metaphor, a bridge connects components of a
graph that elsewhere stays isolated. An analysis of PLE diagrams by Leslie (2012) indicates the structure of PLEs to be an ego-centred hub and stroke structure. It has been argued that the need to connect PLEs can be derived from this structure because it stays in contrary to the connected structure of the internet. Regarding the example of bookmarking tools used in learners PLE this need can be illustrated. As an exemplary survey showed, distance learning participant’s uses multiple bookmarking tools in private and social use cases within their PLE. To make available the knowledge and resources learners collected in their bookmarking tools to formal learning scenarios as learning courses in higher education, the bookmarking tools needs to be connected to the institutions Learning Management System. The issue of connecting Personal Learning Environments with Learning Management Systems also reveals the relation between PLE and LMS in a different light. While the discussion about these two systems often constitutes a contrast between them, this issue focuses on integrating them.

As an exemplary environment to discuss an interface for connecting bookmarking tools as PLE components the Social Learning Management System “Online Campus Next Generation” is used as well as the social bookmarking tool “Edutags”. The mentioned LMS and bookmarking tool uses Drupal as framework. A challenge in realising this interface is to assign the learners bookmarks to the corresponding course within the LMS. To solve this need the courses are marked with acronyms. Bookmarks are imported by the LMS with the corresponding tags from the generic learners bookmarking tools and assigned to the courses by matching the tags to course acronyms. With this procedure, tag clouds can be formed out of the bookmarked web resources of the course learners.

This article shows the need of rich metadata in feeds as the RSS 2.0 standard offers. Feeds are an easy way to connect web tools used in PLEs but to preserve meaningful
information collected in the bookmarking tools, tags and marks assigned to a resource by the learner needs to be considered as well. As a way to face dominant design and to include personalisation, Learning Management Systems needs to be designed as permeable systems.
References


Interaction and Reflection with Quantified Self and Gamification: an Experimental Study

BENEDIKT S. MORSCHHEUSER
E-Mail: Benedikt.Morschheuser@uni-leipzig.de
Current position: Research Scientist at University of Leipzig

VERÓNICA RIVERA-PELAYO
E-Mail: rivera@fzi.de
Current position: Research scientist at FZI Forschungszentrum Informatik

ATHANASIOS MAZARAKIS
E-Mail: mazarakis@fzi.de
Current position: Research scientist at FZI Forschungszentrum Informatik

VALENTIN ZACHARIAS
E-Mail: zach@fzi.de
Current position: Division Manager at FZI Forschungszentrum Informatik
Abstract

In this paper, we present our research on the impact of gamification – ‘the use of game design elements in non-game contexts’ – to increase the motivation of students to use PLEs (Personal Learning Environments) that enhance interaction and support reflection in lectures. To examine this, we conducted an experiment with the Live-Interest-Meter (LIM), a Quantified Self (QS) application which allows capturing, sharing and visualizing several types of feedback with the aim of improving the learning experience during and after lectures. The results show that perceived fun has a positive effect on the motivation to use the LIM and the motivation to use the application with gamification is significantly higher than for the application without it. Therefore, gamification seems to be an appropriate enabler to engage people in using QS approaches as PLEs for improving their learning experiences.

Introduction

Recently there has been a growing interest in the impact of gamification, i.e. ‘the use of game design elements in non-game contexts’ (Deterding et al., 2011), on motivation in several contexts, including business and education (e.g. Thom et al., 2012; Lee & Hammer, 2011). In the context of learning, gamification may contribute to increase the motivation of students to use tools for optimizing their personal learning environment (PLE) and knowledge about their own learning behaviour in the future.

In the case of informal learning, several tools have been developed and tested within the EU-Project MIRROR – Reflective Learning at Work, to support reflective learning in

---


5 http://www.mirror-project.eu
work environments. Some of these tools are self-tracking applications, also known as Quantified Self (QS) tools, i.e. tools that collect personally relevant information to gain self-knowledge about one's own behaviours, habits and thoughts. Rivera-Pelayo et al. (2012) defined an integrated model which describes how QS tools can support reflective learning. This support is divided in three possible dimensions, namely (i) tracking cues, (ii) triggering reflection and (iii) recalling and revisiting experiences, with the aim of guiding learners to achieve their desired outcomes. One of these MIRROR QS tools is the Live-Interest-Meter (LIM) (Rivera-Pelayo et al., 2013), which allows capturing, aggregating and visualizing feedback given to the lecturer with the aim of improving interaction and supporting reflective learning for both speaker and audience. In this concrete scenario, the desired reflection outcomes may be improvements of the presenter's skills and performance when addressing an audience. In order to achieve this, the LIM implements the three dimensions defined in the integrated model.

According to Warschauer (2006), ‘the intersection between interaction and reflection is of critical importance in education’. In his article, Warschauer discusses the relationship of technology to literacy by focusing on computer-mediated texts, but the importance of enhancing the interaction and reflection is also applicable to data in other formats (Warschauer, 2006).

This is the case of the LIM, which aims at capturing several interaction aspects during the lecture (e.g. feedback), making this data available retrospectively, and thereby improving reflective practices. Both students and lecturers can benefit from the LIM, as students are provided with an easy means to assess their learning (e.g. understanding of the lecture’s

---

6 [http://www.quantifiedself.com](http://www.quantifiedself.com)
content) and lecturers can gain insights about their performance and the students’ perspective, by analysing the captured feedback. The LIM has a uni-dimensional configurable meter that allows students to track their feedback and evaluate the lecture (e.g. speed of speech or comprehension). During a lecture and afterwards, the individual learning experience is supported by the visualization of this tracked feedback data, which is also aggregated and analysed, and by peer comparison. Therefore, this contributes to the learners own learning process. Studies with the LIM and other MIRROR apps have shown that the use of such QS reflective learning applications in educational and working contexts faces a lack of motivation. Concretely, the results of several studies conducted with the LIM showed concerns regarding the students’ voluntary participation to give feedback and actively be involved in the lectures (Rivera-Pelayo et al., 2013).

With the goal to enhance the user’s engagement, we examined whether gamification can increase motivation to use QS tools like the Live-Interest-Meter. We conducted an extended literature review on gamification, the QS community and learning through reflection in order to create a theoretical framework. We also analysed successes and failures of existing gamification approaches. Following, we conducted an experiment to analyse the users’ intention to use an adapted version of the Live-Interest-Meter with and without gamification.

In the following, we present the background of our work, including gamification, its role in Technology Enhanced Learning (TEL) and related approaches. In Section 3, the presented case study will be explained in detail. Following, the conducted experiment will be described in Section 4. Finally, we will outline our findings (Section 5) before concluding this paper.

Theoretical background
The use of game design elements in non-game contexts (Deterding et al., 2011), also known as gamification, represents a huge trend in Human-Computer-Interaction (HCI), marketing (Zichermann & Cunningham, 2011), enterprise (Schacht & Schacht, 2012) and education (Lee & Hammer, 2011). Already in the 1980s, Malon et al. (1982) researched the positive impact of game elements in interfaces and suggested to use video game elements to enhance the interest, joy and satisfaction of computer systems. Following the predictions of analysts like Gartner (2011) and gamification visionaries (Schell, 2010; McGonigal, 2011), it is likely that gamification will play an important role in future urban spaces, including new forms of gamified education (Charles et al., 2011). Since the rise of gamification, education is a popular application field of this new motivation method. Charles et al. (2011) examined that gamification in education and TEL can increase the learners’ engagement, strengthen the social relations, raise satisfaction, help to identify personal strengths and weaknesses and give a more detailed personal feedback.

The use of gamification to support learning through self-reflection with QS tools has not been previously studied in detail. However, this combination has been successfully applied in many popular applications like Nike+7, HealthMonth8 or Mint9. All these examples motivate people with gamification to collect personal information about their behaviour. The target of our research is to transfer this approach to the education context and to examine, if

---

7  http://nikeplus.nike.com

8  http://healthmonth.com

9  https://www.mint.com
gamification can improve the motivation to collect data and reflect on it with technology enhanced PLEs in order to improve personal learning.

**Case study**

The object of our research is an adapted version of the Live-Interest-Meter, a Quantified Self application and PLE that supports the reflective learning process for presenters and listeners. This version of the LIM, which was developed based on Rivera-Pelayo et al. (2013), consists of two main components: 1) the *Meter*, a mobile app that allows capturing and visualizing live feedback in lectures and 2) the *LIM-Community*, a web platform to review past presentations, analyse the personal learning behaviour and interact with other users.

![Figure 1. Prototype of the LIM meter as Android App](image)

The Meter (Figure 1) was designed to quantify and track the performance of the presenter as well as the context of the students during a lecture in order to improve the individual learning process of both students and presenter. The tool allows listeners to evaluate a lecture in real time on a uni-dimensional meter, whose scale can be chosen from a
preconfigured set (speed of speech, interest, difficulty and comprehension). The gathered data is aggregated and visualized to the users. If a certain threshold value is exceeded, the presenter will see a discreet hint and can react on it, thereby receiving information about the presentation and adapting it to the audience. This live feedback loop is illustrated in Figure 2. Participants can also compare their individual learning situation with peers. Therefore the Meter supports learners who can reflect on their own performance and improve their behaviour in comparison to peers but also the presenter, who gets real-time feedback about the lecture.

![Figure 2. Schematic illustration of the LIM scenario](image)

Later, participants can reflect on a past lecture, by logging in into the LIM-Community. This web platform allows reviewing captured lectures, visualized and aggregated in graphs and enriched with collected metadata like date, time, topic and participants, and also context information (notes added by the audience). The students can discuss about lectures in forums and can evaluate their collected data. Thus, the LIM-Community can be used to recall information from past lectures combined with the associated events in the audience. The data from each lecture is also available for the lecturer, who can review in the LIM-Community
the feedback received in each session and reflect on it in order to improve future presentations. The combination of the Meter and the LIM-Community provides a personal learning environment that helps presenters as well as regular attendees of lectures to visualize, understand and improve their personal learning process and behaviour.

**Experiment: The Gamified LIM**

We conducted an online experiment with a 2x2 Latin Square design (Hicks, 1973) to analyse the impact of gamification on the motivation to use the LIM, by examining the users’ intention to use a gamified and a not gamified version of the tool.

**Gamification of the LIM**

In order to keep the distraction of the students to a minimum during the lectures, gamification was only applied to the LIM-Community to foster the motivation to collect quantitative and qualitative data during lectures. In a software design process, based on Radoff’s (2010) player-centred design model, we selected multiple game mechanics and interface elements for the gamified version of the LIM, based on analysed needs of our target audience. We developed personas, derived from the surveyed participants of Rivera-Pelayo et al. (2013) and matched them with the player types of Bartle (1996) and interviews/profiles of Mayer (2009).

Central element of the gamified version is the personal Knowledge Tree. This narrative element stands for the personal learning progress and grows with each lecture in which the user collects data with the LIM. Engagement in using the LIM or the accomplishment of tasks are rewarded with badges and points. The animated badges, e.g. little birds or squirrels (see Figure 3 right), can be decorated in a tree branch, which represents a lecture. The overall personal progress is indicated in points and can be compared with other players in global leaderboards.
Experiment

Considering successful gamified QS examples like Nike+4 or HealthMonth5, it seems that QS approaches can benefit from gamification. Therefore, gamification may be also an appropriate enabler to engage people in using QS approaches as PLEs for improving their personal learning experiences. Concerning our experiment, our first hypothesis was:

**H1:** The intention to use the LIM with gamification (game elements, game mechanics, storytelling and playful design) is higher than without gamification.

Consequently, if gamification can increase the motivation to use the LIM in general, we also believe that gamification can support the motivation to keep tracking, according to Quantified Self, over a long-term period. Li et al. (2010) points out that a lack in motivation is one important barrier in the QS process and motivation to keep collecting personal data must be
raised regularly for long-term success. We believe that suitable gamification elements are able to counteract that problem in a systematic and methodical manner. This leads to the following hypothesis concerning the LIM:

**H2:** The intention to use the QS application LIM long-term and to visit the Community regularly is higher with gamification than without.

In general, it is assumed that gamification can enhance intrinsic motivation. Igbaria et al (1994) showed that ‘system usage is affected by both extrinsic motivation (usefulness) and intrinsic motivation (fun). Both are important in affecting the individual decision whether to accept or reject a new technology’. Based on this, we believe that this is also true for gamified QS-applications:

**H3:** The perceived fun during the usage has a positive correlation on the usage intention of QS applications like the LIM.

We conducted an online experiment which was 20 days active and allowed us to reach the appropriate target group. Each participant was randomly assigned to one of two groups. Group 1 (G1) evaluated first the non-gamified version of the LIM and then the gamified version, whereas group 2 (G2) evaluated the versions the other way around. After a short video introduction and verifying the role of the participant in lectures, the gamified (G) or non-gamified version (O), depending on the group, was presented to the subjects (see Figure 4). Subsequently, we asked the participants a set of questions. Afterwards, we presented them the other version of the LIM-Community and asked them the same questions. Finally, we
asked demographical data and supplementary questions, like the interest to learn from personal QS data. The experimental design allowed us to perform two different analyses between the gamified and non-gamified version: the independent differences between the randomized and independent groups (between-subject) as well as the responses at the individual level (within-subject).

The questions that were asked after each presentation were divided in four sections (see Table 1). The intention to use the software - behavioural intention (BI1), which based on Fishbein & Ajzen (1975) is an indicator for the real usage - was derived from successful TAM studies of Venkatesh & Davis (2000) and Davis (1989). The questions about the long-term usage (BI2) were inspired by Igbaria et al. (1994). Perceived usefulness (PU) was operationalized with five items oriented at Venkatesh & Davis (2000) and Davis (1989). The questions were adapted to the LIM needs. To measure FUN, we used the proven construct from Igbaria et al. (1994) consisted of a 7-point semantic differential with six pairs.

Table 1. Research factors, questions and reliability assessment
### Data analysis and findings

<table>
<thead>
<tr>
<th>Research Construct</th>
<th>Questions</th>
<th>Cronbach’s alpha</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>G</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>PU</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General usefulness (i),</td>
<td>0.898</td>
<td>0.897</td>
</tr>
<tr>
<td></td>
<td>usefulness to improve</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>effectiveness (ii) and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>performance (iv), usefulness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for self reflection (iii) and self</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>improvement (vi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rewarding /unrewarding (i),</td>
<td>0.925</td>
<td>0.868</td>
</tr>
<tr>
<td></td>
<td>pleasant/unpleasant (ii),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>fun/frustrating (iii),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>enjoyable/unenjoyable (iv),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>positive/negative (v),</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>interesting/ uninteresting (vi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>BI1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General intention to test (i)</td>
<td>0.912</td>
<td>0.902</td>
</tr>
<tr>
<td></td>
<td>and use the meter(ii), the community (iii), the collected data (iv)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>BI2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intention to use the meter (i),</td>
<td>0.876</td>
<td>0.837</td>
</tr>
<tr>
<td></td>
<td>the community (ii) and the collected data (iii) regularly</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
During the online experiment, the website was visited by 607 unique visitors and 14% of them participated in the study. At the end, 70 complete valid data sets (according to control variables and having specified that the participant takes part in lectures regularly) could be used for the analysis. The automatic randomization resulted in 35 valid data records in G1 and 35 in G2. The distribution was homogeneous (Female G1: 13, G2: 13; male G1: 22, G2: 22; median age G1: 26, G2: 24; attend lectures regularly as student G1: 29, G2: 28; attend lectures regularly at work G1: 10, G2: 10; QS interest G1: 22, G2: 19). Therefore, the application of Pearson Chi-Square tests did not show significant differences in the groups, concerning demographic data and QS interest. We assessed the internal consistency of the measurement model by computing Cronbach’s alpha coefficients for each of the four constructs PU, FUN, BI1 and BI2 in both groups and both versions (gamified (G) and not gamified (O)). All 16 were between 0.775 and 0.945 and showed a high reliability (see Table 1).

**Within-subject analysis**

Figure 5 visualizes a descriptive analysis of the individual answers to the two LIM versions (G and O). Comparing the BI1 and BI2 item sums of each participant showed that both kinds of usage intention were higher in both groups with gamification than in the group without gamification. We used non-parametric tests because the application of Kolmogorov-Smirnov-Tests showed that it is possible that BI1(G) (p=0.045) and PU(O) (p=0.046) are not normal distributed. For this reason, we verified our hypotheses 1 and 2 by using Wilcoxon signed-rank tests. The analysis shows that the intention to use the LIM (BI1) and the long-term and regularly use of the LIM and the LIM-Community (BI2) is with gamification significantly higher than without. These results support our hypotheses 1 and 2.
Furthermore it was shown that also perceived fun is with gamification significantly higher (see Table 2).

Table 2. Results of the within-subject analysis, Wilcoxon signed-rank test

<table>
<thead>
<tr>
<th>Comparison</th>
<th>N</th>
<th>Sum of ranks</th>
<th>p (one-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PU G - O</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative ranks</td>
<td>17</td>
<td>478.00</td>
<td>0.025*</td>
</tr>
<tr>
<td>Positive ranks</td>
<td>35</td>
<td>900.00</td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FUN G - O</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative ranks</td>
<td>12</td>
<td>298.50</td>
<td>0.00**</td>
</tr>
<tr>
<td>Positive ranks</td>
<td>46</td>
<td>1412.50</td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BI1 G - O</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative ranks</td>
<td>10</td>
<td>280.00</td>
<td>0.00**</td>
</tr>
</tbody>
</table>
The within-subject analysis is based on the individual comparison of both versions of the LIM. With the between-subject analysis we tried to determine whether the results are comparable, even if the participants only know one alternative. A tendency for the gamified version was also recognized in this analysis, in which we examined only the independent first answers in each group i.e. the answers to the not gamified version (O) in G1 and the answers to the gamified one (G) in G2. The intention to use the LIM (BI1 & BI2) was with gamification higher than without gamification (Figure 6). However, our hypotheses could not be verified with tests due to the small sample in the between-subject observation.
Correlation analysis

To test H3, Spearman's rank correlation coefficients for FUN, BI1, BI2 and PU were calculated (see Table 3). All group-spanning correlation coefficients were one-tailed positive significant at $\alpha=0.001$ (with Bonferroni correction). The results show a positive correlation between FUN and BI1 & BI2 in both cases. It can be concluded that perceived fun during the usage (FUN) may have a positive impact on the usage intention (BI) of QS applications like the LIM - in general (BI1) higher than in long term (BI2). This finding supports our third hypothesis and compared with the results from the within-subject analysis, it can be said that gamification can increase perceived fun (see Table 2), which have a direct influence on the intention to use an application like the LIM.

Additionally, the correlations show that also PU may have a positive significant impact on BI with higher correlation coefficients than between FUN and BI (see Table 3). These findings follow the results of Igbaria et al. (1994), who measured a stronger influence of PU on BI compared to FUN on BI.
Table 3. Group-spanning Spearman-Rho correlations between FUN, PU, BI1 and BI2.

<table>
<thead>
<tr>
<th></th>
<th>with gamification</th>
<th>group-spanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sums of BI1 BI2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FUN correlation coefficient</td>
<td>.691***</td>
<td>.561***</td>
</tr>
<tr>
<td>PU correlation coefficient</td>
<td>.743***</td>
<td>.679***</td>
</tr>
</tbody>
</table>

|                          | without gamification | group-spanning |
|--------------------------|                       |                |
| Sums of BI1 BI2          |                       |                |
| FUN correlation coefficient | .732***         | .572***        |
| PU correlation coefficient | .773***         | .569***        |

*** p < 0.001 (with Bonferroni correction). (N=70)

In addition to the analysis presented above, we conducted a group-spanning comparison of the individual responses. This analysis yielded that 62 out of 70 participants (88.57%) are willing to test the LIM (independent from gamification) and 64.14% (47 out of 70) recognized clear benefits in using the LIM at study or work. Additionally, 45 out of 70 (64.28%) replied to the question ‘If you would use the Meter in a lecture once a week, how often would you login into the LIM-Community’ that they would login once a week or more frequently.

**Conclusion**

In this study, we showed that gamification can increase the motivation to use QS applications, like the LIM, to collect personal data about the own learning and improve the learning process. The hypotheses H1-H3 were supported by the statistical analysis of the experimental results. The general as well as the long-term intention to use the LIM were with
gamification higher than without. According to Fishbein & Ajzen (1975) and Davis (1989) it can be argued that these intentions have a direct impact on the actual usage. Further, it could be shown that perceived fun has a positive effect on the motivation to use the examined PLE. Together with the finding that perceived fun is with gamification higher than without, we can conclude that gamification can increase the motivation for using the examined application.

Considering the gamification findings and the result that nearly 2/3 of the respondents see clear benefits in using the LIM to improve their personal learning process, gamification seems to be an appropriate enabler to engage people in using QS approaches as PLEs for improving their learning experiences.

Regarding the limitations of this work, the sample size was insufficient to validate the hypothesis with a between-subject test. However, meaningful tendency for gamification was indicated between-subject and the performed within-subject analysis showed high significant results. Furthermore, the measurement was hypothetical and self-reported. Larger experiments in real settings are planned to validate our results. However, this study provides a first important contribution to the successful use of gamification approaches for improving interaction and supporting individual reflective learning with QS tools as PLEs.

Acknowledgement

The project “MIRROR - Reflective learning at work" is funded under the FP7 of the European Commission (project number 257617).
References


*Academic Exchange Quarterly, 15*(2).


Indianapolis: Wiley Publishing, Inc.


The Mobile as an ad hoc PLE: Learning Serendipitously in Urban Contexts

Ruthi Aladjem
Knowledge Technology Lab at Tel Aviv University

Rafi Nachmias
Full Professor of Science Education and head of the School of Education
Tel Aviv University
Abstract

In this paper we describe results from a pilot study of informal serendipitous learning mediated by mobile technologies, during first visits to cities. Learning interactions were explored with the underlying premise of unveiling potential paths for consolidating discrete learning events into coherent learning experiences. The analysis of learning interactions revealed three themes that are discussed in this paper—the availability theme, the social theme and the awareness theme. We suggest that the mobile device serves as an “ad hoc PLE (Personal Learning Environment)” that offers on-demand support for learners, thus encouraging them to explore the city and to utilize opportunities for learning and interaction, while accommodating their individual needs and preferences.

Background and introduction

Travel situations have long been recognized as holding substantial learning potential (Mitchell, 1998; Falk et al., 2012). In this context, a city may be regarded as an exploration ground; all is new and invites explanation, clarification, and further information. A visit to a new city carries endless learning opportunities, from the local language, the history of the city, its architecture, art, culture and so on. Travellers are often in a state of mind that makes them eager to learn and explore (Mitchell, 1998; Falk et al., 2012) and learning takes an informal, serendipitous nature. By informal learning, we are referring to learning incidents that are not planned nor organized (Kleis et al., 1973); the term serendipitous learning accentuates the incidental and unplanned aspect of informal learning processes, though it does not suggest that learning is random, as it is in fact determined by the learner’s goals, interests, and prior knowledge (Buchem, 2011).
Before the age of smart mobile devices, tour books, tour guides, and paper maps served as the common support tools, for visitors looking to explore and learn more about their travel destinations. Information was thus limited to the scope of the book, preselected by an editor or an expert guide. A chance encounter with a point of interest that was not deemed as significant enough to appear in a tour book might have ended with no further investigation. As a result of the lack of immediate information, the learning interest that was evoked by the point of interest, might not have been fulfilled or further explored. This situation has changed dramatically since the oncoming of the social web and the advent of mobile devices, no longer is there a single source of information or lack of immediate support. The mobile’s perpetual connectivity allows access as well as to information at anytime, anywhere, and on any topic of interest, as well as active contribution (Jenkins et al., 2006; Kress & Pachler, 2007; Scardamalia & Bereiter, 2006). Furthermore, the mobile device has become one with the learner, carried everywhere at all times, holding vast potential for supporting learning in authentic settings and contexts. Learners are free to follow their personal interests, to define their own learning goals and to engage in active, collaborative, learning processes among learners with shared interests (Dieterle, Dede, & Schrier, 2007; Laurillard, 2007; Sharples, Taylor, & Vavoula, 2007).

The notion of a Personal Learning Environment (PLE) has been described from multiple perspectives with varying definitions and design directions (Henri & Charlier, 2010; Zhou, 2013). Adhering to a view of a PLE as an approach to the use of technologies, that is “comprised of all the different tools we use in our everyday life for learning” (Attwell, 2007), we suggest a view of mobile devices as potential ad hoc PLEs for travel situations; comprised of tools selected by learners according to their context dependent learning needs, as they arise in real time. Mobile services and technologies such as navigation tools, social networks and
location-based applications, although not created specifically for learning purposes, may allow learners to engage in knowledge interactions through activities such as sharing, searching and reflection. By selecting applications that support their personal, context dependent needs as they emerge in real time, learners may potentially turn a city visit into a personal, active, and collaborative learning experience.

Following, we will describe the research approach of our pilot study, aiming at identifying and analysing informal serendipitous learning processes during urban explorations, supported by mobile devices. We will than present the main findings and discuss possible implications.

Research approach

The pilot study was conducted as part of a PhD research, aimed at identifying and analysing key factors that play a significant role in incidental, serendipitous learning processes, supported by mobile technologies. The pilot takes a qualitative, learner-centred, approach that includes in-depth interviews with 10 early adopters of technology, who own a smart mobile device. Early adopters are often characterized with such personality traits as personal innovativeness, active information seeking, and intrinsic motivation for exploration (Agarwal & Prasad, 1998; Straub, 2009). These characteristics seem congruent with desirable qualities of 21st century learners and with the socio-constructivist ideal of an active learner involved in constructing knowledge while interacting with a community in authentic settings (Sharples, Taylor & Vavoula, 2007; Wenger, 1998). For the purpose of this study, any knowledge interaction that occurs outside of a formal learning environment is considered an informal learning incident (Kleis et al., 1973; Livingstone, 1999). The research questions focused on the ways in which mobile tools and applications are being used in order to construct knowledge in authentic settings (the city). The analysis of learning interactions also
considered the learning needs that emerged during the visit, the tools and applications that were used in order to support those needs, the types of learning activities (for example, “push” contributions or “pull” requests) and the contexts in which the activities took place.

Results

All subjects owned a smart mobile device (six subjects owned an iOS device and four owned an Android device). Subjects gave a detailed description of up to three recent visits that they had made to new cities (i.e., cities that they had not visited before), bringing the number of cities visited to a total of 21. All subjects reported that they had chosen to use their mobile device as the sole tool for support and communication during their visit; no additional artefacts (such as a paper map, a tour book, or a tour guide) were used.

During their visit, subjects were continually engaged with their personal mobile environment, using versatile mobile applications; different applications were selected alternately to support different needs. It is beyond the scope of this paper to discuss all applications in detail, but they included: location-based navigation and information services (such as Google Maps, Yelp, TripAdvisor, Foursquare, Browser Search), social interaction tools (such as Facebook, Twitter, Google Talk), tools for real time documentation (such as Instagram, flickr, Evernote), real time scheduling services (such as bus and subway schedules), and translation tools (such as Google Translate, iTranslate). It was found that the tool selection was not necessarily based on the technical features that the applications offered but was context dependent; different applications often carried similar features (for example, both Facebook and Foursquare have location-based features and support “check-ins”) but were used in different contexts and situations for different purposes. The determining factor seemed to be the way in which subjects interpreted the main purpose of the application and what they had felt would best suit their needs (for example, checking in on Facebook was described as an effective
means for sharing with friends back home while checking in on Foursquare was often done for pertinent purposes such as seeing if there were other users at the current location and initiating new encounters).

Three major themes emerged from the analysis of learning interactions: the availability theme, the social theme, and the awareness theme. A description of each theme follows.

**The availability theme**

Walking around the city carrying a mobile device means that one is perpetually connected. Subjects had mentioned that the fact that information and communication are readily available and only a click away, affected their behaviours and decision-making processes. This seems, first and foremost, to have affected their personal sense of control over their environment. For example, one subject mentioned that “just knowing that I could not really get lost, allowed me to get lost in the streets, wandering aimlessly without a worry and just looking around. “

Availability also affected the perception of the need to plan ahead; most subjects reported that they preplanned almost nothing for their trip because they knew that they would have their mobile with them. Only one subject stated that he regularly prepares a list of locations to visit; based on prior research and recommendations, he places the list on a mobile map that he uses to navigate in the city. However, he also noted, “If the applications worked perfectly, all the items on my list would appear on them anyway and this might have been redundant.”

Availability also allowed subjects to make decisions in real time; in several cases, subjects received recommendations for nearby locations from friends who realized that they were nearby (as they saw their check-ins). In one instance, a subject checked in while in the north of Paris and a friend commented that he must visit the famous Père Lachaise cemetery; this
visit later led to a college project on Oscar Wilde (who is buried at the cemetery) that was based on the information collected and shared during this unplanned encounter.

Finally, availability allowed for benefiting from location-based services and for the ability to learn in context. In fact, context was often the trigger for learning interaction, as one subject mentioned, “If I come across anything that seems interesting, I immediately look for more information by searching, posting a question on Twitter or simply by photographing, tagging and sharing.” Lack of an available connection and the high cost of mobile internet were mentioned as a major issue. Having an internet (Wi-Fi) connection was mentioned in the interviews as a basic and critical need; as one subject mentioned, "I am lost without my mobile and it must be connected all the time- I can’t imagine my world without it”.

The social theme

The ability to stay in touch with one’s close social group (friends and family) as well as to be able to receive information from and contribute to a larger community, were mentioned throughout the interviews. Subjects had reported versatile ways and contexts in which they chose to use the social features available in different mobile applications. Subjects, especially if traveling alone, kept a continuous communication with their close social circle; sharing and receiving feedback. This contributed to a feeling of a shared learning experience; as one subject noted, she felt as if “my friends were taking part in my expedition, even if they were not technically there.”

The ability to benefit from social support formed on the basis of context or need was also mentioned; subjects regularly used location-based applications that are based on community contribution such as Yelp or Foursquare, to receive information on discoveries that they had
reached. Sharing, sometimes led to unexpected discoveries; for example, “I posted a picture of a café and a friend told me that an art gallery next door was just opening an exhibition.” Finally, though sharing was usually done in real time, social activity allowed subjects to return, virtually, to discoveries that they have shared; subjects also reported that they sometimes accessed previously shared items in order to add titles or insert tags.

The awareness theme

As a result of their intensive use of mobile social tools while exploring the city, subjects become more aware of the reciprocal nature of their activities. Subjects mentioned that they came to realize that their actions had more than a personal meaning and that their activities, such as sharing, contributing information, and answering questions, could affect others. One subject, for example, summed up by saying that “just as I have been depending on the courtesy of strangers so can my actions have meaning to others and not just to my personal group of friends.” Realizing that their activities resonate, affected subjects’ long-term tendency to be actively involved in knowledge contribution after the visit ended.

Another subject said, “I had used foursquare years ago, when it was launched but after a while didn’t really see the point anymore and stopped, after my trip I make a point of using it again as I realize that others will read and benefit from my reviews.”

In summary, it was found that the use of the mobile as an ad hoc personal learning environment has contributed to a shift in the relationship between learners and the object of learning, while exploring the city. The mobile has contributed to an increased sense of control over the surroundings and allowed for true immersion with the dynamic city and all that it has to offer. The mobile device also allowed learners to interact with their community, as part of the learning process and had increased their awareness of the fact that their contributions can
resonate and can benefit others, thus encouraging them to engage in knowledge building processes even once their visit was over.

**Discussion and conclusions**

The pilot study illuminates the transformation that mobile technology has brought to the learning experience during visits to a new city. The study also highlights ways in which the mobile device can serve as a dynamic learning environment that is activated and controlled by learners, for exploration and learning. The wide array of tools and applications available to learners, all under the “umbrella” of the mobile device and the choice of this technology as the sole learning environment for exploring the city, suggest that the mobile serves as an on-demand personal learning environment, an ad hoc PLE for the visit. Effectively, learners are taking an active part in designing their PLEs (Henri & Charlier, 2010) by selecting and utilizing dynamic components based upon their contextual needs and preferences, as they emerge in real time.

The mobile, serving as an ad hoc PLE, supports a serendipitous learning process. Learners do not need to, and often chooses not to preplan their visit, because of their reliance on the perpetual connection to contextual sources of information and to their own communities. This ad hoc PLE supports dynamic learning processes with extensive opportunities for immediacy that is needed both for the learners’ changing needs as well as due to the city’s static and always changing nature. With no predetermined plan and no expert to lead the way, learners are in control of the learning process; live concerts, parades, traffic jams and essentially everything that happens in the city, is injected, in real time, into the exploration process. Though a single interaction may seem trivial, this ad hoc PLE essentially connects discrete learning interactions onto a comprehensive personal learning experience
(Aladjem & Nachmias, 2011), each interaction may lead to several potential trajectories and a final learning path can only be sketched after the fact. With a feeling of control over their environment, largely due to the availability of resources and the social support received through the mobile PLE, learners are free to fully experience the city without worrying about getting lost. Learners undergo a truly serendipitous and immersive learning experience by engaging in authentic, contextual learning interactions. Personal points of interest that were not likely to appear in an expert tour book, now become meaningful learning activities as they are shared and interacted upon, thus changing the level of granularity of learning and increasing the array of potential learning triggers.

Learners are continually engaged in social collaborative learning activities such as responding to comments, tagging previously shared items or adding titles, these activities lead them to virtually revisit previously shared discoveries and view them through the diversified eyes of the community. Revisiting past learning experiences allow learners to engage in reflective and ultimately more profound learning experiences (Dieterle, Dede & Schrier, 2007; Sharples, Taylor & Vavoula, 2007). Due to their reliance on communal contributions, learners become increasingly aware of the notion that their own activities can hold more than just a personal value, realizing that their contributions resonate and can be of benefit to other learners in a virtual community. It can be said that through their own activities learners come to realize that they are a part of a dynamic collaborative knowledge construction process and that they are not just consumers of knowledge, but are also assigning meaning, sharing with the virtual community and changing the balance between contribution and receipt of information (Kress & Pachler, 2007; Scardamalia & Bereiter, 2006).
In conclusion, a visit to a new city is a highly intensive and condensed exploratory experience that may serve as a microcosms and a reference point for demonstrating the potential of the mobile as an informal learning tool. The mobile device has transformed the experience of serendipitous urban exploration and the ways in which learners interact with their surroundings and construct knowledge by serving as a powerful ad hoc PLE. Serendipitous learning processes could potentially be directed, with the support of the mobile PLE, to revolve around disciplines and areas that are relevant not only to informal, but also to formal learning objectives (such a History or Language Studies). Finally, when considering the city of the future we envision a city visit as a truly personalized learning experience, we believe that urban planners and stakeholders should consider the need to cater for “mobile tourism” not only by making sure that an internet connection (WiFi) is freely available everywhere but mostly by planning mobile services that take into account and accommodate the personal needs of visitors interested in exploring and learning about the city.
References


Buchem, I. (2011). Serendipitous learning: Recognizing and fostering the potential of microblogging. Form@ re-Open Journal per la formazione in rete, 11(74), 7-16.


Henri, F., & Charlier, B. (2010). Personal learning environment: A concept, an application, or a self-designed instrument?. In Information Technology Based Higher Education and Training (ITHET), 2010 9th International Conference on (pp. 44-51). IEEE.

MacArthur Foundation. Available at:
mitpress.mit.edu/books/full_pdfs/Confronting_the_Challenges.pdf


An Exploratory Study of the Personal Learning Environments of Security and Investigation Professionals

Antony E. Ratcliffe, M.Ed.
PhD Student, Institute of Learning Innovation
University of Leicester
tony@ratcliffe.ca
Abstract

This paper describes and discusses how security management and investigation professionals use Personal Learning Environments (PLE) for work-related learning and continuing professional development. It is based on an exploratory study, using a qualitative description approach. An online questionnaire was completed by 67 study participants in 17 countries, followed by Voice over Internet Protocol (VOIP) or telephone interviews with 11 of them. The study found that these professionals participate in online discussion groups and access networks and resources. Their collaborative activities in online spaces are limited for reasons that include security, privacy, authenticity of information, and employer restriction concerns. Many therefore may limit opportunities to learn from their local, national, and international peers within PLEs. This also limits discussions of digital literacy skills that might otherwise be expected. Study participants were limited to those who responded to a request for participation posted in online discussion groups. Further research may identify those who are more actively involved in online collaboration and identify reasons for different levels of participation. Presenting case studies of successful collaborative efforts may encourage others in the occupation, enhance continuing professional development, and contribute to the research literature connecting PLEs with careers. This study contributes to the literature on PLEs and digital literacy relating to adults and work-related learning.

Introduction

Many occupations require qualifications or certifications prior to employment. Voluntary, or non-compulsory, certification occurs during the developing career. Employees’ educational studies may be formal, but they develop knowledge through informal learning for certification or overall work-related learning. Away from classrooms, their study may be independent - often in solitude - or it may include collaborative learning with others. Modern
technologies make collaboration much easier, but employees may be missing opportunities to enhance their collaborative informal learning through using online technologies in occupational settings.

This paper describes and discusses how security management and investigation professionals (security professionals) use Personal Learning Environments (PLEs) for work-related learning and continuing professional development. Security professionals are in management, advisory, consultant, and investigative roles with broad responsibilities for the security and risk management of organizations. They meet face-to-face for collaboration and learning activities, and they earn professional designations, often by self-study or with face-to-face study groups. Some security professionals continue university education, often part-time and at a distance. They also participate in work-related online discussion groups (forums). The aim of this exploratory study was to gain an overview of how and the extent to which security professionals use PLEs and what digital literacy skills they need to do so, in advance of a broader study. The study was global because of the international nature of business and security threats: security professionals from around the world join online groups for informal learning.

Related literature

Personal Learning Environments and Personal Learning Networks

Online or blended (classroom and online) programs, both formal and non-formal, may offer online platforms for resource access and discussions, known as Virtual Learning Environments (VLEs) or Learning Management Systems (LMSs) (Wilson et al., 2006). An alternative approach for open and informal learning is the PLE. The PLE may include a structured VLE or LMS, but the PLE extends much further. The PLE may be described as a concept (Attwell, 2006, 2007), considering “a PLE is comprised of all the different tools we
use in our everyday life for learning” (Attwell, 2007, p. 4). Conole, de Laat, Dillon, and Darby (2006) studied what higher education learners are using and how. Referencing this study, Sclater (2008) stated, “there is strong evidence that students now see the personal computer as their primary learning tool, and this can be regarded as a de facto PLE” (p. 5). In addition to the personal use, institutions may offer PLEs they develop to support formal learning (Salinas, Marin, & Escandell, 2011; Sclater, 2010) and commercialization occurs with the development for educational institutions and business organizations.

At the end of the 2006 Association of Learning Technologies conference, at Edinburgh, United Kingdom, there was no definitive position on what the PLE was (Attwell, 2007). A review of the literature by Fiedler and Väljataga (2010) revealed that even those espousing the PLE as a concept or approach were still treating it as a technology. More recently, Buchem, Attwell, and Torres (2011) analyzed in excess of 100 publications through an activity theory lens, identifying that there are “different conceptualisations of PLEs” (p. 3) and that “the majority of publications come from Higher Education” (p. 15). It may be difficult to separate the thinking of the PLE as an approach to learning from the visualization of how a PLE might look. Either way, a PLE “offers a portal to the world” (Downes, 2006) with access to people and resources. Whether the PLE is a theory or concept, or a set of technological tools, there are places where the learners meet. According to Gee (2004), “an affinity space is a place or set of places where people can affiliate with others based primarily on shared activities, interests, and goals, not shared race, class, culture, ethnicity, or gender” (p. 73). Jones and Hafner (2012) extended the term to “globalized online affinity spaces, where people can meet, interact, and build relationships and communities” (p. 115).

When learners come together, in person or online, they may be building a community of practice (Wenger, 1998). A community of practice forms with three essential elements:
domain, community, and practice (van Harmelen, 2008; Wenger, 2006). This acknowledges
that members are actively practicing in relation to a domain while working together as a
community. In contrast, an online discussion group (or meeting in person) may include those
who join but do not actively participate. Those on the periphery might not be recognized as
active members of a community, but they could be in the early stage of legitimate peripheral
participation (Lave & Wenger, 1991). According to Lave and Wenger, legitimate peripheral
participation is the process by which a new learner will join a community of practice and
develop knowledge toward “full participation in the sociocultural practices of a community”
(Lave & Wenger, 1991, p. 29). However, the mere presence of a discussion group may not
meet the criteria to be a community of practice.

The research literature covers the PLE, but there is much less written about an
associated term, Personal Learning Network (PLN) (Couros, 2010). Couros’s (2010) research
relating to “the networked teacher” as a PLE (p. 124) led him to state, “My PLN definition is
simple: personal learning networks are the sum of all social capital and connections that
result in the development and facilitation of a personal learning environment” (p. 125).
Although the literature is not definitive about the relationship of the PLE to the PLN, the
view in this study is that the PLN and personal web tools are components of the PLE, as
illustrated by Wheeler (2010). Further, the current study adopts the view of the PLE as a
concept, as previously attributed to Attwell (2007), above.

**PLE and work-based learning**

The study developed from an interest in how online communities, networks, and other
resources are used to support work-related learning and continuing professional development.
It sought to find evidence of PLEs and to identify the digital literacy skills presented in these
environments. The learning investigated was informal, considered by Hager and Halliday
(2006) as that which is not formal, taking place beyond a formal structure, unintentionally or planned. The learning could also be to supplement that of a formal learning situation offering, “specified curriculum, taught by a designated teacher, with the extent of the learning attained by individual learners being assessed and certified” (Hager & Halliday, 2006, p. 29). Further, and likely related to workplace training sessions, informal learning could support non-formal learning that is defined as “non-credentialised but still institutionally-based and structured” (Selwyn, Gorard, & Furlong, 2006, p. 7).

Younger workers are not necessarily more technologically inclined and higher users of a PLE. In one study, Attwell (2007) found that older workers made greater use of technologies. He speculated that it might be attributed to their responsibility level, access, and flexibility in their work. Attwell identified the potential uses of PLEs for continuing professional development, for sharing knowledge in organizations, and for training and development. He saw an opportunity for the PLE concept to be introduced in schools and used in relation to work and lifelong learning. Recently, researchers considered the competences of university students in two European countries and concluded that “students do not possess all needed technical, functional and social competences for self-organization, self-learning and self-cognition” (Ivanova & Chatti, 2011). This suggests that current workers and new entrants to the workforce may lack the necessary skills to establish and maintain a PLE. A discussion of digital literacy skills follows.

Adult learners participated in this research study. In andragogical theory, adults are responsible for their own learning (Knowles, Holton III, & Swanson, 2011). Researchers such as Brookfield (1984, 1986) and Candy (1991) addressed self-directed learning and the PLE may be suited to support this kind of learning, whether it be informal or formal.
Digital Literacy and PLEs

An extensive review of the research literature on PLEs revealed that “only a few publications discuss what skills, abilities or competencies are necessary for developing and using a PLE (e.g. Wild et al. 2009)” (Buchem, Attwell, & Torres, 2011, p. 14). Digital literacy skills, or digital literacies, are the skills that may be required by security professionals in an online environment. The research literature contains numerous related terms, sometimes used interchangeably, including digital literacies, digital literacy, and new media literacies (Coiro, Knobel, Lankshear, & Leu, 2008; Livingstone, Van Couvering, & Thumin, 2008). Digital literacy skills may be considered under several frameworks. Gilster (1997) provided an early definition of digital literacy:

“the ability to access networked computer resources and use them..., the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers.” (Gilster, 1997, p. 1)

According to Gilster (1997), literacy means much more than just reading, and he identified key competencies for digital literacy: “the ability to make informed judgments about what you find on-line..., critical thinking”; the ability to read and move around using hypertext and hyperlinks; and “developing search skills” (pp. 2-3). Gilster pointed out that the Internet provides new ways of dealing with media (p. 34).

One digital literacy framework (referred to as media literacy) is that of Jenkins, Clinton, Purushotma, Robison, and Weigel (2006) with 11 literacies: play, performance, stimulation, appropriation, multitasking, distributed cognition, collective intelligence, judgment, transmedia navigation, networking, and negotiation. These were found to be too
detailed for the level of activity identified in this study. Rather, more adaptable to the study, Jones and Hafner (2012) discussed practices that can be expected in the digital world: “online gaming, social networking, peer production and collaboration, and practices involving digital media in the workplace” (p. 14). They described literacies as

“the ability to creatively engage in particular social practices, to assume appropriate social identities, and to form or maintain various social relationships”

(Jones and Hafner, 2012, p. 12)

Jones and Hafner (2012) identified that learning occurs within gaming and the associated online affinity spaces. They referred to 3-D virtual worlds, with Second Life as an example. While not a game in the same way as video games, virtual worlds provide opportunities for in occupational learning. Business case studies presented by Knapp and O'Driscoll (2010) included one that may have appeal for security professionals. “Virtual Border Service Officer Training” used Second Life in an educational setting to role-play border crossing interviews with travelers entering Canada (Jones & Hafner, 2012, pp. 158-173). The term ‘digital’ pertains to the tools being used. Social networking “has given internet users the ability to create the connections between the content based on social relationships” (Jones & Hafner, 2012, p. 144). Haffner and Jones explain that “ordinary users of the internet” are able to make connections between people and the content that has been created online.

Digital Literacy and Security Professionals

As security professionals find or create information of interest, it can easily be shared with others. By its nature, social networking is often open and not anonymous, allowing the
participant to be identified and establish credibility. Jones and Hafner (2012) addressed privacy and not maintaining the anonymity that the Internet can otherwise provide. However, as discussed later in this paper, the study reveals that there are individuals who would prefer not to share their views openly. Not sharing may impact the attitude toward, and development of, digital literacy practices.

The skills of collaboration and peer production extend the ability of individuals to co-produce globally with colleagues. Through social networking technologies, the feeling of remoteness can be reduced (Jones & Hafner, 2012). As in more traditional groups, not all will want to participate equally, due to a lack of interest and/or skills. Jones and Hafner (2012) described benefits and challenges of collaboration and peer production. They defined peer production, or commons-based peer production in full, as “massive numbers of people, who are distributed across the globe and connected to each other by digital networks, work together voluntarily to promote projects that they are interested in” (Jones & Hafner, 2012 p. 158). An example is Wikipedia.

Digital literacies at work pertain to the digital work environment. The Jones and Hafner (2012) framework recognized the information age, the global distribution of work, remote workers, team work models, and the workers who work on contract or encounter frequent job changes. Employers and employees are impacted by the needs and opportunities to adapt that are created.

**Research Questions**

Security professionals could not be expected to know the term, PLE, found in the research literature. It was anticipated that they could describe how they use online communities, tools, resources, and networks for their work-related learning and continuing professional development. It was also anticipated that digital literacy skills and practices
would be identified. Considering the PLE as a concept, the research questions were to
determine how PLEs are being established by security professionals who use online
technologies in ways that support their learning. This included the tools they use, their
networks, how they have developed skills, and whether they are actually taking advantage of
opportunities to learn within a PLE.

Personal observations and knowledge of professional development in a few different
occupations revealed that professional development programs, particularly through self-study,
do not actively support or encourage what would be seen within a PLE. It was also known
that security professionals network in person and online, but the extent of the application of
online activity to learning was open to exploration. The main research question asked was:

*How are security management and investigation professionals using personal learning
  environments (PLEs) and digital literacies for work-related learning and, in particular, for
  continuing professional development?*

The sub questions were:

1. What web-based tools and resources are used as part of the PLE of participants?
2. What are the digital literacy skills required to function within a PLE?
3. How have participants developed digital literacy skills?
4. Are participants contributing within a participatory culture and online affinity spaces?
5. How is continuing professional development within work-related learning settings
   being supported through the use of a PLE?

**Methodological Approach**

The exploratory study occurred from August 19, 2012, until October 19, 2012, in two
phases using an online questionnaire and online interviews. The results were to inform the
research methodology, design, and data collection methods for a subsequent larger study.
Research Design

The design aimed to explore the security management and investigation community, as widely as possible, to identify how security professionals use PLEs and to inform the design of the subsequent study. As a qualitative study, text responses in the questionnaire and semi-structured interview questions sought rich data. It was exploratory, so the qualitative description methodology provided “straight descriptions of phenomena” (Sandelowski, 2000, p. 339).

Requests for participation were posted to 13 online forums (or groups) frequented by security management or investigation professionals globally, 12 on LinkedIn and one on the website of a professional association. LinkedIn is a professional networking, social media site. Members of LinkedIn maintain public profiles and may participate in a wide range of discussion groups. Four of the 13 LinkedIn groups were small and later determined to be inactive.

Online questionnaire

An online questionnaire invited participants to participate in an interview during either the exploratory study reported here or the later study. Thirty-five participants agreed to be interviewed. Purposive sampling selected questionnaire respondents who indicated they had something to share. Small batches of interview requests followed until 10 had been completed. An eleventh participant with limited access to telephone and online communication responded to questions by email. A Canadian service hosted the online questionnaire, and a summary of the research project was posted in online discussion groups to solicit participation in this study. An information sheet and an informed consent form preceded the questions. Questions asked, mapped to the research questions, were as follows:
1. What web-based tools and resources are used as part of the Personal Learning Environment of participants?

- Which devices do you use to access the internet?
- Are there restrictions on any of the software programs or applications you use for learning purposes that makes them inaccessible in your workplace? Please explain.
- Beyond software and applications, are there other restrictions on any of the computers or hardware devices you use that prevent you from using them in your workplace for learning purposes? Please explain.
- How often do you participate in each of these online activities, for personal, professional, or learning related purposes?
- Please describe any other online activities you do for personal, professional, or learning related purposes and/or provide any comments on the above responses.
- Which social media profiles do you maintain for personal and/or professional reasons, and what is your frequency of use?
- Please identify any 'other' from the previous question along with frequency of use.
- How do you use social media in relation to your continuing professional development?
- Do you have a network of contacts not at your office with whom you communicate for work-related learning questions or relating to your continuing professional development?
- Other than face-to-face, how do you connect with your network of contacts when you have questions relating to learning?

2. What are the digital literacy skills required to function within a Personal Learning Environment? and 3. How have participants developed digital literacy skills?

- How comfortable are you with the following activities? (12 items identified)
- Please comment on activities that you do not do or with which you have low comfort. It would be helpful to know your reasons.
- How have you developed your computer skills to their present level?
- When I encounter a challenge with online technologies, I tend to be one who will...
- If being introduced to new online technologies or skills to assist my continuing professional development, I would prefer to experience them...

4. Are participants contributing within a participatory culture and online affinity spaces?

- Are you involved in an online mentoring relationship?
- What are the online tools and technologies that you use for the mentoring activity?
- Do you participate in collaborative problem-solving other than working face-to-face?
- How do you use technology to participate in collaborative problem solving?
- Can you think of something you have created in an online environment for sharing with others?
- If you answered 'yes' to the previous question, what did you create?

5. How is continuing professional development within work-related learning settings being supported through the use of a Personal Learning Environment?

- Can you give an example(s) of how your learning has been assisted through online technology that would not have otherwise been possible or as effective? Please describe.

**Online interviews**

Personal interviews were conducted using Skype, a Voice Over Internet Protocol (VOIP). Participants chose videoconference, audio, or to receive a call to their telephone.

With the participant’s consent, each call was recorded by using a Skype add-on tool. A basic thematic analysis aided by a qualitative analysis program followed interview transcription.

The following six guiding questions were asked to further investigate the research questions:

1. How would you describe your work-based learning over the past two years? How has it changed from the past?
2. I’m interested in the tools and technologies you use in relation to work-based learning, informal in particular. How have they changed, and how do you see them changing in the future years?
3. How about your social networks? Can you describe your networks and how they are used for work-based learning? How have they evolved with new technologies?
4. In our digital world, it is easy to create learning resources and share them with others. What stands out that you have seen, whether you used it or not?
5. Again, think of digital resource opportunities, what have you created that has been shared and reused by others?
6. From your perspective, what is really being done well digitally in relation to learning? What remains to be done?
The term ‘work-based learning’ was used during the interviews. However, ‘work-related’ has appeared more appropriate. The explanation given to participants at the time of the interview clarified the focus on learning related to work, whether at a worksite or at another location including traveling.

**Ethical Considerations**

This study was in keeping with the University of Leicester Research Ethics Code of Practice, and the Association of Internet Researchers provides guidance for using online research methods through an email discussion list and an ethics guide (Association of Internet Researchers, 2012; Hooley, Marriott, & Wellens, 2012). Study participants gave informed consent after reading an information sheet as the start of the online questionnaire. The survey software, to support anonymity, did not collect the Internet address of the country of questionnaire access. Participants identified themselves at the end of the questionnaire only if they agreed to a personal interview. They could also email the researcher separately to avoid linking a name to the questionnaire.

**Results**

The exploratory study confirmed the ability to access participants, there is an interest in the research, and there is more to learn that will inform the security management community and academia. This section presents the data obtained during the questionnaire and interview phases.

**Survey results**

The questionnaire asked 22 questions to answer the research questions. Access to the online questionnaire occurred 137 times from August 19, 2012, until September 7, 2012 (20 calendar days). As the first step, 103 individuals acknowledged the informed consent, of which 67 (65%) completed the questionnaire for inclusion in the results. Thirty-five (52%) of
those who completed indicated their willingness to participate in an individual interview during the exploratory study or main study.

Questionnaire participants represented 17 countries (Table 1).

Table 1

*Country of Residence of Questionnaire Participants*

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>United States of America</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Australia</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Bahrain, New Zealand, South</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Africa (2 from each country)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burma, Cambodia, China, France, Hong Kong,</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>India, Baltic States, Mexico, Romania, Russia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1 from each country)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Rounding error of 1%.*

All but one completing the questionnaire identified their ages (Table 2). Only one indicated being below the age of 35 years.
Table 2

Age Range of Questionnaire Participants

<table>
<thead>
<tr>
<th>Age range</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 to 34</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>35 to 44</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>45 to 54</td>
<td>29</td>
<td>43</td>
</tr>
<tr>
<td>55 to 64</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>65+</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Not answered</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. Rounding error of 2%.

The participants were predominantly male (Table 3).

Table 3

Gender of Questionnaire Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Not answered</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Interview results

Ten individual interviews were conducted from October 1 to 19, 2012, and an eleventh participant answered questions by email due to limited availability for telephone or
online conferencing. Interview participants had identified themselves in the online questionnaire. Communications choices involved connecting on Skype with videoconferencing, connecting with just audio, or receiving a telephone call. Four chose to use videoconferencing, but for one a poor connection resulted in a Skype to telephone call instead. Six others received Skype to telephone calls. All 10 participants provided permission to record the interviews. The 10 interviews ranged in length from 21 to 78 minutes, with participants from Canada (60%, n=6), the UK (20%, n=2), South Africa (10%, n=1), and Baltic States (10%, n=1). The email interview involved a USA professional.

Data analysis

In this exploratory study, two major themes emerged: online activities and online challenges. The activities are what security professionals do and how they do it. The challenges encompass what they do not do and why they do not do it. Some coding was required to sort the data, so this was accomplished using NVivo for qualitative data analysis. The coding was kept broad to avoid “premature coding and sorting [which] are serious threats to analysis when researchers abdicate their full responsibility” (Thorne, 2008, p. 144).

Online activities

Most participants responded to researcher requests in LinkedIn discussion group messages. While 67% read discussion messages regularly, only 13% responded to messages regularly. The other choices were ‘infrequently,’ ‘tried it but stopped,’ or ‘never.’ Questionnaire participants responded about their involvement with specific online activities. The percentage represents those who do the activity regularly:

- Starting discussion topics by linking to an article, story, etc. (15%)
- Writing blog posts (7%)
- Posting updates on Twitter, Facebook, or other social media (29%)
- Gaming such as World of Warcraft (3%)
- Activities in a virtual world, such as Second Life (1%)
Participants completing the questionnaire identified other online activities with which they are involved:

- Email
- Work related research
- Course work including research, online study portals, podcasts, course discussion boards
- Online training programs for software and products
- Skype for overseas contacts
- Webinars, webcasts, and podcasts
- Virtual conferences
- YouTube for research including conferences and speakers
- Educational programming from Khan Academy and iTunesU
- News from local, national, and international sources
- Reading
- Restricted professional discussion groups or sites
- Internet communities, including Reddit.com
- Language learning
- Completing professional certifications
- Mentoring
- Solving client problems beyond own experience
- Sharing organization knowledge with the public
- Maintaining currency in relation to industry trends
- Relationships with learners when teaching within online course platform
- Finding hard copy text books to order, preferring over e-books

Interview participants added the following online activities:

- Presentations from BrightTALK and TED Talks
- Global communication
- Making learning continuous, even after the course ends
- Accessing the opinions of many people, from different sides of an issue
- Course learning from anywhere
- Email distribution lists, as frequent as several times daily
- Using videos from YouTube when teaching a subject area in which instructor does not have expertise
- Text alerts of major happenings before the news

The questionnaire and interviews explored what participants had created and shared. Responses included preparing materials for courses and workshops and sharing them online.
Participants mentioned developing websites (for internal use by their organization and for public consumption), databases, and a Wiki (an online document that can be edited by others). Some wrote papers, articles, and blog posts.

Participation on LinkedIn was the most prominent online activity to consume information and connect with industry colleagues. Email (97%) and telephone (81%) are the most prominent methods of contact with colleagues and others. The preference for email allows messages to be selectively and easily sent to a large number. Privacy of the communication was a concern. Sending by email avoids others knowing about the nature of the enquiry when not appropriate, rather than asking within discussions groups. One security manager commented on networks for learning:

“Professional network sites like LinkedIn provide great opportunities for learning whether through posting links to articles, requesting assistance with research, or generating discussions. It makes it much easier to get a variety of perspectives and find out the differences and similarities in performing security work in different industries as well as different countries. Technology has evolved to the point where we can carry on real-time conversations with professionals in other time zones and can get immediate assistance as situations unfold instead of having to wait for “normal business hours” and adjust for time differences. Security never operates solely on normal business hours.”

Security manager, USA

**Online challenges**

The second theme was the challenges of online activities. This section covers security professionals’ decisions to avoid or minimize activities. It also includes restrictions placed upon security professionals in the workplace. A small number saw no need for online
activities. Their comments included satisfaction with current methods, no need for online activities to develop a network, and no need for immediate information feeds. Online activities were a waste of time for some due to being of limited value and because of the amount of ‘noise’ created. One participant made the following comment and highlighted the fear of employer criticism:

“I find that the forums are generally limited to people who are out of work and consultants who only speak for themselves, and people from large organizations don't necessarily participate because they don't feel that they are only speaking for themself, they don't want to be accountable for the things they are saying in those forums. But other than that, I really enjoy them, and for that reason I don't participate. I don't need my human resource department calling me about something I put online.”

Security manager, Canada

Having limited time was a reason for reduced online activities. One participant stated that it was important for something to catch his attention and motivate immediate action. Another was attracted to activities that involved connecting with someone in a “leadership role.” One participant expressed a lack of knowledge of what is available online, being only aware of webinars. Other comments included:

- “‘entertainment’ social media…a waste of time”
- “I don’t tweet, I think it’s idiotic frankly.”
- “I dislike social media.”
- “I think blogs are a waste of time: reading about some idiot and what he had for breakfast: nobody cares.”
- “I don't care about somebody's personal opinion on something. Like to me it ranks up there with blogging as a complete waste of time.”
- “Pre-recorded content webinars, I think are disastrous.”
One participant observed: “Formal society groupings (corporations, governments, universities) have not fully grasped the big change in distributive, collaborative learning and how that will affect people in everyday real world.” Another participant mentioned that social media are banned at work for productivity-related reasons. Another participant said that excessive personal use would result in a discussion with the employee about the use.

Employer or other workplace restrictions were numerous. They included the following:

- rules against non-business use
- prohibitions against downloads or the use of external and devices
- emergency only use of the internet on mobile devices
- restrictions to some websites and applications
- special permissions required
- personal devices not allowed
- firewalls, outdated technologies, and compatibility issues not allowing access
- equipment such as a webcam not provided

Some participant and employer concerns related to security and sensitive activities.

Concern about computer hacking and espionage encouraged the use of internal resources and prohibited USB devices in one company. Another participant spoke of vulnerability if able to access computers and turn on the camera remotely. There is concern about data remaining in existence and who might have unintended access to it. Identity theft is feared. Authenticity is also a concern. Before relying on information found on the Internet, participants wanted to validate the source. This was not always easy to do. A concern related to someone publishing online using the identity of another. One participant suggested that a reputable organization should verify the credibility of what might be course offerings. Another participant was confident with his personal ability to identify suspicious material but added he could not be certain. These challenges appear to be beyond those strictly related to learning, but they may impact opportunities to access online communities, resources, and networks.
Discussion

The main research question asked, “How are security management and investigation professionals using PLEs and digital literacies for work-related learning and, in particular, for continuing professional development?” This question presumed that research study participants used PLEs and would demonstrate digital literacy skills, particularly since they were primarily recruited online. The research study questionnaire and individual interviews revealed a limited range of online learning activities, but the data provided a start at understanding why such activities might be limited or focused in online discussion groups.

Sub question 1 asked, “What web-based tools and resources are used as part of the PLE of participants?” There were no surprises; they use computers and mobile devices for Internet access, email, and telephone calls. Sub question 2 was, “What are the digital literacy skills required to function within a PLE?” The research literature answers this and provides skill frameworks. The study yielded limited finding of such skills, as participant activities were often limited to reading rather than identifying examples of activities such as peer production, collaboration, and gaming.

Sub question 3 enquired, “How have participants developed digital literacy skills?” They identified that they developed their skills attending courses, getting help from friends, family, and work colleagues, searching the World Wide Web, reading, exploring, and experimenting. There appears to be no lack of ability with the presence of willingness and support. Confidence was present: participants felt able to learn whatever was required in the ability to learn whatever is required for operating proprietary systems and following protocols. There was very little interest in gaming and virtual worlds, though one participant raised them as essential for teaching certain skills.
Sub question 4 was, “Are participants contributing within a participatory culture and online affinity spaces?” They appear to be online, but for many the level of activity is low. While SMIPs read and respond to discussion messages, and they might start discussions, many contribute infrequently. They are more likely to be consumers of information rather than producers or co-producers. Two participants expressed a preference for seeing the work of organizations and ‘thought leaders’ with noted expertise.

Sub question 5 asked, “How is continuing professional development within work-related learning settings being supported through the use of a PLE?” Discussion groups and various online resources were sought when information needs arose. Some SMIPs did contribute resources for others, but a primary activity was consuming the available information. This suggests a different approach may be needed in the main study to identify possible examples of those creating and sharing content.

Prominent themes were security, privacy, and authenticity concerns in addition to not seeing a need for online activities, having a lack of interest, and having no time. These concerns are personal for many, but employers often have equipment, software, and access restrictions. Security threats are an ongoing concern. Daly (2013) explained that the very act of sharing socially is what can expose an individual to threat, such as providing personal information that could be used to create a security breach. These threats can indirectly result in a minimized use of online resources if the general use of computers and other devices is curtailed.

Despite the factors described that limited the activities, 67 participants provided data relating to their online activities. Online communities, tools, networks, and other resources are used for purposes of work-related learning and continuing professional development. A high use of the telephone and email may represent collaboration occurring in non-public
spaces with 2 or more participants; however, the reported use of discussion groups demonstrates a lot of reading of the news and information posted by others.

Conclusion

This was an exploratory study of how security professionals are using their PLEs and digital literacy skills for work-related learning and continuing professional development. It was global and involved a total of 67 study participants from 17 countries. All completed an online questionnaire, and 10 participated in individual interviews, online or by telephone. An eleventh study participant provided input by email.

In the questionnaire, study participants provided information that included devices they use, their technological skills, online activities, networks, collaboration, and learning. Those interviewed were asked more about their learning, tools and technologies, social networks, learning resources, and digital literacy practices. The participants, as security professionals, clearly accessed discussion groups and other resources for information to keep up in the industry or to answer questions that arise. Some create information for others, including linking to news stories and the blog post of themselves and others. Collaboration also takes place in private settings with the more traditional technologies of telephone and email. Some participants expressed their reluctance and caution when sharing in online spaces. More study participants could be seen to be consumers and users of information rather than creators. The data did not provide a lot of examples of security professionals contributing within the participatory environment. This might be attributed to many security professionals being in the early stage of legitimate peripheral participation, which may lead to greater participation as knowledge and comfort increases. At that time, examples of digital literacy practices may be more evident. This may provide examples to encourage other professionals to participate in the sharing of their knowledge while learning from others.
Future research

A subsequent and larger study (in progress) commenced with observations in online communities, followed by interviews with security professionals to more closely examine how online communities are used for work-related learning and professional development. Security professionals often work within environments with practices influenced by global events. The need to share and collaborate for work-related learning and continuing professional development is not expected to lessen. Observations, discussion, and interpretation may lead to a better understanding of their online communities and uses of networks and resources in the security management and investigation fields. There is much to be understood in this area of research, particularly beyond higher education settings and related to the workplace.

Acknowledgement

The assistance of Professor David Hawkridge, visiting Professor at the Institute of Learning Innovation, is appreciated for his editorial review and valued guidance.
References


Connected Older Adults: Conceptualising their Digital Participation

Linda De George-Walker
Central Queensland University
School of Human, Health and Social Sciences, Bundaberg, Australia
Email: l.degeorge-walker@cqu.edu.au

Mark A. Tyler
Griffith University
School of Education and Professional Studies, Brisbane, Australia
Adult and Vocational Education
Email: m.tyler@griffith.edu.au
Abstract

Older adults’ experience of the digital divide is apparent and under explored. This paper presents a model for conceptualising older adults’ digital participation by positioning self-efficacy theory, digital competence and personal learning environments together. In proposing the model we seek to illuminate a pathway toward digital participation for older adults that is afforded by developing digital self-efficacy. Following the overview of our model, we exemplify our steps towards a research agenda that seeks to examine this model by outlining the current study we are undertaking.

Introduction

As adults move toward their latter years, they may experience acute complications in the process of ageing well: existing with a reduced income, health issues, and social dislocation due to no longer holding economic and socially valued roles. There has been some evidence to suggest that digital technologies have the potential to improve opportunities for older adults to socialise, access services and learning, and in turn improve their quality of life and enhance social capital; moreover some of the fastest growth in uptake of technology is occurring in older adult cohorts (Cotton, Ford, Ford, & Hale, 2012; Warburton, Cowan, & Bathgate, 2013). Yet, these benefits may be accruing for relatively few older adults as the digital divide fails to narrow to any significant degree with older adults continuing to experience lower levels of digital technology use compared to younger people, and with apparent group differences in technology use within older adulthood (Warburton et al., 2013; White & Selwyn, 2012). If, however, we wish to capitalise on the potential for older adults in an ageing population to “contribute to the re-forming of society” (Martin, 2009, p. 3) and for digital technologies to improve the health and wellbeing of individuals and communities, it is imperative that we seek to more fully understand what influences older adults’ digital
participation, including issues associated with the heterogeneity of older adulthood and technology access, but also choice and motivation.

With this in mind, our challenge in this paper is to map a model that signposts a path towards examination of ageing adults as they navigate the digital era (Figure 1). Our conceptualisation has its basis in Bandura’s (1997) self-efficacy theory, a motivational construct in the social cognitive tradition. Over the past decade, self-efficacy has appeared as a variable of interest alongside others for explaining older adults’ digital technology use, but to the best of the authors’ knowledge no self-efficacy framework integrating Personal Learning Environments (PLEs) and digital competence has been adopted to explain older adults’ digital participation. In the paper, we first present an overview of self-efficacy theory and its association with older adults’ digital participation. We then chart a path towards exploring how digital competences and PLEs might afford digital self-efficacy and digital participation and promote social connectedness, identity enhancement and the well-being of older adults.
Self-Efficacy Theory and Older Adults Digital Participation

Self-efficacy can be defined as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). Self-efficacy is a belief about capability rather than actual skills, and while both are required for effective functioning, Bandura asserts that self-beliefs are the critical factor for personal agency, the exercise of self-control, and achievement (Bandura, 1997). Certainly, confidence that one can achieve beyond their capability is not likely to make it so, but if individuals do
not believe they have personal capability, they will not attempt to do so irrespective of whether they have the skills. This may well be the case with some older adults as they confront the digital world with studies showing that those older adults with higher technology self-efficacy are more likely to be internet users, engage with Facebook, and adopt computer technology compared to those who feel less confident (e.g. Bell et al., 2013; Czaja et al., 2006; Eastin & LaRose, 2000). The implication is that seeking to develop older adults’ technology-related confidence may prove valuable for cultivating older adults’ digital participation.

Self-efficacy theory also specifies four antecedents or sources that influence self-efficacy judgments: enactive mastery experiences (previous accomplishments); vicarious experiences (observed or modelled experiences); verbal persuasion (verbal or social feedback associated with experience); and physiological and emotional states associated with experience. The self-efficacy judgments arising from these four sources affect goals, persistence, and motivation, which in turn affect behaviour and performance. Self-efficacy is cyclical, incorporating a feedback loop whereby performance and its consequences become new sources of efficacy information. That is, self-efficacy is both a product and a constructor of experiences. According to self-efficacy theory then, older adults’ digital participation may be enhanced by seeking to improve their self-efficacy through the mechanisms associated with the sources of efficacy information. Practically this might be achieved by conceptualising digital technology training and support according to the sources of efficacy information, and although there are studies that have explored the impacts of training and support on older adult’s digital participation (e.g. Russell, 2011) the authors know of no studies to date that have used the sources of efficacy information to guide the design, implementation or evaluation of technology-related learning and support experiences for
older adults. Additional to the sources of efficacy, comparison of one’s personal competence in relation to the task and the nature of the setting also contribute to self-efficacy judgments. Personal competence can be considered as current functioning, which along with analysis of the current context, contributes to self-efficacy judgments that are a prediction of future capability. In the next section we argue that in our integrated self-efficacy model of older adults’ digital participation the concept of personal competence is appropriately conceptualised as digital competences, and that PLEs offer a comprehensive approach to the analysis of contextual aspects that might influence older adults’ digital self-efficacy judgments.

**Integrating Digital Competences, PLEs and Self-Efficacy Theory**

Older adults are reported as having the lowest levels of digital competence of all consumers, this being cited as a key factor for older adults’ low digital participation (Warburton et al., 2013). What is digital competence? A simple search on the Internet and within the academic literature reveals an array of definitions and variations in the use of the term digital competences such as: technological literacy, e-literacy, internet literacy, and digital literacy; and it is often associated with other concepts such as information literacy, media literacy, visual literacy and communication literacy, all of which offer a particular nuanced perspective. Current major projects and models reported in the literature nevertheless tend to be framed in terms of either digital competences or digital literacies. Reviews of current definitions of these terms, two of which are offered below, indicate the concepts of digital competences and digital literacies may be similar in their intention and application:
[Digital competence] “(...) consists in being able to explore and face new technological situations in a flexible way, to analyze, select and critically evaluate data and information, to exploit technological potentials in order to represent and solve problems and build shared and collaborative knowledge, while fostering awareness of one’s own personal responsibilities and the respect of reciprocal rights/obligations.”

Calvani, Cartelli, Fini, & Ranieri, 2008, p. 186

[Digital literacy is] “(...) the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process.”

Martin, 2005, p. 135, DigEulit project

A review of various frameworks and models of digital competences and digital literacy also initially suggest they are interchangeable terms. For example, some models of digital literacy emphasise the notion of multiple digital literacies and refer to a range of technical, cognitive, motor, and socioemotional skill sets required for navigating the digital world. The model of Eshet-Alkalai (2012), for example, refers to six digital literacies: photo-visual (understanding and communicating graphically), reproduction (manipulating digital material to create new and meaningful materials), branching literacy (constructing knowledge from non-linear navigation of hypermedia environments), information literacy (critical consumption of digital information), social-emotional literacy (communicating effectively in online contexts), and real-time thinking (processing and evaluating large volumes of digital information simultaneously). Similarly, several models of digital competence also reflect the
multi-faceted skills needed to engage with the digital world. For example, the European Digital Competence (DIGCOMP) project has identified knowledge, skills and attitude (KAS) competences as necessary to engage with the digital world: information management (identify, locate, access, retrieve, store and organise information), collaboration (link with others, participate in online networks and communities, interact constructively), communication and sharing (communicate through online tools, taking into account privacy, safety and netiquette), creation of content and knowledge (integrate and re-elaborate previous knowledge and content, construct new knowledge), ethics and responsibility (behave in an ethical and responsible way, aware of legal frames), evaluating and problem solving (identify digital needs, solve problems through digital means, assess the information retrieved, and technical operations (use technology and media, perform tasks and through digital tools) (Ferrari, 2012). This model notes that these KAS competences may develop according to levels depending on age, depth of application, or cognitive complexity.

Martin (2009), however, offers a different take on conceptualising digital literacy, modelling it as three levels of engagement with the digital. The first level, digital competence, is according to Martin a precursor of digital literacy, and is the skill and differentiation of skill levels necessary for digital engagement. Similar to the notion of multiple digital competences presented above, Martin suggests that digital competence presents as levels of expertise to be mastered, from the basic to the complex, and includes such activities as finding and retrieving information on the web, using task specific software, generating content for web presentation and the like. At level two, digital usage emphasises the connect between a user (individual, group, or community) and the life situation to which the digital competence is being deployed. Successful doing can result when the user’s digital expertise shapes a unique response to a task or problem (Martin, 2009). In Martin’s model,
digital transformation is the third and final level of digital literacy. This stage is reached when innovation and creativity are used to stimulate change in personal and social circumstances and contexts. Digital usages offer the catalyst and conduit for these changes. When applied to older adults this may mean enabling and maintaining social networks by remaining connected through email, chat room and various instant-messaging opportunities; or challenging the societal perceptions about older adult consumers as they launch themselves into the convenience of online purchasing, participate in online social commentary through social networking sites, or engage in digitally mediated forms of learning. We argue that these transformational consequences of digital usages that shape identities and facilitate social inclusion are the critical aspects that may promote the observed improvements in older adults’ health and wellbeing as a result of digital participation.

What is clear from this review of various definitions, models and frameworks is that digital literacy is more than being technologically savvy; the digitally literate have necessary knowledge, skills and attitudes in information management and communication, as well as being good technical operators. Further, these knowledges, skills and attitudes, although described as digital literacy in some models, may be more appropriately considered as digital competences, themselves only one component of what it means to be digitally literate. We argue that digital competence as a set of knowledge, skills and attitudes, and a sub-component of digital literacy, aligns best with the concept of personal competence in self-efficacy theory and is therefore an antecedent of digital self-efficacy. An increase in digital competence to varying degrees and with consideration of individual capability, circumstance and purpose will feed the self-efficacious position that feeds back into widening and deepening digital participation, a process that offers a cycle of contribution and development particularly into and through Martin’s (2009) usage and transformation levels of digital
literacy. As degrees of self-efficacy increase, an increased motivation is experienced that 
prompts wider and deeper digital participation; and this in turn leads to the creative, 
innovative, and transformative activities that may promote older adults' health and wellbeing.

As indicated in the definitions of digital literacy and competence provided above, and 
as detailed in Martin’s model, digital participation is contextualised by the nature of the task 
to be achieved and the characteristics of the environment. Contextual influences are also 
crucial for self-efficacy judgments. It is here that we argue PLEs offer an opportunity to more 
fully conceptualise these individual and social aspects of context as they apply to digital self-
efficacy and digital participation for older adults. PLEs are fluid and relational learning 
contexts in which individuals are both autonomous and interconnected; they appropriate 
available external (digital and non-digital) and internal tools, methods and resources within 
communities to problem solve, learn and develop (Buchem, Attwell, & Torres, 2011).

While we could not locate studies looking specifically at PLEs and older adults’ 
digital competence, digital participation, or digital self-efficacy, the literature demonstrates 
the importance of the personal and social context for older adults’ digital participation. For 
example, there is evidence that approaches that are agentic and capitalise on the existing 
interests and needs of older adults can motivate digital technology use; and that staying 
connected with family and friends, the accessibility of aged based interest groups or 
intentional communities, the availability of support for technology assistance, less formal 
instructional settings, can influence older adults technology use (Bell et al., 2013; Rees Jones, 
Gilleard, Higgs, & Day, 2011; Kearns, Tyrrell, & Bend, 2002; Selwyn, Gorard, Furlong, & 
Madden, 2003).

Ivanova and Chatti (2011) state that “a PLE can be viewed as a supporting tool for the 

enhancement of the learner’s performance in his or her activities management as well as for
the acquisition of knowledge, skills and expertise (p. 2). Similarly, we model PLEs as personal and social affordances (including, but limited to the notion of “tools”) that along with the sources of efficacy and digital competences can facilitate digital participation through building self-efficacy (Figure 1). Future research will be needed to clarify the key features of older adults PLEs related to their digital participation, and the specific relationships among older adults’ PLEs and the other variables in our model. In the next section of the paper we exemplify how we intend to clarify these proposed relationships by presenting an overview of a research study that we are currently undertaking as part of a larger research agenda that seeks to examine our proposed model of older adults’ digital participation.

**Our Current Research**

Currently we are studying older digital users and non-users (the digital participation dimension of our model – see Figure 1) and the relationship of these positions with their digital self-efficacy (the self-efficacy dimension of our model). We are also examining how digital self-efficacy may develop in older adults by focusing on aspects associated with two other dimensions in our model – these are the personal learning environments dimension and the sources of efficacy dimension. More specifically for personal learning environments, we are investigating technology access, personal utility and social influence. For the sources that are proposed to influence self-efficacy judgments, we are investigating mastery experiences, in particular previous success with digital technologies. Digital anxiety is an example of the physiological and affective source that we are focusing on.

More broadly in our research we are interested in examining the various specific paths of influence to digital participation and wellbeing suggested in our model. Importantly, we
wish to create opportunities for older adults to voice their digital experiences, this we envisage will alert to the range of influences on digital participation that are not necessarily reflected in our model presently. This will necessitate that our methodologies are flexible as demonstrated in our current study where we are using a parallel or embedded mixed methods approach (Cresswell & Plano Clark, 2011) in which both quantitative and qualitative data will be gathered simultaneously to allow us to path analyse and predict the proposed relationships between digital participation, self-efficacy, sources of efficacy and personal learning environments, but also to gain a deeper and more nuanced perspective about the barriers and affordances for digital participation among older people.

We are necessarily interested in the continuum of older digital technology users – from the non-user to the high-level-user – and we argue this as requirement to gaining a full appreciation of the factors that facilitate and hinder digital technology use of older people. Hence, and as exemplified in our current study, we have considered carefully the data collection methods that are inclusive of older people at various points on this continuum. An online survey, for example, would almost certainly exclude the older non-user from our study; hence we have opted for a face to face structured survey to gather both the quantitative (Likert-type) data and qualitative (open verbal responses) data.

**Conclusion**

Achieving positive experiences of the digital by older adults appears as a reasonable goal that accords well with the mentioned notions of social contribution and wellbeing. Digital engagement by older adults needs to be purposive and agentic, and we argue that a means of achieving this is by the building of efficacious responses to particular experiences and contexts that afford learning. Further researching what these actually are, that is, which
are most influential and which might best be leveraged to increase older adults’ technology self-efficacy, appear as our next step toward deepening an understanding of older adults’ digital terrain.

References


Innovation, Knowledge and Sustainability with PLEs: an Empirical Analysis from SAPO Campus Schools Pilots

Carlos Santos
Assistant lecturer and Ph.D. student
Communication and Arts Department
University of Aveiro, Portugal
e-mail: carlossantos@ua.pt

Luís Pedro
Assistant Professor
Communication and Arts Department
University of Aveiro, Portugal
e-mail: lpedro@ua.pt

Fátima Pais
Computer Science and ICT teacher in secondary education
PHD candidate in the Multimedia in Education Doctoral Program
University of Aveiro, Portugal
e-mail: fpais@ua.pt
Abstract

SAPO Campus Schools (SCS), a project developed by the University of Aveiro and SAPO within the Labs SAPO R&D facility, is a Web 2.0 services platform designed for schools (K1 through K12). Based on an empirical study of use cases of the platform, this paper analyses preliminary data gathered from a group of pilot schools that have institutionally adopted SCS. Building on the concept of BA (Nonaka & Takeuchi, 1995), which relates to the engagement of people interacting in a given space in order to create knowledge, and in the assumption that SCS can become a school’s BA and promote disruptive innovation, our main goal is to understand if and how these dimensions intersect in the use cases and whether the changes already noticed in schools will be sustainable on the long run.

Introduction

Sapo Campus Schools (SCS), a project developed by the University of Aveiro, SAPO and TMN within the Labs SAPO R&D facility, is a Web 2.0 platform specifically designed for schools (K1 through K12) that results from the reinvention of another, similar, platform designed for Higher Education (Santos & Pedro, 2009). In September 2012, a group of pilot schools was chosen to sign a protocol making a commitment to promote the formal and institutional adoption and use of SCS. The signing of this protocol assured the participation of the different schools in this research project, making it easier to get feedback from users in a real setting. This feedback also allowed the developer team to uncover flaws in the system and to get real and almost live input on how to improve the services provided. On the other hand, these schools were also faced with the challenge of opening themselves, by promoting and encouraging openness, collaboration, content production and sharing. Because SCS
makes it possible to create and manage personal learning spaces from an individual perspective (teacher/student/other users), it was also important to discuss the concept of Personal Learning Environments (PLE) within each institution.

This particular research project attempts to verify if this process can become a catalyst for disruptive innovation (Christensen et al., 2008) and the creation of spaces where new knowledge can emerge in schools – BA (Nonaka & Takeuchi, 1995). In the following sections we will revisit these concepts, making way for the analysis of specific use cases that are currently under way in SCS. After that, we will discuss the methodological strategies behind this empirical analysis, the cases themselves and will put forward some final remarks.

**Background**

Schools can become advocates for knowledge management through the creation of institutional learning spaces, where everyone can share, create and display knowledge. Drucker (2002), for instance, refers to the creation of knowledge as an innovation source that has undergone change. Pais et al. (2012) summarize the different types of innovation presented by Christensen et al. (2008) by stating that

“(...) sustainable innovation is about making something better and disruptive innovation is about making something new”.

Pais et al., 2012, p. 5

Hargreaves (cit. in Ferrari et al., 2009) points out that the idea behind disruptive innovation is the opposite of that of sustainable innovation. Figueiredo (2009) doesn’t share this vision as he states that despite the high level of failure associated with sustainable innovation in education, this path can be explored. However,
“[t]he promising path to innovation in education systems is through disruptive innovation that quietly grows in the margins of the system, unobtrusively until starts changing it, irreversibly”

Figueiredo, 2009, p. 29

We argue that SCS could be a vehicle for this innovation combined with institutionalization. Miles (1998) presents institutionalization as a change to be taken as normal, as something that is part of organizational life; and that has unquestionable resources of time, personnel and money available. The apparent paradox in the SCS conception - institutional versus personal dichotomy - may actually be another catalyst for change.

Considering knowledge creation and the role it plays in promoting innovation, SCS can actually support this space: BA. As stated by Pais et al. (2012, p. 15):

“BA is characterized by the involvement of people interacting in a given space, what sets it apart from ordinary human interaction, the main difference relying on the goal of these meetings: BA aims at creating knowledge.”

SCS can, therefore, be an optimal space for schools that create and share knowledge, the kind of schools that Cheng & Chen (2008, p. 383) consider to be” the cradles of innovative knowledge, [that] have a rich collection of intangible assets”.

**SCS anatomy**

SCS’s design was based on a set of principles that had a direct impact on usage and user interaction. Openness, one of those fundamental features, involves two different kinds of issues. Because we are dealing with minors (students) that interact within a digital environment, the platform must be safe and in compliance with legal and regulatory requirements. Hence, all content published by users of a given school can only be accessed
by other members of the same school, which includes not only other students, but also teachers, parents, guardians and other stakeholders, all previously validated by the platform’s institutional administrators. Inside SCS, all published content is visible to all members of the community, thereby achieving the digital metaphor of the school space. Another consequence of this openness is having a horizontal rather than a hierarchical outlook and structure. Within SCS all users have the same permissions, even though they can play different roles while performing different activities. This choice means that the community must have self-regulation mechanisms, with schools playing a key role in promoting digital citizenship and education. Another fundamental principle underlying the design of SCS is sharing, with a wide range of services being made available to users, making it possible for them to store, organize and share resources in different formats. The creation of blogs is not controlled or subject to institutional permission: any logged-in user can create all the blogs he wants and invite others to manage them. The same applies for photos, videos and the recently integrated file sharing service. Users can also create groups (open or closed; public or private) and make them available to the community.

The principle of personalisation is attained by the creation of a Personal Learning Environment (PLE). This personal and non-transferable dimension suggested by Westenbrugge (Kompen, et al., 2009, p. 34), makes it possible for users to construct their own PLE. Another key feature of SCE is institutionalization, in the way schools must make a commitment to promote the formal and institutional adoption and use of SCS. The combination of these two principles (institutionalization and personalization) was carefully thought out in order to “ensure to the educational agents the possibility of building and customizing their own PLE based on commonly-used Web 2.0 services, while simultaneously
not restricting the range of potential learning activities that can be carried out in a diverse environment as the educational context” (Pedro et al., 2012, p. 3).

**Methodology**

The processes of adopting technology can be very complex and challenging, especially when they involve significant procedural changes. Even though the introduction of SCS on itself does not imply change, the way it is used by different agents in different school settings can be highly disruptive. Therefore, despite all the institutional support and commitment, and as seen from previous experiences and projects, full implementation and adoption can be very difficult.

The use cases of SCS being presented in this paper result from a pilot study group that benefitted from certified training workshops supervised by the University of Aveiro. These workshops were strategically thought out not only to promote the institutional adoption and appropriation of SCS, but also to facilitate and promote the creation of PLEs at an early stage of their development. These workshops took place between November 2012 and April 2013 and consisted of a total 30 hours of work (15 in attendance and 15 at a distance). After introducing some basic concepts and discussing the philosophy behind Web 2.0 and how it relates to teaching and learning dynamics, the participants had the opportunity to explore SCS and were challenged to develop and execute an educational project that involved the platform. These workshops became very important in promoting and supporting the appropriation of SCS, not only from a more technical perspective, but also and foremost because they allowed people to share and discuss their on-going progress, questions and problems in a constructive way. Based on this sharing and on the opinion of the users, participants often realigned their initial projects, gradually feeling more comfortable using SCS and understanding its underlying principles.
From the group of pilot schools, three were chosen for this analysis. Even though these schools (hereafter referred to as school A, school B and school C) are geographically close (within a 50 km radius), they are very different from each other. School A is located in a fishing village and has 378 students (ages 3 to 15) and around 40 teachers. School B is located in a rural setting. It is attended by 2606 students (ages 3 to 18) and has 241 teachers. It is a cluster school made up of 10 different establishments, 8 of which are geographically scattered. School C is located in an urban and industrialized area and is a junior/high school attended by students from the 7th to the 12th grade. It is a former industrial school known for its use of technology with 971 students and 134 teachers.

As described previously, all schools had to sign a protocol and were institutionally and formally bound to the project, also having access to specific training and support. Nevertheless, because of the different settings and features, the adoption and use of SCS was very diverse. The perceptions and feedback gathered both online and throughout the onsite training sessions made it clear that, even though schools officials have initially been very welcoming and receptive of the project, they adopted different strategies that influenced and constrained the way SCS was used by teachers and/or students. These perceptions are supported by the statistical data gathered from the platform.

![Figure 1. Percentage of registered users](chart.png)
In order to analyse Figure 1 you have to keep in mind the specific features of each school. Students attending school A are between 3 and 15 years old. The percentage of registered users refers to the total number of students, including those who are too young to use the platform by themselves. School B is a very particular case. As mentioned before, this is a cluster school made up of 10 different establishments, being that only 5 of those schools have registered users. While school B1 is attended by 13 to 18 year students, students in B2 are between 10 and 12. B3 and B4 are nursery/preschools (ages 3 to 5) and B5 is a primary school (ages 6 to 9). With overall older students (ages 13 to 18), in school C all students are autonomous and could register themselves in the SCS platform. Drawing from this analysis, schools A, B5 and C are arguably those that stand out.

Even though the number of users can be considered an objective source of data, it is important to complement this analysis with the activity reports of each school. In order to get a more complete and comprehensive analysis, a user activity rate was defined. This rate was based on the ratio between the number of registered users and the activity in each school (number of comments, states, photos, videos, links and posts). The results can be seen in the chart below:
In the following analysis, School B4 will be left out because there was no activity other than the registration. Chart 2 confirms the idea that schools A, B5 and C are those in which there are more registered users and that are globally more active. However, as we can see from the results in school B5, there is no direct correlation between the number of registered users and each school’s activity. Even though it has the lowest number of registered users of the 3, school B5 is the one with the highest activity rate.

After defining and validating the choice of schools to be analysed, it was important to select specific use cases within these schools. These cases were selected based on different criteria that included creativity in the use of the platform, the impact on student engagement and content creation. Because these projects were publically presented and discussed as part of the training workshops, in addition to the data from the platform itself, this analysis also considers interviews with school administrators and the input of the teachers involved.
In school A, the project selected – “AEC (Curriculum Enrichment Activities) for all” – clearly illustrates the potential and the impact that SCS can have in younger audiences. Working with 6 to 9 year old students, the teachers involved in the project created a blog and different groups in which all students could post information, photos or videos regarding not only classroom or school activities, but also other content they found relevant. The different spaces were also used for collaborative projects and to promote contests that involved the school community. Besides being very engaging and involving a great number of students, this project also prompted other teachers to develop their own ventures within SCS. The fact that it played a significant role supporting other initiatives is widely recognized and was pointed out by the school’s administrator in an interview.

The “GeoSapo” project from school B was also selected because of its impact. A more personal endeavour, it involved a group of motivated teachers that created an engaging project that appealed to other teachers and even other schools. At a first stage, the project aimed at publicizing a wide range of activities that promoted the local geopark, but it quickly evolved into something more dynamic, taking full advantage of Web 2.0 features. This project was at the core of a process that can lead to disruptive innovation.

In school C we have selected 2 cases to analyse: “Weekend Discussions” and “The 3R Club”. The first example was selected because of its diversity and levels of participation. Unlike the previous cases, it has a very different background and goals, with SCS being used to support discussions on topics that aren’t usually discussed in the classroom. After a process of negotiation, the teacher and the students agreed that every Friday, a student would have to suggest a topic to be discussed synchronically the following Sunday, from 7:00 to 8:00 p.m. As for the second project – “the 3R club” – it didn’t have a predefined audience, supporting an already existing recycling group that was open to all students. Because it was the first time
the teacher responsible for the project worked with social networking services, there were some initial reservations. But, despite the initial scepticism, SCS became a cohesive agent, with a high level of engagement, with more and more challenges being posted every week.

Nevertheless, it is also important to mention that not all projects developed within the platform succeeded in promoting participation and engagement. In some cases, like in school C, at least one project had virtually no interaction. One thing that emerges consistently in all schools involved is the personal dimension that embodies the concept of PLE and can be easily found in the examples described. Using SCS, teachers and/or students create and regularly update blogs about their own personal interests and share photos, videos and links, also commenting and interacting in different ways.

Throughout the following sections of this paper we will examine these cases more comprehensively, systematically revisiting their unique and differentiating features, as well as common and constant elements that make up the processes and may be the drivers for disruptive innovation. Setting out to describe some examples of how a Web 2.0 platform is being used in different schools and relating that with innovation and knowledge creation processes, this study does not intend to thoroughly analyse each particular case, but rather draw a broader picture, exploring possibilities that have already been noticed.

Use Cases

Project “AEC for all” (School A)

Recently, trying to meet families’ needs by adjusting schools schedules, the Portuguese government created the Curriculum Enrichment Activities (AEC), a funded program that aims at broadening the primary school curriculum and ensure a full day education. Arguing that schools should offer more than just curricular activities and that they should promote physical education, sports, arts, technology, scientific inquiry and foreign
languages education, the Ministry of Education developed a regulatory framework to ensure that after their regular classes, children can stay at school and engage in pedagogically enriched activities.

At school A students can take part in Study Room, English as a Foreign Language, Sports, Arts and Story Time. Even though they are not compulsory, most students are enrolled in these activities. Considering only those attending English and Arts classes and whose teachers took part in the training workshop, this particular use case involved a total of 112 students. When asked to come up with a project that combined features of Web 2.0 and SCS and that was within the scope of the AEC, the teachers involved tried to create an articulated and interactive space, where all participants could share authorship and publish content. To be accessed outside the classroom, this space would be used to showcase the work being done in the different activities. Using a blog, participants should regularly post texts, pictures and videos displaying their work, so that other members of the community could comment on it. This blog was created and then shown to the students. In order to showcase the features of the platform and make it easier for students to register, a demo-user for each class was created. The first interactions within the SCE took place using these demo-users in the classroom, as students started to register themselves.

After this approach and due to difficulties in the registration process, the teachers involved asked for parents’ permission to register the students in the platform. At the time of this analysis, 58 students were registered in SCS and listed as blog authors. Of those 58, 51 took active part in the blog either by publishing post or comments.
Figure 3. Activity distributed by participant/user type/role

As can be seen in Figure 3, in the time frame analysed, 92 posts and 505 comments were published. Because it is a blog open to the community, there are some comments that were made by other teachers and students who are not directly involved in the AEC project.

Overall, and even though most content was published by the teachers, students were very active in commenting. In fact, as it can be seen in figure 4, there was a steady increase in student participation. This can indicate a growing familiarity with the platform, with students feeling more confident to interact as they become more autonomous. In addition to this, student activity tends to mirror teacher activity, repeating its pattern.

Figure 4. Activity - monthly distribution
If you analyse the blog’s activity more closely, you can also observe that activity peaks in the blog are concurrent with specific school events, such as the school’s Christmas party or the celebration of Valentine’s day. In that way the activity timeline in the platform seems to replicate the school calendar and activities, with user participation decreasing significantly in school holidays.

In Figure 5 you have an example of students’ activity. Following a collaborative writing task in the classroom, students went online and published a Valentine’s Day Poem. This post was commented on by other students and also by teachers. Soon after this post, students from other classes also posted their own poems on SCE.

![Image of a poem](image)

Figure 5. Student activity

Even though some of the activities were carried during classes, most students interactions took place outside the classroom, after school hours or during study breaks (between 10:00 and 10:30 am and 3:00 and 3:30 p.m).
An empirical analysis of the number of posts and comments also suggests that this blog evolved from being a display of the work being done by the students to become a sharing, collaborative and socialization space, combining formal and informal learning and interaction. In addition to publishing information related to content presented in class, such as a song or the life and work of a given artist, it was possible to identify some of the students’ interest areas and problems, which were later addressed in other settings. When a link to a game was made available, for example, students were asked to post their scores in English, making it possible for one of the teachers to pinpoint a few common mistakes. At another time, after reading some confusing comments about an Albert Einstein cartoon, another teacher took the opportunity to carry out a research assignment about prominent scientific personalities.

The blog was also used to answer questions about the platform and troubleshooting. Many of these comments dealt with space personalization, with students asking how they could change their profile photo, and with publishing content (“How do I publish a video?”, “Can you help me post a photo?”, “I forgot how to publish a video.”). Even though some of these problems were recurring at first, they became less noticeable as students became more
independent accessing the platform. It should also be noted the role played by older and more autonomous students in answering less-experienced users questions and helping them register and taking part in the community.

The data gathered suggests that users were very enthusiastic in participating and interacting with each other and with the content published. However, mostly due to the age of the users, participation was disorganized and at times chaotic, making it impossible to categorize the type of comments and find content patterns. Many students published content and asked questions outside the blog and tried to address specific people rather than focus on space. Students’ comments also suggest that they were interested in synchronous communication with other users, often using comments and posts to chat. Another indication of the users’ lack of experience was the fact that, when trying to comment on something, they would report the content as inappropriate. This could signal that it would be important to have other ways of interacting with content that didn’t imply writing comments.

**GeoSAPO (School B5)**

Located in rural setting and near a geological park, school B5 is a recently remodeled school with a strong connection to the surrounding environment. Each classroom, for example, is named after a geological element that can be found in the near geological park (as the “trilobite room”). In addition to these more symbolic features, and because nature and ecology are a very important part of the curriculum, the school has also developed many projects in this area, the most recent being the “Earth Experiences” program. The project GeoSAPO aims to extend the scope of this program and “developing multidisciplinary activities that promote the Geopark”. Five teachers of this school decided to use SCS to support and publicize their work. Even though it was the first time they worked with web 2.0 platforms, working closely together as a team, the teachers involved managed to overcome
the different obstacles they faced. The first problem relied on the registration process. Due to the age and lack of experience of their students, they had to create email addresses and register them. This process required getting parental consent and working with the families, making them aware of this opportunity of working together with their children and allowing them to actively engage in their learning. In addition to the registration, teachers also had to be creative in order to keep the younger children from forgetting their logins and passwords. They designed a personal and non-transferable card with each user’s information and monitored their activity very closely.

With many registered users working on it, the project became a big hit. In order to address curricular questions, different spaces were created within SCS, with the different classes taking part and participating keenly. That massive participation is demonstrated in the chart below:

![Number of posts and comments by user/participant type/role](image)

**Figure 7. Activity distributed by participant/user type/role**

This chart confirms what was said previously in the methodology section: school B5 has the highest activity rate of all the schools considered in this study, with students not only reacting (number of comments) but also producing content (number of student posts).
Moving beyond the initial project, many students also spontaneously created blogs and posted their own content, as can be seen in the following examples:

- **Fun PEB09** – a place where all the PEB09 (the author’s classmates) can laugh
  
  A 4th grade student created a blog where he could post jokes. This is an interesting example because the author asked his classmates to join him, so they would not only react to what was being written, but also post their own jokes and funny stories.

- **Infinite Music**
  
  A third grade student who was passionate about music and the transverse flute, created a blog where she would post videos, photos and texts on this topic.

The chart above also gives us important data regarding teacher participation. As you can see, there is a significant number of comments from teachers who are not involved in the project. As we mentioned before, school B is a cluster school made up of 10 different establishments, being that all of them can access content being published by the different schools. Many of the comments from other teachers, are also from different schools. This dynamic gave way to the collaboration between schools, with school B5 positively influencing and driving other teachers and students to develop their own projects. This was a two-way influence and collaboration, as users from other schools would often interact with users from school B5.

As for GeoSAPO, in order to support the project, teachers at school B5 created a “GeoSAPO time”. Every Wednesday morning, students taking part in the project would meet in the school library to share what they had learnt throughout the week, ask questions about SCS and prepare competitions and challenges. Because it was difficult for some younger
students to keep up with all the activities, older students would often monitor and help them. These meetings went viral, with other students becoming curious and eager to take part in the project. Another distinctive feature of this project is the fact that it involved people outside the school. As mentioned before, parents were key players in adopting and using the platform, as it supported their involvement in their children’s school activities. This evidence is also supported by the following chart:

![Figure 8. Student participation: daily distribution](image)

Most activity in SCS took place after 5 p.m., i.e. outside school hours. Even though the time alone is not enough to determine parental participation, there are other indicators that support this assumption:

- Most students that log-in after 5 p.m. are 3 to 5 years old and do not know how to read and write;
- Some posts are co-signed by parents, showing their support in using the platform;

Throughout the whole process it is also important to mention the interaction strategies adopted by the teachers involved, who would readily answered all their students’ questions and stimulated them. They also developed an informal user policy and promoted online safety. According to them, this was SCS’ most significant benefit: the fact that it made it possible for them to showcase their work in a safe environment within the school community.

**The 3R club (School C)**
In Portugal there is a national programme that encourages the collection and recycling of plastic bottle caps, with several companies exchanging them for orthopaedic material. Carrying on the work of previous years, the 3R (Reduce, Reuse, Recycle) club from school C is involved in this campaign and aims at raising people’s awareness for this movement. Working closely with local authorities and CERCI (a centre for the rehabilitation and integration of people with disabilities) the club is always reaching out to the community and trying to find new active members. When asked to come up with a project involving her students, Web 2.0 services and SCS one of the teachers responsible for the club, together with a group of 9th grade students, outlined a plan of action that included:

- **The creation of the “3R Club Blog” where different events could be publicized.**
- **Researching and posting creative projects that used recyclable and reusable materials;**
- **Advertising collection points throughout the school;**
- **The creation of a group in SCS where participants could work together in order to design two bottle caps collection containers. All caps collected should then be recycled, with the funds raised proceeding to the local CERCI.**

In the following chart we can see the number of posts and comments on the blog, according to the type of user.
Even though, when compared to others, this blog did not have a significant number of contributions, there are some distinctive features that should be taken into account and are relevant for this analysis. On the one hand, it was a new experience for all those involved, being that the teacher responsible for the blog had never worked with Web 2.0 services before. Nevertheless, she prompted student participation, asking them for comments, posting challenges and even giving out rewards. In one of these challenges, the teacher posted a picture of a container somewhere in the school, asking students to guess where it was:

“Is it a giant candy, a vase? No! It’s a hidden plastic container used to collect plastic caps from those who drink water or yogurts at school. Have you seen it?? Where is it?? Have you ever used it?? I don’t think so. I keep seeing caps in the regular bin. Why don’t we use the recycling bins and put the caps on a separate container???
There will be a sweet award for the first to guess where this cap collector is!!”

Teacher, School C

Student feedback was immediate and the winner was given a chocolate bar. But the most interesting aspect of the project was the fact that, as the different challenges were
issued, many of the discussions extended beyond SCE, taking place in and outside the classroom. According to the teacher in charge, many students that were not involved in the project would question her about the challenges and the results. Because it is a non-curricular project, most interactions took place after classes. In the following chart we can see the daily distribution of student activities (number of posts and comments).

![Daily and hourly distribution of students participation (number of post and comments)](image)

Figure 10. Student participation: daily distribution

In order to publicize the project and the different club activities posted in the blog, the teacher also used the school’s mural, regularly reaching out to all members of the community and inviting other students to take part in the project. This was considered to be an effective strategy. Another interesting feature of the project was the fact that many other teachers also engaged in the discussions. This interaction played an important part in keeping students motivated and making the project known.

As mentioned previously, one of the challenges issued involved the creation of two cap collecting containers. Open to the school community, in order to enter the competition participants should publish rough drafts that would then go through a selection process. With the help of teachers and students, two drafts were chosen. Because there were many constraints associated with the actual building process, in one of the training sessions the teacher supervising the project asked for the cooperation of arts teachers and students.
Another teacher attending the workshop offered to help and working collaboratively (both teachers and students) they built the container below (Figure 11):

![Figure 11. Container](image)

This container went on to win a municipal award.

**You speak, I speak, we speak (school B)**

Involving an 11th grade class (students ages 16-17), this project was open to the community and, according to the teacher in charge, aimed at “promoting the use of Web 2.0 as a way of bringing participants closer and developing their critical sense”. Reaching outside the classroom and moving away from formal content, it consists of using SCE to promote a weekly debate with students. Having started in January, every week a different student would post a topic, some context and a few questions on a blog in order to kickoff the discussion.

This discussion took place synchronously, using comments on the post. Because it requires participants to be online simultaneously, a meeting time was previously negotiated and agreed upon. Participants agreed to meet every Sunday from 7:00 to 8:00 p.m. Participation was optional and there was no kind of reward or compensation other than taking part in the
discussion and sharing personal thoughts and opinions. The topics discussed were very
diverse and can be seen in the following table:

Table 1. Discussion Themes

<table>
<thead>
<tr>
<th>month</th>
<th>Discussion theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>Young writers</td>
</tr>
<tr>
<td></td>
<td>Teenage pregnancy</td>
</tr>
<tr>
<td></td>
<td>First Sexual Intercourse</td>
</tr>
<tr>
<td></td>
<td>STD (Sexually transmitted diseases)</td>
</tr>
<tr>
<td>February</td>
<td>Media</td>
</tr>
<tr>
<td></td>
<td>Drugs</td>
</tr>
<tr>
<td></td>
<td>Doping and performance enhancing</td>
</tr>
<tr>
<td></td>
<td>drugs</td>
</tr>
<tr>
<td></td>
<td>Can a teacher be a friend?</td>
</tr>
<tr>
<td>March</td>
<td>Domestic Violence</td>
</tr>
<tr>
<td></td>
<td>Homosexuality</td>
</tr>
<tr>
<td>April</td>
<td>Sports in Adolescence</td>
</tr>
<tr>
<td></td>
<td>Music festivals</td>
</tr>
<tr>
<td></td>
<td>Precocious Youth</td>
</tr>
<tr>
<td></td>
<td>Young people and social networks</td>
</tr>
</tbody>
</table>

In the period covered in this analysis, 18 students (from a total of 24) took part in the
discussions. The following chart illustrates the distribution of activities within of the group:
As can be seen in the previous chart, from January to April, there were 14 posts, each for a different topic, generating 752 student comments. An empirical analysis of the comments indicates that the teacher took on the role of mediator, moderating the discussion: the students played the most active role, The following chart details the distribution of the blog activity throughout the time considered in this analysis:

The graph shows that after a very promising beginning, the blog activity decreased and became more stable. Much like in other cases described before, in March, in the weeks

![Figure 12. Activity distributed by participant/user type/role](image)

![Figure 13. Activity - monthly distribution](image)
corresponding to the Easter holidays, there is a further decline in the number of interventions. If we overlap the data from the graph with the topics covered in the discussions, in January all but one dealt with sexuality. These topics appeal to the target audience and seem to arise their curiosity. If you go through the comments, you can see there are still many myths and misconceptions surrounding these matters. In addition to the sensitivity and the intimate nature of these particular subjects, the fact that the debate was public had an impact in the discussions. When discussing and commenting on this project, other teachers referred that they followed the blog and the interactions but didn’t feel comfortable enough to engage in the discussions, given their personal nature.

Even though the students taking part in the debates belonged to the same class and had know each other for at least two years, after the first discussion many revealed other sides of their personalities. In the first discussion, for example, one of the students shared a passage of poem he wrote. His classmates, who were not aware of his interest in poetry, reacted immediately, expressing their surprise. Students’ engagement in the discussions wasn’t limited to text. They shared many links related to the topics being discussed, adding to the debate.

**Conclusion**

The current activity of SCS is not limited to the practices briefly described above. SCS is already a platform where information, knowledge and experiences can be shared and can be considered a quality step forward towards the elimination of hierarchical institutional barriers. To some extent, the use cases described evidence that SCS can help institutions overcome these barriers: teachers and students are at the same level, the only difference between them lying on the setting and the role they play at a given moment. In the schools described it is usual for students to ask questions regarding curricular content. These
questions are answered not only by other students, but also by teachers. Moving beyond independent projects or individual blogs, the schools’ digital wall are used to showcase different activities and to discuss all sorts of issues, prompting and adding value to the interactions taking place.

SCS is a Web 2.0 platform based on SAPO core technologies that may promote communication, sharing and collaboration in schools (K1 through 12). It also reveals the built-in dimension of Personal Learning Environments (PLE), making it possible to create and manage personal spaces with all the PLE features, within the institutional whole that makes up a school. The focus on the platform should not, however, be viewed from a technic standpoint that instrumentalises the PLE, but rather from a humanist perspective that values the individual or groups of individuals and their control over their learning activities – both formal and non-formal (Fiedler & Väljataga, 2010). SCS can, therefore, be considered an institutional supported PLE in which the focus is on the schools’ commitment as a whole, rather than on isolated initiatives from teachers or students. As we have seen from the uses cases, in SCS, each school establishes its own network, using elements of their community. This option can be seen as a limiting aperture, but is related with privacy issues mostly due to the age of the target audience. This fact was particularly relevant in schools A and B.

Christensen et al. (2008) refers to disruptive innovation not only as something concerned with the improvement of a product (as sustaining innovation) but also with a radical change of paradigm and principles that underlie the product or process. Disruptive processes usually take place in smaller groups, slowly and gradually being adopted by larger groups. Of the cases described, this can be best seen in school B5, where SCS has been the catalyst for change. With an initial small group of active participants, its use has steadily spread to the rest of the school and is already promoting change in practices and procedures.
Angehrn, et al. (2009) identify some characteristics that a platform that supports and sustains innovation process should incorporate:

“Collaboration, knowledge sharing and exchange, reciprocal trust, recognized ownership, reinforcing and enlarging innovation stake-holders’ networks, clear network visualization, simple and reliable technology (...) all these factors need to be taken into account to develop effective IT tools aimed at supporting and boosting innovation processes.”

Angehrn, et al., 2009, p. 207

Even though some of the characteristics mentioned by Angehrn, et al. do not depend on the technological platform itself but rather on use, SCS can be viewed through these lenses in order to verify if it meets the conditions thought necessary for innovation.

Christensen et al. (2010) argue that combining change and innovation, and using technology as a catalyst for a disruptive, student-centered process, can be the key to have a school fitting the values of today’s knowledge society. The same authors also suggest that the personalization of teaching accommodates students’ multiple intelligences, as postulated by Gardner (1993) and can play a pivotal role in this process.

BA can be translated as place and is defined as “a shared space that serves as foundation of knowledge creation” (Nonaka & Konno, 2005, p. 1). Even though there are pieces of evidence that suggest it can become BA, and thus promote disruptive innovation, it is still early to draw definite conclusions. If in fact SCS is becoming part of the school ecosystem, only time will tell if these changes will be sustainable on the long run.

Acknowledgement

A special thank you those who contributed to this paper especially to Sandra Vasconcelos and Jorge Braz. Research done in partnership with the PTDC/CPE-CED/114130/2009 project,
funded by FEDER funds through the Operational Programme for Competitiveness Factors - COMPETE and National Funds through FCT - Foundation for Science and Technology (Portugal).
References


Analysis of the Future Professionals' PLEs as Lifelong Learning Basic Skill: Presenting the CAPPLE Project

Dr. Paz Prendes  
Research Professor in Educational Technology  
Director of The Group of Research in Educational Technology (GITE)  
e-Learning Coordinator  
University of Murcia

Dr. Linda Castañeda  
Senior Lecturer in Educational Technology  
Department of Didactics and School Organization  
University of Murcia  
Email: lindcaq@um.es
Abstract

In this paper we want to present the CAPPLE Project, a research project centred on the exploration and understanding of Personal Learning Environments (PLEs). In understanding PLEs one can find out a deficit in fundamental research concerning the structure and composition of learners PLE in higher education. The CAPPLE Project addresses this issue by describing and analysing the prospects for the Personal Learning Environments (PLEs) of future Spanish professionals. It includes the analysis of this in technical, functional and graphical terms. The project is looking for the PLEs of the Spanish professionals with potentially an immediate incorporation into the labour market of every area of knowledge, in other words, senior students in Spanish universities. The main goal is not just to describe those PLEs, but trying to explore the underlying trends and models and, at the same time, discover the implications of these conclusions in the education in general and in the Spanish Higher Education Institutions, in particular. For its purposes, the project is using a mixed methodological approach. A variety of research methods such as expert discussions, survey, workshops, diagram analysis, is applied in order to provide a strong research perspective and guarantee solid research. CAPPLE project in its first version is working with fundings from the National Ministry of Economy and Sustainability for three years (2013-2016. project reference EDU2012-33256). This paper presents the CAPPLE project and gives an overview about the methodological approach, including tasks and the project schedule. CAPPLE is an ambitious, complex and multidisciplinary project. This project can have a direct impact on the fundamental research on PLEs (modeling, analytical tools, naturalistic evidence of their existence, and so on), as well as on institutional strategies surrounding them, both for initial professional learning and also basic education.
Introduction

The concept of PLEs gives everybody a background to reflect on the value of systematic organization and building of own environments to learn. PLE is an environment that will grow and continuously change throughout life. The basic idea is quite simple. If teachers teach students how to learn habitually on the Internet (continuously building, managing and improving their PLEs), students will continue developing themselves professionally and personally, in their jobs, workplaces and even at home. Consequently, formal learning – and universities in this case - must offer to students opportunities to adapt the “official” learning environments implemented in institutions to their own training needs. In parallel, institutions have to provide students with the necessary skills for managing and enriching their own personalized environments to learn. The research question followed in this paper is what kind of strategies students use to organize their PLEs and which strategies come from formal learning? With the description and analysis of the current PLEs of future professionals, the aim is to understand what kind of transversal learning contributes to the creations of PLEs. Answering this question allows to better understand the processes of creation, management and enrichment of PLEs, as well as which strategies can be applied to improve these processes in formal education. We understand PLEs are key elements of citizen’s learning development, as well as a crucial part of a citizen’s digital identity and lifelong learning competence. The CAPPLE project is funded by the National Minister of Economy and Sustainability for three years (2013-2016). This paper gives an overview about the state of the research in the first project year.

Objectives of the project
The CAPPLE project – http://www.um.es/ple - is called after its initials in Spanish:

"Competencias para el aprendizaje permanente basado en el uso de PLEs (Entornos Personales de Aprendizaje): análisis de los futuros profesionales y propuestas de mejora", i.e.:

"PLEs (personal learning environments) based lifelong learning skills: analysis of future professionals and suggestions for improvement", is a national funded project (EDU2012-33256 Ministry of Economy and Competitivity) in which we attempt to describe and analyse the prospects for the personal learning environments (PLEs) of future professionals. It includes the analysis of this in technical and functional terms, learning strategies, experiences, resources and tools associated. The project is studying professionals with potentially an immediate incorporation into the labour market of every area of knowledge, in other words, senior students in universities or vocational training.

Taking into account the current situation of education systems as well as the state of research in this regard, the overall goal of CAPPLE project is the description and the prospective analysis of Personal Learning Environments (PLEs) of the Spanish future professionals in all areas of knowledge. The aim is to understand how these environments are built, what are their characteristics, what strategies have been used to set them up and which ones are associated with formal education as well as what type of cross training deficiencies can be detected. A better understanding of the processes of creating, managing and enrichment of PLEs would stimulate the development of strategies to improve the empowerment of students to create PLEs in formal education, understanding that these are key elements of the educational development of citizens, their digital identity and its life's long learning skill.

This overall goal can be broken down to the following objectives:
1. Describing specific strategies and tools used routinely by senior university students from all areas of knowledge to enrich and manage their learning, inside and outside the classroom. Especially those that take place in online contexts.

- Designing a reliable and valid instrument for collecting information about the strategies and tools used by the students to manage and enrich their learning, inside and outside the classroom, especially in online contexts. These includes tools and procedures to acquire, manipulate and recreate information individually as well as collectively, and strategies, tools and processes to share.

- Describing and classifying learning strategies used by students (self/targeted professional/personal, formal/non-formal/informal) and how students perceive its relevance.

- Identifying and categorizing ICT tools used by students to learn, both from its technological aspect (social media, social networks, aggregators, free/owners) as well as in its functional aspect (publishing tools for collaborative knowledge creation, reading tools, multimedia information sources).

- For precising if each network tools and learning strategies are used with a specific function or if used with various functions in different contexts.

2. Analyzing, both technically and functionally the personal learning environments (PLEs) of the Spanish future professionals from all the knowledge areas.

- Describing and modelling types of Personal Learning Environments (PLEs) that appear among the students surveyed.

- Identifying parts of such environments and the most common components of these PLEs.

- Examining the level of awareness that students have about their learning processes and their own personal environment.

3. Achieving a joint analysis of both the components and the models obtained and its educational implications regarding the improvement of strategies aimed at enriching the process of creating and managing PLEs for future professionals the university.

- Analyzing the degree and type of influence given by the students to the formal educational institution (the university) as provider of these strategies and described environments, as well as analyzing which of these are perceived by future professionals as acquired in parallel, transverse or tangential to the university.

- Analysing the differences between the different knowledge areas about the models of PLEs found, as well as the strategies and tools contained therein.
• Identifying the educational implications on initial training regarding the elements and the models found.
• Identifying, based on student responses, cross-cutting strategies (technological and training) which would be implemented by Higher Education institutions for the enrichment of the PLEs of future professionals.
• Making proposals for concrete strategies (technological and training) to be carried out from university contexts to enrich the process of creating and managing the PLEs of future professionals.

4. Disseminating the data and conclusions of the project and proposing the extension of its scope not only the Spanish university, but to the European and international contexts both in terms of the data being obtained in progression, as the most important conclusions the project itself.

**Methodological approach**

This project underlies a very complex research process, not only because we are working in an "emergent" field and with an emergent concept of PLE in terms of Veletsianos (2010), but also because following the Cinefyn Framework by Snowden & Boone (2007) we are trying to analyse a very complex context: the university initial education, where definitively "right answers can’t be ferreted out" (Snowden & Boone 2007, p. 3). We could include this project in which MacMillan & Schumaher (2001) called applied research, i.e. research that "focuses on a practice field and is concerned with the development and application of knowledge gained in the inquiry into the practice" (MacMillan & Schumaher 2001:23). Specifically, in this research we focus on the study of educational practices (learning practices, to be precise) of future Spanish professionals or, what is the same, senior university students. We are going to analyze their practices to learn, and from those practices, we want to explore the empirical and analytical relationships that could exist and would allow us to draw some inferences about these particular realities in the broader scope of our study group.
The approach of this study is a mixed approach, basically because what we want to study, and how we intend to do, corresponds to two approaches (MacMillan & Schumaher 2001):

- A non-experimental quantitative approach in which we try to describe, compare, and correlate the strategies and tools used by future Spanish professionals to learn (objective 1 and a part of the objective 2)
- A non-interactive qualitative approach, in which we also intend to analyze and understand how these strategies and tools are configured, in specific models of personalized learning environments -one for each person probably, and can also explain more generalized trends, associating some to the learner characteristics: its region, age or area of knowledge (goals 2 and 3 of the project).

Consequently, in this research we opted for a design with a mixed methodology, i.e. utilizing a qualitative and quantitative approach, both the data collection and the analysis of them, combining these data and analysis, or using them, sometimes for parallel and sometimes sequentially (Tashakkori & Teddi 2003). Even if taking a varied approach to the object of study makes it more complex, we opted to retain this mixed approach because of the advantages of such an approach. According to Newby (2010) these advantages are:

- More and better chances of triangulation of data, by resorting to various ways of getting data and diverse sources as well, getting not only the measure of anything, but an appreciation of this phenomenon or reality (Newby 2010, p. 128).
- More and better options to unravel and deploy the object of research. This is especially helpful in the case of complex processes that must be unravelled for a better understanding, in this specific case self-regulated learning processes and personal learning environments.

Furthermore, we understand that it is crucial in this research where will require a display of the same sample, where we try to modeling particular types of PLEs that we will find, as well as when we enter the part of educational and institutional implications, the redefinition and refinement of the research will be desirable. So, as Newby (2010) explains, this type of approach increases our chances of doing so.

**Principal tasks**
The project objectives explore the object of interest, and describe various lines of work around these future professionals. Based on the objectives, there are four phases in our research:

**Task 1, Phase 1**: Design and validation of instruments for collecting information on PLEs: If we try to analyse PLEs from a pedagogical perspective as personal learning approaches, we must begin from a clear perception about what a PLE is and what the mechanisms of learning that are working behind the PLEs are. Based on the available literature in the field, and taking into account the lack of unity on the definition of the PLE concept (Buchem, Attwell & Torres, 2011), we decided to follow the PLE definition by Castañeda & Adell (2010) as a conceptual base. Castañeda & Adell (2010) define PLE as "a set of tools, data sources, connections and activities (experiences) that each person use habitually to learn" and includes. Our conceptual based includes the proposal of Attwell (2008), in which PLEs include tools, data sources, connections and activities for reading (in multimedia), reflecting and doing, and sharing. Based on the definition and the PLE structure as proposed by Castañeda & Adell (2012) and Castañeda & Adell (2013), PLEs mean the
knowledge mechanisms that every person uses to learn. The crucial parts and components of PLEs are shown in Figure 2.

Figure 2. PLE Components (Castañeda & Adell, 2013:20)
Consequently, if in this project we try to analyse PLEs, we understand we must build an instrument for collecting data about these components. We also understand that the data collection couldn’t be only centred on the "isolated" components, we need something that would provide us some structure to this information; so, we understand that the data collection must recover information close to what Boekaerts (1997) called “the self-regulated learning strategical components”.

The main idea is not to use those concepts (self-regulated learning and this particular PLE’s definition) as a fixed framework, but as discussion starters. In the project, a group of experts (the project team) is going to develop a model of understanding that will be used as a base for creating the self-administrated survey. The survey will be used as a principal data collection instrument that, for reliability, accessibility, ease of use and ease of treatment, will collect a wide range of data. After the survey design, the validation of the instrument will be carried out in four phases:

- **Expert review**: A final review of the elements and categories included in the survey, as well as the scales and structure of it.

- **Cognitive interviewing**: As Dillman (2007, p. 143) remarks, “cognitive interviewing has been developed determining whether respondents comprehend questions as by the survey sponsor, and whether questions can be answered accurately”. It is a very simple technique that can provide information to explore.

- **Pre-test piloting**: Piloting will be carried out with a pilot sample of 250-300 senior university students from the 5 areas of knowledge described by the Spanish Ministry of Education: Arts and Humanities, Science, Health Sciences, Social Sciences and Law, and, Engineering and Architecture.

- **Factor analysis**: This analysis will try to reinforce the validity and reliability of the questionnaire elements related to its theoretical bases.

**Task 2, Phase 2**: Exploration and statistical analysis of the components of PLEs of senior students in Spanish universities. In this phase the main task includes the exploration of
the current state of PLE components and associated mechanisms of the senior students in Spanish universities. After the validation process, the main collection of data will be carried out using the survey with a sample of approximately 1,500 students (for a 95% confidence level), from a total study population of 250,000 students. Even if we cannot work with a totally random sample, in order to guarantee the representativeness of survey data we will work with a stratified sample collected in the different regions of the country. After the collection of data, the first analysis will be based on the statistics that could give us some information about how our senior students - future professionals - learn and organize their learning. In this part we have planned not just a “critical reading” of the statistical report, but organizing some focus groups with experts (divided by geographical zones), to analyse the data, from the general educational perspective, as well as from the Higher Education institutional perspective.

**Task 3, Pase 3:** Diagraming PLEs and understanding the underlying models. In order to go deeper in the exploration of other ways for analysing PLEs, in this project we are going to analyse PLEs, also, from the graphical point of view. Following some studies conducted before by other authors (e.g. Willson, 2008; Casquero et al. 2010, Casquero, 2013, among others), we consider PLE diagrams as an important research aspect. Therefore, in this project we have proposed the creation of a tool - the PLE's diagramer - for collecting information and automatically providing the graphical representation of PLE based on this information. Consequently, during the data collection process (included in the task 2) and using the theoretical model and the survey developed as theoretical framework, we are going to develop a PLE Diagramer Software. Once the whole data (task 2) is collected, we will resample these – at this time randomly - and enter these sampling data into the diagramer. The main idea is to obtain a graphical representation of the existence and nature of PLE
components, as well as the relationships between them. Then, the diagrams corresponding to
the resample data—will be analysed, first in small groups by some experts, and then together
in a greater group of discussion. The idea is trying to detect PLE graphical models if there,
trends, special relationships between concepts, mechanisms, even styles related to gender,
area of knowledge and so on. Additionally, after the analysis, if the developed tool and the
conclusions are relevant, we have the intention of making the tool accessible to public in the
Web, as a mechanism for self-evaluation and improving own PLEs.

Task 4, Phase 4: External analysis, models catalogue and institutional implications of
data. The final part of the project will have a wider and global perspective of the preliminary
conclusions we have obtained on the previous phases. We consider crucial that, after some
particular analysis it must be done a global one, which could relate every part into usable
conclusions, for research, for educational practice, as well as for the theoretical framework of
the field. For this part of the project, we will work, not only with the panel members of the
research team, but with a group of international experts who act as the project's international
advisory board.

In addition, this discussion will be held in parallel in Spanish and English, trying to get the
most out of the skills of our experts. It is expected that the analysis will be done over in two
face to face working days with 3 main sessions: a discussion session in English, Spanish
discussion session and a plenary session. The idea is that experts will meet them in two
consecutive groups of work; a discussion group in English, and a discussion group in
Spanish. Therefore, researches will be assigned to a discussion group mainly decided based
on which language is more comfortable to engage in a discussion of this draft. All experts
may attend the two sessions of discussion, but in one of them they could just participate as a
spectator. Thus, the two discussion groups have different members, with only two exceptions:
one of the researchers of the core group, which will act as coordinator of the meetings, moderator and facilitator, and another, which will act as rapporteur and documentary of the same.

In these discussions we will not only discuss the PLE modelling analyses made in the previous phase, but since all the findings also have phase 2, we will address in the discussion groups which are the educational and institutional implications and important conclusions we have reached with the data. Later there will be a plenary session work (with both groups), which will contain the conclusions of both arguments. At the same plenary meeting, and once exposed the conclusions, we will create working groups to draft and document a catalogue of models and their components as well as the proposals and implications suggested by the group. These new working groups will be coordinated by researchers, that will feature the work of others not attending the same. Additionally, we try to include in this new analysis practical proposals consistent with the conclusions we have obtained. This is the time to emphasize that we do not understand the goal of this project to develop a model catalogue of desirable or good PLEs, but to try to analyse what PLE models are used by current and future professionals and to provide explanations, suggestions and proposals about what this means in the face of education and formal training.

In order to achieve every objective -and task- in the three years period of the project, we have programmed some periods only dedicated to one phase or main task - for concentrating our resources and efforts - and some periods with activities in parallel. The schedule is described in Table 1.
Table 1. CAPPLE Project Schedule

**Current and future steps**

At the moment of writing this paper, we are still in the middle of the first phase. We have just started the questionnaire validation process, so we do not have data for sharing yet. We are in the middle of an ambitious, complex and multidisciplinary project that we firmly believe that may have impact on both fundamental research in this field (with modelling PLEs, the creation of a tool for analyzing and diagramming them, over and above the empirical evidence of the PLE's nature), as well as institutional applications of its findings to the initial vocational training strategy, and why not, even basic education.
We think it's an innovative proposal and intends to take another step in research on PLEs. We actually don't know much about how will be the end of this research, we are trying to learn and improving it day to day. That is the challenge that we propose and we present it to you for continue discussing and learning.
References


Book available complete or by parts on www.um.es/ple/libro


