

Developing a framework for research on personal learning environments

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Each learner is unique and will have unique learning experiences. What motivates learning, what triggers curiosity, and what tools might enhance learning will be different for different learners. This makes the design of a Personal Learning Environment that serves as an aid to each possible learner, a challenge. The design of learning experiences is a complex matter and involves not only using effective technologies and applying cognitive triggers, but there is a need to also design for the affective dimension of human experiences: the impressions, feelings and interactions that a learner might or could have with the online content, with others, and with technology. Our research in the design and development of a Personal Learning Environment led us to the development of a research and design framework that encompasses the full process cycle, from inception of the PLE idea, research of suitable tools to incorporate in it, and the recommendation of a prototype after educational research and evaluation of learner experiences with the learning environment. The research highlights tools suggested by 'super-users', motivational factors in connectivist learning, and competencies required to operate in such a learning environment.

Tags

PLE, MOOC, learning
experience, research design

1. Introduction

Over the past five years, the proliferation of emerging interactive social media has influenced the design and development of learning environments. The Learning Management System (LMS) has come to maturity, but has been seen by educational technologists as not capturing the spirit and possibilities that new media have to offer to enhance the learning process. They are controlled by educational institutions and are subsequently used to support institutional learning (Weller, 2010). Each learner is unique and will have a unique learning experience. New technologies now make possible for learning opportunities to be sought and controlled by the learner through online systems. This has instigated the research and development of a different type of learning environment than the LMS: the Personal Learning environment (PLE), which is designed to afford the learner control over his or her learning, rather than to place this control in the hands of the educational institution. The needs, requirements and experiences of using a PLE will be different for each learner, which makes the planning and development of a PLE that serves as aid to each possible learner a challenge.

Several research projects in the development of PLEs are currently taking shape worldwide. These PLEs all have the control of the learner at their centre, although as most are being developed in and by institutions of Higher Education, the implementation of most is related to institutional learning (Buchem et al, 2012; Fraser, 2009; van Harmelen, 2009; Wilson, 2007). The research described in this paper and the evaluative framework developed is positioned outside educational institutional boundaries and constraints in order to develop a 'pure' PLE that supports learners in their lifelong and life-wide learning endeavors. This learning could be

informal and directed fully by the learner, or related to institutional learning, but the PLE owner is the one to make choices about the experience and the process; the one to be in control (Kop, 2010).

Educationalists and learning technologists (Latour, 2005; Lankshear and Knobel 2006; Wilson, Liber, Johnson, Beauvoir, Sharples, & Milligan, 2006 2006) philosophized on how the second wave of Internet technologies could be instrumental in moving from a hierarchical institutionally-based teaching approach to a networked approach. Social media would facilitate the transformation from an educational model that is structured in courses, controlled by the institution using a 'broadcasting' model in an enclosed environment, to becoming a model adaptive to learners' needs, owned by individuals, while using an aggregation model in a personalized open learning environment, and a fluid extension of the wider informal personal space. Communication could be facilitated through the use of social software such as blogs and wikis, while information would be validated by others on the Internet through social bookmarking tools in addition to others on the network. According to some, a PLE should be accompanied by social networks and suitable private and public communication channels (van Harmelen, 2008) so that learning can take place in a community of learners. Haythornthwaite (in Van Harmelen, 2008) argued that membership in a community of learners can transform weak ties into strong ties by private communication and thus facilitate a higher level of engagement than if only conversation on a network were to be used. Moreover, semantic Web features, such as the intelligent use of personal data and data collected related to earlier learning activities might be used to aggregate relevant information for and by the learner.

This article will outline a learning design framework developed to evaluate a Personal Learning Environment. It will outline methodological concerns, and focus on the identification of technologies found most valuable for a PLE by 'super-users', the functionality of the learning environment, as well as the pedagogical and educational issues that are of importance to create valuable learner experiences.

2. PLE Research and Evaluation

To design, research, and evaluate a PLE development and capture its usage, the learning process and the educational outcomes, is challenging. The openness of the environment and the number of different dimensions that can be investigated are vast. Moreover, PLEs are so new that apart from research in institutionally based PLEs/ePortfolios (JISC, 2008; Kompen,

Edirisingha, & Monguet, 2009; van Harmelen, 2008) not much empirical research in their development and use has been published yet. In addition, in the relatively new field of Learning Technology, researchers have been grappling with the question of how best to research learning design innovations. As designing a new learning environment is a multi-faceted process, researching whether an innovation is effective in a particular educational setting is complex. To add to this complexity, learning technology is a multidisciplinary field that has attracted people from a wide variety of disciplines from the sciences, engineering, humanities, psychology to education, all with different traditions in research approaches and methods. What then would be a suitable research approach for the rigorous investigation of educational issues in the context of innovation and the design of new technology enhanced learning environments?

The USA National Research Council Committee produced guiding principles for Scientific Research in 2002. Shavelson, Phillips, Towne, and Feuer (2003) argue that all the sciences, including scientific educational research, share basic principles. In their words, all scientific research should:

- Pose significant questions that can be investigated empirically
- Link research to relevant theory
- Use methods that permit direct investigation of the questions
- Provide a coherent and explicit chain of reasoning
- Attempt to yield findings that replicate and generalize across studies, and
- Disclose research data and methods to enable and encourage professional scrutiny and critique.

(Shavelson et al., 2003, p. 26)

This seems to be a guide relevant to most disciplines of study. The aim of most empirical research is to be as objective as possible. In fact, most researchers aspire to be unbiased in their views, to be objective in their methods and to create knowledge that is reliable and that stands up to scrutiny. The consensus amongst educational researchers is that a certain level of objectivity can be reached through the use of mixed-method approaches. In educational research the researcher has to make the choice between research in the processes taking place, the

perspectives and understandings of the people in the setting, or research in the outcomes of the educational occasion. If they take the first approach, they are not so much interested in the “input and output” of education, but in what happens between the two: “it presents detail, context, emotion and the webs of social relationships that join persons to one another” (Hammersley et al., 2001, p. 55). Quantitative research can show that change has taken place before and after tests, but qualitative research can show the detail of how change came about.

One approach to take would be Design Based Research, which is a methodological approach that examines and analyses in a systematic way every aspect of a new learning design innovation. Bannan-Ritland (2003) for instance showed with her learning design framework what a rigorous research approach this could be. From the moment the initial idea for the development is born, an exploration of the literature takes place, and then through an iterative process of development and testing, evaluation, and the dissemination, diffusion and adoption-stage of the tested prototype of the designed environment, research takes place. Areas researched could be the usability of the different components and the product and interface design of the software developed, the interaction between the components, the experience design, the pedagogical or instructional design, and the educational research to find out

more about the learning process and if the innovation actually enhanced people’s learning experience. This seems a viable way to research a PLE as it includes research in all important design and development areas. It involves a combination of qualitative and quantitative research, including market research to find out what components and tools people find valuable in the personal learning environment, usability testing to find out if the components developed in the different iterations actually work, and collecting data on the learning experience by using ethnographic methods and data mining.

Our PLE research project has used a design-based research approach, and the following framework visualizes the initial phases of research and development already undertaken towards the eventual diffusion of a PLE platform:

A combination of background research, innovation development, and educational research have been used to investigate our Personal Learning Environment in a robust and innovative environment to instigate learning and to enhance people’s learning experiences on open online networks .

The design of a PLE is not only an applications design challenge but also a matter of designing appropriate pedagogical and epistemological infrastructure (Conole, 2013; Rubens, Emans, Leinonen, Skarmeta, & Simons, 2005). These infrastructures

Design Based Research Approach consisting of:	Design type	Research methods	Development phase	Evaluation phase	Dissemination phase
Background research	Product design Usage centred design Interface design Learner experience design Instructional design	Literature review Super-users surveys Close contact with PLE researchers worldwide	Feed results of literature and surveys into the design		Journal articles, book chapters, conference papers
Educational research	Learner experience design Instructional/ scaffold design	Piloting testing and comparisons of learning in case studies (with different users in different scenarios)	Case studies in MOOCs Workplace-based Multi-media based without and with PLE	Evaluation of learner experience Evaluation of instruction/ facilitation/ scaffolding Theory development	Journal articles, book chapters, conference papers

Table 1. Initial phases of research and development of a Personal Learning Environment

could be important influential factors on the pedagogical usability of a PLE. Consequently, scenarios involving users (not just “end users” but users at the center of the design, see Shackel, 2009) have been generated to test the different PLE tools and functionalities that support networks of people, content and services that are adaptable and responsive to changing needs and goals, while capturing evidence and artifacts of the context in which learning takes place, whether formally or informally. Component development and testing have unfolded in iterative cycles involving users, tasks, tools and functionalities within a PLE. Plans for usability testing involve education design and the assessment of the impact of features such as scaffolds and just-in-time information presentation (linking supportive information to the task), which are believed to result in quality learning outcomes (Merriënboer, Kirschner, & Kester, 2003). The PLE will also offer opportunities for free, unguided, and unstructured exchange and collaboration, which some have argued does not necessarily result in productive activity or learning (Kreijns, Kirschner, & Jochems, 2003; Winn, 2002), but which have been highlighted by others (Downes, 2009; Cormier and Siemens, 2010) to be required to truly get immersed in networked learning.

3. The Learning Experience

There are different traditions in qualitative educational research, and Mayes (2006) proposed the use of the Interpretative Phenomenological Analysis (IPA) approach in e-learning. In his research in formal e-learning, he emphasised the need to not only research issues related to the institutions and teachers, but to also capture the learner perspective (Mayes, 2006). His report on the LEX (Learning EXperience) project provides a convincing argument to choose an alternative method to that used in e-learning research in the past. He decided to use IPA and typified the method as ‘a method for exploring how participants make sense of their own experiences’ (Mayes, 2006, p. 6). It explores a particular phenomenon and tries to capture ‘a detailed story of the participant’s own experience, rather than an objective account. It assumes that participants are experts in their own experiences and can offer researchers an understanding of their feelings, intentions and motivations, and attitudes’ (Mayes, 2006, p. 6). This method could be used to assess the learner experience in a PLE.

The majority of models representing the way people learn in e-learning and other forms of design based learning are currently founded on the development of positive learning

outcomes under the influence of effective teaching practice in institutions of Higher Education (Falconer & Littlejohn, 2006; Derntl, Neumann, & Oberhuemer, 2009). The standards available are also based on teaching and learning in Higher Education (Derntl et al., 2009). The challenge for modeling the learning design in a Personal Learning Environment is that it is not founded on institutional design practices with their focus on instructor led teaching, but on a design in which the role of the learner is the determining factor. He or she would control the learning process: the learning tasks, the learning resources and the learning supports. It could be argued that resources and artifacts, called mediating artifacts by Conole (2013), play a role in the learning experience.

The motivation to learn, however, and the choice of artifacts, would solely rest with the learner and stem from his or her need to learn, which would be influenced by a variety of factors, such as interactions with others, authenticity of tasks, personal ambitions and interests. This learner control is the guiding principle in the PLE developed in our research, as opposed to other PLEs being developed in an institutional context (Wilson, 2007; Attwell, 2009, van Harmelen, 2009; Fraser, 2009). The PLE project research and development team has made choices about the composition and interaction of components and scenarios required to build this vision and to create meaningful personal learning experiences that reflect this. The design of a PLE in this sense requires consistency in components design that will aid the development of a meaningful learning experience. All these aspects and their interrelation influence how meaningful a learning experience will be to a learner. The developers should ‘understand what makes a good experience first, and then [to] translate these principles, as well as possible, into the desired media without the technology dictating the form of the experience’ (Shedroff, 2009, p1). Learning should be the central focus of the design of the experience.

However, decisions had to be made on what to research and what features to develop. There are clearly several challenges to learners who move away from the support of educator and institution. These relate, amongst others, to issues related to the learner level of autonomy in the form of confidence and motivational factors related to ordering, sequencing and finding learning resources, and in critical literacies required to learn in an open networked environment (Bouchard, 2013). Skills and abilities needed to thrive in a PLE are not negligible, especially if people have to learn and develop these by themselves. A Personal Learning Environment is, after all, a place where

people direct their own learning, instigate communication, and organize and structure the learning activities.

How will the PLE allow for this? How to research these factors in an open networked environment? What can the learning environment itself mean in the development of these competencies and abilities? There are no fast answers to these questions as not much research has been carried out to obtain a better understanding of the new ways of learning. Our chosen research approach has been twofold:

1. To find out from current advanced technology users and developers with relation to an educational and learning environment what tools, features and support structures they would find most useful in a PLE. Data have been analyzed and applied to the design and development of the PLE.
2. Educational research has been carried out in the form of case studies that compare the use of generic ICT features in an educational environment with the use of aggregation, sharing, repurposing, and exploitation of artifacts in the context of connectivist-style Massive Open Online Courses (cMOOCs), as PLE enablers.

4. PLE Education Research

The PLE research project explored three interlinked research questions related to the educational aspects of personal learning environments, including:

1. Does the PLE support people's learning?

A broad based inquiry explored the impact of personal learning environments on "adult learning". Research themes focused on how learning is supported (impacted) in the PLE, including social constructivist and connectivist perspectives, as well as theories of networking, complexity and self-organization. The research delved into personal learning competencies more specifically, e.g. critical thinking, reflective thinking, self-monitoring skills, independence and autonomy, along with other factors that influence learning, including teacher-facilitator-moderator-tutor- knowledgeable other roles, motivation (intrinsic motivation), and persistence and engagement in learning.

2. Does it enhance the learning experience?

The research examined how the PLE might enhance the learning experience, specifically how the various tools and technologies

are utilized, the frequency of use, and the processes and artifacts produced. In addition, the nature of the interactions between PLE users, their occurrence and their quality will be investigated in depth.

3. How does a PLE support the learning process?

These questions have been investigated by comparing and contrasting particular learning situations, after initially carrying out a preliminary study with advanced ICT users. The two instances were as follows: 1) A learning situation where a generic learning environment and generally available technological tools were being used and 2) A learning situation where PLE was the topic and the learning environment was a Massive Open Online Course. Case studies were conducted that focused on particular features, challenges in learning and its development, and target participant groups. Case studies provided opportunities to explore if and how people access and use tools to support personal learning in different situations and for different learning activities, and how people actually function in a PLE- type environment, such as a MOOC. Research methods were mixed and included both quantitative and qualitative data sources, analyses and reporting. We measured for change in the learners themselves as documented through self-reports and tracking of additions or modifications to personal profile data. Both quantitative and qualitative data on participants' capacity to acquire or develop personal learning competencies (e.g., critical thinking, reflective thinking, self-monitoring skills, independence and autonomy, etc) were collected. Methods of data collection included: observation, data-mining in combination with critical event interviews, the use of reflective diaries by learners, educators and focus groups. The educational research was designed around different end users, groups, and interaction modalities in an attempt to address educational assumptions and research directions in building a PLE, including: control and self-direction of learning, the role of support and scaffolds and their impact on learning, social versus individual learning, thus documenting better practices and educational outcomes.

5. Preliminary Study Results

Surveys of potential PLE end users were conducted to collect baseline information on experiences and perceptions regarding learning in relation to the tools and functionalities already in use.

At the first stage of the PLE research we asked advanced ICT users, people who are using advanced technology in their everyday life and learning, which tools they use, and how and why they choose to use them. We surveyed “super-users”. In the literature, the word “super-user” is used in different contexts and in different meanings, ranging from loyal users in social media campaigns, to the user account responsible for the IT system administrator, to brand ambassadors (Merritt, 2009). In this paper we define super-users as people who use advanced Internet tools and technologies in an educational environment. These tools would include information aggregators, editors and publishers; tools that exploratory research highlight as possibly important to a Personal Learning Environment.

The first phase of the research involved gathering information from potential users; what they consider to be the important components, applications and tools in a PLE. The methodology included surveying “super-users” on their use of existing tools, applications and systems in order to enhance the development of the highest possible PLE specification.

6. Use of Online Applications

A first survey was conducted to collect baseline information on experiences and perceptions regarding learning and use of technology by Internet users, on tools and functionalities already in use in order to learn what the important issues and features in the development of a Personal Learning Environment might be. The survey questions were developed based on knowledge and expertise within the PLE research and development team. The online survey format was tested internally amongst the NRC PLE research and development team before it was launched at large. The survey included 28 questions and contained closed and open-ended questions; some allowed only one answer, others provided multiple options, with text boxes for additional comments and elaboration.

An invitation to participate in the online survey was advertised on the Principal Investigator’s online learning daily newsletter—OL Daily (<http://www.downes.ca/news/OLDaily.htm>) and an email was sent to a targeted list of individuals who participated in an online symposium on Personal Learning Environments (PLEs) and Personal Learning Networks (PLNs), <http://lrc.umanitoba.ca/blogs/ples/about/>

Findings from convenience sampling are usually not representative of the general population, so conclusions from this preliminary data set are limited in their generalisability.

The goal was thus to derive useful information from the data to inform the PLE design and development process. In total, 204 surveys were completed. Respondents’ profiles and background information provided the criteria for recruiting and retaining those who were skilled or experienced to participate in subsequent surveys and usability testing. Inclusion criteria include: adults over the age of 18; experience with computers and the Internet; and experience with social networking tools and applications (e.g., Facebook, RSS, forums, blogs etc.).

The survey was structured in several sections, starting with a section containing information on participants’ background and on their use of technology, including their motivations and frustrations. Another section surveyed participants on their management of learning; where they find information and what helps them understand and combine information more specifically. Finally, the last part of the survey dealt with design issues in creating a Personal Learning Environment. The overall sample size was 204, with majority of males (55%), and 44% female respondents.

Figure 1 highlights the age range of participants as capturing a broad spectrum of learners from young adults, middle-aged, to mature adults, with a majority between 43-48 years old (22%).

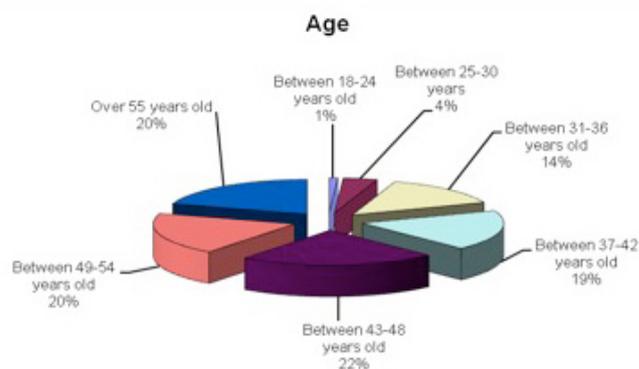


Figure 1. Percentage for age range for PLE survey participants

Although most participants were from North America (48%), there was strong representation from both Europe (27%), and Australia (18%). The majority of participants possessed either college or university level education (90%). A majority of respondents were employed (82%) in the following professions or areas: university instructor, departmental EdTech liaison, software designer, high school teacher, research assistant, K-12 school principal and deputy principal, and knowledge developer. Participants were also asked about their use of technology and their level of use. In general, survey participants rated their

technical ability as excellent (42%) or very good (39%); we can assume that the majority was comfortable with various computer technologies.

Motivational factors in using computer based technology were diverse (see table 2). The motivational factors with the highest percentages were the “desire to learn something new” followed by “producing something that they can be proud of”, and the lure of finding “a real gem of information”. Other important motivational issues were “to see something made by others that is really amazing” and “when others recommend something really interesting”. Other comments related to motivation highlighted issues of efficiency, supporting others in their use of technology and learning, and the requirement of using the technology in the work place.

Motivation factors	Number	Percentage (%)
When I learn something new	196	96
To produce something that I can be proud of	149	73
When I find a real gem of information	148	73
To see something made by others that is really amazing	129	63
When others recommend something really interesting	128	62

Table 2. Motivational factors in using computer based technology (N=204)

Participants were also asked about their frustrations with the use of computer-based technology in general. The most common frustrations as chosen from a list of options were as follows: advertising (62%), when technologies do not work (62%) or “phishing” or identity theft (46%) as listed in table 3.

Answer	Number	Percentage (%)
Advertising	126	62
When it doesn't work	126	62
When someone is trying to "phish" my identity	93	46
Telephone answering loops	67	33
When I can't find what I am looking for	66	32

Table 3. Frustrations related to the use of computer-based technology (N=204)

When using editing and publishing tools, blog publishing tools ranked highest in preference followed by online word processors and photo and video sharing sites. Real time communication/collaboration tools were ranked 5th in the category of editing and publishing tools. Finally, with regards to the use of online services, activities or applications, participants showed a preference for several different choices. The top five choices are listed in table 4.

Services/Applications/Activities	Number	Percentage (%)
Online learning environment (school, college, university)	158	77
Internet shopping	134	66
Internet application organizing tool (iGoogle...)	128	63
Online product reviews and ratings	121	59
Leave comments and rate people's blogs	114	56

Table 4. Online services, activities, or applications consulted (N=204)

Participants identified “other” online services, activities or applications either consulted or engaged in on a regular basis. Among them were Twitter, Etherpad, lino, wallwisher, Zotero, Librarything, WordPress blogging, RSS-Feedly, forums such as <http://forums.whirlpool.net.au>, <http://www.dtvforum.info/> and Ning, just to name a few. Social networks were also consulted for sharing photos, videos, for meetings, creating and socializing in Virtual Worlds (e.g., Second Life), blog writing, and various social media.

Survey respondents provided information related to their management of learning and what helps them to learn. Figure 2 illustrates where a majority of respondents find information on a topic of interest, with the majority indicating Google or other search engines (98%), the web (92%), followed by social networks (69%), RRS feeds (69%), and books (68%). Friends were also important in finding information (50%) and other options were explored as well, including: university subscription services, databases (e.g., EBSCO, Lexis/Nexis, Naxos), professors, researchers, popular media (e.g., newspapers, magazines, ads), YouTube, occasionally TV, and online library collections.

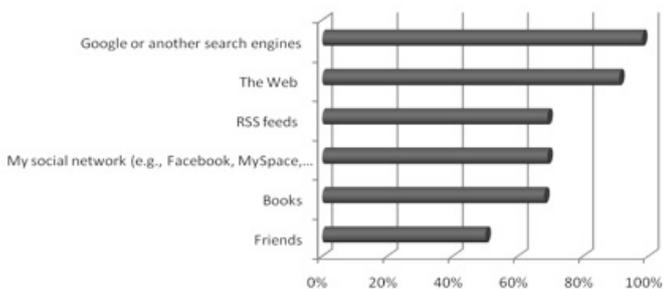


Figure 2. Most popular resources to help find information about a topic of interest

Next, the most popular modes or mechanisms used for understanding and combining information are presented. Figure 3 reveals that a majority of respondents prefer “interactive activity” (69%) for understanding and combining information, followed by “presentations using graphs and charts” (54%), or “when presented in a video podcast” (52%).

Participants expanded on their answers regarding mechanisms that help them understand and combine information. What follows is a sampling of their comments:

- when I can discuss it with others, screencasts and slidecasts
- when I can organize it so it makes sense
- when it is posed as a challenge
- when I take notes and rework/process them
- when someone tweets a useful link and someone else tweets a link to a related story
- when I can combine and check information flexibly
- when it’s blogged or op-ed’d
- when I can do something with it

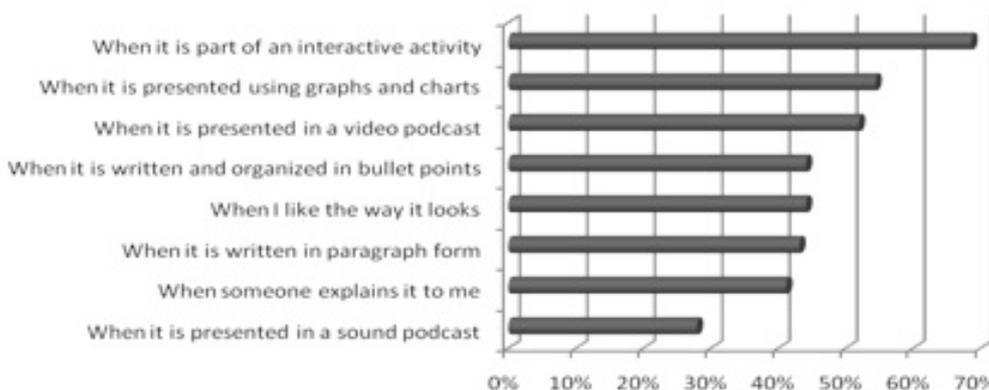


Figure 3. Popular means for understanding and combining information

- when it is written simply without a lot of extra words and jargon
- Cmap, visual approaches
- solitude and reflection

This information could potentially inform the design and development of learning support mechanisms or scaffolds that would be available to learner/users of the PLE. In addition, a majority of participants indicated a preference for sharing interesting information from someone with their social network (79%) and thinking about the information (78%). Sharing the information via email (71%) was also important, while commenting (61%) and writing (57%) of blog posts was also seen as a valuable activity related to received information. Under “other” comments, a high number of respondents indicated a preference for (social) bookmarking options to help them understand and combine information (e.g., share on Greader, Diigo, Tag it in Delicious and Retweet). A majority (83%) of participants indicated a preference for talking with other people to help them reflect on either a topic or learning activity. Receiving feedback from others, knowledgeable persons in particular, were seen as important for 56% of respondents. Writing it down in their own words (74%), was also a well-liked strategy to facilitate reflection. Several found reading related material to be helpful (58%) as well as being on their own without distractions (50%). Another important aspect of the survey was aimed discovering which features and design issues of a Personal Learning Environment would be of greatest importance to learners. The features that were viewed as highly desirable in a PLE are presented in figure 4.

When presented with a list of possible features for a PLE, participants emphasized both the ease of navigation and the

offering of a variety of tools within the PLE as key requirements. In addition, functionalities that would enable interactivity, encourage personal development, and facilitate customizability of their personal learning environment where also requested. Components to help with career and employment planning, and to write a CV were all seen as less important. Comments in the 'other' response section ranged from issues of effectiveness and organization, to flexibility, shareability and transferability.

Participants were asked which information search and organization features would be most desirable in a PLE and several options rose to the top of their priority list. The PLE should not only help learners find information relevant to them, show information in a variety of formats (e.g., text video,

audio), allow learners to 'mash up' information from different sources; it should also help learners to collect information, edit and produce something from it, and publish it on the internet. Responses provided under the 'other' option reflected a desire for personalization, the integration of social bookmarking, and social networking applications. Percentages for the most important features and issues in designing one's own personal learning environment are highlighted in figure 5.

Survey respondents were also asked about features they would need to have to support their learning in a PLE. Table 5 highlights features that would support 'learning from others' and 'help manage learning activities', including structuring, organization and planning, and finally storing learning activities as a priority

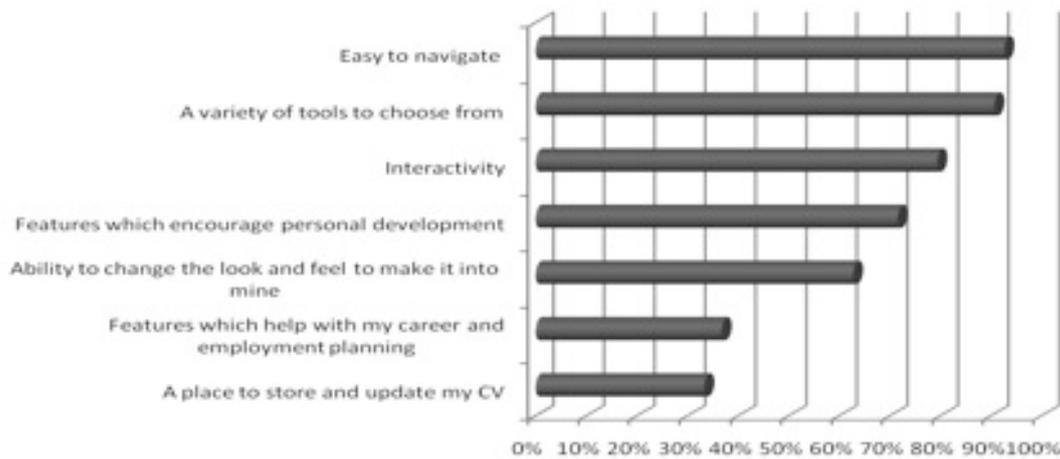


Figure 4. Desirable design features in a PLE in general

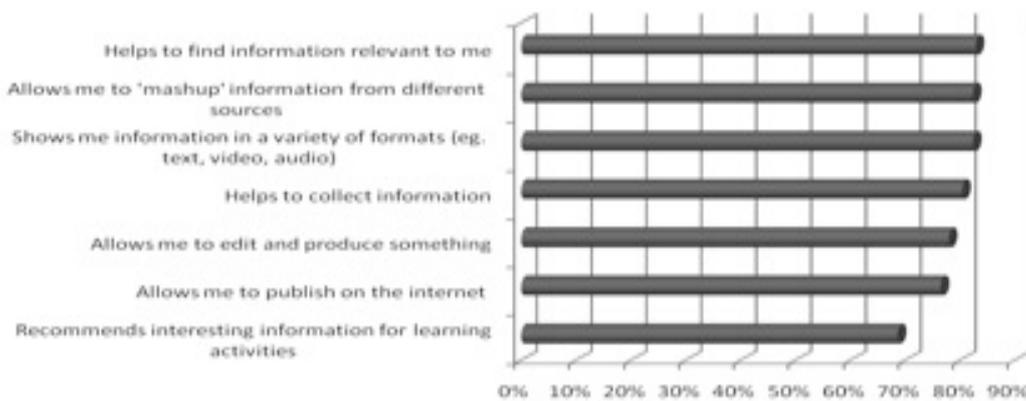


Figure 5. Desirable PLE features for information search and organization

for a majority of respondents. Other important features for supporting learning in a personal learning environment are presented in the following table 5.

Motivation factors	Number	Percentage(%)
Allows me to use it to learn from others	176	86.27%
Allows me to structure my learning activities (e.g., in folders)	163	79.90%
Features that help me to organize and plan my learning	162	79.41%
Provides a way to store all my learning activities	160	78.43%
Allows others to give me feedback on my learning activities	144	70.59%
Allows me to teach others	141	69.12%
Allows me to socialize with others	134	65.69%
Provides feedback on my learning activities	116	56.86%
Helps me to be critical of the information and resources I find online	107	52.45%
Teaches me about how the tool or application works	96	47.06%
Features that help me to learn about differences in quality of information sources	88	43.14%
Helps me to understand how search engines and other information sources work	62	30.39%
Other	15	7.35 %

Table 5. Features that support learning in a personal learning environment

To find out if learners would object to recommendations based on data collected in their learner profile and earlier searches for finding relevant information for them in the future, respondents were asked to provide either an affirmative or negative answer. These percentages are presented in table 6.

From earlier searches	Number	Percentage(%)
No answer	12	5.88%
I would be happy	170	83.33%
I would be unhappy	22	10.78%
No answer	18	8.82%
I would be happy	120	58.82%
I would be unhappy	66	32.35%

Table 6. Data collected from earlier learning projects for finding relevant information

7. Information Aggregation

Participants from the first survey were invited to participate in a second survey which examined the use of information aggregation tools and technologies, and to share issues and challenges based on their previous experience with collecting various forms of data and information from various sources. Their views would help to inform the design and development of PLE components related to information aggregation. In total, 68 participants completed the survey, with a majority of males (57%) between 43-54 years of age, with representation for groups 25-26 years of age to seniors 55+ (same characteristics as for the sample population for the online application survey). Table 7 provides a sampling of issues and features raised by the “super-users” which should be considered in designing tools for information aggregation within a PLE.

Important features and issues
Ease of use Tools and networking options
Loading time of the environment options for customization
Personalization and choice over automatic inclusion of information streams
Intelligent information searching options
Some indication of trust and reputation of sources as relevant for information searching strategies used
Synergy/ integration with LMS systems
Visual representation for the organization of information— i.e. automatic tagging, ranking for quality and relevance, e.g. number of stars, flags, annotations
Cross platform environment with mobile options

Table 7. Features and issues for designing tools for information aggregation

8. Editing and Publishing Information

Information and recommendations for supporting editing and publishing activities in a PLE were also gleaned from a sample of 62 respondents (“super-users”) who participated in the first and second survey, with comparable demographics for age, education, and ICT skills as previously described. Table 8 presents some of the important features and issues to be considered in designing editing and publishing tools for use in a PLE, first in general, then for specific activities such as text, photo, web, video, as well as sound editing and publishing.

Survey respondents also highlighted important features and issues in web editing, video editing, and sound editing which included many of the same options mentioned previously for general text and photo editing and publishing activities: namely ease of use, flexibility, capacity, variety and range of options/formats, and mash up capability using a variety of applications. There was also a preference for using a combination of editors, for organizing one’s own editing and publishing activities, and having an intuitive interface design. Other valuable features for editing and publishing include options that are ‘handy’ and

‘right for me’ with the option to “customize” and “refine the organization” as much as possible.

9. Case Study of the Critical Literacies MOOC

The first case study (that would lead to the design and development of a PLE was) carried out in a Massive Open Online Course. The design of the Critical Literacies MOOC (CritLit) was based on an understanding of the skills and capacities required to effectively learn using a PLE. The course encouraged learning in a network, based on a model of the personal learning environment, in which each learner aggregates and works with a unique set of resources. There may be a central theme or structure offered by the facilitators, however there is no particular body of knowledge or information expected to be acquired by learners. The research underlying the course examined whether learners can employ a generic PLE environment in order to develop those capacities, specifically whether learning may occur in a PLE or whether an additional pedagogy is required prior to the use of a PLE. Baseline information from students entering the learning situation, their learning experiences, and

General
Ease of use Simplicity Universality
Compatibility issues in editors
Clear and easy: menus, navigation, structure, instructions
Simple and complex tracking advanced features right click options: help keyboard shortcuts user defined styles macros
Multimedia file inclusion options: images, video, audio
Text Editing
Various formats: brochures, newsletters, blogs, etc. Inter-operability (e.g., file format)
Online collaboration simple and granular sharing
Indexing and cross referencing
Photo editing
Cropping resizing (dimension and resolution) options RAW import, non-destructive brightness / color and exposure adjustment options; the ability to adjust hues, in addition to options to use artistic filters and to use layers
Ability to add text and shapes add metadata captions label annotations
Simplicity ease of use universality level adjustment connectivity
Options to convert and save in a variety of file formats multiple formats intelligent file size optimization
Extensive tutorials & help intuitive interface multiple import export options low cost open source (free) solutions
Produce mash-ups with a variety of applications save them somehow

Table 8. Features and issues for designing tools for editing and publishing information

their learning outcomes will be compared and contrasted across a generic learning environment “without PLE-type components” first, then across “with personal web environment” conditions as PLE research and development efforts progress.

In total, 377 registered for the CritLit course with most of the countries of the world being represented. The highest number of participants was from Canada and from the United States. Only the countries with the highest number of registered participants are represented here for practical reasons. A total of 40 participants out of 377 completed the first survey with 50% having indicated they had participated in a Massive Open Online Course before. For many of the respondents, the experience could be described as positive as some of their comments highlight below.

[CCK08] MOOC--being a for credit learning added to the motivation to complete.
... a rich experience [...] I could connect to many people and points of view .
[in the cck09 course] I enjoyed the experience of autonomy in relation to my own learning. I learned to design my PLE , and all the processes helped me to substantiate my ideas on didactics and education.
Transformative in terms of my thinking about the future of education.
I found the course a thought provoking exercise.
[...] I was highly excited . It changed my pedagogy forever!!
In my opinion tutors make the difference!

Table 9. Highlights of previous MOOC experience

Participants were also asked to reflect on negative aspects of previous MOOC experiences. Some reported becoming less active as the course progressed, having a difficult time finding the information, feeling overwhelmed, and a lack of confidence in their use of technology. Survey respondents were asked to share two learning objectives that they would like to accomplish in the course. Some expressed objectives related to learning within the environments, gaining experience with the tools and technologies, using web2.0 tools efficiently, and getting firsthand experience with PLE and connectivism. Others set objectives to build on and assess their own literacies and implement this kind of course at their university. Social aspects of learning within an MOOC were also emphasized such as developing relationships and learning from others and sharing personal experiences in the educational environment. Some more general objectives for learning included: information exploration and networking, learning how to manage online information better, learning how to assess the quality of online information, and exploring how Critical Literacies can help building Personal Learning Environments. Conducting research in open online course and networks was the intent for a few others. In addition, many of the respondents indicated a preference for asynchronous communication as they preferred having time to think and reflect before posting their thoughts, while others felt that it was easier to analyze the topic of discussion. Some participants highlighted difficulties with attending synchronous events and also a preference for text and image based communication over video and audio with slides, as it made it easier for them to skim and re-read.

Figure 6 illustrates that the preferred tool(s) for learning, communicating, collaborating and engaging in online courses for the majority was “their blog or blogging” (n=9). Twitter

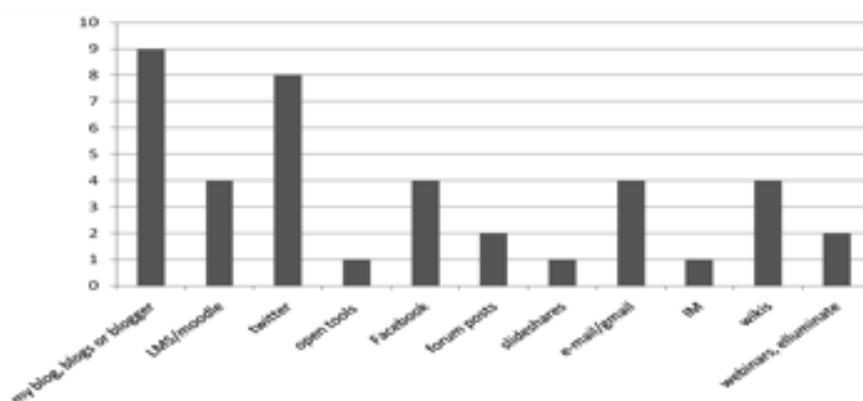


Figure 6. Preferred tool and technologies for learning, communication, collaborating, and engaging

was the second most popular tool for learning (n=8), followed by Facebook, email/Gmail and wikis (n=4) as the third most popular amongst the 40 survey respondents.

Other preferred tools are also listed in figure 6. Other activities were offered within the course as well, including: weekly wrap up sessions, live guest speaker presentations, and The Daily newsletter which provided a summary of the week's activities and artifacts produced—blog posts, twitter messages, and forum exchanges for the most part.

A total of 13 participants in the Critical Literacies 2010 Online Course completed a second survey midway during the course. The following are some of the challenges they reported in participating or fully engaging with resources in the course: difficulty situating the content of this course within their own frames of reference, following the structure of the course, understanding the critical literacies required in a networked learning environment, keeping things together and finding time to follow. The dispersal of conversations in different tools did not help according to some participants with frustrations at having to look in many different places for course materials and with topic shifts which are perhaps an integral and defining element of PLE. Respondents were also asked to reflect on the aspects of the environment that they benefited from the most up to this midway point (e.g., tools, technologies—blogs, forums, twitter, or others). Participants highlighted the following as useful support structures in the course: the Moodle forum which served as an outline of the course, links and reading lists, the course blog, RSS feeds pointing to blogs of interest, writing

their own blog, the Daily newsletter, and weekly webinars with experts in their fields.

A total of 8 participants in the Critical Literacies 2010 Online Course completed the final survey and highlighted the following negative aspects regarding their learning experience at the end of the course: insufficient interaction on the Moodle discussion board, lack of integration between different modes of interaction (e.g., blog postings vs Moodle discussions), weak connections between proposed readings and nominal weekly topics, and the lack of any criteria for evaluating progress. Survey participants were invited to provide additional comments on what they felt was the impact of the course structure, activities, resources and presentations on their learning. Participants elaborated on other important aspects of the course in supporting their learning. Their statements are best captured in the following themes: the importance of guided instruction in a MOOC, course structure, activities, resources, and presentations as having an influence on learning and reflection on the strategies used in their own teaching, facilitation provided through slideshare presentations and blip TV videos and the importance of providing good conceptual and technical assistance, the value of guest speakers and countless others providing substantive blog posts, which served as a model for neophytes, and the advantage of having discussions archived for those who could not participate in the live sessions. Survey respondents also provided the following comments and suggestions for improving on the course: facilitators should ask questions on weekly topics in the Moodle forums, better alignment of course content with the theme of Critical Literacies, having a first week only orientation, last week only summaries and feedback, more assigned tasks and

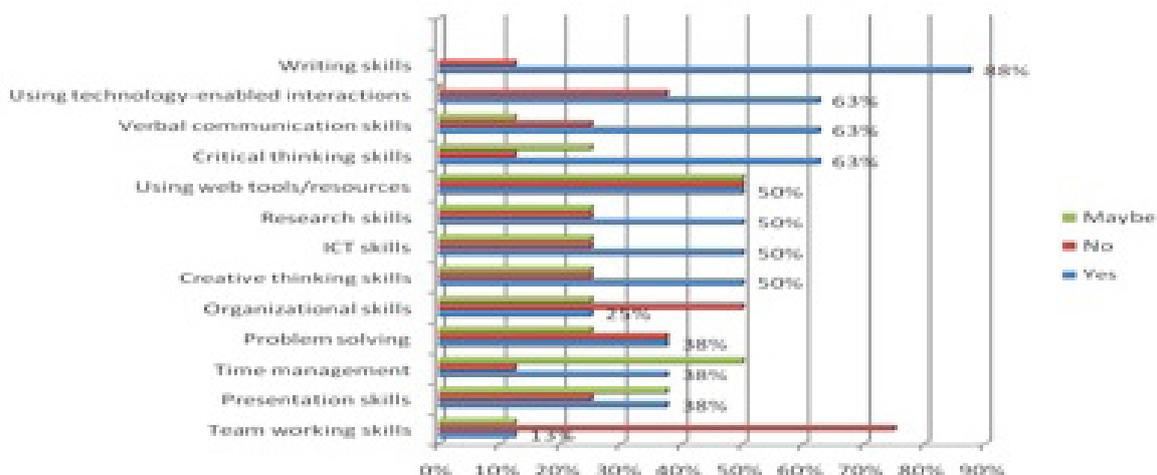


Figure 7. Percentage agreement for skills impacted as a result of taking the course

activities (preferably asynchronous), and lastly, more criteria and/or tools for self-evaluation.

Finally, 88% of respondents (sample size of 9) planned to take a new MOOC course and 75% indicated that they had gained new skills through the course. Figure 7 illustrates which skills participants felt were impacted the most with the highest percentage agreement for having developed writing skills (88%) followed by the use of technology-enabled interactions (63%), verbal communication skills (63%), and critical thinking skills (63%) as a results of their participation in the course.

10. Discussion and Conclusion

The emphasis of the PLE research project is on the quality of the learner experience. Therefore, it is essential to capture data on the learning process while using a PLE. A design based research approach was proposed which included: 1) A cycle of surveys of super-users to inform the design and development process, and 2) Educational research in the form of case studies that compare the use of generic ICT features in an educational environment with the use of aggregation, sharing, repurposing, and exploitation of artifacts in the context of connectivist-style Massive Open Online Courses (cMOOCs). Our pilot study has taught us that we will require a balanced sample group, which means that participation in our future cases studied will continue to be open to learners with different educational levels and backgrounds and interests, from high level education, lower level education, and those looking for practical experience. A mixed methods approach will be adopted which will include both quantitative and qualitative methods, and virtual ethnography. Research questions will examine the effectiveness of a PLE for learning and the challenges in creating an optimal learning experience for all. To date, findings from surveys and a preliminary case study of a generic personal learning environment suggest that the learning experiences were impacted by much more than the tools and technologies but also by philosophical, ethical and pedagogical issues surrounding their use, on an individual level and in relation to others inside and outside our social network.

A careful planning of the research along the lines of our research and design framework as highlighted in figure 1 has proved to be valuable for informing the research and design of a Personal Learning Environment and further evaluation of the learning experience can be carried out. The different phases of the framework have lead us in a systematic way through an initial exploration phase, and a planning, development

, piloting and researching phase in order to figure out the required components and technologies for a new Personal Learning Environment. The potential exists for an enormous palette of possibilities for creating effective, meaningful, and successful experiences. The most important concept to grasp is that the learning experiences conveyed in our pilot studies are important and that we can learn from them whether they are traditional, physical, offline experiences or whether they are digital, online, or other technological experiences. We know a great deal about experiences and their creation through established disciplines that can - and must - be used to develop new solutions. Most technological experiences-including digital and, especially, online experiences-have paled in comparison to real-world experiences and have been relatively unsuccessful as a result. What these solutions require is for their developers to understand what makes a good experience first, and then translate these principles, as well as possible, into the desired media without the technology dictating the form of the experience" (Shedroff, 2009, p.3.). The components we have chosen for our PLE are ones which can help the learner in his or her learning. Not just to work more effectively, but also to get to a more intense level of engagement and learning than without a PLE. Six components have been identified as essential in a PLE: personal profiler, aggregator, editor, scaffolds, recommender, and services. The PLE research and development team have gained insight into the importance of communication between all parties involved in the research and development process: the managers, the person whose vision of the PLE was being developed, programmers, and researchers with educational and technical expertise in order to create a PLE that would be in the control of the learner, but would also interact with data flows, other people, tools and services.

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Edition and production

Name of the publication: eLearning Papers

ISSN: 1887-1542

Publisher: openeducation.eu

Edited by: P.A.U. Education, S.L.

Postal address: c/Muntaner 262, 3r, 08021 Barcelona (Spain)

Phone: +34 933 670 400

Email: [editorialteam\[at\]openeducationeuropa\[dot\]eu](mailto:editorialteam@openeducationeuropa.eu)

Internet: www.openeducationeuropa.eu/en/elearning_papers



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