First Time Building of a PLE in an ICT Post Graduation Course: Main Functions and Tools

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Abstract. In this paper we start by developing a model of the main functions of a Personal Learning Environment after a literature review. This model is then used to identify the most represented PLE functions and tools in the students' first time diagramming of a PLE in an Information and Communication Technology (ICT) Post Graduation Course. The results show some of the prevalent learning patterns associated with e-learning 2.0, with an emphasis on communication and collaboration function/tools although further research is needed to confirm the conclusions.

Keywords: PLE, PLE main functions, web 2.0 tools, e-learner 2.0

1 Introduction

The concept of a Personal Learning Environment (PLE) has been associated with the need to rethink the way we learn by using Virtual Learning Environments and in particular the Web 2.0 tools and services. Having this in mind, a module about PLEs was introduced in the Virtual Learning Environments course of an Information and Communication Technology (ICT) Post Graduation Course we have been teaching in a Portuguese Higher Education Institution. This paper has a twofold purpose. It addresses the experience and results of students' PLE building assignment in that course in the year of 2011. But to study their results we had to establish the main PLE functions based on a literature review. That meant we had to reflect on the PLE physiology - to use S. Wheeler terms (2010) -, gaining more insight and awareness about its use. Building a graphical model and a new PLE interface also contributed to this purpose. So the main objectives of the study are:

1. To develop a model of the main PLE functions and represent it in a graphical way.
2. To identify the most represented PLE functions and tools in the students' first time building of a PLE.
3. To infer about students' learning conceptions based on their tool choices.

This study will also help us reflect about and refine our own PLE and, in an action research perspective, will contribute to the evaluation of the procedures and activities developed to improve the quality of the learning experience in next course editions.

2 Theoretical Framework and Literature Review

The concept of a PLE had its genesis in 2001 with a paper from Olivier & Liber (2001) about the integration of personal and lifelong learning in institutional contexts, gained momentum from 2005 onwards and has been developed by authors like S. Wilson, M. van Harmelen, G. Atwell, S. Downes, G. Siemens and T. Anderson[1]. In 2010, S. Downes, G. Siemens, D. Cormier and R. Kop offered a Massive Open Online Course about Personal Learning Environments, Networks and Knowledge (PLENK) (http://connect.downes.ca/index.html) and since that year the PLE conference has been yearly dedicated to the subject (http://www.pleconf.com/). Associated with learning in the Web 2.0 era, Downes seems to have clearly in mind a PLE function in his seminal paper about e-learning 2.0 when he writes:

"The e-learning application, therefore, begins to look very much like a blogging tool. It represents one node in a web of content, connected to other nodes and content creation services used by other students. It becomes, not an institutional or corporate application, but a *personal learning center* [our italics], where content is reused and remixed according to the student's own needs and interests. It becomes, indeed, not a single application, but a collection of interoperating applications - an environment rather than a system" (Downes, 2005, par. 30).

A PLE may be minimally described, as the name suggests, as a personal environment where someone learns. That environment must be customizable, designable by the learner according to his learning style, needs, context etc. The tenets of a constructivist learning theory apply here as the rationale is that we learn interacting with our environment and by customizing and tailoring the environment we will be able to learn better[2]. By supposing we learn in interaction with others and by building artifacts, the sociocontrutivist and constructionist views of learning are also present (Harmelen, 2008; Mota, 2008). And, to a connectivist learning theory, by assuming we learn by making connections between people, resources, artifacts etc., sensemaking from a surplus of Web information, a PLE is an essential resource (Kop, 2011). The discourse on the PLE nature has evolved with opposing conceptions of the PLE as a technology (a tool collection) or a concept or approach (an ecology of tools, people, resources, with an organic, mutable and adaptive nature) (Fiedler & Väljataga, 2010), eventually with a more philosophical/pedagogical nature dealing with how people and resources are connected through technology (Pata, Väljataga, & Tammets, 2011). As part of the ontology of this environment we may find tools or applications, services, resources, people. We learn using those tools, interacting with the resources and with the people that make up our community or network. It is worth referring that part of the environment is, as such, a shared environment or, better put, a distributed learning environment (DLE) (Pata et al., 2011, p.89).

[1] About the genesis and development of the PLE concept vide Mota (2008, 2009).

[2] In a review of the PLE literature study Buchem et al. refer that the"the later literature has focused on constructivism as an overarching approach to learning through PLEs" (2010, p.33).

2.1 Our Assumptions

The conception of a PLE used in this study stresses its technological nature[3]: the learning environment as a collection of tools and services a learner may choose to access resources and a network of people (the PLE including the Personal Learning Network), an interface to access the different entities. This same conception was patent in the students' PLE assignment: to select a set of tools and services, preferably Web 2.0 and free, they could have easy access to develop their PLE. That means leaving out physical devices (like desktop computers, tablets or smartphones) and all round platforms like Elgg (server installation needed). The presupposition was that the browser (using multiple windows or tabs) and personal desktop, or a specific service or application, would serve as the interface. A conception of how we should learn (to match the learning theories referred) is also present: that of an e-learner 2.0 that takes advantage of affordances of the social media and web 2.0 applications (McLoughlin & Lee, 2007).

2.2 In Search of the Main PLE Functions

A prior question imposes itself: by trying to identify the PLE main functions aren't we idealizing a generic PLE? And is not a generic PLE a contradiction in terms? Being personal there is a fundamental dependence on the learner profile and context of learning (subject, academic or professional context, purposes will determine the choice of tools). It is even possible to argue that the PLE may change when the person engages in different tasks or projects[4]. This question is indirectly addressed by Fiedler & Väljataga when they say there is a need to deal with the model of the "personal learner" in the PLE research literature (2010). Like Janssen (2009), we argue that, although being personal, it is possible to identify its main functions, being the specific tools variable and object of a more personal choice. To choose the tools we must search for them, evaluate them and select the ones with the affordances we need to learn. Some of the criteria will be usability and functionality but critical mass of users may also be important (like in social networking services). Nevertheless, the personal learner profile is indeed that of an e-learner 2.0.

After a first acquaintance with the concept a few years before, it was only by attending the PLENK that we started developing our own PLE. We used Symbaloo as an interface and used coded colors to separate tools and services serving different functions[5]. We identified then the main PLE functions to build it but for this study we reviewed some proposals and refined our model and PLE.

One of the most simple and clear representation of the PLE functions is that of Wheeler (2010) who identifies the main functions of generating, organizing content, sharing content and communication, the last represented as a circle intersecting the other ones.

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[3] We are, of course, aware of the reductionist view it entails.

[4] If the focus is on the person we may say he as different PLEs, if we focus on the environment we may say that the PLE is changeble.

[5] For a report about the use of Symbaloo as a PLE interface vide Harwood, 2011. It is a good interface solution but has the problems of not allowing links to desktop apps and does not address the problem of tools that have multiple functions.

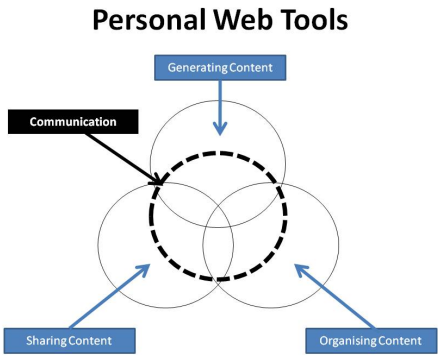

Fig. 1. Physiology of a PLE (S. Wheeler) http://steve-wheeler.blogspot.pt/2010/07/physiology-of-ple.html

Although it cannot be reduced to it, a module of information/knowledge management is a central part of a PLE. Not referring directly to a PLE, Siemens (2010) proposed this view, of what he calls a "sensemaking system" (the learner profile would be that of a researcher or student, but it can be generalized to others). The main functions presented are: Access, Selection & Use, Extension & Extrapolation and Recall & Context.

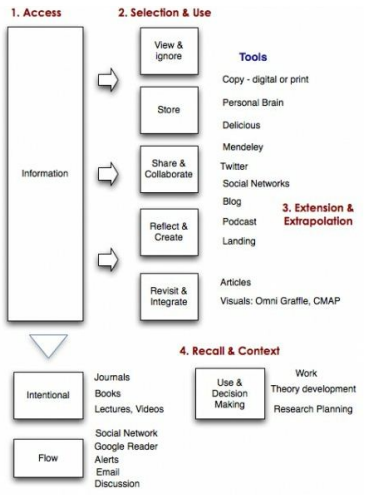

Fig. 2. How do you manage your information? (G.Siemens) https://landing.athabascau.ca/pg/blog/read/19803/how-do-you-manage-your-information

Peña-López (2010) references Reading, Storing and Sharing as the main functions in his PLE, using a similar information workflow analogy. Janssen (2009) tries to identify the main functions in a project to build a conceptual model for a generic PLE

and a toolkit to develop personal solutions[6]. After reviewing the literature he selects Analyzing, Authoring, Collaborating, Organizing, Presenting and Searching as the main functions. Fournier (2010) used the functions of searching and organizing information, aggregate information, editing and publishing information to study what users find important components, applications and tools on a PLE. In a somewhat different perspective, Buchem, Attwell, & Torres (2011) made a literature review of publications about PLE using the Activity Theory Lens framework of six interrelated components: subject, object, tools, rules, community and division of labour. The PLE tools (including external and internal) must address functions of Customization and Facilitation (these were the dimensions used) related to subject, object, rules, community and division of labour. Attwell, Bimrose, & Brown (2008), considering "a PLE should be based on a set of tools to allow personal access to resources from multiple sources and to support knowledge creation and communication" (p. 82) suggest an inventory of the possible functions of a PLE:

- "Access/search for information and knowledge;
- Aggregate and scaffold by combining information and knowledge;
- Manipulate, rearrange and repurpose knowledge artifacts;
- Analyze information to develop knowledge;
- Reflect, question, challenge, seek clarification, form and defend opinions;
- Present ideas, learning and knowledge in different ways and for different purposes;
- Represent the underpinning knowledge structures of different artefacts and support the dynamic re-rendering of such structures;
- Share by supporting individuals in their learning and knowledge;
- Networking by creating a collaborative learning environment." (*Ibidem*)

Based on the analysis of these proposals we will present our PLE Main Functions Model in the Results Section.

2.3 Context

The context of the research occurred in a Portuguese higher education private institution which, as part of the Bologna process, has been integrating ICT in their educational practice using the Moodle LMS as the privileged tool (more details about the institutional project in Fidalgo, Paz, & Santos, 2011 and Lencastre & Monteiro, 2008). We taught a course called Virtual Learning Environments as part of a Post-graduation course in Information and Communication Technologies functioning in a distance education regime (with only 10% of the classes occurring face to face). The course had the duration of 50 hours and the class (20 students) was divided in groups and each group, with our monitorization, had to prepare and teach one of the modules remaining as student in the other modules. The last module was *Learning in Networks: from Learning Management Systems (LMS) to Personal Learning Environments (PLE)* and had as objectives:

[6]We owe to G. Janssen, which we have met during PLENK, the idea of depicting the PLE main functions and the Personal Brain solution, a tool that we already used, to build an interface to multiple functions'

- To characterize and explore LMS and PLEs;
- To identify advantages and disadvantages of LMS and PLEs;
- To design a PLE.

After the previous modules taught only in the institutional Moodle Learning Management System, this last module was opened to/with social media and the following applications were use with Moodle:

- Communication: Skype (voice and text), Twitter.
- Social bookmarking: Diigo.
- Knowledge construction and learning interaction: Google+

There were 3 activities in the module, extending for a week: each of the 15 students (the remaining 5 were acting as teachers) should contribute with 5 links for tools to build a PLE (in Diigo group http://groups.diigo.com/group/ict_tools, public and open group, with membership subject to approval), discuss LMS or/and PLE issues (in Google+) and diagram and present their PLE in the end. A Google + HangOut with two PLE experts was also promoted, recorded and saved in Vimeo (at the time Google+ had no such function). In what refers to the PLE design assignment, the students had the freedom of choice to diagram their PLE only as a visual representation or as a functional one, like an interface to the tools. They had to explore previously delivered resources about PLEs and carry out their own searches about the subject. Although they had access to resources dealing with PLE functions, there was no guidance about how they should organize and present the PLE according to particular functions. They could use the web 2.0 tool they thought more adequate to make this presentation[7]. Once delivered to Moodle, only available to the teacher's eyes, all the products of this last assignment were published using Scoop it (http://www.scoop.it/t/ples-ava-pg-tic-2011). This course occurred in the final stages of the Post-Graduation but for the students it was the first time they had contact with the PLE concept although having prior knowledge and experience of use of ICT and Web 2.0 tools and services.

2.4 Methods

We made a review of the literature to build a model of the main PLE functions. After reviewing the literature about the functions' classification we have built categories to make the content analysis of the students' PLEs and determine the most represented PLE functions. As previously referred, there was no teacher guidance to organize and present the PLE according to main functions. Some of the students represented functions but most of them did not, presenting only the tools. That meant that the content analysis was made following a closed procedure using predefined (by the researcher) categories (the PLE Main Functions Model we will present) and a deductive process (Anderson & Kanuka, 2003, p. 176; Cohen, Manion, & Morrison, 2009, p. 476).

The PLE Main Functions Model will be presented by a mind map. The most represented PLE functions and the applications selected by the students will be presented by a graph with the descriptive statistics about these choices. One of the difficulties

[7]Some of the tools chosen to present the PLE: Xmind, Symbaloo, Gliffy, Prezi, Mindmeister.

we had was the fact that some tools have simultaneously multiple functions (like the searching function, or the publishing/sharing in most web 2.0 tools). We have chosen to present the results in two graphs: a first one in which we classified the tools and services assuming its main function (in a few cases assuming two main functions) and a second one in which we made the analysis assuming the multiple functions of the tools and services.

To deal with the problem of graphical representation of multiple functions we also used ©TheBrain, a mindmapping application that enables multiple parent node capability. Both mind maps will be published in the web so that they may be viewed and explored electronically by viewers due to their interactive nature.

3 Results

We will start by presenting the PLE Main Functions Model.

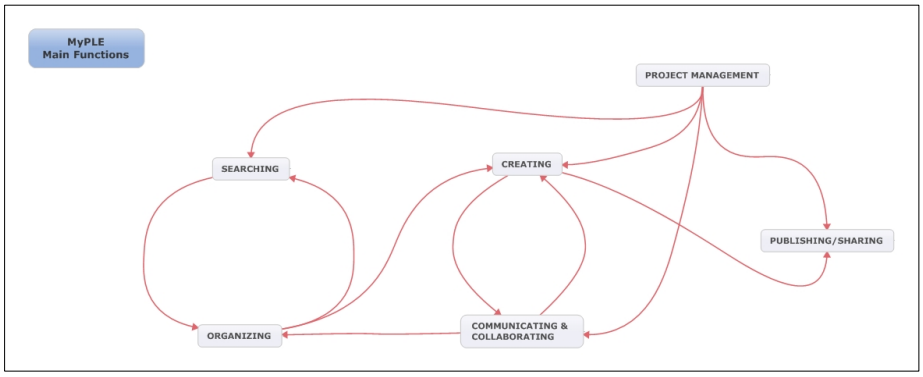

Fig. 3. The PLE Main Functions Model[8]

Table 1. PLE functions and dimensions

Function	Description
Searching	This function includes the search for content in the Web, in your Personal Learning Network (PLN), the retrieval of archived, organized content and searches made by agents like Google alerts and RSS. *Examples of applications' categories: search engines, RSS*
Organizing	This function includes tagging, reference management, bookmarking (to enable the retrieval and easy search of information), archiving either in physical drive or in the cloud. *Examples of applications' categories: bookmarking, tagging, reference management, note taking, backup and sync tools*
Creating	In this function we include all the production activities directly associat-

[8] To access an online mind map representing the functions and more detailed workflow depiction go to: https://www.xmind.net/m/FHch. In this space we intent to accept feedback from users that will be reflected in future improvements of the PLE Main Functions Model. NB: the PLE INTERFACING function is not represented in the model but was used to categorize the data.

	ed with learning: authoring, building (posts, messages, papers, blogs, artifacts, etc.). It has a close connection with Communicating/Collaborating because learning occurs with others, in collaboration or cooperation. *Examples of applications' categories: productivity tools*
Communicating/Collaborating	This function includes all the activities related to interaction with the Personal Learning Network (discuss, debate, comment, teamwork, etc) and has a close connection with creating. *Examples of applications' categories: communication tools, social networking tools, collaborative tools*
Publishing/Sharing	This function refers to publishing to the web once created (or controlled sharing) of the learning products. *Examples of applications' categories: web publishing tools, social networking tools*
Project Management	This function refers to the management (including timing) of your learning (goal setting, task scheduling, note taking) *Examples of applications' categories: agenda, project management tools*
PLE Interface	Interface to enable access to the tools, services and people *Examples of applications' categories: personal pages, aggregating services*

3.1 Students PLE's Results

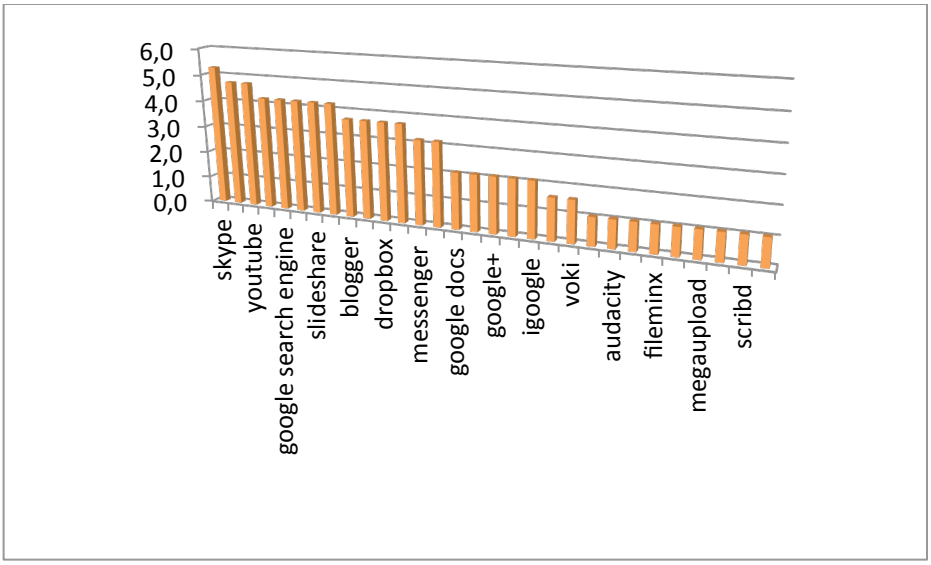

Fig. 4. Most referred tools in students' PLEs (%)

There were 29 different tools/services chosen by the students in their PLE representation, being the most frequently referred presented in the graph.

The next graphs will present the most represented PLE functions and tools.

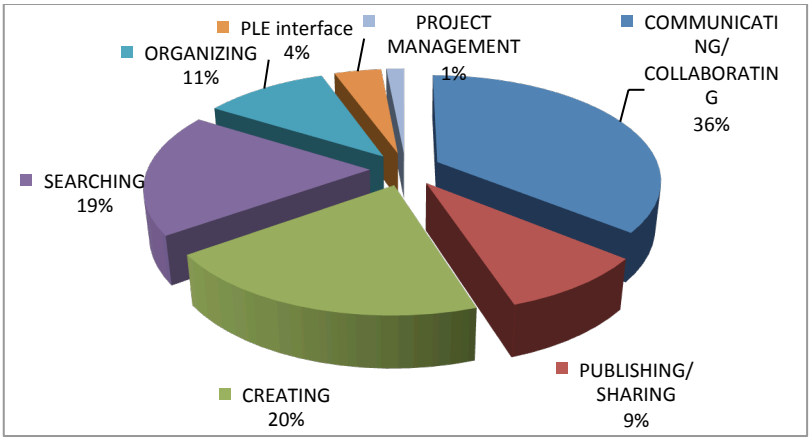

Fig. 5. Students choices assuming only each tool main function

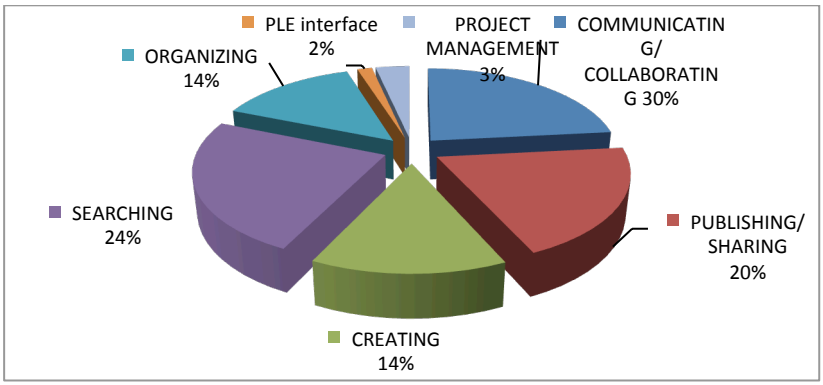

Fig. 6. Students choices assuming multiple functions of the tools [9]

The results of classifying the tools by their main function showed that the most represented PLE function was Communication and Collaboration (36% of the tools) followed by Creating (20%) and Searching (19%). Organizing and Publishing/Sharing came next with 11% and 9%. Tools representing PLE interface and Project Management functions were the least selected (4% and 1% of the tools).

The results of classifying the tools assuming their multiple functions showed that the most represented PLE function was still Communication and Collaboration (30% of the tools) but now followed by Searching (24%), Publishing/Sharing (19%) and Creating and Organizing (both with 14%). Tools representing PLE interface and Project management functions continued to be the least selected (3 % and 2% of the tools). The fact that most of the tools and services selected by the students were Web 2.0, characterized by having multiple functions (like communication and publishing) explains the more balanced results in this last graph.

[9] To access a mind map presenting the tools and services with multiple functions go to: http://webbrain.com/u/139E.

4 Conclusions

The model of the PLE functions proved fit to make the analysis although more work is needed to test it more thoroughly. The results show the prevalent functions students attribute to a PLE and, consequently, some of the underlying presuppositions about how they conceive learning in the Web: they privilege interaction with others (communication and collaboration) and also creating and searching for content. The fact that the function of learning management is so underrepresented may indicate that the regulation of their learning process needs to be enhanced, as some studies suggest (Costa & Cruz, 2010).

As limitations of the study, we must refer the fact that being the first time the students dealt with the concept and the short time span of the PLE assignment (one week) has certainly influenced the results. On the other hand, the functions were assumed as categories of analysis by the researcher and, as some of the tools are multifunctional, it is difficult to know what particular use they had in mind. The data reflect tool selection but their use for learning and the privileged function they were chosen for will have to be researched by other means. Other question is the clarification of the purpose for the use of the PLE that affects the choice of tools (there is a mix of tools they have used throughout the course, some they plan to use and some related to their professional field). Bearing on the conclusions we must also stress that few tools selected may not mean less time using them. These questions may be addressed, for example, interviewing the subjects about their reasons to choose the tools, in what functions they classed them and their conceptions of what is learning in the web. In terms of instructional design we plan to ask for a screencast explaining their choices in the PLE assignment in the next course edition. Further investigation would have to be centered on the elusive concept of tool affordance (McLoughlin & Lee, 2007), conceived not as an objective property of the tools but something changeable, dependent from context, learners' perceptions and needs (Pata et al., 2011, p. 91) and would imply a more holistic research framework.

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