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Personal Learning Environments: A study among Higher Education students' designs

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ABSTRACT

Even if we can find several PLE models and proposals based on the use of Web 2.0 resources, the problem of what resources to choose and how to organize them has not yet reached a specific or clear solution. During a semester, 18 students of Social Education at the University of Barcelona learnt how to use Web 2.0 resources in Social Education, and were then invited to prepare and use their own Personal Learning Environments (PLEs) with two platforms: Symbaloo and Protopage. An analysis of both platforms, demonstrates their preferences in software, functionality, web tools, individual application and those aspects of the software that they choose to include in their spaces. Results show that the subjects prefer flexible and simple platforms that let them integrate their own resources from Web 2.0. We have found some notable contradictions between the theoretical models and the practical applications that seemed more coherent and logical. Students broadened the use of these PLEs to other subjects and non-formal learning situations. Future studies ought to consider the importance of the freedom to choose resources and the use of Web 2.0 services for practical and useful PLEs.

Keywords: *Personal Learning Environments; Higher Education; ICT; Web 2.0; Self-regulated learning.*

INTRODUCTION

The problem

Personal Learning Environments (PLEs), that is, an individual learner's online resource management platform, seems to have an increasingly significant role to play as a learning organizational tool, particularly in areas of metacognitive skills like Self-regulated learning. From 2004 (Leslie, 2008), several models and prototypes have been proposed, remarking the benefits of Web 2.0 cloud-based resources. The key problem is what to select and how to organize them. Several proposals of PLE design have dealt with this problem, many from a theoretical point of view. In this study, we gave a group of Higher Education students the opportunity and the needed competencies to organize their own PLE, and thereafter, we considered three questions: what, what for and how.

The questions

The first question is about technology: the concept of a PLE is at the basis of this decision. We can use a complex and self-sufficient tool with every resource included and with a more technological approach, or we can use an open environment based on the free use of Web 2.0 services.

The second question examines the main reason why we consider the use of PLEs to be helpful. Of course, from an administrative and management point of view, Learning Management Systems (LMS) are a more suitable solution for learning institutions. We believe that PLEs are valuable in that they support a self-regulated learning process. While other tools, such as e-Portfolios, are beneficial as they support students to record their own learning pathways and thus make changes if need be. PLEs force students to organize their learning from the outset.

The third question is a more practical one: what elements do we have to include in a PLE and how to organize them.

While the experimental study collects information from a group of students at the University of Barcelona as a pilot approach, we begin positioning ourselves in a conceptual framework for these three questions.

CONCEPTUAL APPROACH

We begin by conceptualizing a PLE in order to address two main lines of debate: a technological approach vs. a pedagogical approach and the coexistence of PLEs and LMSs.

Learning from history

The acronym PLE appeared in November 2004 (Severance, Hardin & Whyte 2008), in the title of one of the sessions of the 2004 JISC/CETIS Conference. Brown (2010) identifies the starting date of the PLE approach in the year 2001, when NIMLE (Northern Ireland Integrated Managed Learning Environment) was set up. Taraghi, Ebner and Schaffert (2009) cite Olivier and Liber (2001) as one of the first to describe the idea of a PLE.

We can consider a PLE as an *in-fashion* concept when several special issues about it were launched from well-known publications in 2008: eLearning Papers (Ehlers & Carneiro 2008) or Interactive Learning Environments (Liber & Johnson 2008).

However, the concept, and the words, *Personal Learning Environment,* have a longer history. According to Google tool *Ngrams* (http://ngrams.googlelabs.com/), the expression *Personal learning environment was cited* in 1965. We have found that a publication in 1969 of the University of Washington affirmed:

> *Thus, a knowledge of the abilities, interests, and aspirations of each individual pupil would appear to be a prerequisite for constructing his/her personal learning environment* (1969, p.41).

Even the year before, in 1968, the Association for Student Teaching (1968, p.137) also made a reference to the expression PLE: *…which can be set up by a professional colleague who shares experiences in a personal learning environment*.

So, we can thus assume, that the idea of a personalized environment for learning comes from the ideas about the individualization and personalization of teaching at the end of the sixties. But the technological approach begins with the 21st century. If we consider that the Web existed at that moment more than 10 years, and computers and other technologies more than 20, why have PLE's not appeared before?

Milligan et al. (2006) consider that, in short, we had too many students for so few teachers, and the technology adopted by the educational systems of the 20th century was modified in order to

become more efficient. Therefore, it took on traditional teaching models, omitting the pedagogical opportunities of new technologies.

So, a PLE is more a pedagogical change in the use of technologies than a technological change in educational systems. In fact, the tools involved are not very different to the ones of a LMS: blogs, wikis, office online…. During the 20th century, ICTs were used to reproduce the old model. From the beginning of the 21st century, educators have begun to discover the options of ICT to respond to old pedagogical problems such as individualization.

Our work is based on this assumption: how we use ICT in a different way to respond to learning personalization demands. The study included in this work is only a part of this research line, where we consider the technological elements that users select for their PLEs.

Clarifying the concept

Harmelen (2006) defines a PLE as an e-learning system for individual users allowing collaboration with other PLEs and VLEs. Two main characteristics are found: it has to be self-directed and it has to be used for the personalisation of learning. Later, he would describe a PLE as being based on *Social constructivism* (Harmelen 2008).

Ullrich et al. (2008) consider a PLE more as a framework which allows learners to manage their own learning environments, and the collection of content and tools are secondary in their discussion. For Dabbagh & Kitsantas (2012), a PLE consists of social media tools that allow students to gain competence or knowledge. This idea of the relevance of social media appears in several authors.

PLE definitions usually emphasise an active and self-directed role of students in their learning process (Attwell 2007; Schaffert & Hilzensauer 2008).

We can also define what a PLE is by its characteristics. Throughout the article, we will discover some of them, but Milligan et al. (2006) extract this clear description: The tools provided through a PLE allow the learner to:

- Learn with other people
- Control their learning resources
- Manage the activities they participate in
- Integrate their learning

From these different but closely related visions, we can adopt a basic idea about what a PLE is; an eclectic approach. This is the concept that we have offered to students in this pilot research. Related literature was included and revised by them.

Learning Management Systems vs. Personal Learning environments

Despite the differences, we group the concept of LMS, LME or VLE as the employment of virtual learning environments, overseen by the teacher. On the other hand, PLEs are managed by the student.
A PLE is an emerging technology that appears in contrast to LMS-LME (Schaffert & Hilzensauer 2008) and they highlight seven pointers of its most obvious differences:

- Learner as active, self-directed creators of content
- Personalisation with the support and data of community members
- Learning content as an infinite *bazaar*

- Social involvement
- Ownership of learner's data
- Culture of educational institutions and organisations
- Use of social software tools and aggregation of multiple sources

Auinger et al. (2009) consider LMSs as closed and rigid environments, with restrictions about the use of Web tools. However, PLEs overcome these restrictions through using mashups.

Mott (2010) compares a Learning Management System (LMS) and a PLE. For him, LMSs, e.g. the virtual campus at universities, are ubiquitous as they generally assume the teaching-as-knowledge-transfer paradigm. Mott describes an LMS as *centrally managed, hierarchical, content-focused, and teacher centric*. PLEs use to be *non-institutional collections of tools aggregated by individuals to support their own learning activities*. Without doubt, PLEs are not widely used.

LMSs are widely employed by Higher Education institutions, supporting teaching and learning activities (Omari, 2008) but, more effectively, administrative functions (Mott 2010). A PLE is certainly an alternative, but with limitations:

- There is a lack of security during access to different services
- A medium to high level of digital competency is necessary to use different interfaces
- The user jumps between multiple identities

Federated Database Systems offer a solution that combines the distribution of services with usability and simplicity (Martínez et al. 2012; Cebrian, Serrano & Cebrian 2014).

Mott suggests the idea of open learning networks (OLN) as the bridge to overcome the gap between LMSs and PLEs. An OLN intends to be simultaneously secure and open, integrated and modular, private and public, and reliable and flexible.

He also proposes a new role for blogs that combines options like the LMS (teachers' or groups' blogs) and the PLE (students' blog). The OLN is created through different blog-based network resources. Blogs have been traditionally used as an alternative low cost LMS for Latin American institutions or for secondary education in some countries. Blogs are being considered as an alternative to the LMS: University of Mary Washington deployed an instance of WordPress Multiuser (http://umwblogs.org) as an alternative platform for their students and teachers; links are created between blogs and administrative instances. Other cases were recorded at the University of British Columbia (http://blogs.ubc.ca), the College of Wooster (http://voices.wooster.edu), and the City University of New York (http://commons.gc.cuny.edu). Mott (2010)

After some years of the coexistence of PLEs and VLMs, we could ask ourselves why the PLE is a *looser tool* (Mott, 2010). Wilson et al. (2007) developed the idea of *dominant design*: An LMS is the dominant design that blocks the emergence of other solutions that are more adequate for lifelong learning and personalization. According to their analysis, the options for an *alternative design* to substitute the *dominant design* are few.

While it is currently not clear if PLEs will take over formal learning *officially*, it is evident that VLEs will continue dominating the scene because of their administrative functionality, e.g. registering and course payment, providing course descriptors, syllabi, reading lists, class-times, examination dates, results… Only a significant change in the systems could lead to a change of status quo, and this right now is not clear (Sclater, 2008). In our study, the LMS has been a very simple information and resource repository website: http://www.lmi.ub.es/cursos/web20/2012usosTIC/

The evaluation was done through tutor interviews each two weeks, when they showed their tasks that were contained in Web 2.0 services. They organized their own PLEs with a start page and a bookmark space: Protopage (figure 1) and Symbaloo (figure 2).

***Figure 1**: Protopage, a start page platform*

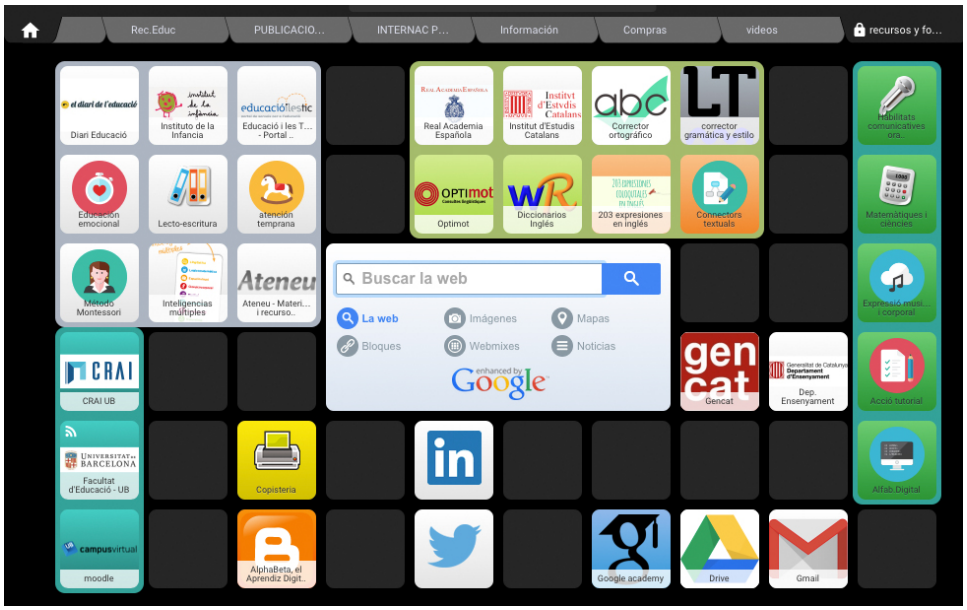

***Figure 2:** Symbaloo: a social bookmarking platform*

PLE and Self-regulated learning

PLEs affect the learning role directly (Adell & Castañeda 2010) in that they are a challenge to traditional teaching methods. There is wide consensus that a PLE is a good approach to developing a friendly Self-regulated learning environment.

Valtonen et al. (2012) define a PLE based on the central position of students in their learning process, with special emphasis on self-regulated learning.

Harmelen (2006) cites *self-regulated* as one of the dimensions of a PLE. Later, he affirms:

> *Increasingly, there is a shared understanding that the educational approach driving the development of Personal Learning Environments (PLEs) is one of learner empowerment and facilitation of the efforts of self-directed learners* (Harmelen 2008, p. 35).

Dabbath & Kitsantas (2012) refer to the great potential of a PLE to support student self-regulated learning in higher education contexts. Evidently, this is mainly based on the use of social media: a challenge to Higher Education is Web 2.0 technologies and social media empowering students *to take charge of their own learning*.

As the students in the pilot study had learnt about SRL and they knew that their PLE would help them to self-organize their learning, our research asked them to try to solve the problem of choosing and organizing Web 2.0 resources in the most efficient way.

How literature addresses the problem

Our study is not limited to describe the students' PLEs description but comparing it with the theoretical approach. So, the questionnaire was built based on previous work of other authors, that we summarize below.

The use

The use of a PLE is usually based on the following:

- Simplicity: it is simple to use
- Addictiveness: after using it for some time, it becomes some kind of necessary resource for the learner
- Complexity: it contains many elements and organisation is an important aspect
- Sharing: a good indicator of the use of a tool of Web 2.0 is if it is recommended or shared in a social network

Several studies have analysed the structure and functions of PLEs in formal situations: Valtonen et al. (2012) found that students built their PLEs for:

- Mirroring conventional learning environments
- As an environment for reflection
- As an environment to showcase skills
- As an environment for collaboration and networking

Our first objective is to understand how students use a PLE.

The components

Reviewing a previous study of Valtonen et al. (2012), we found that they suggested to students to use Ning, which was employed by all bar those studying computer science. Their preference was blogs or web pages. In another approach, Drexler (2010) considers these components:

- Contacts
- Information management
- RSS
- Synchronic communication

So, the second research question examines the components we could include in a PLE. Our starting point was a previous research study on 37 PLE models, extracting a list of 26 Web 2.0 services to include in a PLE (Leslie 2008).

The integration

Schaffert & Hilzensauer (2008) consider that a PLE is not merely the sum of all used tools but a combination of Web services and Social applications in one specific way.

To better understand how students integrate the components of their PLE, we are going to compare two approaches: in Protopage, the components are integrated in the interface through widgets and frames, while in Symbaloo, the platform includes only links to the components that open in separate windows.

- Protopage is a widget-based environment that suits the model *tools included* as described by Taraghi et al. (2009).
- Symbaloo is closer to a *visual bookmark environmen*t even if a central window lets us access some information.

METHODOLOGY

Only a part of the research related to the organization of the PLE by the students is included in this text.

We have directed our research as an artefact analysis (Goetz & LeCompte 1984; Wilhelmina et al. 2005). We will analyse the PLEs built by undergraduate students after a one-semester long course where they have become familiarized with several Web 2.0 tools.

They will freely build their own environments using two platforms. The research questions are developed according to the literature reviewed and described below.

We could also consider this as an exploratory study with characteristics of a pilot phase for a wider descriptive work. The comparing of both platforms, Symbaloo and Protopage, suits a quasi-experimental model for paired data.

Treatment

During a semester, an arbitrary group (a non-probabilistic selection) of students studied the educational application of a variety of Web 2.0 tools. The teaching methodology used is determined by the following elements:

- Immersion; learning by doing.

- Blended; distribution of activities in face-to-face and non-face-to face environments.
- Task-based learning; the content is organised in themes, each of which posed a series of challenging tasks.
- Personalisation; formative assessment and accreditation were carried out continuously through personal interviews or in a small group. There was some degree of freedom to choose levels of deepening and broadening the content.
- Socialisation; through classroom activities, and the use of social media.
- Accreditation assessment by rubrics on the tasks.

During a one-month period, the face-to-face sessions were interrupted temporarily by fully online actions: sessions with the group (divided in two sub-groups of 16 people) for online classes with the help of videoconference and desktop sharing. At this point, students began to organise their learning environment through Symbaloo.

The following month, they, now with the presence of a teacher, continued experimenting with another platform (Protopage). There would still be one month more of personal work.

An observation tool was constructed which was applied with the help of the students to the environments developed by them. The questionnaire could be applied to the environment constructed with Symbaloo, to the one constructed with Protopage and to a third one constructed with whatever tool and which the student considered to be a personal workspace.

Population and sample

This study is circumscribed to students of Educational courses at Higher Education institutions. However, this is an exploratory work with a non-probabilistic sample. In consequence, the use of inferential results, as a degree of significance, has only an illustrative meaning, giving us an image of the relative value of results in accordance with the sample size.

The sample was composed of 38 students of “Social Education” studies, at the University of Barcelona. They had taken a course about the use of Web 2.0 resources in Education. Among the assigned tasks, they worked on a topic called “Personal Learning Environment”, that included the development of prototypes in both Protopage and Symbaloo platforms. This study refers only to the 32 students who completed the actual task.

The whole course marks were assigned at the end of January, 2013. To separate the evaluation perception from the research on PLE construction, we waited until March 23rd, when the students received an e-mail inviting them to fill out a questionnaire on their use of Symbaloo and Protopage. Previously, during the task evaluation in November, they had been questioned about their “PLEs” but without any systematic data collection, as it could only motivate them to reflect on their use, and avoids the suggesting of specific options.

Nine responses were collected. After the Easter holidays on April 4th, a new mail was sent out, reaching 17 responses in three days. Two weeks later, we received one more.
There were 18 completed questionnaires submitted in total. The system eliminated duplicated answers. 15 students included their names. 14 students did not answer the questionnaire. The average mark obtained by students who answered the questionnaire in the course was 8.2 out of 10. This mark was obtained from their scores during the course, from several activities and exams that included not only the PLE but 6 themes more. The average mark for students that did not answer was 7.1. A t-comparison for impaired data gave us t= 0.0268, significant at 0.05 but not at 0.01. So, we accept the hypothesis of non-difference with an alpha risk of 5%.

Data collection tool

The observation guide is in the form of a questionnaire in which the students are questioned regarding specific aspects of their environments in Symbaloo and in Protopage (as well as the option of adding another).

Block 1

Information was gathered through a series of six questions regarding their perception of the tools and their use. Objective data about the PLEs produced and their use was also gathered with the rest of the questions. Although it is evident that students can distort the answers, it is worth remembering that their participation is voluntary and whatever type of relation between this study and their academic life was excluded. In addition, items of validation were included to contrast the soundness of some aspects, and were subsequently used in the processes of reliability.
The second series of items contrast the structure and functions following the scheme of Valtonen et al. (2012). The third series continued along the lines of the second research question that we raised (*for what*) and following Dabbagh & Kitsantas, (2012), consider the capacity of extending the use of a PLE to other environments. The students were only obliged to organise the content of the subjects in their spaces, but the possibility of taking advantage of it for other uses (examples shown) had been detected.

The last series of questions explored the idea as to whether the PLE had assisted the students to self-regulate their learning, avoiding the use of a test like the one prepared in the Telepeers project (Underwood, Bartolomé & Lefrere, 2011) would have been more suitable.

Block 2

The second block gathered information on the elements that they had included in their PLEs, both in one or the other platform. These elements are resources and services of Web 2.0. Some authors have outlined that the students preferred the use of Web 2.0 tools which are offered in VLEs (virtual campuses of their university) (Sclater, 2008). It thus comes as no surprise that authors like Mott (2010) propose disaggregating the PLEs using the open tools of the Web, in accordance with the user's specific needs.

Analysing which type of tools to be considered, Dabbagh & Kitsantas (2012) and Adell & Castañeda (2010) point out that social networks must be regarded as fundamental in a PLE. In this regard, it is worth considering the increasing usage of social media among undergraduate students in accordance with the study of EDUCAUSE Centre for Applied Research of 2010 (Smith & Caruso 2010).

Furthermore, blogs and other systems for the distribution of news are normally included (Mott, 2010). Dabbagh & Kitsantas (2012) include wikis, calendars, YouTube or Flickr, social networks, social bookmarkers.

Milligan et al. (2006) analysed various visions of a PLE, identifying that it is a key component in the use of Web services.

Finally, the procedure that we have opted for was to examine 37 designs of PLE's collected from the Web and to analyse the content obtained in Table 1, which shows us the frequency of occurrence of specific Web 2.0 tools in the 37 designs.

***Table 1**: Frequency of use of Web 2.0 services in PLE models*

Web 2.0 tool	n	Services cited
Blogs	32	Blog - Blogger, Wordpress
Social bookmarking	30	Social bookmarking - Delicious, Diigo, Digg, Zotero
Social networks	29	Social networks - Facebook, Linkedin, Academia, Plurk, elgg, Basecamp
RSS	27	RSS - Reader, Feedly, Bloglines,
Microblogs	27	Microblogs - Twitter
Searching	20	Search engine - Google, Yahoo,
Images	20	Images sharing Flickr
Videoconference	19	Videoconference - Skype, flashmeeting
Video	18	Video sharing/repository - Youtube
email	18	email
Wikis	16	Wiki - wikispaces,
Online office	13	Online office - Google Docs
LMS	12	LMS - Moodle, Sakai, Blackboard
Mail lists/news	10	Mail lists/newsletters
Slidecasts	9	Slidecast repository - Slideshare
Wikipedia	8	Wikipedia
Start pages	7	Start pages - Netvibes, Protopage, iGoogle, Windows live
Chat/IRC	6	Chat/IRC - MSN
Calendar	6	Calendar
Podcast	6	Podcast
Music	5	Music
Curriculum docs	4	Curriculum documents
Virtual worlds	4	Virtual world - Second Life
Forums	4	Forums
portafolio	4	e-portafolio
Files	4	documents repository - Dropbox, Drive
Physical	3	Physical objects/sites - books, etc., libraries,
Book's store	2	Book's store - Amazon
Data base	2	Data base
Courses	2	Free courses
Address book	1	Address book
Webinars	1	Webinars
Drawing	1	Drawing
Other media	1	Other media - TV, Radio
Maps	1	Google Maps
Analytics	0	Google Analytics

With respect to the questionnaire, we only consider the services that appeared in more than 10% of the models (n>3.7), which provided a list of 26 services of Web 2.0 (the first 26 in the Table), whose presence in the PLEs of the students would be checked.

Finally, the option of *mail lists/news* was eliminated for the very reason that it had not been worked on in the course and was superimposed with the regular use of the forums. (e.g. in the Moodle campus).

Validity and reliability

Internal validity was assured through the traditional procedures of judges and the comparison with the theoretical bases on which they are supported. With regard to the external validity provided by the comparison of already existing tools, due to the lack of reference instruments to contrast block 1 (use and assessment of environment), external validity was performed exclusively on block 2 (selection of tools) items.

In this block, in relation to the resources included in the PLE, the post-analysis showed that, independently of the existence or not of an exact coincidence between the selections carried out by the students and those carried out by the models undertaken in the web, both distributions show a minimally significant correlation. Given the nonparametric character of the data, the approach chosen was to apply a comparison test between the ordinal distributions; Spearman correlation coefficient for ordinal data. The order was generated from the moment the resource was chosen by a student, be it in Protopage, in Symbaloo or in both.

Just as on other occasions of this project, the non-representation (random selection) of the sample does not provide an inferential value to the outcome, nonetheless, it is an indicator of relevance or significance.

Applying the coefficient of Spearman, rs = 0.40 is obtained which is significant for alfa=0.05. This would conclude with the non-independence of the distributions and the existence of a correlation between both. This would also imply that the results obtained correlate with those of the theoretical results indicated by the experts in their PLE models.

As regards reliability, every attempt was made to ensure it by factors like the limited time necessary to respond or to the veracity of some key questions like the name of the subject that responded (100% concordance).

The construction of the tool does not permit the application of a reliability index (correlation between items) in the style of those applied in tests of personality traits, since the items measure different variables. However, we can analyse some items that, although they are not equivalent, should logically show some sort of coherence (that would reflect the reliability of the test). For instance, the content of the items in Table 2 suggests that we might encounter a high correlation between these, since finding the positive use of the tool in the subject could bring about the use of it in other environments. Without any doubt, the inverse is not certain since there could be other factors that will discourage the dissemination of use of this phenomenon. In the analysis that we have undertaken, it is easier to find factors that act more against the correlation than in favour, since there has been no communication with other teachers, hence there have not been any external incentive elements for its extension of use.

***Table 2**: Items a16 and a19*

Item	Reflects
a16	if the platform has been used in other subjects
a19	if it has helped to self-regulate their learning in this subject

Table 3 provides us with the correlation indexes and the levels of significance associated between those items in the case of the use of Symbaloo and Protopage:

***Table 3**: correlation with significance for a16 and a19*

Platform	Correlation	Level of significance
Protopage	0.527	0.036
Symbaloo	0.591	0.012

Because this is a quasi-experimental study, the character of the sample does not permit us to obtain an inferential significance of the data, but indeed can be interpreted as an indicator of the correlation coefficient found.

ANALYSIS

We analyse only data related with the three questions posed:
- Platform preferences
- Application of a PLE
- Elements of a PLE

Platform preferences

The first questions in block 1 summarised the opinion the students had of the platform, and its application.

Symbaloo vs. Protopage

Students answered each question separately, from a1 to a9 for Protopage and Symbaloo. A Likert scale of 4 points reflects their agreement with the statement.

***Table 4**: a1-a9 averages on a 1-4 ordinal scale*

Item	Protopage	Symbaloo
[a1]-Is it easy to use?	2.76	3.50
[a2]-Is it attractive to use?	2.71	3.44
[a3]-Have you used it much?	1.88	3.00
[a4]-Do you continue using it now?	1.53	2.39
[a5]-Would you recommend it to a classmate for his/her studies?	2.35	2.94
[a6]-Would you recommend it to a friend?	2.20	2.88
[a7]-How many tabs (categories, webmix, etc?) have you created?	2.06	2.06
[a8]-In total, how many gadgets, widgets, blogs, links, etc?) have you created?	2.00	2.25
[a9]-Have you shared any category/webmix/etc.?	0.36	0.13

While a7 and a8 show a similar attitude towards both platforms, items a1 to a6 show that Symbaloo is perceived as easier and smarter, as it has been used more amongst the students and they recommended it over Protopage.

Is there a correlation between finding a tool easy and smart and its use? We have correlated four items.

***Table 5**: Correlation/significance between a1-a4 items for Protopage and Symbaloo*

Platform	a1-a3	a1-a4	a2-a3	a2-a4
Protopage	.666 / .004	.720 / .001	.631 / .007	.643 / .005
Symbaloo	.33 / .176	.080 / .753	.649 / .004	.575 / .013

We found that there are differences between both platforms. For Protopage, there is a significance (.01) correlation between these items, while for Symbaloo, we found this occurs only for *smart* but not for *easy*: students that used Symbaloo more are not those who considered it to be easier.

Perhaps the meaning is related with their expertise of the different levels: you can use some applications at simple or complex levels (e.g. MS Word), however, the more complex the use, the more useful the tool.

Note that because of the tool design, students' responses inevitably included comparisons of both platforms even when answering on just one. So, a basic user of Symbaloo could perceive that it is easier than Protopage but with less options. An advanced user could perceive a higher level of difficulty for Symbaloo but with more options.
A surprising result that appears is in some negative correlations.

***Table 6**: Correlation between easy/smart and useful, crossing platforms.*

Subjects with a high use of …	assessed in…	easiness	attractiveness
Symbaloo	Protopage	-.344	-.505
Protopage	Symbaloo	-.086	-.341

In fact, this is a logical result: users that find Symbaloo easier (or smarter) use this platform more than Protopage, and vice versa.

The third platform

Only one student added a third platform: Hootsuite. His answers have not been analysed but it is interesting to note the kind of tool chosen. Hootsuite is a kind of aggregator of social networks that permits messages to be managed with columns by topics/environments, and sending new contributions from different accounts. That is in line with some approaches that PLE initiated from social media.

The use of platforms

We study the use that each student makes of his/her environment according to Milligan et al (2006), analysing the presence of new applications and specially related with the self-regulation of learning.

There were no significant differences between both platforms. Those instances where Protopage was preferred, were academic: *To organise training materials provided by the teacher* and *To leave proof of your activities and your skills –links to your tasks*. The last one is very close to digital portfolios. In Symbaloo, these two applications are surpassed by the management of social networks.

***Table 7**: a10-a22 averages on a 1-4 ordinal scale*

Item	Protopage	Symbaloo
[a10]-To organize materials coming from Moodle or the teaching environments by the instructor	2.25	2.65
[a11]-To reflect about your learning	1.75	2.24
[a12]-To keep a record of your activities and your skills (links to your work)	2.44	2.29
[a13]-To do group work	1.69	1.71
[a14]-To manage your social networks	1.88	2.65
[a15]-In the ICT's subject	3.24	3.5
[a16]-In other subjects of the university	1.29	2.00
[a17]-In other activities out of the university	1.41	2.22
[a19]-(SRL) In the ICT's subject	2.88	3.06
[a20]- (SRL) In other subjects of Social Education	1.63	2.00
[a21]- (SRL) In other studies	1.11	1.61
[a22]- (SRL) In other fields of non-formal learning	1.5	1.94

As a whole, we detect a preference for Symbaloo, except for leaving proof of one's own tasks. The reason for this was that it was a compulsory task –see a.15. It is also because for Protopage, it is possible not only to link to the academic task but to show the academic product inside the same window.

The analysis of average values could let us underestimate the significance of some items. So, in item a16; the use of a PLE in other subjects, we get an average = 2, that means *little* in the scale used. However, if we analyse the frequency in Table 8, we find that a third of the students incorporated their PLE by choice to other activities in the subjects, after no less than 3 months of using it.

***Table 8**: [a16] Have you used it in other subjects in this institution?*

Use in other subjects	n
Not at all	9
Little	3
Quite a lot	3
A lot	3

Another interesting result: a17 versus a16 and a24 versus a21. We found that spreading the use of PLEs, even for SRLs, seems higher out of formal studies. It appears that the use of self-organised learning spaces is more welcomed in non-formal education environments. We could also reflect about the current convergence of formal and non-formal systems. One could also recognize that perhaps there has been too much rigid design of some courses, with little or no space for personal autonomy, together with over-detailed assessment activities.

Elements included in personal environments

This is a key question in this research and we could reformulate it as to what decisions does a student take when choosing resources or services to include in his/her PLE, after accessing a wide sample of Web 2.0 sites. Participants were informed about the concept of a PLE but they did not access specific models.

Table 1 showed us the frequency of the use of Web 2.0 services in PLE models. The outcomes have been integrated in Table 9 with the actual inclusion of these resources in the students' environments in Protopage and Symbaloo.

***Table 9**: Web 2.0 resources/services in students' PLEs and in theoretical models*

Ref.	Web 2.0 tool	Protopage	Symbaloo	Theoretical models
b1	Your blogs or that of a classmate	11	14	32
b2	Favourites shared like Delicious, Diigo, etc.	1	2	30
b3	Social networks like Facebook, Linkedin, Academia, elgg, Ning... (Twitter excluded)	9	16	29
b4	Subscriptions to blogs like Reader	9	15	27
b5	Twitter	9	13	27
b6	Search engine like Google, Scholar...	9	13	20
b7	Flickr	0	1	20
b8	Skype or other system of videoconference	2	5	19
b9	Youtube or other system of sharing videos	13	14	18
b10	Your electronic mail	9	16	18
b11	Wikis (apart from Wikipedia)	2	5	16
b12	Google Docs or Drive	12	15	13
b13	The Moodle campus	8	12	12
b14	Slideshare or Prezi	1	1	9
b15	Wikipedia	10	12	8
b16	Protopage similar to Netvibes, iGoogle, Windows live	3	4	7
b17	Messenger or other chats	1	2	6
b18	Calendar	14	7	6
b19	Podcasts	2	1	6
b20	Music of another type	2	3	5
b21	Teaching materials	9	11	4
b22	Second life	7	6	4
b23	Forums or mailing lists	4	5	4
b24	Portfolios	3	3	4
b25	Dropbox (or Drive as a repository)	7	7	4
	OUT OF	18	18	37

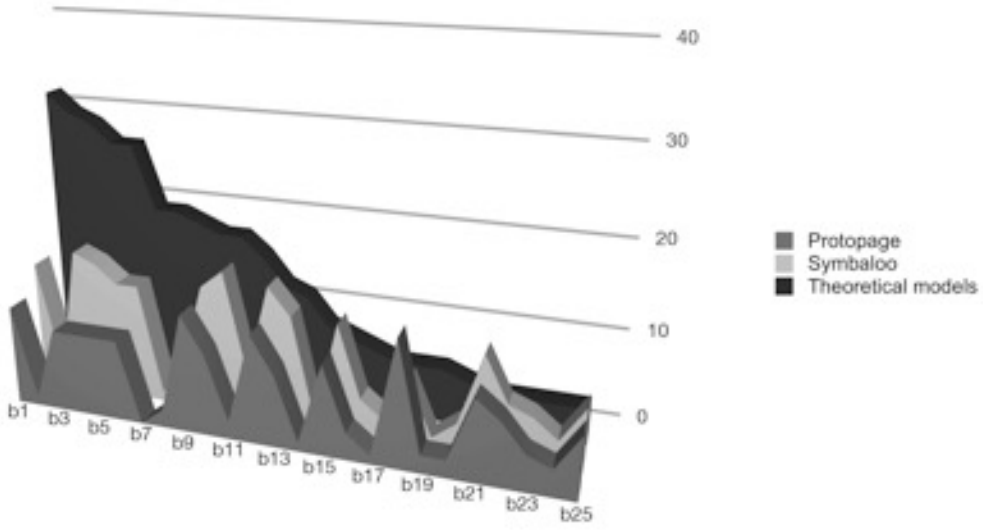

***Figure 3**. Web 2.0 resources/services presence*

In Figure 3, we see a proportional representation of this table. Apparently, there is a clear difference between students' choices and theoretical models.

Resources overvalued by experts

We have found these resources overvalued in the theoretical models: social bookmarks and image sharing (Flickr). Both were resources that had not been presented to students during the course.

Another resource is videoconferences, e.g., Skype. The explanation for this could be that this is an application that cannot be linked or embedded in Symbaloo or Protopage.
In Protopage, we found other resources with lower results: Wikis, Facebook, blogs, RSS and Twitter. A recurring feature amongst these resources is the embedding of large sub-windows in the Protopage categories.

Resources undervalued by experts

We now consider resources that appear in not so many models but that students include in their PLEs.

The calendar can be found in Protopage. It is a clear decision by students and we could ask ourselves why it does not appear more in the theoretical models. The calendar is a practical tool to organize their own time and work.

In Symbaloo, we find the Training materials, Google Docs, Dropbox, Wikipedia and Youtube. Again, they seem to be very practical and a useful resource for collaborative work and for other academic tasks. Why do experts consider that the blog is more necessary in a PLE than in Google Docs or the Wikipedia?

Other results have not such a clear justification. Second Life was presented very quickly and we did not work with it in the classroom. Experts put it in 22nd position out of 25. However, this is an interesting tool for students: perhaps we are not considering the influence of videogames with 3D reality representations.

Resources preferred by students

These are the resources chosen by more than half of the students:
- In Protopage: Calendar, Youtube, Google Docs, Blogs, Wikipedia
- In Symbaloo: Facebook, Email, RSS, Google Docs, Blogs, Youtube, Twitter, Search engines, Virtual campus, Wikipedia, Learning materials

RESULTS

We need to point out that these results have been obtained from students with a medium level of knowledge in Web 2.0 resources. Of course, inviting students to prepare their own PLE, they have had to previously have a minimum level of digital competence that includes skills in Web 2.0 services. In this framework, we have achieved some results.

Platform preferences

Students prefer simple tools, where access is easily integrated to their usual resources. So, PLE software designers could avoid including word processors, files exchange systems, video

repositories… and to facilitate that students include, if needed, the links to the tools that they are using.

Aesthetic aspects seem to be relevant, just like scalable interfaces that permit a fast-initial learning curve, but with more complex options for experienced users.

Use of the PLE

Students do not limit the use of the PLE to the subject where it has been introduced. They moved quickly to other subjects or other spaces out of the school. So, it is clear that a PLE is not only restricted to the academic environment and it is even more easily adopted out of formal learning.

On the other hand, students perceive a PLE as a help to self-regulate their learning and their lives. PLEs are systems to improve the management of personal activities. We could play with the acronym and describe the SRL as *Self-Regulated Life*.

Elements of a PLE

Despite some common elements between the designs of the theoretical models and those of the students, it is clear that there are relevant differences. These could be explained through current reasons, e.g. an unknown tool, but in other cases, the practical point of view of students is a basic criterion in choosing the elements. That confirms that students are the ones who should decide what elements to include in a PLE, and that is the differential element when comparing a PLE and a VLS. Hence, students must participate with a high degree of freedom and that has to be considered when designing software platforms.

As a global result, this study seems to validate authors that prioritize students' freedom and the use of Web 2.0 resources in an educational framework versus those that consider software development or the selection of resources as key to include in a PLE. And this is also related with the use of Web 2.0 technologies by generation Y (Halse & Mallinson 2009, Kennedy & Cook, 2013).

CONCLUSIONS

Students prefer those platforms with less complex functionality which allows for an individualised organisation of their learning resources. So, the general rule of "the simplest the best" is a good indication about what software to use with our students.

Students apply practical criteria to choose and organise resources. In this way, they are not afraid of losing some elements if this helps them to use their personal learning environment more efficiently.

When students begin to use a software or platform to organise their tasks and resources for one specific subject, they usually extend their use to other subjects as well as to other activities beyond their academic work.

This work suggests that future PLE research has to consider digital literacy as a basis for the personal construction of spaces. But this is also a personal task, under the initiative of the student, and not of the teacher.

Limits of this study and future trends

This is an exploratory study and its results cannot be generalized because of sample size and the selection process, as well as geographical and cultural limits. But it lets us have some important lessons that could guide future work in the context of a wider and international research team.

From our results, we can continue now with new research, avoiding some distractors and centring the work on the key questions. It seems that the comparison between these two kinds of platform, represented by Symbaloo and Protopape, is not relevant as no substantial differences have been found in the resources chosen for each one. On the contrary, the use of a PLE out of the limits of the subject seems to promise more interesting findings.

It seems that the delay between the end of classes and the distribution of the questionnaire has proven to be advantageous. And the questionnaire itself does not seem to present serious liability and validity problems, even if, with a random sample, this issue could be addressed in a more satisfactory way.
So, the next step will be to prepare a future study with a wider and representative sample, at international level.

REFERENCES

Adell Segura, J & Castañeda Quintero, L 2010, 'Los Entornos Personales de Aprendizaje PLEs: una nueva manera de entender el aprendizaje' in R Roig & M Fiorucci, (eds), *Claves para la investigación en innovación y calidad educativas. La integración de las Tecnologías de la Información y la Comunicación y la Interculturalidad en las aulas.* Marfil, Alcoy. Available from: http://digitum.um.es/jspui/bitstream/10201/17247/1/Adell%26Castañeda_2010.pdf

Association for Student Teaching 1968, *Yearbook,* vol. 47. Association for Student Teaching, Washington.

Attwell, G 2007, 'Personal learning environment – the future of learning?' *eLearning Papers*, vol. 2. Available from: http://elearningeuropa.info/en/article/Personal-Learning-Environments---the-future-of-eLearning%3F?paper=57211

Auinger, A et al. 2009, 'Mixing Content and Endless Collaboration – MashUps: Towards Future Personal Learning Environments' in C Stephanidis, (ed.), *Universal Access in HCI, Part III, HCII 2009, LNCS 5616*, pp 14–23. Springer-Verlag, Berlin- Heidelberg. Available from: http://dx.doi.org/10.1007/978-3-642-02713-0_2

Brown, S 2010, 'From VLEs to learning webs: the implications of Web 2.0 for learning and teaching', *Interactive Learning Environments*, vol. 18, no. 1, pp. 1-10. Available from: http://dx.doi.org/10.1080/10494820802158983

Cebrian, D, Serrano, J & Cebrian, M 2014, 'Federated rubric service to facilitate self-regulated learning in the European university model', *European Educational Research Journal*, vol. 13, no. 5, pp. 575-583. Available from: http://journals.sagepub.com/doi/pdf/10.2304/eerj.2014.13.5.575

Dabbagh, N & Kitsantas, A 2012, 'Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning', *The*

Internet and Higher Education, vol. 15, no. 1, pp. 3-8. Available from: http://dx.doi.org/10.1016/j.iheduc.2011.06.002

Drexler, W 2010, *The networked student: a design-based research case study of student constructed personal learning environments in a middle school science course*, PhD thesis, University of Florida. Available from: http://www.wendydrexler.com/web_documents/drexlerdissertation041310final.pdf

Ehlers, U & Carneiro, R 2008, 'Personal learning environments', *eLearning Papers*, vol. 9. Available from: http://elearningeuropa.info/en/print/57347

Goetz, JP & LeCompte MD 1984, *Ethnography and qualitative design in educational reseach*, Academic Press, New York.

Halse, ML & Mallinson, BJ (2009), 'Investigating popular Internet applications as supporting e-learning technologies for teaching and learning with Generation Y', *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, vol. 5, no. 5, pp. 58-71. Available from: http://ijedict.dec.uwi.edu/viewarticle.php?id=861

Harmelen, M 2006, 'Personal learning environments' *ICALT '06- Proceedings of the Sixth IEEE International Conference on Advanced Learning Technologies*, Washington, DC, USA, IEEE Computer Society, pp. 815-816. Available from: http://wiki.ties.k12.mn.us/file/view/PLEs_draft.pdf/282847312/PLEs_draft.pdf

Harmelen,M 2008, 'Design trajectories: four experiments in PLE implementation', *Interactive Learning Environments*, vol. 16, no. 1, pp. 35-46. Available from: http://dx.doi.org/10.1080/10494820701772686

Kennedy, DM & Cook, J 2013, 'Digital natives: An Asian perspective for using learning technologies', *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* vol. 9, no. 1, pp. 74-79. Available from: http://ijedict.dec.uwi.edu/viewarticle.php?id=1558

Leslie, S 2008), *PLE Diagrams*. Available from: http://www.edtechpost.ca/ple_diagrams/index.php/

Liber, O & Johnson, M 2008, 'Personal Learning Environments', *Interactive Learning Environments*, vol. 16, no. 1. Available from: http://dx.doi.org/10.1080/10494820701772645

Martinez, E., Tellado,F., Bartolomé, A (2012), 'Las rúbricas de autoevaluación como complemento a los diarios de los blogs', *paper presented to II Congreso Internacional sobre Evaluación por competencias mediante erúbricas,* Málaga, October 2012.

Milligan, C, Beauvoir, PH, Johnson, M, Sharples, P, Wilson, S & Liber, O 2006, 'Developing a Reference Model to Describe the Personal Learning Environment' in W Nejdl and K Tochtermann, (eds.), *Lecture Notes in Computer Science*, vol. 4227, pp 506-511, Springer, Berlin, Heidelberg. Available from: http://dx.doi.org/10.1007/11876663_44

Mott, J 2010, 'Envisioning the Post-LMS Era: The Open Learning Network', *Educase review online,* (3/3/2010). Available from: http://er.educause.edu/articles/2010/3/envisioning-the-postlms-era-the-open-learning-network

Olivier, B & Liber, O 2001, 'Lifelong learning: The need for portable Personal Learning Environments and supporting interoperability standards', *The JISC Centre for Educational Technology Interoperability Standards*, Bolton Institute, Bolton, UK. Available from: http://wiki.cetis.ac.uk/uploads/6/67/Olivierandliber2001.doc

Omari, A 2008, 'Jordanian physics students' utilization of online instruction and their attitudes towards it', *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* vol. 4, no. 2, pp. 60-77. Available from: http://ijedict.dec.uwi.edu/viewarticle.php?id=448

Schaffert, S & Hilzensauer, W 2008, 'On the way towards Personal Learning Environments: Seven crucial aspects', *eLearning Papers*, vol. 9 . Available from: http://www.elearningeuropa.info/files/media/media15971.pdf

Sclater, N 2008, 'Web 2.0, Personal Learning Environments, and the future of Learning Management Systems', *ECAR Research Bulletin,* vol. 2008, no, 13. Available from: https://net.educause.edu/ir/library/pdf/erb0813.pdf

Severance, C, Hardin, J & Whyte, A 2008, 'The coming functionality mash-up in Personal Learning Environments', *Interactive Learning Environments*, vol. 16, no. 1, pp. 47-62. Available from: http://dx.doi.org/10.1080/10494820701772694

Smith, S D., & Caruso, J B 2010, *The ECAR study of undergraduate students and information technology 2010, Key findings*. EDUCAUSE Center for Applied Research. Available from: https://library.educause.edu/resources/2010/10/the-ecar-study-of-undergraduate-students-and-information-technology-2010key-findings

Taraghi, B, Ebner, M, Schaffert, S 2009, 'Personal Learning Environments for Higher Education: A Mashup Based Widget Concept', *Proceedings of the 2nd Workshop on Mash-Up Personal Learning Environments MUPPLE'09*, Nice, France. Available from: http://www.researchgate.net/publication/229077025_Personal_Learning_Environments_for_Higher_Education_A_Mashup_Based_Widget_Concept/file/d912f4fffe1206cb9c.pdf

Ullrich, C, Borau, K, Luo, H, Tan, X, Shen, L & Shen R 2008, 'Why Web 2.0 is Good for Learning and for Research: Principles and Prototypes', *17th International World Wide Web Conference*, Beijing, China. Available from: http://dx.doi.org/10.1145/1367497.1367593

Underwood, J., Bartolomé, A & Lefrere, P 2011, 'Big issues: The example of learning platforms' in R Carneiro, P Lefrere & K Steffens, *Self-Regulated Learning in Technology Enhanced Learning Environments A European Perspective*, Sense Publishers, Rotterdam, pp. 145-154.

University of Washington, 1969, *The College of Education Record 1969.* University of Washington, Washington.

Valtonen, T, Hacklin, S, Dillon, P, Vesisenaho, M, Kukkonen, J & Hietanen, A, 2012, 'Perspectives on personal learning environments held by vocational students', *Computers & Education*, vol. 58, no. 2, pp. 732–739. Available from: http://dx.doi.org/10.1016/j.compedu.2011.09.025

Wilhelmina , C, Savenye, WC, Rhonda , S & Robinson, RS 2005, 'Using qualitative research methods in higher education', *Journal of Computing in Higher Education*, vol. 16, no. 2, pp. 65-95. Available from: http://dx.doi.org/ 10.1007/BF02961475

Wilson, S, Liber, O, Johnson, M, Beauvoir, PH, Sharples, P & Milligan, C 2007, 'Personal Learning Environments: Challenging the dominant design of educational systems', *Journal of e-Learning and Knowledge Society*, vol. 3, no. 2. Available from: http://services.economia.unitn.it/ojs/index.php/Je-LKS_EN/article/viewFile/247/229