
# THE PLE CONFERENCE 2012

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## Proceedings

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# Using SymbalooEDU as a PLE Organizer in Higher Education

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**Abstract.** This paper presents a case study related to the use of personal learning environments (PLE) in higher education. In this study, SymbalooEDU, a self-management tool was used. This tool allows students and teachers to organize their bookmarks, RSS and widgets in a visual way, using tabs and blocks with colours and different space distribution. Although it can be used for different purposes, its use as a PLE organizer seems to be interesting. This study aims to find out whether personal learning environments powered by institutions are meaningful and useful for students and lecturers to learn; what students do with this tool at a personal and academic level and what type of elements they include; and whether this kind of tools facilitate merging formal and informal learning. The data were gathered through questionnaires, interviews and observation, and results and conclusions are drawn up from these data.

**Keywords:** PLE, organization tools, higher education, Web 2.0, Formal and Informal Learning

## 1 Introduction

Recently, some research and empirical studies have been conducted on Personal Learning Environments (PLEs), and although many authors have been trying to define the PLE concept (Buchem, Attwell, & Torres-Kompen, 2011), there is still no agreement on it. However, PLEs are here to stay (Sclater, 2008), since personal learning is gaining greater importance in education. Moreover, real educational contexts need more empirical studies in order to include these environments and to take into account students' needs and preferences in their learning.

Considering these aspects, our paper aims to contribute to the field of empirical studies on PLEs in higher education. Its importance resides in the necessity to find strategies to integrate VLEs and PLEs, so that the gap between formal and informal learning can be overcome.

From our point of view, PLEs foster and facilitate the type of learning's perspective that education has been searching for some time: the user-centred learning approach.

This study is derived from project EDU2008 05345 'Designing Methodological Strategies for the Use of Shared Knowledge Spaces through Software Tools and Knowledge Management Systems in Virtual Learning Environments'. From a technological perspective, the aim is to overcome the rigidity of VLEs by integrating other environments and, from a pedagogical perspective, to use student-centred educational strategies.

## 2 Reference Framework

PLEs are considered from different perspectives (Fiedler & Valjataga, 2010). With this study we consider both technological and pedagogical points of view. On the one hand, we use SymbalooEDU as a tool to collect other services and tools. On the other hand, the introduction of this tool is done with the purpose of being useful for students and lecturers to construct their own PLE.

### 2.1 Background

The background of this study is based on some of the following issues:

- The potential offered by Web 2.0 tools. Their possibilities are multiple due to their characteristics (Castaño & Maiz, 2007): 1. The activity is focused on the web, 2. Any user can participate by publishing and sharing content in the web and 3. The published content is easily localizable and referenced;
- The importance of learning centred on the students, and not on the institution (Olivier & Liber, 2001) or the teacher (Salinas, 2009). This is related with the attitude of the *prosumer,* which describes the situation when information consumers are also producers of new information (Schaffert & Hilzensauer, 2008). Students have the possibility of participating actively in decision-making concerning their learning;
- The need for life-long learning (Attwell, 2007; Olivier & Liber, 2001). This necessity leads to giving importance to informal learning (Attwell, 2007), the integration of informal and formal contexts, and reflection on one's own learning process (Dabbagh & Kitsantas, 2012). For this reflection, students must develop and apply self-regulated learning skills. According to Cross (2009), we understand that 'learning is formal when someone other than the learner sets the curriculum' while 'informal learners usually set their own learning objectives'. We have to bear in mind that PLEs are built bottom-up starting with personal goals (Dabbagh & Kitsantas, 2012);
- Restrictions presented by VLEs. Some of these are the lack of openness and integration with informal services, resistance to change, or failure to take into account the user (García-Peñalvo, Conde, Alier, & Casany, 2011). This is consistent with what Liber (2005:10) stated, 'there is a mismatch between what people are doing on the Internet, and what leading learning environments are providing'.

Starting from these elements, we consider that PLEs are more suitable environments for learning than VLEs. According to Chatti, Agustiawan, Jarke and Specht (2010), PLE characteristics are: the possibility of personalization, support for informal learning and lifelong learning, openness and decentralization, bottom-up approach – attending learners' needs -, knowledge-pull and ecological learning. As can be seen, they tackle some of the most important restrictions presented by VLEs.

We can find a lot of definitions for PLEs in the last five-six years as can be seen in Buchem et al. (2011). Like other authors (Attwell, 2007; Castañeda & Adell, 2010), we consider that a PLE as the collection of tools, services and devices that we use in our everyday life for learning, in any context – formal and/or informal. The tools included in PLEs are aimed at facilitating three cognitive processes (Attwell, 2007): reading, reflecting and sharing. Therefore, we are talking about three types of tools with different functions (Wheeler, 2009): accessing information, creating and editing information, and interacting with other people.

### 2.2 Relevant Experiences

In the last few years, some studies in the field of PLEs in higher education have been carried out in Spain and abroad.

Some of them are worth noting due to their interest for our case study:

- Design and development of postgraduate student PLEs based on Google Apps (Marín & De Benito, 2011). University of the Balearic Islands;
- Integration of Moodle (VLE) and Mahara (e-Portfolio) for working on projects with undergraduate students (Salinas, Marín, & Escandell, 2011). University of the Balearic Islands;
- Development of undergraduate student PLEs using different web 2.0 services (Santamaría, 2010). University of León;
- Implementation of a preconfigured PLE based on Google Apps in order to merge institutional and personal services, allowing social networks to be generated and maintained (Casquero, Portillo, Ovelar, Romo, & Benito, 2008; Benito, Casquero, Tejedor, Ovelar, & Portillo, 2007). University of the Basque Country;
- Implementation of a virtual campus where Moodle, personal services and social networks are presented - SAPO Campus (Santos, Pedro, Ramos, & Moreira, 2011; Santos & Pedro, 2010). University of Aveiro, Portugal;
- Implementation of a PLE based on a mash-up of widgets connecting different web applications (Taraghi, Ebner, & Schaffert, 2009). Graz University of Technology, Austria.

## 3 The Case Study

### 3.1 Background Context to the Activity

The study was conducted in two courses of Educational Technology in the studies of

Pedagogy at the University of the Balearic Islands, held between 26th September 2011 and 25th January 2012. Both courses used the blended modality, with face-to- face lectures complemented by virtual support and tasks. One of the courses is entitled 'Distance and Flexible Education' in the fourth year of the degree and the other one is 'Development of Didactic Materials' in the third year of the degree.

In both courses, the SymbalooEDU tool was presented in one of the first face-to- face lectures as a workshop on the tool. In this seminar, we explained to students how to use this tool to organize their own PLEs. Use of the tool was not included in the course assessment, so its use was optional. The intention with this session was to encourage students to become aware of their learning process by reflecting on the tools they usually used, the webpages they usually visited, the services they accessed, and so on.

On the other hand, one of the course lecturers was aware of the existence of this tool. Actually, he was already using it to organize his PLE in sections: research, teaching, personal tools, etc. Before the workshop, the use of SymbalooEDU was described to the other lecturer, who was enthusiastic about its usefulness and used it for different purposes. One of these purposes was to collect the reference links of her course so as to facilitate her students' access to them. This was a resource page for her students embedded in the course in the institutional VLE as can be seen in Figure 1.

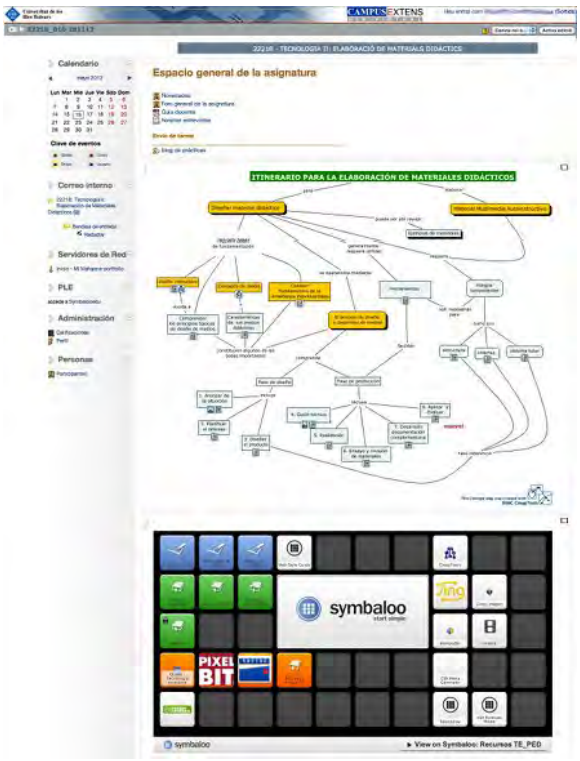


**Fig. 1.** Screenshot of the course 'Development of Didactic Materials" on the institutional VLE

The methodology of the courses was based on projects. In the case of 'Distance and Flexible Education', in groups, students had to design a prototype for a course in a virtual environment, an IT strategy or a virtual community. In 'Development of Didactic Materials', students had to elaborate multimedia material in groups.

### 3.2 Questions Posed

With this case study we wanted to find out some issues related to PLEs in education:

- What tools can foster the construction of a PLE in higher education?
- Do students and lecturers consider building their own PLE at university useful?
- What is the user experience with this kind of environment?
- Can an environment designed initially from an academic context go beyond and be used as one's own PLE?
- What kind of tools form part of a student's or lecturer's PLE?

### 3.3 Methodology

For this study, an intentional sample of 73 students – between both courses – and their two lecturers was used. Most of these students were women under 24 years of age, with full-time dedication and unemployed. Concerning previous familiarity with technologies and web tools, this is supposed to be medium-to-high since students had to pass a/some course/s related to educational technology before attending these ones.

For this case study, we selected a web service rather than a software tool. To differentiate these types of services, we adhered to the classification of Castañeda (2010). Although this typology is used for social networks, we understand it as a broader classification where Web 2.0 tools could be framed. The advantages of using web services with regard to a software tool are ease of use, availability on the web, universality of use - there is no need for installation – and the fact that it is free for personal use.

SymbalooEDU is this web service. It allows the customization and configuration of one's own homepage - called webmix - by building it with visual blocks to access preferred services and bookmarks. It can be used to create one's own PLE but it is also interesting, for instance, as a student or teacher's tool or repository for a course[1].

To obtain information regarding these issues we established three data-gathering procedures:

- Student questionnaires in two stages. Their objective was to collect data related to the students' experience with this prototype of PLE. For example, items such as usefulness for learning, personalization possibilities or ease of use were taken into account;
- Observation of the screenshots of the students' environments. For this, students were

[1] Some other uses of SymbalooEDU in education can be seen at: http://www.symbalooedu.com/tag/educator-spotlight/

asked to send us a screenshot of their PLEs in SymbalooEDU through the questionnaires;
- Interviews with the course lecturers and with some students. This procedure was applied so as to triangulate data and to represent graphically what learning processes were performed and what tools were used to do them.

### 3.4 Study Phases

The study was conducted in three phases, as shown below:

- First phase: Design of a preconfigured environment with SymbalooEDU. This contained basic institutional services and some generic ones. The lecturer who was unaware of this tool learned about it;
- Second phase: Workshop for students on the use of SymbalooEDU. The previously designed environment was shared with the students in the workshop. During this session, students were encouraged to use the tool to organize their own PLE by modifying the initial elements. Use of the tool was not included in the course assessment, so its use was optional and voluntary;
- Third phase: Appraisal of the experience by students and lecturers. Data collection was conducted through student questionnaires, observation of student PLEs and interviews with lecturers and some students.

**First Phase.** As previously stated, a preconfigured environment was designed to integrate institutional services as well as some generic tools. The institutional services were links to the university webpage and intranet, and the institutional VLE. The generic services were widgets for showing the weather and the time, performing a search on the web, looking up words in the dictionary, translating words into another language, creating a task list, and making notes.

The preconfigured environment can be viewed in the following screenshot:


**Fig. 2.** Screenshot of the environment designed on SymbalooEDU

**Second Phase.** The workshop on SymbalooEDU was conducted with each group of students in the two courses.

In these workshops, the facilitator and lecturers gave a brief explanation about what the PLE was and how to configure it in SymbalooEDU, as well as about the usefulness of doing so. In the sessions, students were encouraged to create an account in the service and then to copy the preconfigured environment. After that, the idea was that they would adapt it to suit their educational needs. Additional face-to-face and web support was also provided.

**Third Phase.** In order to collect information about the students' initial experience in SymbalooEDU and their first impressions, an initial questionnaire to fill in via web was designed.

After a month and a half, a second questionnaire was implemented to learn about the evolution in the use of this environment and students' opinion based on such use. The design of this second questionnaire was improved by taking into account the first results.

In addition, interviews with the course lecturers as well as some students were conducted. The latter were selected by their attendance frequency to class and the use of the tool as a PLE. In these interviews information about PLE use and the tools students and lecturers usually used were collected and represented in maps.

## 4 Research Results

As the three data-gathering procedures aimed to collect data concerning the same items, we divided this chapter into different sections according to the issues on which we extracted information.

Between the first and the second questionnaire, students were asked to answer some questions related to the following issues:

a) Usefulness of the environment (both questionnaires);
b) Ease of use (both questionnaires);
c) Customization and adaptation to the preconfigured environment (both questionnaires);
d) Use of the SymbalooEDU tool (only second questionnaire);
e) Use of other tools different from SymbalooEDU (only second questionnaire);
f) Overall assessment of the pilot study and the suitability of the tool (only second questionnaire).

In a), b), c) and f) students had to indicate their degree of agreement or disagreement with several statements on a scale of 1 to 5, with 1 being strongly disagree and 5 strongly agree.

In the first questionnaire, out of the total of 105 students, 66 answered it. Out of these 66, 31 were non-completers and 35 completed it. In the second questionnaire, out of the total of 102 students that did not refuse to participate further in the first round, 29 completed it and 11 did not. Therefore, we had 40 questionnaires answered in this second round. When we indicate that there are partial answers we are referring to students that

began to fill in the questionnaire but gave up when they had to send the screenshot of their environment. Although the same people were invited to participate in the two questionnaires, not exactly all of them were involved in both: some did participate in both – 27- but others participated for the first time in the second questionnaire -13- and others, who had participated in the first, did not participate in the second - 33.

Most of the students - 73% in the first questionnaire and 80% in the second one - who filled in the questionnaires were enrolled in the course 'Distance and Flexible Education'. This seems logical, since most participants were on that course.

Students were also asked to provide screenshots of the PLEs in the questionnaires in order to analyse the new content included. A total of 48 screenshots sent between the first and second questionnaires were taken into consideration. To process the information provided by these screenshots on both questionnaires, we conducted a content analysis. New blocks and their typology, environment customization and degree of adaptation to the preconfigured environment were considered.

Last but not least, interviews with some students and the two lecturers were also conducted. In the interviews, information was sought regarding the main objective to obtain more information about the components of the PLE of students and lecturers. After the interviews, maps were designed to represent the types of elements included in the PLEs graphically – similarly to what was done in de Benito, Lizana, and Salinas (2011). This representation was according to the classification of tools proposed in Wheeler (2009).

### 4.1 Usefulness of the Environment

Concerning the tool's usefulness for one's own learning, about 60% of students agreed or strongly agreed - ratings 4 and 5 - in both questionnaires. It is noteworthy that no-one was in total disagreement and 30% neither agreed nor disagreed -first questionnaire. The latter percentage dropped to 13% in the second questionnaire.

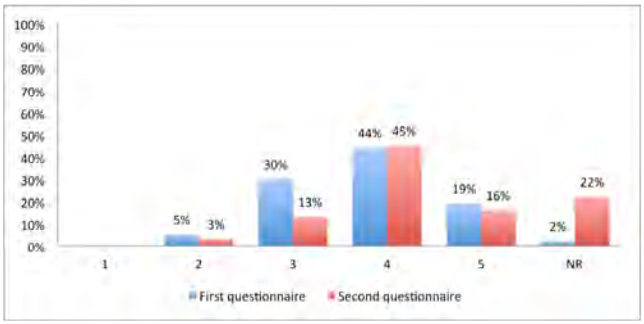


**Fig. 3.** SymbalooEDU seems a useful tool for my learning.

Regarding the tool's usefulness to construct the PLE, students had to assess several statements related to learning inside and outside the university.

As the results on the four statements show, students considered SymbalooEDU a

useful tool to manage personal learning in the course, at university, in all areas of their lives and throughout their life. However, it is remarkable how the students assessed the usefulness of SymbalooEDU to manage their personal learning at university in the second questionnaire - 87% - and undecided students fell to 17% with respect to the first one. Apparently, students thought of this tool as an academic one, since positive assessment was lower the larger the field of application of the learning management.

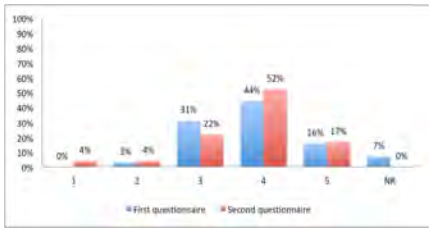


**Fig. 4.** I think this tool is useful to manage my personal learning on the course


**Fig. 5.** I think this tool is useful to manage my personal learning at university

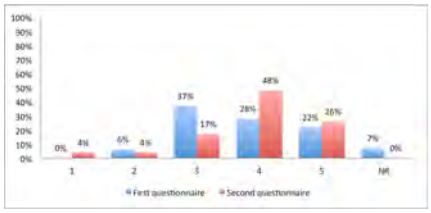


**Fig. 6.** I think this tool is useful to manage my personal learning in all the areas of my life


**Fig. 7.** I think this tool is useful to manage my personal learning throughout my life

Concerning lecturers' perceptions regarding the tool's usefulness, they valued it quite positively in the interviews. The lecturer of 'Development of Didactic Materials' remarked that SymbalooEDU, though useful, is still only a tool for adding bookmarks and homepage. However, she highlighted that what may be interesting as a learning tool is the possibility of adding annotations to value the new resources added to the webmix. On the other hand, the lecturer of 'Flexible and Distance Education' thought that SymbalooEDU is a really good tool for learning but especially for organizing yourself and having everything that you use at hand. What he remarked as the most notable limitation for learning is its inability to collaborate and work with another person in a webmix – nowadays the tool only allows unidirectional sharing.

### 4.2 Ease of Use

As far as ease of use is concerned, there seems to be no doubt in the first questionnaire, since the assessment is quite positive - 82% agreed with the statement. In the second survey this percentage dropped to 62%, presumably due to the increase in the proportion

of no response.

In relation to whether it was easy to become disoriented in the options offered by the tool, over half students in both questionnaires considered the guidance tool was appropriate. Despite this, 20% of students thought that orientation through the service was difficult.

### 4.3 Customization and Adaptation to the Preconfigured Environment

Neither does there seem to be doubts as to whether the tool allowed many possibilities for customization and configuration: 85% of students agreed. The second questionnaire also lowers the percentage, for the same reason discussed above, down to 62%. Also noteworthy is the reduction of lack of positioning - rating 3-, reduced from 30% to 10% from a questionnaire to another.

Moreover, the majority of students - 68% - believed that SymbalooEDU provides many blocks, links or widgets that interest them. In the case of the second questionnaire, the percentage drops to approximately the half of agreement.

In relation to the degree of adaptation to the preconfigured environment, many participants that used the tool indicated that they did not introduce meaningful changes in the initial environment. In fact, most of them did not personalize their PLE with their name but kept the default name of the preconfigured one. Concerning the customization of the PLE wallpaper, most of them changed the background for one from the collection of SymbalooEDU. Only a few of them changed it for a personal image.

Despite this little customization, most students reported in the questionnaires that they added new blocks in their environment. These new blocks were dedicated mainly to: entertainment, keeping up on social networks, performing academic searches, following specific personal interests, editing content on blogs, staying informed, asking questions and banking. This is consistent with what it is observed in the screenshots of the PLEs. In fact, the new blocks were, in order of frequency, related to leisure (especially fun websites like *Visto en Facebook, Cuánta razón, ...*), those related to social networks - especially Facebook and Windows Live – and Web 2.0 tools and services based on audiovisual media both with and without social characteristics - especially Youtube, and watching series on the internet, the latter included in the leisure section.

As far as tools requiring download and installation were concerned, few blocks were observed in the screenshots of the PLEs. This is not surprising since SymbalooEDU is a web service and it would not make much sense to incorporate tools that cannot run if not in desktop version. It can also happen that, even if the tools have a web version, students may only use the desktop version, and in this case it would not be incorporated into their PLE in SymbalooEDU.

To differentiate between learning contexts – personal, academic or professional –, students and lecturers performed some organization techniques in the webmix. In the interviews, they pointed out different strategies: assignment of colours to the blocks according to the type of link or function, the placement of the blocks in the same webmix or the creation of new webmixes dedicated to something.

On the other hand, most students did not create new webmixes different from the preconfigured environment. When they did, three scenarios were possible: 1. The new

webmix was the page of resources copied from the course of 'Development of Didactic Materials' - for its students -, 2. The students created a new one with their name or writing 'my webmix/Webmix', copying institutional services from the preconfigured webmix and adding some more blocks of frequent use, and 3. in some specific cases, students created new webmixes to devote to different areas of their interest, e.g. shopping, leisure, training...

As for the widgets included in the preconfigured environment, they were rarely used. Most students left them as they were at first, some students removed all of them, and very few students added something new, like the Google search engine - although the generic search engine was already included -, the horoscope, Wikipedia or agenda. When students were asked in the interview about the use of these widgets in their PLE, most of them said they hardly used them. They said that they kept them in their environment in case they needed them one day or so as not to have such an empty webmix.

### 4.4 Use of the SymbalooEDU Tool

One question that was only in the second questionnaire was whether students used SymbalooEDU after the workshop. More than half students – in blue - indicated that they had, which is interesting to know.

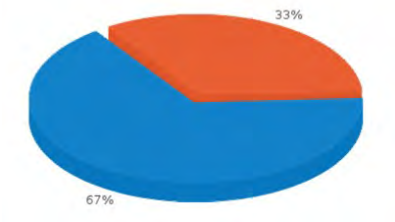


**Fig. 8.** Using SymbalooEDU tool for the design of PLEs

Among the reasons for not using the tool, the most featured were not under- standing and not considering it useful for the construction of their own PLE.

Some comments in this regard are the following:

'I do not quite know how to handle it, but I will try.' 'I do not usually use these tools; I only use them in the course.' 'I learned to organize my work without this tool, and more effort will be required to handle it than continuing as up to now.'

Related with the latter comment, students were also asked about the time spent configuring their PLEs. Only a few of them configured their PLE exclusively during the workshop. For almost half of students, this task took them several days during the weeks following the workshop while a quarter of students did it during the time between the first and second questionnaire.

### 4.5 Use of Other Tools Different from SymbalooEDU

After obtaining the results of both questionnaires, we interviewed some students from both courses and their lecturers. Interviews confirmed what was observed in the screenshots and reaffirmed the conclusions drawn so far. In addition, we obtained information concerning the use they gave to their PLE elements.

In this section we have included some relevant maps of the PLE interviewees. To understand the symbols used on the maps, the caption is incorporated:

- Colour: Academic applications or services are in yellow. Personal and academic use of services is in green. Personal use is in orange;
- Forms: A rectangle for applications with an installed version - in some cases it is the only possibility to use the tool - and a circle for web services.

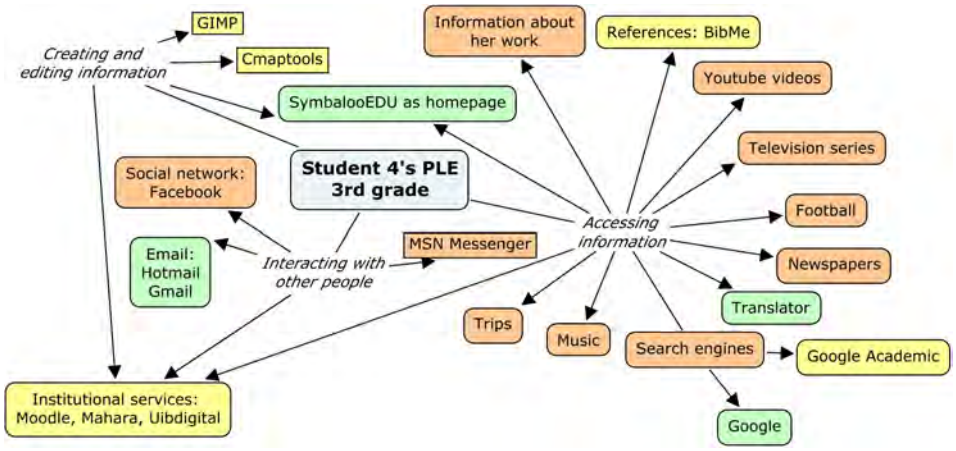


**Fig. 9.** PLE map of a student

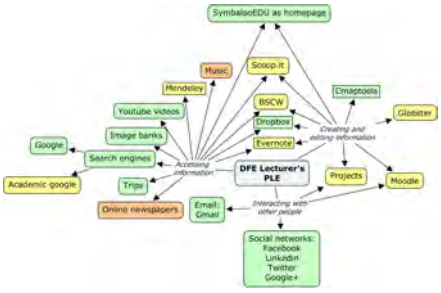


**Fig. 10.** PLE map of the 'Development of Didactic Materials' lecturer

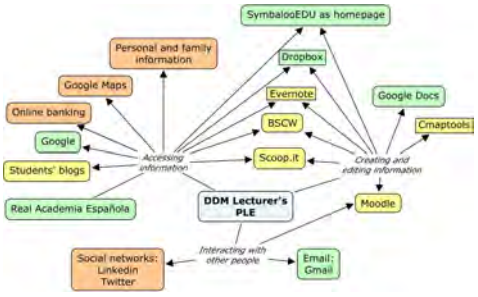


**Fig. 11.** PLE map of the 'Distance and Flexible. Education' lecturer

Related to the tools that interviewees included in their PLE, it is worth noting that one of the students stressed not only the personal but also academic use of the social network

Facebook. She was using Facebook for collaborating and sharing with classmates in a group page. This may be interesting to bear in mind when incorporating social networks into a PLE and emphasizes the potential of social networks for education. The use of tools and applications in an academic context can end up affecting the students' PLE. This environment sometimes integrates them, but not always with the same functionality and context as at first. This can be observed in the maps of most students interviewed from 'Distance and Flexible Education'. The same applies for some of the students interviewed from 'Development of Didactic Materials'.

One of the questions students were requested to answer was what other tools they usually used that were not included in the SymbalooEDU environment. Some applications, most of them installable, were identified. We can recall, for instance CmapTools or Gimp. Moreover, many students used these tools on other courses, but in the same context – academic. It is worth remembering that it was usually in this context that they started to use them.

### 4.6 Overall Assessment

Finally, students had to assess the suitability of SymbalooEDU for designing the PLE on a scale of 1 to 10. 1 stood for the lowest score and 10 for the highest one. This adequacy was punctuated quite positively: 97% above the value of 6.

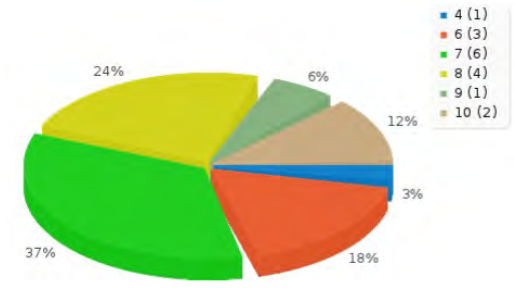


**Fig. 12.** Assessment of the suitability of the tool for designing the PLE

Some students included reflections and comments in the observations box of the questionnaires. We include some of the most meaningful:

- 'It is very useful software, but for the time being it seems difficult. However, I think it is like everything: difficult until I get used to it.'
- 'I find it very useful day by day, as it lets you organize websites that you use by the different blocks, which also have the possibility to be edited with an image and so on, which makes it more interesting.'
- 'I am a person who likes to have everything very organized and this software allows me to have all my programs organized in one place and have easy access to them.'
- 'I think Symbaloo is a very useful tool. It helps us to organize ourselves and allows

us to access the websites we frequent quickly. I think that, now and in future, it will be very useful. Therefore I think it is a good working and learning tool.'

- 'As I need or discover new tools, I incorporate them to Symbalooedu.'
- 'Symbaloo is a tool that, perhaps by learning to use it in the first academic year, we would get more out of it. From different courses lecturers would invite us to use it and exploit it to the maximum, thus in the non-academic future we would use it for self-learning. Now, at the end of the studies, everyone will use it until tasks and exams, and then only 10% of students will continue using it.'

## 5 Conclusions

SymbalooEDU seems to be an interesting tool for fostering the building of a PLE, especially due to its ease of use and its customization possibilities. It is also considered useful for learning by both students and lecturers alike, despite its flaws.

The results drawn from the questionnaire show that most students used the tool only for academic purposes. Presumably due to this, they did introduce some little changes – background, new blocks and change of name - in the preconfigured environment that the institution offered to them. These considerations are consistent with other similar studies (Valtonen, Hacklin, Dillon, Vesisenaho, Kukkonen, & Hietanen, 2012; Salinas et al., 2011). Nevertheless, students added applications for personal use, especially social networks and web services related with media.

It was interesting to see that some students talk about SymbalooEDU as part of their PLE. In most cases, it is useful for them to organize themselves and their different life contexts. Moreover, as the results from the interviews showed, other tools whose use was learned before this course can be integrated into the PLE. We think that these aspects are encouraging to improve the support for merging formal and informal learning. We believe that tools initially provided by the institution do not necessarily need to be restricted to this context; in fact, they might become part of the student's PLE. However, the introduction strategy of the tool may have some influence in this use.

Concerning reflection on their own learning, students and lecturers had to organize their learning and contexts tools in order to build their PLEs in SymbalooEDU. For this purpose, they followed different organization strategies to construct their environments, for example colors, space distribution or icons, among others. The different tools that constitute their PLEs are used with diverse functions, like the ones represented in the maps. This type of things may have sparked off some reflection on their learning in the participants of this experiment.

As for the limitations of the experiment, we can highlight the strategy for the tool's introduction. As stated above, the use of SymbalooEDU was optional and not compulsory for the final assessment of the course. This can also be a strength because students were free to use it and even gave it a personal touch. Another point is that the courses were short: they lasted only 4 months. The experiment runs the risk of being considered an isolated case and being reduced to this type of courses.

Previous familiarity with the use of ICT tools was also considered a weakness, since all the students had attended Educational Technology courses before. They are also

students from education and from a specific university. It is difficult to generalize these results. It would be advisable to extend this type of studies to students from other studies and universities.

In spite of this, some students remarked that organizing the links in SymbalooEDU required more effort than continuing as up to now. This seems to be consistent with the results and considerations of other similar studies, such as the one by Salinas et al. (2011) or Valtonen et al. (2011). Another thing that is highlighted in this study, and also in the latter one, concerns ICT skills and is related to the effort and time spent in building the PLE. Some students' observations focus on a lack of ICT skills to be able to use the application. Therefore, although the ease of use of the tool is notable, students think that their ICT skills are not sufficient to be able to use it.

Another difficulty presented in this experiment is the impossibility of finding out directly what is going on in the students' PLEs. We tried to solve this situation by collecting data from the initial state of the process and afterwards, but it would be worth knowing about the constant evolution in the use of the PLE.

Related to the use of SymbalooEDU to build the PLE, we would like to recall the lecturers' comments concerning this tool. Although according to the SymbalooEDU website, the tool is supposed to be used as a PLE, actually it needs more in order to be a PLE. Actually, it is a tool for organizing access to PLE elements.

## 6 Future Work

Regarding the continuation of this work, we expect to collect more long-term data from this study and to carry out this experiment with students in the first years of their studies. Configuring their own PLE – with SymbalooEDU or other tools - can be helpful for them and the track that they follow during their university studies may become clearer.

It would also be interesting to consider extending the introduction of the tool in other studies in order to find out whether it is useful to build the PLE in other types of studies or not.

Finally, we will also be considering the usefulness of other types of tools to build the PLE by carrying out experiments like the one above.

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# Building Identity in an Institutionally Supported Personal Learning Environment - the case of SAPO Campus -

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**Abstract.** Social media is changing the way individuals learn, collaborate and express themselves, fostering the construction of an identity and reputation available to almost everyone. More than Curriculum Vitae, the construction of an online identity may reveal the sum of the learners' skills and experiences. Introducing online identity as a concept that reflects the path of the learner's personal, academic and professional lives, this paper presents the results of a case study developed at University of Aveiro, aiming to analyse how a group of thirteen students build identity in both open social online platforms and a platform provided by their Education Institution. Data was collected through in-depth interviews, questionnaires and observation. Although still in progress, the study revealed the presence of two different online identity profiles (context-driven and user driven online identities), and the student's awareness about their own online identity and reputation as learners and as professionals.

**Keywords:** online identity, SAPO Campus, Personal Learning Environments, Higher Education, digital environments

## 1 Introduction

Technology and social media changed the way individuals learn, collaborate and express themselves. More than a way to transmit information, the Internet became a platform where content is created and negotiated, fostering the development of communities that encourage and enhance the collaborative capabilities that already exist in individuals [1]. By emphasizing the contribution of the user in creating and organizing content and information, the web emerges as a place where knowledge is socially constructed and shared, reflecting a human and social dimension where networks of people, data and services grow towards a connective and innovative environment [2].

In a scenario strongly influenced by the presence of participatory media, students begin to think, work and enjoy themselves in ways different from the ones experienced by previous generations [3], engaging in a process where they can be responsible for their own learning. Learners have now the possibility and opportunity to move between different learning spaces and to interact with communities and environments, allowing learning and online presence to expand and take place in several spaces, no

longer bounded and controlled by institutions [4] [5]. As the network eases the connection and interaction between sources of knowledge, it also fosters the creation of an interconnected space where learners can access, share and build knowledge in ways that meet their learning goals and the needs and realities of the new global society [6] [7].

When it is almost impossible to remain outside the digital world and, therefore, outside the production of an online identity [8], the construction of a presence over the web (identifiable through participation and interaction) enables the learner to build a reputation on the network. Understood as a continuum [8], the construction of identity in digital environments encompasses authentication – the information that validates the individual's identity in digital systems [9-11] – and content – information published by the individual in order to communicate and interact with the online environment. Either referred as digital (when related to authentication) or as online identity (when related to participation and content creation), the digital presence of individuals can be recognized in the publication of content [12-15]; in the creation of profiles [14] [16]; and in the typology of participation [17]. The network becomes an environment where learners are encouraged to build a presence and an identity that encompasses their personal and academic profile [15].

## 2 Building Identity in a Digital Learning Environment: a case study

When the economy of knowledge demands new learners and creators, the learner's online identity may reveal the sum his/her experiences and skills, reflecting the path of his/her learning journey. More than a Curriculum Vitae, learner's online identity may reveal to peers and to the wide community the sum of his/her experiences and skills, his/her ability to communicate, interact and share online. Whether in open social platforms (e.g. Facebook, Twitter, Google +), weblogs (e.g. Wordpress, blogger) and online forums, or in institutionally supported platforms (i.e. online spaces provided and supported by Education Institutions), learners are building an identity that arches over many spaces, evidencing their path as learners and professionals.

### 2.1 Background

In a knowledge economy where the learner's abilities to search, evaluate, create and share information and synthetize knowledge are of vital importance [18], students look at schools as places that support the creation of learning communities, places where they can learn to learn, where creativity and innovation are cultivated [19] and where they develop learning abilities and new skills possible to be used throughout their life. No longer able to ignore the changes that social tools and new learning approaches have brought to the educational context (e.g. peer learning, connectivism, network knowledge), Higher Education Institutions (HEI) must be aware of the way students work, share and interact with each other in an interconnected and without frontiers world.

When skills as innovation, multidisciplinarity, collaboration and problem solving are understood as core-competencies for the new realities and contexts, Universities

must look at their students as active promoters of its own quality, offering them the infrastructure and pedagogical approach they need in order to build a relevant curriculum and their own identity over the web.

Developed at the University of Aveiro (UA) - Portugal, SAPO Campus is an integrated Web 2.0 services platform based on user-generated content production and aggregation for use in HEI, offering its users – students, lecturers, staff – a technological infrastructure able to foster and promote the development of communication, sharing and collaboration skills, therefore contributing to more personal and relevant learning experiences. SAPO Campus is available to all the UA community since September 2009; blogs, wikis, photo and video sharing services are available and being used as a platform for communication, interaction and content sharing in both formal (educational) and informal (social) contexts, offering its users the space to enhance, in an institutional environment, their digital presence and reputation. Besides having a space where they can assemble and manage information (through a feed aggregator), in SAPO Campus registered members can create and share content, building and managing their online identity. Learners, staff and lecturers can use SAPO Campus social tools for communication and interaction, as well as to share content with the community. All content – published under a Creative Commons license – is visible not only to the UA members but to all the web community.

By providing its members a platform where they can build, manage and share content and information, SAPO Campus offers an institutionally supported online environment that encompasses the formal and informal dimensions of learning (more about the SAPO Campus project can be found at http://campus.ua.sapo.pt).

There is, however, a question: when the HEI – by presenting the aforementioned technological infrastructure and pedagogical approach – creates the conditions for the development of new ways of learning and building identity, are students confortable in using the institutional scenario to meet their personal and individual learning goals and needs? When given the means, do students transfer their digital skills and identity to a formal institutional scenario?

While some studies reveal that students mix both general and institutional course tools to meet their personal and individual needs, using technologies to support every aspect of their study, suiting their own particular needs and harnessing the potential of the different technologies for their learning [20], others sustain that the gap between formal and informal environments remain, revealing the learner's difficulties when transferring digital skills from their everyday life to a formal (institutional) educational scenario [21].

### 2.2 The Case Study

In order to understand how students build, manage and perceive their identity in formal and informal environments, how they learn and reveal their skills, and how students, institutions and the employees perceive and value skills and competences that go beyond the curriculum (e.g. communication and collaboration skills, ethics, teamwork, creativity, online presence), a case study is being developed at the University of Aveiro - Portugal, focused on the analysis of the informal and institutional online presence of a group of thirteen students from two classes of a Master Degree Course (convenience sample, 13 students aged between 21 and 40

years, 7 male, 5 female).

**Methodology.** Data was collected through questionnaires, observation and in-depth interviews made to selected students.

In-depth interviews aimed to understand how they perceive their own online identity, how they handle content and address privacy and reputation issues, and how they reveal, through the identity they are building in formal and informal environments, the skills and competencies they acquired and developed. In order to achieve it, during the interviews students were asked to think and talk about the perception they have on their own online identity: the way they express themselves in online environments, how they manage their privacy and the professional, social and academic impact of the online identity they are building. Students were also asked about the advantages, disadvantages and impact of having an online identity built upon an institutionally supported platform (i.e. SAPO Campus).

Observation included the gathering and analysis of all posts (messages, pictures, links, video and audio files) published by participants in SAPO Campus and in informal online environments (i.e. Facebook and Twitter).

Data was gathered over two periods of nine months: from September 2009 to July 2010, and from September 2010 to July 2011, and a total of 3692 messages were analysed: 1249 Facebook posts, 2096 Twitter messages and 347 SAPO Campus posts. All posts were analysed according to content – personal, social, academic, professional or organizational – and to format (text message, picture, link, audio or video file). Content categories were based on [17] typology on online identity.

Personal content included: reference to family and/or friends; sharing emotional status; reference to sensitive issues. Social content included: content related to music or movies; status messages that do not reveal points of view or emotions. Academic content included: sharing content related to academic activity. Professional content included: content related to the professional activity; sharing interests and skills. And *organizational content* included: content with direct reference to the institution (academic or professional) and content published in the name of the institution.

**Results.** As data collected from the in-depth interviews was analysed and crossed with data collected from observation, it revealed the existence of two main online identity profiles: context driven and user-driven online identities.

Students with a context-driven online identity reveal special attentiveness when choosing and selecting the content they add to their online profile: *"I can't afford to be misunderstood just because of a wrong opinion"*, "*none of the content is too personal, I try not to compromise myself"*.

Context-driven online identity includes two groups:

a) Students who, although having an active online presence, are careful when writing and interacting online, selecting and publishing only content that they believe will not be misunderstood by the community. As they sustain not to use informal online environments to evidence their abilities and/or skills, they choose to support their online identity on social content, most of it text messages and audio/video files.

Students included in this group have as main concern the lack of control about who access and reads what they publish (what [16] refers to as "invisible audiences"). In order to control that access, they manage their identity in online spaces by selecting content according to the platform: social content in social platforms, academic content in formal/institutional online spaces. These students try not to share personal content, either in informal or formal online spaces.

**Table 1.** Context-driven online identity - content distribution (I)

| Online platform | Typology | Format | | | | Total | |
|---|---|---|---|---|---|---|---|
| | | Text messages | Links | Audio/ video | Photos | | |
| Facebook | Personal | 4 | 0 | 0 | 14 | 18 | 19.4% |
| | Social | 16 | 8 | 25 | 13 | 62 | 66.7% |
| | Academic | 0 | 3 | 2 | 0 | 5 | 5.4% |
| | Professional | 2 | 0 | 0 | 0 | 2 | 2% |
| | Organizational | 0 | 4 | 1 | 1 | 6 | 6.5% |
| Twitter | Personal | 8 | 2 | 0 | 0 | 10 | 2.7% |
| | Social | 1110 | 95 | 87 | 7 | 299 | 82.1% |
| | Academic | 10 | 20 | 4 | 3 | 37 | 10.2% |
| | Professional | 0 | 4 | 0 | 0 | 4 | 1.2% |
| | Organizational | 1 | 13 | 0 | 0 | 14 | 3.8% |
| SAPO Campus | Personal | 0 | 0 | 0 | 0 | 0 | 0% |
| | Social | 1 | 1 | 1 | 102 | 105 | 48.6% |
| | Academic | 49 | 22 | 10 | 30 | 111 | 51.4% |
| | Professional | 0 | 0 | 0 | 0 | 0 | 0% |
| | Organizational | 0 | 0 | 0 | 0 | 0 | 0% |

b) Students that, being careful and selecting content according to the platform are using social and academic online spaces to build a professional profile and reputation. Their online presence includes information about their actual interests and occupations, their expectations and desires about their professional future, their skills and competences.

These students are trying to expand their area of influence and evidence themselves as professionals, and therefore tend to share content between platforms and to interact with experts of their field of interest. As they are trying to build a professional reputation over the network, their main concern (regarding privacy) focuses on the persistence of data and information; they are careful when publishing content and try to gain some control over the impact of their identity by selecting an managing their online contacts.

**Table 2.** Context-driven online identity - content distribution (II)

| Online platform | Typology | Format | | | | Total | |
|---|---|---|---|---|---|---|---|
| | | Text messages | Links | Audio/ video | Photos | | |
| Facebook | Personal | 2 | 0 | 2 | 2 | 6 | 0.8% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Social | 18 | 67 | 522 | 31 | 638 | 89.2% |
| | Academic | 1 | 4 | 1 | 0 | 6 | 0.8% |
| | Professional | 2 | 42 | 5 | 11 | 60 | 8.4% |
| | Organizational | 0 | 4 | 2 | 0 | 6 | 0.8% |
| Twitter | Personal | 1 | 0 | 0 | 1 | 2 | 0.5% |
| | Social | 76 | 143 | 98 | 19 | 336 | 79.4% |
| | Academic | 12 | 38 | 1 | 2 | 53 | 12.5% |
| | Professional | 0 | 7 | 0 | 0 | 7 | 1.7% |
| | Organizational | 2 | 21 | 2 | 0 | 25 | 5.9% |
| SAPO Campus | Personal | 0 | 0 | 0 | 0 | 0 | 0% |
| | Social | 5 | 0 | 0 | 0 | 5 | 6.3% |
| | Academic | 39 | 23 | 6 | 7 | 75 | 93.7% |
| | Professional | 0 | 0 | 0 | 0 | 0 | 0% |
| | Organizational | 0 | 0 | 0 | 0 | 0 | 0% |

User-driven online identity profile students, although being aware of the visibility and exposition of published content, claim to be building an identity that mirrors their real self, sharing content disregarding the social, academic or professional characteristics of the platform. As they claim to be confortable in sharing *"whatever comes to mind",* they publish information regardless of contextual constrains and guided only by their desire to share, being confortable to address sensitive issues (e.g. political, ideological). These students adopt a more stress-free attitude towards the construction of their online identity, claiming "*not making a lot of drama about it*" and therefore making their online presence "*a mirror of the real world*".

**Table 3.** User-driven online identity - content distribution

| Online platform | Typology | Format | | | | Total | |
|---|---|---|---|---|---|---|---|
| | | Text messages | Links | Audio/ video | Photos | | |
| Facebook | Personal | 48 | 5 | 1 | 15 | 69 | 15.7% |
| | Social | 40 | 110 | 127 | 42 | 319 | 72.5% |
| | Academic | 3 | 34 | 4 | 0 | 41 | 9.3% |
| | Professional | 0 | 1 | 2 | 0 | 3 | 0.7% |
| | Organizational | 0 | 7 | 0 | 1 | 8 | 1.8% |
| Twitter | Personal | 31 | 8 | 0 | 11 | 50 | 3.8% |
| | Social | 412 | 510 | 87 | 62 | 1071 | 81.8% |
| | Academic | 46 | 62 | 0 | 4 | 112 | 8.6% |
| | Professional | 26 | 16 | 3 | 2 | 47 | 3.6% |
| | Organizational | 3 | 25 | 1 | 0 | 29 | 2.2% |
| SAPO Campus | Personal | 0 | 0 | 0 | 0 | 0 | 0% |
| | Social | 0 | 0 | 2 | 6 | 8 | 15.7% |
| | Academic | 17 | 9 | 5 | 12 | 43 | 84.3% |
| | Professional | 0 | 0 | 0 | 0 | 0 | 0% |
| | Organizational | 0 | 0 | 0 | 0 | 0 | 0% |

Although adopting different approaches to their own online identity, student from both online identity profiles revealed to be more confortable in using open social platform to share content about themselves and their interests, which may explain why

the SAPO Campus platform was mostly used to display and share work related to academic projects and achievements.

Regarding the importance of the institutional platform, students from both groups mentioned the visibility and exposure of content, the harnessing of the institution's reputation and the credibility as main benefits of sharing and publishing their work on the SAPO Campus platform. Interviewed students also reveal an awareness regarding the Higher Education Institution corporate image:

"*I imagine that someone from the outside, as it [the platform] is related with the University, that people come and see, they look for information, they would see there [in SAPO Campus] an example of what it is being done here, and I don't want to, I am careful not to mess the University's good name with something I published.*"

From their perspective, by adopting an institutional platform to share their work and interact with others, they are blending their online identity with the institution's one, leading to a situation that can be valuable for both sides: as students, they may benefit from the HEI reputation and credibility; and the Institution may benefit from the quality of the content produced and shared by students.

In this scenario, students would act as prescribers of the HEI own quality, presenting to the community the work that is being developed inside walls: "*If the University has prestige their students feel somehow responsible for being related to a prestigious University, therefore they will want to have a prestigious work*."

## 3 Discussion of the Results

Although still in progress, preliminary data revealed that students are adopting the institutionally supported platform to meet and support their learning needs, gathering and sharing content related to their academic path and activities.

The analysis of data collected through interviews and observation point out that, when compared to informal environments – where participation is more intensive but more informal/social and mainly composed by music videos and links to other pages – students are building a more formal and conscious online presence in SAPO Campus, sharing content related to their academic activities and pre-editing the content they want to share.

Data analysis revealed that both context-driven and user-driven online identity profile students' adopt the institutionally supported platform to build a presence based on academic content. In the context-driven online identity profile, 63% of all content published on SAPO Campus was coded as "academic", mainly text messages - posts. In the user-driven online identity profile, 84,3% of the 51 posts, photos and videos published on SAPO Campus was coded in the same category.

In SAPO Campus, most of the content is academic related and, in order to increase the visibility and exposure of published content, often shared to informal platforms (Twitter and Facebook). Collected data also reveals that SAPO Campus users tend to value the feeling of security provided by customisable institutionally supported technologies, as well as the possibility of building an online presence in a platform associated to their HEI, where they can share their work and thoughts to both the academic and present/future employers in a more visible way.

## 4 Conclusions

As active producers of online content, students are building an identity available and accessible to almost everyone, designing a path that blends their personal, academic and professional lives and experiences. More than a curriculum vitae, their online identity may reveal to peers, to the community and to the market the sum of their experiences, their skills, their ability to communicate, interact and share online.

In a highly competitive setting such as the labour market, people should be conscious of the importance of the digital dimension of their lives; HEI, in turn, must be aware and concerned about the development of these new competences and look at its members as active participants and engaged learners.

Although still in progress, the case study introduced in this paper may be useful in understanding how students learn and build their online identity in a social platform provided by the HEI they choose as students. The analysis of the data collected through observation and content analysis revealed that students are, in fact, aware of their own online identity, as well as of the relevance of building a solid and truthful online reputation as learners and as professionals.

It is our belief that in the new connected world, the study and comprehension about how identity is built and displayed in online environments may be the basis for the construction of a more responsible, conscious and truthful reputation, fostering the creation of more valuable and well-prepared learners. For that reason, this paper may contribute to understand and rethink on how the academic community is using an institutionally supported online platform not only to achieve their learning goals but also to express their identity as learners, creators and professionals.

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# Steps to Reflect on the Personal Learning Environment. Improving the Learning Process?

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**Abstract.** The work that we describe here is a work in progress that we are carrying out in the University of Granada. The main objective of this work is thinking about learning processes that occur in current society and especially in the framework of Higher Education, trying to analyze the tools that compose the Personal Learning Environment of each student. In this research we try to relate the tools in the students' PLE with the stages of learning in the theory of learning of Gagné. This knowledge could guide us towards the improving of our teaching processes and students learning.

**Keywords:** Personal Learning Environment; Learning processes; Reflection process; Self-regulated learning; Higher Education

## 1 Introduction

Lately there have been an increasing number of people thinking that the learning environments based on ICT are evolving with the evolution of the users. We are in a society in which the relationships between people are strongly influenced by the technologies that they use, and this fact affects the way in which they confront their learning processes as well. These processes have stopped being fixed schemas that consist of several steps previously defined and become open situations chosen by learners and focused on their own needs. Thereby, current learners develop processes of knowledge acquisition that are self-centered and regulated by their own rhythms and styles of work. In addition, they are able to communicate and share all their experience with virtual communities at the same time. In our context, Higher Education, we are seeing all these characteristics in the current process towards the European Higher Education Area that try to approach the diversity of universities in a common framework. In this scenario, the methodological guidelines that universities have to follow are focused on the self-regulation of students, their active work in the learning environments, and the need of long-life learning as a tool of professional development.

This evolution in learners and their learning methodologies have to be translated into an evolution in their virtual environments. In this knowledge society, we look for information through the networking facilities available to us, and we can communicate and share our knowledge by using these technologies. All these possibilities are becoming the real learning environment which is handled in a natural and comfortable way by users. However, in the past few years, in most educational institutions, virtual

learning has been handled by Learning Management Systems (LMS) and nowadays most institutions have their own institutional virtual campus based on their LMS or even several, and different LMS coexisting together. Some authors have begun to think about the weaknesses of these systems, and pay attention in another more flexible and more customized learning methods. For example, Mott (2010) [15] points that many students, teachers, instructional technologists, and administrators consider the LMS too inflexible and are turning to the web for tools that support their everyday communication, productivity, and collaboration needs. Blogs, wikis, social networking sites, microblogging tools, and other web-based applications are supplanting the teaching and learning tools previously found only inside the LMS. Along the same line of thought, Camacho and Guilana (2011) [5] collect the ideas of some authors [10], [18] who argue that LMS reproduce the traditional teacher or institution-centered closed model, whereby students are simply managed into a standard production system. According to them, this circumstance has changed dramatically with the explosion of Web 2.0 technology and social networks, that produced the movement of users to an open platform in which they are connected by interests, participate in social networks, and create communities of practice generating a collective intelligence. Regarding the needs of collaboration and social participation, Dabbagh and Kitsantas (2012) [9] point out the idea that LMS do not capitalize on the pedagogical affordances of social media. For example, they do not allow learners to manage and maintain a learning space that facilitates their own learning activities and connections to peers, and social networks across time and place, so they can't take advantage of digital and networked technologies, not only to look for information, but also to share information.

In this situation we can think about looking for another types of virtual learning environment that collect all these desired characteristics in an open, collaborative and flexible way [5], [15], [20].

## 2 Theory Background

The main objective of this work is thinking about learning processes that occur in current society and especially in the framework of Higher Education. All we say in the previous section guides our reflection towards a scenario in which students learn in an informal and collaborative way, and take advantage of social networking and information and communication technologies. It seems that the idea closest to this scenario is the concept of Personal Learning Environments (PLE).

In a simple definition “a PLE is comprised of all the different tools we use in our everyday life for learning” [3]. This definition that sounds quite plain reflects the main ideas of these environments: self-regulation of the environment, adaptation to our own needs, including our daily services and tools (social and networking), and providing learning (formal and informal). According to Valtonen et al. (2012) [20] from the work by Attwell (2007) [3] and by Schaffert & Hilzensauer, 2008 [17]; the idea of PLEs is to set students in more central roles in two ways: first, students are allowed and encouraged to build and administer their own learning environments in ways that best suit their learning needs and purposes; second, the aim is to provide students with a more active role in the learning process, as self-directed agents taking more responsibility for their learning. These definitions and approaches emphasize the

pedagogy and not the technical tool or software, so the tools will be adapted to the needs of the user.

Following Valtonen et al. (2012) [20], we can stress on one hand the theoretical aspects that are behind the building of PLEs, pointing the facilities for self-regulating and personalize our own learning environment, and on the other hand, the capacities for developing collaborative learning. However, the students have to have higher order thinking skills for orienting, planning, executing, monitoring, and evaluating the processes of learning. Because of this, it is interesting to study how students build their own PLEs and what competences and skills they need for it, according to their own learning styles.

In our research in progress, we compare the characteristics of students' PLEs with the theory of learning of Gagné [11] in order to understand which mechanisms lead them to build these PLEs. We try to use this information to improve learning and teaching.

Gagné's theory try to offer a theoretical framework that could be used by teachers in order to improve planning the instruction. We are going to establish a relationship between this theory and the idea of PLE to improve the design and planning of our learning experiences using this type of environments.

Gagné studies simultaneously learning and instruction in his theory, since he thinks that they have to be studied together. He establishes that, in order to achieve certain learning outcomes, it is necessary to know [19]: a) the inner conditions that take part in the process and b) the outside conditions that may help an optimal learning.

In order to explain the inner conditions that take part in learning processes, Gagné makes a schema that shows the different stages in the learning process, taking into account that inner activities are closely related to outside activities and this will cause certain learning outcomes. The eight stages are [19]: motivation, understanding, acquisition, keeping, memory, generalization, implementation and feedback.

Outside conditions are defined by Gagné as those events that enable learning processes. Through the designing and planning of our learning environments, we can thus make these outside variables appropriate to develop the learning experiences. This theory addresses the organization of these outside conditions in order to achieve certain learning outcomes according to each learning process and style: ordering these variables to improve students' motivation, attention, acquisition …

Our main purpose in our future research will be to relate the widgets or tools in students PLEs to these outside conditions that are in their learning process. Thereby, most important source of information will come from the students through the representation of their own PLEs and the interpretation and categorization of each tool. We are going to collect all these information and analyze it in order to extract our conclusions. We think that this analysis could help us to organize the instructional design of our teaching experiences taking into account the steps of Gagne's theory directly related to the outside conditions that students mention as different tools and widget in their PLEs.

In this field of work there are a lot of researches and studies that have helped us to reflect in our own work and reinforce some issues. Thus, for example, the works of Berthold et al. (2011)[4] or Costa, Cruz & Viana (2010) [8] emphasize the importance of assign the widgets that learners use in their PLEs to their corresponding learning techniques in order to improve learning outcome and success on one hand, and on the other hand in order to recognize the importance of student's leadership in the

organization and management of their own learning. Moreover, studies such as Castañeda y Soto (2010) [7] or Wild et al. (2009) [21] have been dedicated to analyze the fundamental elements that have importance in the building of PLEs. In the first case, they obtain as one of the main conclusions that *"experiences of success related to the use of these tools in learning processes are associated with a mix between a strong learner centered methodology (vital) and a good catalogue of tools"*. For their part, Casquero (2010) [6] and Wilson et al. (2006) [22] offer alternatives in the building of PLEs that mix the institutional part with the access to the web in the first case. In the second case, they emphasize symmetric connections with a range of services both in formal and informal learning, work, and leisure, and identify strategies for implementation and experimentation.

## 3 Methods of the Research

In this work we describe a research in progress in which we try to find out whether reflection on their Personal Learning Environment improves students learning process and teaching development. We study this from two different points of view:

- From the student perspective*:* From the student point of view, the main goal is to become aware of their own learning process. Developing, analyzing and evaluating their own PLE make the student reflect on their process of knowledge acquisition. Therefore, for the students the building of their own PLE becomes a powerful metacognitive tool.
- From the teacher perspective*:* We analyze the PLEs built by the students in order to develop resources that take into account the tools in these PLEs. At the same time we will be able to promote the collaborative learning with the appropriate strategies. In short, we study the learning environments of our students in order to understand the way in which they acquire their knowledge and use this information to improve our teaching in the designing and planning of the processes and the interactions.

The points above will be the two main goals of a future wider study, in which we will analyze the PLEs showed by a set of students at the University of Granada.

Here we primarily intend to exchange ideas, experiences, and researches on the reflection of the students on the building of their own PLEs. The key is to find out how one can contribute to the development and implementation of their own PLEs through self-reflection on their learning processes. In order to do this, we propose to study an experience will carry out at the University of Granada. For our experience we will use two courses with students (about 120) of a degree in Education in the Faculty of Education Sciences. The students will be in the second year of the degree in a subject related to the use of ICTs in Education. We consider that this is the right subject to do this experience due to the contents are focused on provide students with technical resources to improve their teaching skills. This fact could enrich their PLEs throughout the course and we could track the changes on it.

The procedure chosen for this analysis includes the development of an activity proposed by the teachers at the beginning of the course in which students have to develop a concept map of their own PLE. It is considered that the creation of concept maps allows students to organize and relate contents. It is a technique that allows the

knowledge organization and representation and so, students can learn significantly a discipline by doing them [16][12].

At the end of the course, in a subsequent step, the students should think about their PLEs and about its evolution and they will do the concept map again with the changes. The reflection process on their PLE is more important (or nearly as important) as the building process.

The reflection is a deliberate and careful consideration of previous actions, events, experiences, or decisions, and the thinking that accompany these activities. In this research the main starting point is the idea that it is useful to reflect on PLE, because the lessons learned from reflection can be useful to guide and inform future practice. It is also true that learning processes are favored by reflection. However, to improve the learning processes, the reflection on PLE is necessary but not sufficient. Nowadays trying to solve the question about whether the reflection on PLEs improves the learning processes is a fundamental target. In order to try to answer this question, we relate the essential components of a PLE (tools for reading, thinking and relationship) with Gagne's eight stage of learning (motivation, understanding, acquisition, keeping, memory, generalization, implementation and feedback). Students could categorize each tool in one or several stages. This could serve them to know what stages are the weakest and look for tools that help them in these ones.

In order to reflect on the tools that make a PLE it can be useful to think that this concept generally includes three basic elements [1]:

- Reading tools and strategies: the information resources that offer this information as objects (media libraries);
- Reflection tools and strategies: the environments or services to which the information can be converted (sites where to write, comment, analyze, publish) and
- Relationship tools and strategies: environments to relate with other people to learn from or with.

In a previous study, Amberg et al. (2009) [2] investigated the development of the learning process into the creation of a PLE. The learning process based on web to create a PLE was described according to the categories: Browse - Link ("do network") - Collect - Create - Communicate (synchronously and asynchronously) - Share (collaborative development of resources or contents). We'll try to relate the tools used in these categories for defining the PLEs with the stages that we mentioned before.

In our research in progress, we study and analyze how students build their own PLE and which are the main tools that constitute it. We understand that we are in the construction and reconstruction stages following a natural evolutionary process. We ask ourselves whether being aware of the tools in their own PLE encourages students to acquire new tools. We also wonder if this circumstance helps them to be more aware of their ways to learn and so they can intentionally chose which tools can be useful in their learning process.

This study will have several steps that we can summarize as follow and will carry out during 4 month of classes:

- At the beginning of the course students draw a concept map with the main tools that form their own PLE. We recommend them to make it with the tool CmapTools[1].
- At the same time, we ask them to reflect about the building of this environment and fill in a questionnaire that we will elaborate, in which they will have to establish relationships between the tools in their PLE and the stages of learning of Gagné. So, they relate each tool to a stage of their own learning process.
- We analyze the information collected and could define profiles of tools depending on the stage of learning in which they were used.
- We could reinforce using certain tools in certain stages of learning if we consider that these tools could improve learning process according with the opinion of students.
- We could plan and implement strategies of learning that take advantage of these tools in those stages of learning.
- At the end of the experience, we ask the students to draw the concept map of their own PLE again. The objective is that they reflect about the changes that their PLE has suffered since they are conscious of the tools that made it up and the stages in which they use them. We will ask them specific questions about it to guide this reflection.

We have to build the instruments that we will use in this research (questionnaire for relating PLEs with stages of Gagne's learning theory and questionnaire of reflection about the final PLE) but the process is going to be structured as we described above. We will make a list of tools that usually students use in each stage of learning. Thus, we could advise students to manage certain tools in certain stages and we could plan our instructional designing according to this.

## 4 Some Examples of Future Analysis

This current academic year we have begun to collect conceptual maps of students in our subjects to guide all this research and our teaching strategies as well. We only asked students to make a conceptual map of the tools that they use in their daily learning at the beginning of the subject "ICT applied to education" in some courses of an Education degree.

As an example we show the following map (Fig. 1) in which this student classifies the tools in eight categories: Studying; following; learning and knowing; searching; images; audiovisual leisure; reading; and communicating and sharing. For our future analysis we would have to relate these categories with the stages of Gagne's theory or each tool with the stage. In order to do this, we will develop a questionnaire that students will fill at the same time that they are making their map.

[1] Available in http://cmap.ihmc.us/

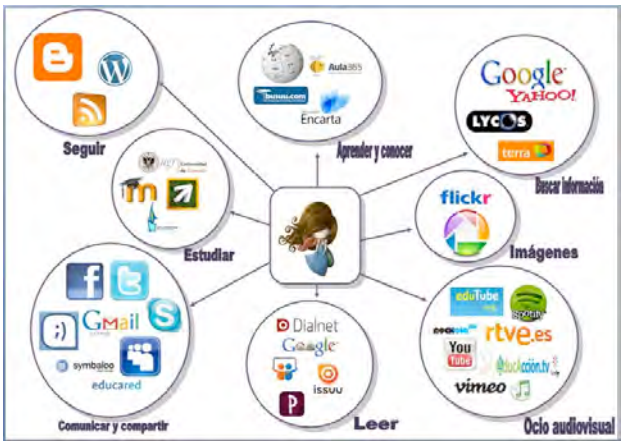


**Fig 1.** PLE before subject ICT applied to education

At the end of the course the same student made this map in which new tools were added to their PLE as we can see in the next figure (Fig 2.) in the categories: collaborative work, resources search and resources developing. These tools were highly related to the contents of the subject.


**Fig 2.** PLE after subject ICT applied to education

In a preliminary overview of the main tools that our students pointed in their PLEs, we can make the following list only as a starting point of our research and as a reflection of their learning styles:

1. Google (Gmail, maps, books, chat…)
2. Microsoft Office
3. CmapTools
4. Digital newspapers
5. Facebook

6. Tuenti
7. Twitter
8. Messenger
9. Hotmail
10. Blogs (blogger, wordpress)
11. Podcast
12. University of Granada Tools
13. Skype
14. Picassa
15. Flickr
16. Spotify
17. Youtube
18. Prezi
19. Outlook
20. Wikipedia, Wikiloc
21. Linkedin
22. Laboris
23. Infojobs
24. Wordreference
25. Delicious
26. …

In order to improve our teaching and planning experiences we could relate each tool and each stage of learning to the Gagne's Nine Steps of Instruction. Thereby we can try to use in the several steps the tools that students already use more frequently. The nine steps of instruction are according to Gagne: 1. Gain attention, 2. Describe the goal, 3. Stimulate recall of prior knowledge, 4. Present the material to be learned, 5. Provide guidance for learning, 6. Elicit performance "practice", 7. Provide informative feedback, 8. Assess performance test and 9. Enhance retention and transfer.

## 5 Conclusions

In the current society the importance of the relationships established through networking and the access to the information and knowledge, are influencing the developing of learning processes. The learning environments are becoming more flexible and decentralized than ever. In these scenarios all the processes are centered on the students and their interactions.

Knowing the way in which students build their own PLEs seems to be an important task to understand their styles of learning and to develop teaching strategies according to those styles. It is important to take advantage of this information not only for teaching purposes but for the reflection of students in their own learning.

The goal of the research explained here is to study in depth this issue. We are currently starting to do some previous studies and preliminary analysis. In these studies we are seeing that students are not very conscious of the tools that they use in formal and informal learning until you ask them to reflect about it. But it's almost a general issue that all the PLEs of the students are much enriched after the course. The tools and widgets that they learn in the subject are added to their PLEs. This could serve them to enrich their learning environments and incorporate new tools that could

help them in all the stages of their learning processes but in those in which the students had more problems above of all.

At the same, time we could learn more from the tools that students need in their learning process. This fact could help us in the instructional design of our subjects by using the tools that students use in certain steps of their learning.

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# Introducing Personal Learning Environments to Informal Learners: Lessons Learned from the OpenLearn Case Study

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**Abstract.** Personal Learning Environments (PLEs) hold the potential to address the needs of informal learners for multi-sourced content and easily customisable learning environments. This paper presents the lessons learned from a case study regarding the use of widget-based PLEs by informal learners for finding and evaluating Open Educational Resources (OER). The lessons learned from this case study have allowed the authors to detect some of the obstacles for the successful adoption of PLEs by informal learners, as well as to identify ways for overcoming these obstacles.

**Keywords:** personal learning environment, open educational resource, informal learning.

## 1 Introduction

Personal Learning Environments (PLEs) are gradually gaining ground over traditional Learning Management Systems (LMS) by facilitating the lone or collaborative study of user-chosen blends of content and courses from heterogeneous sources, including Open Educational Resources (OER).

The implementation of PLEs for supporting informal learners involves a number of challenges. PLEs entail a significant amount of new learning technologies and methodologies that are largely unfamiliar to the communities of informal learners. This paper presents the lessons learned from a case study in informal learning, regarding the use of PLEs for finding and evaluating OER. The outcomes of this case study aim at informing Technology-Enhanced Learning (TEL) stakeholders about some of the problems and solutions for the successful implementation and delivery of PLEs to communities of informal learners.

The remainder of this paper is organised as follows: Section 2 describes the background and introduces the main concepts related to this work. Section 3 presents the OpenLearn case study and section 4 discusses the methodology adopted for evaluating PLE solutions within this case study. Section 5 discusses the evaluation results and section 6 presents the overall lessons learned from this case study. Finally, the paper is concluded in section 7 and the next steps of this work are outlined.

## 2 Background

The Learning Management System (LMS) has dominated Technology-Enhanced Learning (TEL) for several years. It has been widely used by academic institutions for delivering their distance learning programmes, as well as for supporting their students outside the classroom. The LMS has been a powerful tool in the hands of educators, enabling them to complement face-to-face teaching in the classroom with remote work by individual students, as well as groups of them. Popular examples of such systems used by the academic and the business world include Blackboard (www.blackboard.com), Moodle (http://moodle.org), and Sakai (http://sakaiproject.org) [1, 3, 17, 18].

However, the advent of Web 2.0 has altered the landscape in TEL. Learners nowadays have access to a variety of learning tools and services on the web. These tools and services are usually provided by different vendors and in many cases are open and free. Repositories like Wikipedia (www.wikipedia.org), YouTube (www.youtube.com), SlideShare (www.slideshare.net) and iTunes U (www.apple.com/education/itunes-u) offer access to a wide range of learning materials for free. Augmenting and configuring the diverse and distributed Web 2.0 tools and services in order to address the needs and preferences of individual learners is a significant challenge for modern online learning environments.

As opposed to formal learning, which is mostly instructor-led, informal learning is driven by self-study and the initiative of individuals, as well as communities of learners with common goals. The transition from the traditional approach of LMS to Web 2.0-based learning solutions bears significant benefits for informal learners. It puts emphasis to their needs and preferences, providing them with a wider choice of learning resources to choose from. In addition, the success of initiatives such as the Khan Academy (www.khanacademy.org) has proven the importance of Web 2.0-enabled crowdsourcing in informal learning.

The Personal Learning Environment (PLE) is a facility for an individual to access, aggregate, manipulate and share digital artefacts of their ongoing learning experiences. The PLE follows a learner-centric approach, allowing the use of lightweight services and tools that belong to and are controlled by individual learners. Rather than integrating different services into a centralised system, the PLE provides learners with a variety of services and hands over control to them to select and use these services the way they deem fit [5, 6, 19].

The emergence of the PLE has greatly facilitated the use and sharing of open and reusable learning resources online. Learners can access, download, remix, and republish a wide variety of learning materials through open services provided on the cloud. Open Educational Resources (OER) can be described as “teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or repurposing by others depending on which Creative Commons license is used” [2].

Self-regulated learning (SRL) comprises an essential aspect of the PLE, as it enables learners to become “metacognitively, motivationally, and behaviourally active participants in their own learning process” [20]. Although the psycho- pedagogical theories around SRL predate very much the advent of the PLE, SRL is a core characteristic of the latter. SRL is enabled within the PLE through the assembly of independent resources in a way that fulfils a specific learning goal. By following this paradigm, the PLE allows learners to regulate their own learning, thus greatly

enhancing their learning outcomes [8, 14].

Although the benefits of PLEs may seem quite obvious, the adoption of these technologies and the associated learning methods in different learning contexts can be hindered by certain obstacles. For example, the adoption of PLE-based solutions in the workplace is influenced by certain business factors, such as the perceived cost-effectiveness of these solutions, their compatibility with existing solutions, their strategic alignment with organisational goals, as well as the attitude of the organisation's leadership towards change [4]. The present paper attempts to shed some light into the challenges and issues related to the adoption of PLEs in informal learning.

## 3 The OpenLearn Case Study

The European project ROLE (Responsive Open Learning Environments - www.role-project.eu) is aiming at empowering learners for lifelong and personalised learning within a responsive open learning environment. In order to study and evaluate the applications of PLEs in a variety of learning contexts, the ROLE project has setup a number of test-beds. The ROLE test-beds cover a wide variety of rich contexts in which there is potential for significant impacts of both personal learning and responsive open learning environments. Each test-bed concentrates on researching a large sample of representative individuals; this enables ROLE as a whole to collect experiences covering a large variety of learning contexts and requirements.

The Open University (OU), UK comprises one of the ROLE test-beds, concerning the learners' potential transition from formal to informal learning. This transition is being implemented within this test-bed as a transition from the traditional LMS towards the PLE paradigm [10-13].

The test-bed in question is the OER repository OpenLearn offered by the OU. OpenLearn (http://openlearn.open.ac.uk) currently offers in excess of 6,000 hours of study materials in a variety of formats. These include materials repurposed as OER from original OU courses i.e. formal delivery as well as bespoke OER created by both OpenLearn academics and non-OU educators, i.e. enabling informal delivery.

OpenLearn users are primarily informal learners, who want to find and study OER either individually or in collaboration with others. These learners can be in formal education e.g. taking an accredited University course elsewhere and simply looking for additional materials to add value to their primary course or they maybe, what is often described as, "leisure" learners i.e. those who simply want to learn for themselves with no expectation of formal accreditation.

OpenLearn currently uses Moodle as a LMS platform. Therefore, in order to add value to those potential learning experiences, this test-bed has endeavoured to raise awareness of PLEs with both the OpenLearn project team as well as with selected parts of the wider OpenLearn community. The OpenLearn test-bed is measuring some of the expectations, perceived benefits and difficulties of implementing a PLE in this environment. Thus, in effect, enabling the assessment of the overall aim by measuring the transition from formal to informal learning as witnessed through OpenLearn staff and students.

This transition attempts to transform and improve the OpenLearn user's experience by enabling individuals to build and personalise their learning environment thus gaining more control over the potential manipulation and production of as well as

use of OER study materials. In addition, the adoption of certain ROLE widgets inside study units of the OpenLearn Moodle platform is offering further value to those users by supporting a stronger framework to foster particular communities. This presents an opportunity to individual informal learners to be part of a shared learning experience instead of their current potential lone study.

OpenLearn is a pioneering initiative in the production and dissemination of OER, both within the UK and worldwide. In the context of ROLE, we are therefore drawing upon two significant factors that OpenLearn has brought to the OER field: scale and experience [9]. Scale in terms of the quality of archive material available that can be repurposed in varying degrees for online dissemination, and also in terms of developing robust systems (both technological and pedagogical) that provide a meaningful learning experience to large student populations. Experience in terms of producing distance education material that is designed to be studied by informal learners, who often have competing demands on their time, and a range of needs and experience.

By drawing upon these factors, we are reaching out to a global audience of informal learners, in order to raise awareness about PLEs through specialised OER. These OER introduce the core concepts behind ROLE and PLEs and allow the use of ROLE tools with guidance from structured learning activities. Figure 1 shows such a learning activity, where the learner is invited to use a ROLE widget in order to complete a series of tasks. The ROLE OER are available as free study units in OpenLearn and can be downloaded, remixed and republished. The people who study these units are also encouraged to provide their feedback and suggestions about the ROLE tools and PLEs in general.

More specifically, the following ROLE OER are currently available as study units in OpenLearn:

- *Responsive Open Learning Environments* (http://labspace.open.ac.uk/course/view.php?id=7433): This course provides an overview of the concepts behind PLEs and also demonstrates a selection of learning tools that have been developed by ROLE.
- *Self Regulated Learning* (http://labspace.open.ac.uk/course/view.php?id=7898): This course introduces the concept of SRL and guides learners into using the ROLE tools in order to apply the SRL principles into their own learning.


**Figure 1.** A learning activity featuring a ROLE widget inside an OpenLearn course

## 4 Methodology

Qualitative and quantitative data were collected through a number of different research instruments. Introductory workshops were organised presenting the basic scenario of a PLE to the audience, followed by an opportunity to experience using pre-selected ROLE tools implemented into a dedicated OpenLearn study unit. The underlying theme of the workshops was: "Finding and evaluating OER", but the flexible nature of the embedded activity was such that individuals could tailor this theme to meet their own specific needs i.e. by choosing to look for or discover OER pertinent to their own subject areas. Two workshops were conducted using ROLE tools with two different groups, i.e. one with learners and one with educators. Collecting feedback from each group was organised through a survey. This generated both quantitative as well as qualitative data. Representatives from the ROLE project were present at each workshop to deliver information and to circulate during the hands-on part of the session. This was an excellent opportunity to hear how individuals did or did not engage with the ROLE tools. It was a chance to collect some direct qualitative data through comments and feedback from participants.

The first workshop took place at the Joint European Summer School on Technology Enhanced Learning (JTEL) in Crete, May 2011. Participants were 25 postgraduate students from universities across Europe. The JTEL Summer School is an annual event and offers an opportunity for PhD students, in different subject areas, in TEL to meet, exchange knowledge and develop their research skills whilst engaging with the active TEL community of practice. The second workshop took

place at The Open University, Milton Keynes, UK in July 2011 and was attended by 10 educators. It was organised in conjunction with the Support Centre for Open Resources in Education (SCORE). SCORE offers a variety of support mechanisms to the OER community in England. The attending SCORE Teaching Fellows are appointed from a cross-section of English Higher Education Institutions (HEIs).

A similar but not identical, workshop format was used at each event. Whilst the workshop basis was the same (e.g. setting the scene, describing PLEs etc.), the hands-on materials and pre-selected ROLE tools were tailored for the different audiences. After a short introductory presentation about ROLE and PLEs a short question and answer session followed. The main hands-on section of the workshop was then delivered in the form of an activity. Essentially participants were asked to visit the dedicated OpenLearn webpage shown in Figure 2. This enabled the participants to access a group of pre-selected ROLE tools in the form of widgets.

Participants were asked to use the two pre-selected ROLE search widgets called Binocs and ObjectSpot. Engaging in this activity would enable them to find OER that would be suitable to support them in their respective research or teaching scenarios. A third widget, accessing an EtherPad, was also available for this activity and it enabled participants to report their findings in a collective electronic notepad format. At the end of each workshop, a group discussion was also held with the participants contributing about their experiences of using the ROLE tools.

Additionally, the participants were asked to answer a short online survey (see https://fit-bscw.fit.fraunhofer.de/pub/bscw.cgi/39223921). The purpose of this survey was to gather user feedback both specifically about the ROLE widgets, as well as more generally about the perceived usefulness and ease of use of PLEs, via questions based on the Technology Acceptance Model (TAM) [7, 15, 16].


**Figure 2.** The setup of learning tools used in the "Finding and evaluating OER" workshops

# 5 Results

The results of both workshops were recorded in a number of formats. It is fair to say that primarily quantitative data was collected from the questionnaire whilst the majority of the qualitative data was collected in situ when facilitators circulated amongst the participants. Secondly, however, some supplementary qualitative data was also gathered electronically via the pre-selected ROLE tool that enabled participants to access the EtherPad and record their experiences as they happened. In general, some participants were comfortable with using the EtherPad whilst others were most definitely unable to grasp the concept or indeed use it effectively. It was for this reason that the facilitators at each workshop collated notes of what they observed and heard during each event. It is important to note that the questionnaire also contained a number of semi-structured questions permitting free text individual responses.

Overall, the two events were deemed to be very successful. The introduction about the remit of PLEs set the scene and, additionally, participants appreciated the opportunity to use the selected ROLE tools thus the workshops were warmly received by both audiences.

The first event, as previously mentioned, took place during the JTEL Summer School in Crete, May 2011. The audience comprised of PhD students all of whom were aged between 21 and 40. There was an even split between the genders. Most participants declared that they had a good knowledge of TEL (73%) whilst the majority also indicated that they had "some" knowledge of OER (73%). The purpose of the workshop being that participants were encouraged to use the ROLE tools to seek out appropriate OER materials that would support them in their subject areas of research.

In general the JTEL participants overall opinion of using the ROLE tools as part of the learning activity in the workshop was a positive one. Participants recorded in the free text responses of the questionnaire that their experiences of using the tools were "...useful, *especially the search widgets"* along with "LOVED *THEM!!! I found them really useful both for search and collaboration"* and "a *great idea"*. Collating the responses to the fifth question (What did you think of the widgets of the learning activity?) which was also a free text response, one can see that the overall opinion recorded was positive (80%) alongside a much smaller negative response (10%) as well as a small neutral response (10%).

With relation to the perceived usefulness and ease of use of PLEs, the responses were much more mixed (see Figure 3a). Interestingly the groups' strongest opinion related to the statement "Using a PLE would improve my motivation for learning" where some 57% registered a neutral response to this premise. Other strong opinions were also voiced in respect of the statements "I *would find a PLE useful for my work"* where some 52% agreed with 21% strongly agreeing and "I *would find interacting with a PLE requires a lot of mental effort"* invited a 52% disagreement to be recorded. This would suggest that many of the participants recognised that using a PLE required some effort initially along with a discerning thought process but such effort would offer individuals greater benefits in the long run. The remaining statements in this question invited a more evenly spread set of responses.

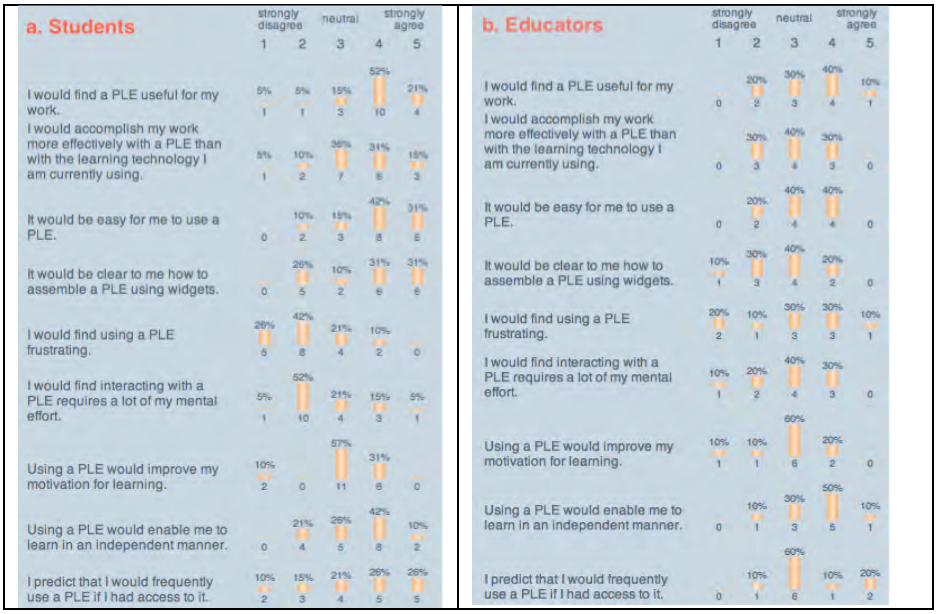


**Figure 3.** Responses of (a) students and (b) educators regarding the perceived usefulness and ease of use of PLEs

Question 7 related to the main premise of the workshop, i.e. the participants' success in finding relevant OER results from their enquiry using one of the ROLE tools (either Binocs or ObjectSpot). It was an opportunity, once again, for them to record their actual opinion using a free text response. Overall the majority (70%) recorded a positive use of the ROLE tools to find relevant OER materials, whilst a small number rated the experience as neither positive nor negative (20%). Only 2 participants, in fact, replied negatively (10%). Recorded comments to this question ranged from simply stating "Yes" through "I found some very useful resources for my research". Some participants chose to record exactly what they found e.g. "Mainly videos and images" or "YouTube, Slideshare" whilst others commented about the actual process, for example: "...finding relevant (materials) ones is hard" or "It was good to be able to see how different licences can be used and how to use the resource for my work".

Participants were also invited to record their opinions related to comments or questions for improving the ROLE tools. Significantly fewer responses were recorded in response to this invitation (50% of group total). It is not clear why this is so. Nonetheless, some useful ideas were recorded, such as "it would be useful that each resource had more indications about how rich it is. Not only number of comments, but also links, embedded content etc." In other words, the participant recognised the value of the ROLE tool for his/her research work and wanted more relevant information to be displayed once a search query had completed i.e. that materials were situated in a wider context (in this case in relation to OER subject matters).

The EtherPad widget, as indicated earlier, was received by workshop participants in different ways. Most of the research students, in this JTEL event, actively used the tool although some were a little surprised by the real-time aspect of it "...somebody is writing on my screen!!!! I am scared". Others considered additional aspects to the

experience in that it highlighted some potential gaps in their own skill set "...I probably have to work on my search skills...". Overall, however, there was a positive, yet critical, response to this invitation indicating that the students who chose to record their thoughts in the EtherPad widget did give some considered attention to their discussion and/or notes.

Other interesting responses ranged from "... I like that I can narrow down the search results to just pictures, apps etc" to suggestions that "...This one is very good! You find the licence and you search for it" indicating, once again, that some students were discerning users of the ROLE tools and thinking through a number of previously unconsidered approaches or ways of using such search engines. Others focused on previous experience e.g. "I used this tool in a conference, we took notes dude!" as well as the not unusual student response of "So... in the morning we can actually make notes together instead of coming to group therapy :)" suggesting that virtual communication might be a replacement for those who were reluctant to be early risers.

The workshop facilitator also noted that students chose to work in teams of two and that no significant technical issues were experienced during the event. She noted that, in some cases, a number of students search results were irrelevant and that the majority of results appeared to return YouTube video links. The latter would appear to happen if all the options in Binocs, in particular, are left checked which is the default option of this ROLE tool. This may suggest that it would be better to leave the default delivery of the tool unchecked thus inviting users to select and check the search engines that are relevant to them/their research.

The facilitator also documented that the majority of students appeared to focus on the Binocs tool rather than the ObjectSpot tool depending upon the type of material that they were interested in finding. There may have been a number of reasons for this occurrence e.g. Binocs was offering OER related materials whilst ObjectSpot concentrated on bibliographic searches which may have been more easily identifiable to the students. She also recorded that at least half the group only used these two tools and did not appear to engage with the EtherPad tool at all. Again, as indicated earlier, there could be a number of reasons explaining this situation.

The second workshop took place with an audience of educators whose age profile was somewhat in contrast to the JTEL Summer School. The majority were SCORE Teaching Fellows who were aged 30-50 with a 60:40% female:male division. Their knowledge of TEL also invited a wider range of responses in that 30% recorded themselves as "experts" with 40% stating "good knowledge" alongside 30% saying that they had "some knowledge". They also recorded an identical response in respect of their OER knowledge. Once again the purpose of the workshop was that participants were encouraged to use the ROLE tools to seek out appropriate OER materials that would support them in their subject areas of either their Teaching Fellow or "normal" research.

In respect to the question "What did you think of the widgets of the learning activity?" the educator participants responded with an even split between positive and neutral comments such as "Good in principle, liked the ability to search file type. Needs wider range of search engines. Didn't work properly on the iPad" as well as many responses of "useful/nice idea/worked well in general" in addition to "... but would be even better if the search results were filtered for Creative Commons licenced items" indicating that the educator recognised the potential of the search tool to be further refined.

As shown in Figure 3b, there was a rather mixed response to the set of questions

about the perceived usefulness and ease of use of PLEs. Overall, most of the educators (ranging from 40-60%) registered that they were neutral in their opinion of the nine listed statements. Likewise, only 10-20% of participants registered either strongly agreed or disagreed views. For example, with respect to the statement "It would be easy for me to use a PLE", some 40% of the educators agreed but, as indicated earlier, another 40% held a neutral view of this statement alongside the remaining 20% registering that they disagreed.

In relation to the success of participants finding suitable OER materials via the ROLE tools again the response was 50:50 in respect of neutrality and strongly agreeing with the premise. It is difficult to ascertain why this is so other than suggesting that the participants appeared to be reasonably comfortable with the idea of using the ROLE tools even though some experienced technical issues recording that "did not work on iPad". It was noted by the facilitator and ROLE colleague present that there was a definite positive "buzz" amongst the audience during the learning activity. This manifested in a number of implicit ways: enthusiastic language being used amongst participants; a sense of excitement that emanated in above average noise levels for the group (N.B. The ROLE colleague in attendance is also a Teaching Fellow and a regular attender at these monthly SCORE events).

Question 8 related to the ease or difficulty of adaptation of the OER for the participants own purpose. Some 50% of the educators registered a neutral response with 30% recording that it was difficult along with the remaining 20% stating that it was very difficult to adapt their OER. This corroborated the previous premise that it is easy to find OER materials but less so to disaggregate the contents and repurpose or remix them to meet local needs.

With respect to the educators finding the learning activity useful for research needs and goals, once again the responses were evenly split (50:50) between a neutral stance and strongly positive. The actual comments centred on simple "Yes" replies through "useful but frustrating" to "It was useful to find that the search widget could be customised to a particular project's needs" confirming that either the facilitator or ROLE colleague had explained that ROLE tools could be adapted to meet local needs too.

The final survey question requested comments or suggestions for improving the ROLE widgets. In exactly the same way as the JTEL Summer School workshop, this invitation revealed a limited number of responses. They were, however, helpful in terms of feedback for the ROLE tool developers and ranged from "support or examples of good use would be helpful - the interface is not immediately intuitive" through "... the search needs to direct users towards OER repositories and/or Google results filtered by licence" to "the search results I got were not necessarily OER". The latter suggesting that definitions of what is being searched for need to be clearer as well as pre-selecting the most appropriate search engines/repositories rather than a wider set of resources that seem to confuse some of the end users.

It is fair to say that there was little engagement from the educators in this learning activity with regards to the EtherPad widget. Only 9 lines of text were recorded in it within this workshop compared to some 50 lines of text recorded during the earlier JTEL Summer School. To encourage use and demonstrate it, the ROLE facilitator used the EtherPad to record the location of the associated survey as an example of how further resources or links could be shared amongst a wider peer group. Nonetheless some useful information was recorded by the educators, one of whom remarked: "... I was wondering how this search tool chooses content to display and

how it displays the search results*"*. Once again indicating that those who engaged with all of the tools did so with discernment and thought sometimes anticipating further potential refinements to the tools.

## 6 Lessons Learned

It is possible to draw out a variety of lessons that have been learned from the transition from formal to informal learning workshops. These emergent themes centre around three main areas: the usability of the learning tools, consideration of the types and styles of the related learning activities formats, as well as both reflecting and acting upon suitable methods that encourage existing and potential future participants to be willing to consider, engage and continue using PLEs for their own learning purposes.

Before exploring the emergent themes, however, it should be noted that the learning tools selected for the previously described workshops were, in fact, only three of those currently available from the ROLE project. They were pre-selected as appropriate for these workshops in order to offer a collective opportunity for participants to seek out different types and styles of subject related OER materials for each group. The secondary aspect of each workshop was to raise awareness about the availability of OER to meet the participants' need to discover appropriate resources. It was also an implied intention both to introduce as well as increase participants' knowledge of the wider area of PLEs to the selected audiences of two separate groups of students and educators.

The first theme of usability focuses around the capacity of any participant to not only use but also understand the use of the ROLE tools. Generally speaking, most people engaged with 2 of the 3 ROLE tools provided i.e. Binocs and ObjectSpot. The third ROLE tool, EtherPad, seemed much more problematic. Some participants simply avoided using it whilst others who did engage with it fully understood its role, facility and perceived usefulness. Indeed some members of both workshops remarked that they would use the EtherPad in their future work. In the case of the students, a number recognised the benefits of access to the EtherPad within a conference environment thus using it within the JTEL event. In the case of the educator group, at least one participant recognised the advantage of a collaborative tool such as the EtherPad and was heard to remark that they would use it in their own subject-based project when they returned to their home institution.

Another aspect of usability that is important to note is the ease of use of the ROLE tools. Fundamentally this effects whether the participant or potential end user can actually use the ROLE tool or not. Obviously, many ROLE tools are in development and may be at different stages of maturity. The workshops with the two groups were invaluable, in this respect, because it gave an excellent opportunity to observe as well as document what participants found easy, difficult or even impossible in relation to using the ROLE tools. There were varied responses (as documented earlier). The majority of participants, however, understood how to use all three tools but some did not seem enabled to filter their searches in Binocs and ObjectSpot i.e. reduce or alter selected repository or platform enquiries.

The second emergent theme, in terms of lessons learnt, focuses on the type and style of the learning activity format. How PLEs were introduced, as well as the provision of appropriate learning activity guidelines was paramount in enabling participants to not only become enlivened to explore the learning tools but also

provided them with a firm foundation upon which to build and enhance their knowledge of PLEs in general. The underlying assumption being that all members of the two audiences were new to both PLEs as well as to the ROLE project and, therefore, has never used its associated tools either.

As a consequence of preparing the introductory lecture about PLEs and the development of a handy quick start guide for participants in the two workshops to use the pre-selected learning tools, a second set of course materials was later developed for OpenLearn users. This second evolution of the aforementioned materials was designed to be delivered online and used in self-study mode, without the need for a tutor or face-to-face tuition. These online courses have thus offered the opportunity to disseminate information about PLEs and a selection of learning tools to a potentially much wider audience, consisting of communities of informal learners, as outlined in section 3 of this paper.

The third theme to emerge from this case study focusing on the transition from formal to informal learning was of a willingness of participants to engage with the offered learning tools. This could be quantified in a number of different ways. It is the most crucial of the three themes reported here albeit that it can be described as possibly the most nebulous to measure in its initial stages. In this respect it can be reported that both groups of participants, the learners as well as the educators, were willing to listen and then try out the learning tools in a collaborative fashion. They also appeared to keep an open mind with regard to the idea of PLEs.

What was not anticipated, however, was the level and enthusiasm of some participants who not only enjoyed the exposure to a new (to them) set of learning tools but could also see the relevance of using some of those tools in their own institutions or research work. Thus their willingness to try out the learning tools was converted through a positive learning experience into the realisation that one or more of those tools would aid them in their every day work (either as student carrying out research or in terms of developing project research). This “conversion” built upon the introduction to PLEs that they heard and the associated quick start guide that they were provided with as structured learning activity materials.

Overall, the OpenLearn case study showed that informal learners are looking for accessible and easy to use learning tools, accompanied with introductory and guidance learning course materials. These tools also need to be easily customizable so that they can fit the learners’ needs and goals. Informal learners want to be able to receive feedback about their learning progress, as well as provide feedback about the usefulness of the tools and their overall learning experience. Finally, fostering communities of learners that have common learning goals and are willing to engage with novel learning technologies is an essential element towards the successful adoption of PLEs by informal learners.

## 7 Conclusion and Further Work

The successful implementation of PLEs and their adoption by informal learners involve significant challenges, as shown by the OpenLearn case study. These challenges are related with the different levels of support required by the target audiences, as well as the overall quality of the offered educational tools and services.

Although the lessons learned from the OpenLearn case study are based on evaluations of ROLE technologies, the outcomes are general enough to be potentially

useful outside the ROLE project as well. For example, various TEL stakeholders seeking to improve the ways they support learners and educators through PLEs could benefit from this work.

The authors plan to continue evaluating the usefulness of PLEs within a variety of learning contexts and scenarios, both in informal, as well as in formal learning. Additionally, pilots of larger scale are scheduled, as well as the evaluation of pedagogical models for self-regulated learning and tools for supporting learners in becoming self-regulated. These studies will allow the authors to further investigate the potential of PLEs in TEL and acquire a better understanding of the needs of various communities of learners and educators.

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# Developing Work based Personal Learning Environments in Small and Medium Enterprises

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**Abstract.** This paper is based on a literature review and interviews with employers and trainers in the north German building and construction trades. The work was undertaken in preparing a project application, Learning Layers, for the European Research Programme.
The paper looks at the development of High Performance Work Systems to support innovation in Small and Medium enterprises. It discusses the potential of Personal Learning environments to support informal and work based learning.
The paper goes on to look at the characteristics and organisation of the building and construction industry and at education and training in the sector.
It outlines an approach to developing the use of PLEs based on a series of layers to support informal interactions with people across enterprises, supports creation, maturing and interaction with learning materials as boundary objects and a layer that situates and scaffolds learning support into the physical workplace and captures people's interactions with physical artefacts inviting them to share their experiences.

**Keywords:** Building, construction, Small and Medium Enterprises, informal interactions, boundary objects, workplace learning, scaffolding

## 1 Introduction

Research and development in Personal Learning Environments has made considerable progress in recent years. Yet although often acknowledging the importance of informal learning, such research continues to be largely focused on formal educational institutions from either higher or vocational training and education. Far less attention has been paid to work based and work integrated learning and still less to the particular context of learning at work in Small and Medium Enterprises (SMEs) (Gustavsen, Nyhan, Ennals, 2007). Yet it could be argued that it is in just these contexts, where work can provide a rich learning environment and where there is growing need for continuing professional development to meet demands from new technology, new materials and changing work processes, that PLEs could have the greatest impact. A work environment in which the workers plan, control and validate their work tasks can both competitive and productive (Asheim 2007). It also requires that workers are able to make incremental and continuous improvements to work processes to develop better products and services. This in turn requires continuous

learning. In contrast to predominant forms of continuous training based on activities outside the workplace, and in response to the perceived lack of take up of Technology Enhanced Learning in SMEs, we propose a dual approach, based on informal learning and the development of network and mobile technologies including Personal Learning Environments. This paper will describe an approach being developed for learning in SMEs, specifically in the building and construction industry in north Germany.

Our approach is based on the development of high performance work systems in industrial clusters of SMEs. In this context, individual learning leads to incremental innovation within enterprises. Personal Learning environments serve both to support individual learning and organisational learning through a bringing together of learning processes (and technology) and knowledge management within both individual SMEs and dispersed networks of SMEs in industrial clusters. Our approach is also based on linking informal and work based learning and practice and formal training.

The paper is based on literature research and on interviews with employers and trainers in the building and construction sector. This work was undertaken in preparation for a project called Learning Layers, to be undertaken through the European Commission Seventh Framework for Research and due to commence in November 2012.

In the paper we look at the ideas behind high performance work systems and industrial clusters before examining the nature and context of the building and construction industries and particularly of SMEs within the industrial cluster.

We develop a scenario of how PLEs might be used for learning and suggest necessary developments to be undertaken to facilitate the adaptation of such technologies for learning.

## 2 The Challenge for Knowledge and Skills for the Workforce

Many industries are undergoing a period of rapid change with the introduction of new technologies, new production concepts, work processes and materials. This is resulting in new quality requirements for products and processes which lead to an emergence of new skill requirements at all levels of personnel, including management, workers, technicians, apprentices and trainees. These changes can be described as a paradigmatic shift from traditional forms of production towards leaner, agile and flexible production based on high performance work systems (Toner 2011).

Leaner business organisations have less hierarchical layers and develop ‘close to production intelligence’ in order to be more flexible to change and to customer demands. The qualifications required of workers within such production or service environment are broader than in traditional workplaces reflecting a shift from functional skills towards multiskilling. Skilled workers require practical and theoretical knowledge in order to act competently in the planning, preparation, production and control of work and to coordinate with other departments in or outside the company.

Information and communication technologies - including both technologies for learning and for knowledge management - are required to allow more decentralised control to support just-in-time and flexible production and services. A key to flexibility and high productivity lies in the qualification profiles of the workforce and in the development of worker-oriented production technologies, which allow more flexible control in the production process.

The following table illustrates the change in innovation management within such companies and the consequences for the skilling of workers, technicians and the apprentices. This change in production philosophy can be described as a move from a top-down management approach towards a participative management approach (Rauner, Rasmussen & Corbett, 1988; Deitmer & Attwell, 2000) which requires a commitment to innovation at all level of the workforce, not just at the management level.

**Table 1.** Innovation management and the skilling of workers (Deitmer 2011)

| Innovation management by: control | Innovation management by: participation | Organisational consequences for the skilling of emerging workers |
|---|---|---|
| function-oriented work organisation | business-oriented work organisations | Learn to work within the flow of the business process and at the work place through experience-based learning |
| steep hierarchy | flat hierarchy | Self regulated working and learning based on methods like plan, do, act and control cycle |
| low level and fragmented qualifications | shaping competences | Be able to shape workplaces and make suggestions for improvement of services and production processes |
| executed work | commitment, responsibility | Developing vocational identity and occupational commitment |
| external quality control | quality consciousness | professional level of training based on key work and learning tasks |

## 3 Learning by Doing and Drivers for Incremental Innovation

Toner (2011) points out that a 'learning by doing' strategy in an innovative work environment can lead to gradual improvement in the efficiency of the production processes and product design and performance (Toner 2011). Such improvements are based on high performance skills by workers. High Performance Work Structures are based on the practical knowledge of the workers underpinned by theoretical knowledge (Nyhan 2002, Rauner). Practical knowledge is generated in the context of application and is shaped by criteria such as practicability, functionality and the failure free use of technologies.

In high performance work systems (Toner 2011, Arundel 2006, Gospel 2007, Teece et.al 2000) the following qualification profiles are emerging:

- High levels of communication, numeracy, problem solving and team working are required as managerial authority is delegated to the shop floor including the design of the workplace, maintenance and continuous product and process innovation;
- Broad Job Classifications which allow functional flexibility by limiting occupational demarcations and requiring workers to be competent across a broader range of tasks than is conventionally expected which in turn requires broad based training;
- Organisational learning around new patterns of activities is based on capturing the learning and work experiences of individual workers and teams of workers;
- Flat management hierarchies provide more responsibility for individual workers and work teams in problem solving and in organising work processes.

High Performance Work Systems require a commitment to innovation at all levels of the workforce; this process is more inclusive, democratic and incremental rather than elitist, imposed and radical. The empowerment of the work force to make proposals for changes and improvement is key. However the adoption of such practices requires continuous learning linked to knowledge management and systems and technologies to support such processes.

Thus the development of work based PLEs could be linked to wider processes of innovation within SMEs.

## 4 Learning and Innovation in Regional Clusters

Many SMEs organise themselves in clusters or networks in order to collaborate, to share knowledge and skill, or even to exchange staff. The network dimension is particularly important as regional clusters have been understood as an instrument of scaling learning in heavily SME dependent sectors. This is reflected by large EU projects like European Cluster Excellence Initiative. It is much easier to economically justify the creation of learning materials which can be reused in an entire cluster and hence by many organisations than just for a few individuals. The challenge from a network point of view would be to identify such high potential learning materials and to find ways to distribute them efficiently within the network. The current focus of cluster initiatives is almost exclusively on scaling up formal training by organising training across network members. While a Communities of Practice perspective has been adopted in some cases to address informal learning processes, these are usually not effectively supported through information technologies (Prestkvern & Bardalen 2008).

Effects resulting from relationships in networks of small organisations for learning processes have received little attention in Technology Enhanced Learning research to date, despite these networks having been identified as a potential way of fostering favourable learning conditions (Deitmer & Attwell 2000). However, we can build here on work in diverse fields looking into these network effects. Seminal work by Granovetter (1973) has made distinction between strong and weak ties in such networks. Further studies investigated the network effects on experience sharing (Baum, 1998), on social networks (Cross, 2001), of trust on knowledge transfer (Levin, 2004) on communication for innovation (Müller-Prothmann, 2006), on communication with new media (Haythornthwaite, 2002) and more recently on

networked learning (Ryberg, 2008). However, the effects on informal learning and on the creation of shared knowledge artefacts are still open issues.

The development and implementation of Personal Learning Environments within the context of regional clusters could support this form of networked informal learning.

However there remain barriers. Research suggests (Perifanou, forthcoming) that SMEs may still be concerned about a perceived loss of competitiveness through openness in collaborative learning contexts. Similarly some SMEs regard learning materials, especially those generated within their organisation, as a potential source of future revenue.

## 5 Learning Approaches and Technological Support for Learning at the Workplace

Research suggests that in SMEs much learning takes place in the workplace and through work processes, is multi episodic, is often informal, is problem based and takes place on a just in time basis (Hart, 2011). Rather than a reliance on formal or designated trainers, much training and learning involves the passing on of skills and knowledge from skilled workers (Attwell and Baumgartl, 2009). Dehnbostel (2009) says that learning in the workplace is the oldest and most common method of vocational qualification, developing experience, motivation and social relations. Learning at work is self-directed, process-oriented form of lifelong learning that essentially contributes to personality development and professionalism, and promotes innovation and employability (Streumer, 2001; Dehnbostel, 2009; Fischer, Boreham and Nyhan, 2004).

A survey undertaken in Germany found work based learning comprised of 43% of training and learning undertaken by enterprises (Büchter et al., 2000).

Thus work based learning is seen as a potential approach to developing continuing learning for the broader competences and work process knowledge required for high performance workplaces. Rather than a reliance on formal or designated trainers, much training and learning involves the passing on of skills and knowledge from skilled workers (Attwell and Baumgartl, 2009). In other words, learning is highly individualized and heavily integrated with contextual work practices. While this form of delivery (learning from individual experience) is highly effective for the individual and has been shown to be intrinsically motivating by both the need to solve problems and by personal interest (Attwell, 2007; Hague & Lohan, 2009), it does not scale well: if individual experiences are not further taken up in systematic organisational learning practices, learning remains costly, fragmented and unsystematic. It has been suggested that Technology Enhanced Learning can overcome this problem of scaling and of systematisation of informal and work based learning. However its potential has not yet been fully realized and especially in many Small and Medium Enterprises (SME), the take-up has not been effective. A critical review of the way information technologies are being used for workplace learning (Kraiger, 2008) concludes that most solutions are targeted towards a learning model based on the idea of formal, direct instruction. TEL initiatives tend to be based upon a traditional business training model with modules, lectures and seminars transferred from face to face interactions to onscreen interactions, retaining the standard tutor/student relationship and the reliance on formal and to some extent standardized course material and curricula.

The development of work based Personal Learning Environments have the potential to link informal learning in the workplace to more formal training. Furthermore they could promote the sharing of experience and work practices and promote collaborative learning within networks of SMEs. Research suggests that in SMEs much learning not only takes place in the workplace and through work processes, but is multi episodic, is often informal, is problem based and takes place on a just in time basis (Hart, 2011).

Learning in the workplace draws on a multitude of existing 'resources' – many of which have not been designed for learning purposes (like colleagues, Internet, Intranet) (Kooken et al. 2007). Research on whether these experiential forms of learning lead to effective learning outcomes are mixed. Purely self-directed learning has been shown to be less effective than most guided learning in many laboratory studies and in educational settings (Mayer, 2004). On the other hand, explorative learning in work settings has often been reported to be beneficial, e.g. for allowing construction of mental models and improving transfer (Keith & Frese, 2005). Some form of guidance may be necessary to direct learners' attention to relevant materials and support their learning (Bell & Kozlowsky, 2008). This is especially true for learners at initial levels (Lindstaedt et al. 2010).

One approach to this issue is to provide scaffolding. The use of scaffolding as a metaphor refers to the provision of temporary support for the completion of a task that a learner might otherwise be unable to achieve. Scaffolding extends the socio-cultural approach of Vygotsky. Vygotsky (1978) suggested that support for learning was provided by a Significantly Knowledgeable Other, who might be a teachers or trainer, but could also be a colleague or peer. Attwell has suggested that such support can be embodied in technology. However, scaffolding knowledge in different domains and in particular in domains that involve a relationship between knowledge and practice requires a closer approach to learning episodes and to the use of physical objects for learning within the workplace. Thus rather than seeing a PLE as a containers or connections- or even as a pedagogical approach – PLEs might be seen instead as a flexible process to scaffold individual and community learning and knowledge development.

## 6 Developing Work Based PLEs in the Building and Construction Sector

In the first section of this paper we have looked at the idea of high performance work systems and innovation and knowledge development within industrial clusters. We have suggested that Personal Learning Environments could facilitate and develop these processes through building on informal learning in the workplace. We have recognized the necessity for support for learning through networked scaffolding. In the second section, we will examine in more depth the north German Building and Construction sector, developing a scenario of how PLEs might work in such a context. We will; go on to suggest further research which is needed to refine our idea of how to develop work based PLEs.

# 7 The Building and Construction Cluster

The building and construction trades are undergoing a period of rapid change with the introduction of green building techniques and materials and new work processes and standards. The EU directive makes near zero energy building mandatory by 2021 (European Parliament 2009). This is resulting in the development of new skill requirements for work on building sites.

The sector is characterized by a small number of large companies and a large number of SMEs in both general building and construction and in specialized craft trades. Building and construction projects require more interactive collaboration within as well as between different craft trade companies within the cluster.

Training for skilled workers has traditionally been provided through apprenticeships in most countries. Continuing training is becoming increasingly important for dealing with technological change. However further training programmes are often conducted outside the workplace with limited connection to real work projects and processes and there is often little transfer of learning. Costs are a constraint for building enterprises, especially SMEs, in providing off the job courses (Schulte and Spöttl, 2009). Although In Germany, as in some other European countries, there is a training levy for sharing training costs between enterprises, there remains a wider issues of how to share knowledge both within enterprises and between workers in different workplaces. Other issues include how to provide just in time training to meet new needs and how to link formal training with informal learning and work based practice in the different craft trades.

The developments of new processes and materials provide substantial challenges for the construction industry. Traditional educational and training methods are proving to be insufficient to meet the challenge of the rapid emergence of new skill and quality requirements (for example those related to green building techniques or building materials). This requires much faster involvement and action at three levels - individual, organisational and cluster. The increased rate of technical change introduces greater uncertainty for firms, which, in turn, demands an increased capacity for problem solving skills (Toner 2011). Despite the recession there is a shortage of skilled craftspeople in some European regions and a problem in recruiting young people for apprenticeships in higher skilled craft work in the building and construction industry.

In the present period of economic uncertainty, it is worth noting that the total turnover of the construction industry in 2010 (EU27) was 1186 billion Euros forming 9,7% of the GDP in 2010 (EU27). The construction industry is the biggest industrial employer in Europe with 13,9 million operatives making up 6,6% of the total employment in EU27 and if programmes were to be launched to stimulate economies, construction has a high multiplier effect.

# 8 Mobile Technologies and Work Based Personal Learning Environments

Although the European Commission has pointed to the lack of take up of e-Learning in various sectors, this is probably too simplistic an analysis. It may be more that in all sectors, e-learning has been used to a greater or lesser extent for learning in particular occupations and for particular tasks. For example e-Learning is used for those

professions which most use computers e.g. in the building and construction industries, by architects and engineers. Equally e-learning is used for generic competences such as learning foreign languages or accounting.

In the past few years, emerging technologies (such as mobile devices or social networks) have rapidly spread into all areas of our life. However, while employees in SMEs increasingly use these technologies for private purposes as well as for informal learning, enterprises have not in general recognized the personal use of technologies as effectively supporting informal learning. As a consequence, the use of these emerging technologies has not been systematically taken up as a sustainable learning strategy that is integrated with other forms of learning at the workplace.

## 9 An Approach to Developing PLEs in the Work Place

We are researching methods and technologies to scale-up informal learning support for PLEs so that it is cost-effective and sustainable, offers contextualised and meaningful support in the virtual and physical context of work practices. Through the Learning Layers project we aim to:

- Ensure that *peer production* is unlocked: Barriers to participation need to be lowered, the massive reuse of existing materials has to be realized, and experiences people make in physical contexts needs to be included.
- Ensure individuals receive *scaffolds* to deal with the growing abundance: We need to research concepts of networked scaffolding and research the effectiveness of scaffolds across different contexts.
- Ensure *shared meaning* of work practices at individual, organisational and inter-organisational levels emerges from these interactions: We need to lower barriers for participation, allow emergence as a social negotiation process and knowledge maturing across institutional boundaries, and research the role of physical artefacts and context in this process.

## 10 The Learning Layers Concept: an Approach to Support Informal Learning through PLEs

Work based Personal Learning Environments will be based on a series of Learning Layers. In building heavily on existing research on situated and contextualised learning, Learning Layers provide a meaningful learning context when people interact with people, digital and physical artefacts for their informal learning. Learning Layers provide a shared conceptual foundation independent of the personal tools people use for learning. Learning Layers can flexibly be switched on and off, to allow modular and flexible views of the abundance of existing resources in learning interactions. These views both restrict the perspective of the abundant opportunities and augment the learning experience through scaffolds for meaningful learning both in and across digital and physical interaction.

At the same time, Learning Layers invite processes of social contribution for peer production through providing views of existing digital resources and making it easy to capture and share physical interactions. Peer production then becomes a way to establish new and complementary views of existing materials and interactions.

Three Interaction Layers focus on interaction with three types of entities involved in informal learning:

- A layer that invites *informal interactions with people* across enterprises in the cluster, scaffolds workplace learning by drawing on networks of learners and keeps these interactions persistent so that they can be used in other contexts by other persons,
- A layer that supports creation, maturing and *interaction with learning materials* as boundary objects and guides this processes by tracking the quality and suitability of these materials for learning, and
- A layer that situates and scaffolds learning support into the physical workplace and captures people's *interactions with physical artefacts* inviting them to share their experiences with them.
- All three interaction layers draw on a common *Social Semantic Layer* that ensures learning is embedded in a meaningful context. This layer *captures and emerges the shared understanding* in the community of learners by supporting the negotiation of meaning. To achieve this, the social semantic layer captures a number of models and lets the community evolve these models through PLEs in a social negotiation process.

The following scenario within the building and construction industry illustrate how these technologies will be operational in the regional North West German building and construction cluster.

## 11 Building and Construction Scenario: Cross-organisational Learning for Sustainable Construction

A regional training provider for the building industry offers courses on how to install PLC (programmable logic control) based lighting systems, a new technology designed for more efficient energy consumption. Veronika, a vocational trainer at a regional branch, designs a course on PLC based systems where she provides electronic materials. In the course, she distributes QR tags which participants can stick on devices in order to receive information on demand. She also integrates work-based exercises in her teaching where users tag PLC systems with QR tags, take pictures or create short videos, and add their personal experiences with these systems that they make available for other people as learning experiences [Artefact Interaction Layer].

Paul is a skilled electrician working in craft trade electrician service company who has not used PLC technology before. The PLC installation instructions are difficult to understand for him because he lacks experience with such installations. He scans the QR tag attached to the PLC with his tablet PC. The system suggests course materials from Veronika's course, relevant standards for the installation from a technical publisher, as well as a short video documenting the installation steps recorded by a colleague [Artefact Interaction Layer]. Moreover, Paul receives the information that two people have experience with this particular PLC [Social Semantic Layer]. Paul calls one of them over Skype and checks that his plan and understanding of the installation is sound and then proceeds with the installation with the help of the video. As several further questions remain, Paul posts them using voice recording and photo to a Q&A tool [People Interaction Layer].

Paul's question is forwarded to Dieter, an Electrical "Meister" in another SME using similar devices, based on his user profile indicating that he has experience with PLC, and because he has indicated his willingness to help. Dieter briefly answers Paul's question, including links to materials (Pictures, …) available in the learning layers repository. Dieter is a well-known "problem solver" in his SME network. By support of the Learning Layers technology he has created a training business in which he gives technical advice service and trainings to other building electrician companies. His comments can be traced by others and recognized as service from the Electrician's Guild.

Veronika, the vocational trainer, is notified by the system that there are currently many new activities around PLC programming and views the concrete questions that occurred [Social Semantic Layer]. With the notification, she also gets recommendations for the most active and helpful discussions and for most suitable and high quality materials people have suggested [Learning Materials Interaction Layer]. She decides to include these in her course to illustrate solutions to potential problems.

The four layers described in the previous section provide the core of the conceptual and technological approach for the development of the PLEs. There are two further critical elements that will be crucial for reaching our vision. These elements are needed for effectively integrating the different layers.

# 12 Further Research

## 12.1 Integration of work Practices with Learning to Support Situated, Just-in Time Learning

We need further investigation into the relationship of informal learning and workplace practices on the individual, organisational and on the network level. In extending previous work, we will especially focus on physical workplaces and the opportunities and constraints that come with supporting learning. Secondly, we require a further focus on existing barriers and opportunities for scaling peer production and learning in cooperative-competitive SME networks. This work will create a model for scaling informal learning in a networked SME context and ensure that the use of tools is integrated through practice as suggested for example by Wenger, et al. (2009). But we generally acknowledge that a key factor for enterprises to staying agile and adaptive is to have a highly skilled workforce. With the rapid development of new technologies, staying up-to-date with know-how and skills increasingly becomes a challenge in many sectors.

## 12.2 Integration through a Technical Architecture for Fast and Flexible Deployment

Our idea is to base PLes on mobile devices, either the users' personal devices or devices provided by the enterprises. However, the Learning Layers concept is based on fast and flexible deployment in a networked SME setting with heterogeneous infrastructural requirements and conditions. Current learning architectures are typically deployed as monolithic in-house installations that lack flexibility for inter-SME networking in response to fast-changing environments. On the other hand, externally hosted solutions are too restricted to features, devices and environments

supported by the provider, again impeding flexibility and fast development cycles. Thus, the challenge of both fast and flexible development and deployment of learning solutions is currently not optimally catered for. This issue requires further research and development.

## 13 First Conclusions

This paper presents the early stages of research and development towards producing a system to support Personal Learning Environments in the workplace. There remains much work to do in realising our vision. We are attempting both to theoretically bring together approaches to innovation and knowledge management with learning and at the same time to develop pedagogical approaches to scaffolding learning in the workplace and develop technologies which can support the use of PLes in networked organisational settings.

Our ambition is not merely to produce a proof of concept but to roll out a scalable system which can support learning in large scale networks of SMEs.

Our approach to developing the use of PLEs is based on a series of layers to support informal interactions with people across enterprises, supports creation, maturing and interaction with learning materials as boundary objects and a layer that situates and scaffolds learning support into the physical workplace and captures people's interactions with physical artefacts inviting them to share their experiences.

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# Enhancing Self Regulated Learning Skills for Improved PLE Use
# A Problem Based Learning Approach

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**Abstract.** Traditionally web-based learning management systems reflect a lack of sufficiently personalised support for learning. The new generation of personalized open learning environments can be seen as an attempt to fill this void. However, literature suggests that PLEs even though pedagogically desirable pose immense challenges for learners and they require support, guidance, and pedagogical interventions to make the best possible use of associated technologies to fulfil their learning goals. This paper examines how problem-based learning can be used to enhance self-regulatory skills among learners resulting in improved adoption of PLEs.

**Keywords:** problem based learning, self-regulated learning, personal learning environments

## 1 Introduction

Personal Learning Environments, an emergent breed of learning environments, enable learners to build their own learning environments to meet their personal aims and goals of learning [1] depending on their context. PLEs are built on externally hosted (in-the-cloud) Web 2.0 tools and services, designed to help learners aggregate and share resources, participate in collective knowledge generation, and manage their own meaning making [2], [3]. Attwell [1] suggests that PLEs can be perceived as individuals organizing their own learning in multiple contexts where informal learning can be used to supplement formal learning and added that PLEs play an important role in advancing the understanding of e-learning. Mott [4] emphasises learners' self-regulating role by defining PLEs as learner-created matrices of resources that they themselves select and organize. A self-regulated learning (SRL) process model is the learner-centric model based on Zimmerman's [5] self-regulated learning approach. According to Schunk [6], self-regulated learning can be defined as "learning that results from learners' self-generated thoughts and behaviors that are systematically oriented towards the attainment of their learning goals" (p. 125). The learners take personal initiative, apply powerful strategies to attain individually valued learning goals and monitor their understanding in order to detect and eliminate possible comprehension problems [7][5]. Fruhmann et al. [8] outlines a pyscho-pedagogical framework

based on SRL that could facilitate learning within a learner curated environments like PLEs.

A recent 'NMC Horizon report' [9] identifies personalized learning systems will probably be adopted in 4-5 years time mainly as they are still in their conceptual phase and there is a lack of robust documentation and relevant case-studies. One of the main problems is in the way current learning approaches are envisioned where the role of the academic (expert) is not well defined and the learner is expected to curate learning resources using a very broad self-regulated learning paradigm. Technologically this leaves the learners completely confused on how to sequence their learning using the available technologies. It has also been vigorously suggested that LMS/VLE are a thing of the past and PLEs are the present and future. The NMC report mentioned earlier disproves this view due to lack of evidence and we feel what is instead required is a transitional model where the role of the academics and pedagogical experts is well defined allowing learners to be supported in effectively utilising a range of Web 2.0 tools within their context.

## 2 Pedagogical Challenges for PLEs

One of the key assumptions behind the current pedagogical approaches is that learners are competent IT users and proficient at learning design. Even though it is largely known that learners may be familiar with the Internet and social software, it seems they do not necessarily know how to use these technologies for 'learning' [10]. Lehtinen [11] would have described the current pedagogic trends as 'romantic constructivism', the assumption that learners are skilled at using open learning environments and finding appropriate sources and information and the best methods for learning etc. He further argued that such pedagogies typically lead to learners impulsive wondering from one source to another, causing frustration and disengagement. The existing pedagogical approaches are also viewed as generic and some form of demarcation between formal, informal and non-formal learning context must be realized in order to make learning relevant to respective contexts. For example a learning environment designed solely around the premised of self-regulated learning environment might not be best suited for formal education. According to Henri et al. (2008), resources used in formal education to support metacognition, self-direction, and reflexivity should be reconceptualised and redesigned in PLE tools that may play a key role in competence acquisition of learners in the near future. Hence e-Learning solutions must second a real evolution where the main efforts should be devoted to support the whole learning process, not only specific parts of the process (i.e. content management, resource delivery, etc.)

It has been noted that the organization of learning contents through the identification of main ideas and interlinking of concepts [12] are seldom employed spontaneously. Metacognitive strategies such as monitoring of one's understanding to identify and overcome impasses are prone to be avoided by many learners [13]. It has also been stated that SRL processes require an initial and sustained level of motivation [14] to proceed. The authors are of the opinion that a combination of these three factors poses a major challenge towards the widespread adoption and utilisation of PLEs. Typically, learners are expected to assemble a set of tools to fulfil their learning goals. As stated earlier, learners are predominantly used to a top down didactic ap-

proach to learning where the instructor is responsible for assembling the learning resources and tools that will best meet the learning objectives of a course or module. The learners usually follow instructions based on a fairly rigid structure. The learners do have the option to engage with interactive content, to a limited degree, depending on the pedagogical approach selected by the instructor. Learners progressing through such a mind-set towards learning in their early stages of their education may not look favourably to the concept of PLEs. In a recent study the researchers [15] observe similar findings and recommend that (a) learners should be encouraged to develop skills and confidence in the selection, application, and use of social media tools for personalized learning and that (b) new pedagogical models and approaches are needed to enhance learners' abilities to organize and customize their own learning environments and advance their self-direction and self-awareness in a PLE. This, along with personal experience with current conceptualization of PLEs, prompted the authors to explore potential pedagogical approaches that could be applied or utilized to help the learners in the gradual transition from the VLE to the PLE era.

## 3 Problem Based Learning

Problem-based learning (PBL) emerged from a rich pool of enquiry in how people acquire and transfer knowledge. PBL has it roots within constructivism. PBL is also regarded as an approach to learning whereby the learner actively constructs knowledge in the learning process [16]. The educational significance of PBL is that it incorporates the goals for learners that are much wider than the acquisition and application of content [17]. The approach is expected to involve or influence the 'whole', or at least many aspects of, the learner's learning experience. It is the ontological and epistemological similarities between PBL and PLEs that prompted the authors to explore how aspects of PBL may be utlised to facilitate the uptake of PLEs. In PBL three phases were identified within a cyclic process. In the first phase, learners encountered problems, instead of facts and theories. Professional reasoning skills were developed and learning needs identified in a co-operative setting with a tutor. Propositional knowledge is presupposed when dealing with problems [18]. However, PBL is not equated with being an expert in the subject, as subject-based learning views tend to do. Instead, importance is placed on what is needed and on the ability to gain propositional knowledge as required. PBL requires integration of '*knowing that' with 'knowing how'*. What is relevant matter is not prejudged. This author's feel is the key similarity between PBL and PLE. PLEs enable learners not only to develop their cognitive abilities but also have a strong emphasis on meta-cognitive elements (*learning how to learn*). In the second phase the learners undertake individual self-directed study. A variety of information resources (books, journals, reports, online information, and a variety of people with appropriate areas of expertise) are used in the search for such information. In this way learning is personalized to the needs and learning styles of the individual. Gijselaers [19] asserts that metacognition is an essential element of skilled learning. Goal setting (What am I going to do?), strategy selection (How am I doing it?) and goal evaluation (Did it work?) are included in this learning. Typically the tutor stimulates the group to reflect on problem-solving behavior by stimulating learners to ask the right questions instead of telling them the answers. In the third phase, the cycle is closed by a co-operative phase again where

newly gained knowledge is applied to the problem and summaries of what has been learned made. The next cycle starts with a new problem.

## 4 Utilising PBL to Enhance Self-Regulation in PLEs

Knuth and Cunningham [20] postulates that in the learning process learners tend to adopt the thinking that in the world there is a single 'correct' answer to any one problem. This thinking is due to some "authority figure decrees that we must." The principle of multiplicity underlines the importance of dialogue with other individuals through collaborative learning. An environment (such as PLEs) where an exchange of views is practiced can be done individually or in small groups, which PBL is very well placed to do. This practice concurs with the idea of constructivism that states that knowledge of concepts is best achieved through multiple and varied applications of the concept. Koschmann el. al. [21] in agreement with this concept pointed out that "aspects of richness in concepts and cases will be missed with single representations, and the resultant simplification may prove misleading." People have different views towards different problems and on how to solve them. PBL encourages an environment of open-minded, reflective, critical and active learning. In this environment, due respect is paid to both learner and tutor as persons of knowledge, understanding, feelings and interests who come together in a shared educational process [18]. Similarly PLEs ensure that there is no 'single' way to learn and the means to learn can vary widely encouraging concepts of openness and personalization. Based on above-mentioned ontological and epistemological similarities between PBL and PLEs we propose a preliminary framework on how PBL can be used to enhance SRL skills enabling the transitioning learners from VLEs to PLEs. In the table below the Personal Learning Space (PLS) is refereed to as a "configurable space every user can access to create content, share content, and aggregate content from other sources" [22].

**Table 1.** Using PBL to enhance SRL in PLEs

| Time / PBL-SRL | Stage 1 (Structured) (Years 1-2) | Stage-2 (Semi Structured) (Years 2-3) | Stage 3 (Unstructured) (Years 3+) |
|---|---|---|---|
| Contextual Problem Statement | The instructor provides the problem and demonstrates how it links to the learning outcome/s | The instructor states the learning outcome and sets a task to collaboratively identify a series of problems that will be used for learning | Learner identifies learning goals and problems |
| Learning Activities | Instructor decides on the pre-requisites and a set of activities required to tackle the problem | The instructor encourages learners to identify pre-requisites and prepare set of required activities in groups | Based on the problem statement learners decide on pre-requisites and resulting activities. |
| Environment Selection | Instructors selects the learning environment and creates learning space for each activi- | Instructors present alternative options and collaboratively decide on a learning environment. | Learner selects learning environment and creates spaces for them- |

| | | | |
|---|---|---|---|
| | ty | Learners create activity based learning spaces as groups | selves |
| Resource and Tool selection | Instructor pre-selects resources and tools but demonstrate how learners can alter them if they want. Must include e-portfolio type tool. | Instructor pre-selects some tools and resources clearly stating that learners need to find the rest | Learners select tools and resources |
| Collaboration and sharing | Instructor actively leads collaboration by forming groups and posing probing questions. Provide pre-populated social bookmarking, web 2.0 content etc. Encourage use of like/rating buttons. | Instructor actively facilitates collaboration by encouraging shared group spaces. Encourage to comment on bookmarks, web 2.0 content, upload/share and peer reviews. | Instructors invited to learning spaces for participation. Learners create bookmarks, web 2.0 content and actively engage without any extrinsic motivation. |
| Motivation | Extrinsic motivators with impact on performance outcomes (part of assignments etc). | Extrinsic motivation with some impact on performance but largely tokenistic in nature. | No extrinsic motivator. |

Table 1 describes an early transformative framework of PLE diffusion among higher education learners during and after their course. The framework is based on the premises of problem based learning wherein the learners are expected to learn by solving problems contextual to what they will be expected to do as part of their day-to-day job once they finish their course. In order to support the learners to make this transition, the amount of personalization a learner needs to engage with is the least at the very beginning of their course. Gradually over a period of time the learner is expected to take more and more control of their learning based on their personal preferences. The various phases of SRL are subsumed within each of the instructor-learner activities outlined above involving planning, environment orientation, feedback and reflection. The framework can be flexibly used within any learning context.

## 5 Conclusion

This paper attempts to propose an early framework on how PBL can be used to enhance SRL skills, which in turn could have an impact on wider PLE adoption within learner cohorts. It is worth mentioning here that the authors are using some concepts from PBL the principles of which are hugely overlapping with PLEs and SRL. Specially, it has been noted [23] that problem-based learning has a positive effect on skills and students taught using problem-based learning had less knowledge but had better recall of the knowledge they had. Researchers [24] have also found positive effects on application and principles. They concluded “PBL had the most positive effects when the focal constructs being assessed were at the level of understanding the principles

that link concepts, the second level of the knowledge structure" (... p. 45). The application of knowledge, not development of knowledge, is the heart of the success of problem-based learning [25]. It is evident from the literature that PLEs even though pedagogically desirable pose immense challenges [12–14] for learners and they require support, guidance, and pedagogical interventions [26] to make the best possible use of associated technologies to fulfill their learning goals.

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# Sapo Campus Schools as a Disruptive Innovation Tool: Could it be the Educational *Ba*?

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**Abstract.** Sapo Campus, a project developed by the University of Aveiro, SAPO and TMN within the labs.sapo.pt/ua program, is a web 2.0 service platform specifically designed for Higher Education. Some time after implementing SAPO Campus at the University of Aveiro, the team responsible for the project accepted the challenge of adapting it to educational settings beyond Higher Education institutions. The institutional adoption of the Sapo Campus Schools (SCS) platform, in which openness, sharing, integration, innovation and personalization converge, will prompt changes in the school setting, not only in the way people relate to one another, but also in the teaching and learning process. Considering the epistemological principles that underlie the use of technology in the teaching and learning process is as important as it is necessary. In this setting, two equally relevant issues related to the adoption of SCS emerge: technology and knowledge. As a result, it becomes necessary to study how knowledge is generated within SCS, from individual, collective and organizational perspectives. If, sensus lato, one can assume an immediate change for schools joining the SCS platform, one cannot infer that the impacts it generates are indeed innovation. Based on these propositions, this paper aims at 1nalyzing SCS, identifying the elements that aspire to reach the knowledge creation Ba, and provide a way to a disruptive innovation.

**Keywords.** Personal learning environments, innovation, knowledge management, Sapo campus schools, BA, creativity

## 1 Introduction

Sapo Campus, a project developed by the University of Aveiro, SAPO and TMN within the labs.sapo.pt/ua research lab, is a web 2.0 service platform specifically designed for Higher Education. According to Santos & Pedro (2009, p. 1104) this project's main goal is:

[t]o develop, launch and assess an integrated Web 2.0 services platform based in SAPO core technologies that may promote the aforementioned skills [communication, sharing and collaboration] in Portuguese HEIs students in order to ease and to support these services use in Higher Education contexts.

Some time after implementing SAPO Campus at the University of Aveiro, the team responsible for the project accepted the challenge of adapting it to educational settings beyond Higher Education institutions. More than just adjusting the platform from a technological point of view, this redesign entails a rhizomatic dimension, con-

sidering that it will be used by a diverse audience of students from all school levels (ages 6 to 18).

Nowadays, Portuguese schools are not sufficiently aware, prepared and equipped to bring the outside world into the classroom and, as we believe, potentially enhance and enrich the teaching and learning process. Frequent users of social networking sites, most students are concerned about keeping their social presence on the web separated from formal learning processes (Observatório do Plano Tecnológico de Educação, 2010).

The institutional adoption of the Sapo Campus Schools (SCS) platform, in which openness, sharing, integration, innovation and personalization converge, will prompt changes in the school setting, not only in the way people relate to one another, but also in the teaching and learning process. It will also and foremost reveal the built-in dimension of Personal Learning Environments (PLE), making it possible to create and manage personal spaces with all the PLE features within the institutional whole that makes up a school. The focus on the platform should not, however, be viewed from a technicist standpoint that instrumentalises the PLE, but rather from an humanist perspective that values the individual or groups of individuals and their control over their learning activities – both formal and non-formal (Fiedler & Väljataga, 2010).

Considering the epistemological principles that underlie the use of technology in the teaching and learning process is as important as it is necessary. In this setting, two equally relevant issues related to the adoption of SCS emerge: technology and knowledge – this discussion constitutes the first section of this document. Going back to the principles behind the design of SCS, the following section discusses the concepts of innovation and knowledge management and creation. In this context we considered two main theoretical approaches: disruptive innovation, based in the work of Clayton Christensen, and knowledge creation by Nonaka and Takeuchi. Adding to these approaches, the concept of creativity should also be taken into account as something that plays an essential role in innovation processes and that occurs in everyday educational contexts. The last section revisits the SCS with the lenses of the previous theoretical corpus, trying to show how it can be the place, the BA, of knowledge creation, towards a disruptive innovation.

## 2 Technology *versus* PLE

The relationship between technology and PLEs can be understood in two distinctive spaces: the first concerns the definition of PLE and the second, which is directly related to SCS, concerns the institutional adoption of technology.

Attwell (2009, p. 57) favors the approach of PLE as a concept "(...) PLEs can be seen as the spaces in which people interact and communicate and whose ultimate result is learning and the development of collective know-how". Downes (2010) also essentially sees PLEs as a concept, recognizing it as the web presence of an individual: "PLE is a concept, rather than an application – it is the idea that a person's web presence can be distributed." Westenbrugge (cit. in Kompen (2009, p. 34)) emphasizes this personalization feature in his PLE definition:

"…the ideal PLE will vary from person to person, as each individual will add different elements to his or hers Personal Learning Environment. Subsequently I believe that the ideal PLE for an individual should not be created by someone else than this person".

Siemens (2007) summarizes the conceptual approach arguing that “PLEs are the concept-entity.”

On the other hand there are authors that lean towards a more technical approach to PLEs. (Kompen, et al., 2009; Hongyu et al, 2010; Anderson, 2006; Qian, 2010; Žubrinic & Kalpic, 2008). Anderson (2006) also presents a distinctive technological definition of the concept when he argues "The PLE is a web interface into the owners' digital environment". Kompen et al. (2009, p. 35) also present a technological dimension in their PLE definition: “Defining what a PLE is usually proves a difficult task; but in the end, there seems to be general agreement on the fact that it is something unique to each individual; a set of tools that support that person’s learning experience.”

As mentioned before, there is still no consensus around the definition of PLE. Some authors place the PLE at a level of (re)instrumentation of teaching and learning. All questions related to customization, selection, adaptation, separation of form and function, tend to be discussed almost exclusively in relation to the current state (or emergent) patterns of Web services or even applications. On the other hand, other perspectives explore a more humanistic approach, showing concern for the individuals (or groups of individuals) gaining control over their learning activities (formal and non-formal). S. Fiedler & T. Väljataga (2010) who carried out a study on this dichotomy conclude that:

For educational theorizing and research this second reading of the term seems to be more appropriate and fertile. Firstly, basing the further development of “personal learning environments” as a concept on the current, and certainly transient, state of the Web, as an emerging leading medium, appears to be rather shortsighted. Secondly, in order to develop and maintain any lasting generative power for theorizing and carrying out empirical research in education, any concept needs to be rooted in an explicit (human) change perspective. (Fiedler & Väljataga, 2010, p. 6)

On this particular issue it is considered that PLE is a concept that lacks the technology to support it. In terms of theoretical framework the references to technology are volatile, considering the pace new ones are emerging. Nevertheless, technologies underpin PLEs and should therefore always be present at the implementation level.
SCS assumes itself as an integrated Web 2.0 services platform and, from this point of view, relies on technology. Nevertheless, the potential use underlying SCS, and the principles that followed its conception and design, significantly change this approach, moving across and focusing on the pedagogical dimension.

As stated before, an interesting debate has been stirring on the neutrality of technology and its impact on knowledge building. Kanuka (2008, p. 4), assuming a non-neutral stance, describes opposing perspectives: "[McLuhan] also made the famous aphorism, ‘The Medium is the message’ giving pause to the assumption of the non-neutrality of technology”. Siemens & Tittenberger (2009, p. 15) openly state that "[t]he choice to use a particular technology also reflects an accompanying world view or existing mindset ". When it comes to educational issues, Attwell (2007, p. 3) adds to this non-neutral premise by arguing that “[t]here is no such thing as pedagogically neutral software”. SCS’s technology doesn’t break away from the previous pattern and, considering its possible impact and the message it conveys in and outside the institution, cannot be deemed neutral. When assuming institutional adoption this non-neutrality becomes even more evident: it’s not about isolated initiatives by/from teachers or students but about a commitment made by the school organization.

## 3 Innovation, Creativity and Knowledge Management

The recent technological explosion has radically changed the behaviors and postures related with technology. Even though a large number of researchers analyze this relationship from a generational perspective, according to White (2008) even though a polarization between technology and users' age may be established, the attitude towards technology is more important than one's generation.

However, our stance on this issue is closer to the "Visitors and Residents" concepts proposed by David White (2008). White (2008) goes even further by stating that the connection between the generational argument and the use of technology might even have a perverse effect, making up for an arid and simplistic explanation for some of the constraints on the use of technology. Due to their close relationship with technology residents have developed special characteristics like multitasking and respond better to non-linear pathways of learning also having a shorter attention span. Traditional and conservative teaching, 1 to N approaches and linear strategies do not achieve the expected results.

There is a gap between the personal environments where technology plays a very important role either through the presence in social networks or through the ubiquity of Internet access, and the student's environment at school, especially in formal learning environments. These living scenarios and the ways students learn in formal versus non-formal contexts is different. In an informal context what is natural to a resident - multitasking, being wired all the time, freedom to participate and to choose the next steps (Christensen et al., 2010; Ferrari et al., 2011) is allowed. In a formal context, a global and pre-established formatting requires standardized skills and knowledge.

The assumption that knowledge generates knowledge through network interaction, heralds a dynamic and highly personalized process (G. Siemens, 2006). Learning has become a social act in which the network education concept emerges or, as put by Dias (2008, p. 6) "only meets its true potential when servicing the collaborative construction of learning as a creation and innovation process". As a result, it becomes necessary to study how knowledge is generated within SCS, from individual, collective and organizational perspectives. It is, therefore, necessary to look for references regarding knowledge management models and understand the prospective innovation processes. A literature review shows that most research in knowledge management does not come from Education, but rather from the fields of Management and Innovation applied to business, markets and companies. Within knowledge management models, the work of Nonaka & Takeuchi (1995) has inspired companies around the world to adopt clear knowledge creation strategies, understanding the role they play and how they can be applied to innovation processes. Referring to knowledge management and reviving the work of the Japanese philosopher Kitaro Nishida, Nonaka & Takeuchi (1995) put forward the concept of Ba. Ba means place and is defined as "a shared space that serves as foundation for knowledge creation" (Nonaka & Konno, 2005, p. 40). Ba is a space for debating, exchanging and promoting ideas, from which new knowledge emerges. This knowledge can be physical, mental or virtual in nature (Clarke, 2010). In this perspective, SCS can become one of these places from which new knowledge emerges, becoming Ba and generating knowledge within, through the engagement and the networks that are created.

Peter Drucker (2002) refers to the creation of knowledge as an innovation source that has undergone change. If, sensus lato, one can assume an immediate change for

schools joining the SCS platform, one cannot infer that the impacts it generates are indeed innovation. Innovation implies changes in action, valued by all those intervening.

### 3.1 Innovation

The concept of innovation is linked to other concepts like change, creativity, value, management, invention and knowledge. Peter Senge (cit. in (Tawhiti, 2005, p. 29) who distinguishes invention and innovation, argued that innovation only takes place when an invention can be "replicated reliably on a meaningful scale at practical cost". Fernandes (2000) states that innovation expresses an intention to change but the contrary does not apply.

One can find different definitions for innovation in the literature. One research direction underlines the novelty of an idea, as others stress the subjective recognition of novelty. A third direction emphasizes the first introduction of novelty and there are also those who focus on the new combination of needs and solutions (Seidler-de Alwis & Hartmann, 2008). In this specific setting it is considered that innovation is a process that implies novelty and has added value, which is consistent with Dawe's ideas, when he states that:

"innovation as ranging from 'high-profile scientific discoveries to low-profile changes in processes or practices. The two common elements are that they are doing something new or differently which adds value to a business operation [and] is useful to the community in which it is applied".

In the literature several types of innovation can be identified, which have a clear dichotomy as a common denominator. Tawhiti (2005, p. 35) identifies two types of innovation - incremental and radical - describing them as:
"Incremental change is a of more on-going nature, with improvements being undertaken within the existing resources so that equilibrium is maintained. Radical change can disturb equilibrium because is more concerned with altering the status quo and breaking new territory".

In 1997, Clayton Christensen, one of the most influential theorists in the field of innovation, introduced the concept of disruptive innovation in his book "The innovator's dilemma". Later, in 2008, H. Horn and C. Johnson wrote the "Disrupting Class", a book which approaches the possibility and the necessity of applying this concept to the educational field. Christensen et al. (2008) distinguish two types of innovation: sustaining and disruptive innovation. To put it very synthetically, we can say that sustaining innovation is about making something better and disruptive innovation is about making something new.

The most common form of innovation is sustaining innovation which is exemplified by Christensen et al., (2008, p. 46): "Airplanes that fly farther, computers that process faster, cellular phone batteries that last longer, and televisions with clearer images are all sustaining innovations". Despite the importance of this type of innovation that is continuous, systematic and meets a special need, Christensen et al., (2008, p. 57) argue that this kind of innovation is not the one that brings about significant changes since "All that would seem to make for a boring and orderly world." On the other hand, disruptive innovation "is not a breakthrough improvement" (Christensen, et al., 2008, p. 47). For disruptive innovation, Christensen et al. (2008) refers to a type of innovation that is not only concerned with the improvement of a product (sustaining innovation) but also with a radical change of paradigm and principles that underlie the product or process. Christensen et al. (2008) present the personal computer as a classic example of disruptive innovation. In the 70s and 80s, DEC had become one of the

most important and profitable companies in the world, investing in continuous improvement of mainframes and minicomputers. The shy appearance of the first personal computers did not change the strategy defined by the company, deeply imbued in a paradigm of sustaining innovation. The consequences of this strategic alignment are synthesized by Christensen et al. (2008, p. 47) "[DEC] was ultimately destroyed by the personal computer."

Although these innovation concepts come from industry and management, Christensen et al. (2008) claim that they can and should be applied to education. Nevertheless it is necessary to make the appropriate changes to the metrics used, bearing in mind the school's mission. Therefore, the metric used in education cannot be profitable but rather have a political and social importance. Notwithstanding this possibility of applying innovation theory to schools, there is a broad consensus around the fact that schools are organizations not open to innovation. Schools are not flexible germinators of ideas, do not encourage synergies or promote motivation (Christensen, et al., 2008; Anna Craft et al., 2008; Ferrari, et al., 2011). Christensen et al. (2008) found that the introduction of technology in education was an essential contribution to disruptive innovation following the line of personalized education. Since all students learn differently, based on the Gardner´s (Gardner, 1993) theory of multiple intelligences as well in the different learning styles, Christensen et al. (2008) contrasts the standardization that now exists in schools with customization, which is necessary for an innovative education that empowers students as well as education for innovation. The introduction of technology in education was not a catalyst for change and hasn´t had the impact it was supposed to have (Christensen, et al., 2008; Ferrari et al., 2009; Hargreaves et al., 2003; Redecker et al., 2009). Christensen et al. (2008, p. 12) justify this status quo by pointing out that technology has been used to support old practices: "They have “crammed” the new technologies into their existing structure, rather than allowing the disruptive technology to take root in a new model and allow that to grow and change how they operate".

Nevertheless and as mentioned before, technology can help to bring change. The development and implementation of student-centric technology will need to bring a shift to student-centered pedagogy (Ferrari, et al., 2009) and to the ownership of learning by learners, in which PLEs can play a key role. It is necessary to foster creativity at all levels, since that can contribute to sustainable and disruptive innovation. Ferrari et al. (Ferrari, et al., 2009, p. 29) refer: "Innovation cannot happen without creativity." Because creativity is a key component of innovation, it is important to distinguish between the different concepts it can represent. Over a decade ago, a team led by Sir Ken Robinson produced a report suggesting ways to innovate education for creativity. This document presented three different views of creativity: sectorial, elitist and democratic (Creative & Education, 1999).

In line with Robinson, Craft et al. (2001) present a bipolar view of creativity, distinguishing the big and little C´s. The first C, Big Creativity, is the one most commonly associated with creativity and stands for social and scientific genius, recognized on people like Da Vinci, Mozart or Einstein. Little C, on the other hand, is the creativity of everyday life, i.e. the ability of finding alternative ways of solving problems (A. Craft, 2001).

There are some similarities between Craft´s Little C approach and Robinson’s concept of democratic creativity (Creative & Education, 1999), in the way they support the existence of a non-elitist type of creativity that steps away from the idea of genius and is associated with small actions in everyday life. It is with this creativity

that students challenge teachers every day to also be creative. These daily teaching challenges that promote the Little C are located on two levels. On the one hand, there is education for creativity and stimulation of divergent thinking, and on the other hand, the need for prior knowledge in the area being reflected on. Ferrari, et al. (2011, p. 350) express the relationship between knowledge and creativity:

"The relationship between creativity and knowledge could therefore be seen as a virtuous circle, where creativity stimulates knowledge acquisition and new knowledge permits new and creative thinking paths."

This approach contains a constructivist view within itself. Going back to Piaget & Roberts' (1976) idea that "To understand is to invent" or according to Figueiredo (2009, p. 26) " Children should learn to explain what exists but also they should learn to create what never existed. That´s creativity and innovation!"

For some time, the question of innovation, coupled with the development and democratization of technology, infected educational discourse. There was even a certain trivialization of the terms innovation and innovative practices that often exhausted their meaning. This was also the case in Education where, as put by Hargreaves et al. (2003, p. 1): "Educational change is rarely easy to make, always hard to justify and almost impossible to sustain". However, there have been recent improvements and changes regarding innovation, particularly when understood /applied on a small scale and also in schools, with society progressively urging institutions to educate better, using fewer resources, while considering the specificity of each individual student. Christensen, et al. (2010, p. 1) summarize this societal shout when they observe that "We have high hopes for our schools"

### 3.2 Knowledge Creation

In 1995, researchers Takuchi and Nonaka presented the book "The Knowledge Creating Company" trying to explain the process of knowledge creation in an organization. With the provocative subtitle "How Japanese companies create the dynamics of innovation" (Nonaka & Von Krogh, 2009), the authors looked at the Japanese companies experiencing an unprecedented success on a global scale. Since then, Nonaka and other researchers have come to establish the initial view of the theory of organizational knowledge creation, widening the spectrum of theory with the backdrop of innovation as a result of knowledge management (Nonaka & Peltokorpi, (2006), Nonaka & Von Krogh, (2009)). According to this theory, "knowledge is justified true belief" (Nonaka & Von Krogh, 2009, p. 636). Thus, true of knowledge is justified through interaction with the world. Knowledge is also understood as dynamic as is created through social interaction between individuals and organizations. As referred by Nonaka & Takehuchi (1991), knowledge is also dependent on the context, dated, or framed in space and time. Takehuchi & Nonaka (1991) distinguish information from knowledge considering that information only becomes knowledge when it is contextualized, i.e. information must be interpreted and joined in/tied to individual beliefs and commitments. Deeply inspired by the work of Polanyi, Nonaka & Takeuchi (1995) distinguish two types of knowledge within a continuum: tacit and explicit knowledge.

Explicit knowledge is universal and supports the ability to act consciously in different contexts. Seidler-de Alwis & Hartmann (2008, p. 134) synthesize this kind of knowledge, emphasizing its public and intentional nature, conscious of the formal and explicit knowledge:

Nonaka et al. (2000) and other authors such as Kikoski and Kikoski (2004) describe explicit knowledge as what can be embodied in a code or a language and as a

consequence it can be verbalized and communicated, processed, transmitted and stored relatively easily. It is public and most widely known and the conventional form of knowledge which can be found in books, journals and mass media such as newspapers, television internet etc. It is the sort of knowledge we are aware of using and it can be shared in the form of data, scientific formulae, manuals and such like.

At the other side of this knowledge continuum lies tacit knowledge, which is rooted in practical action, routines, but also on experience, skills and ideals (Clarke, 2010). Tacit knowledge is deeply related to the individual and is consequently difficult to communicate encompassing an unconscious dimension. Unlike explicit knowledge, tacit knowledge is not associated with a coding system that facilitates transmission/dissemination. Polanyi (1966, p. 4) refers to this kind of knowledge by synthesizing "We can know more than we can tell" and concluding that "most of this knowledge cannot be put into words".

These two types of knowledge, tacit and explicit, are complementary and knowledge creation is only possible through the interaction between them/ achieved through their interaction. Nonaka & Takeuchi (1991, p. 164) subtly synthesized the need for this interaction: "The essence of innovation is to re-create the world according to a particular vision or ideal". Innovation understood as the creation of knowledge is only possible through the social interaction of tacit and explicit, in a process that Nonaka and Takeuchi describe as knowledge conversion (Clarke, 2010). The interaction between the different forms of knowledge conversion is "the spiral of knowledge" (Nonaka & Takeuchi, 1995) and establishes the SECI process (Socialization, Externalization, Combination internalization) shown in the image in figure 1.

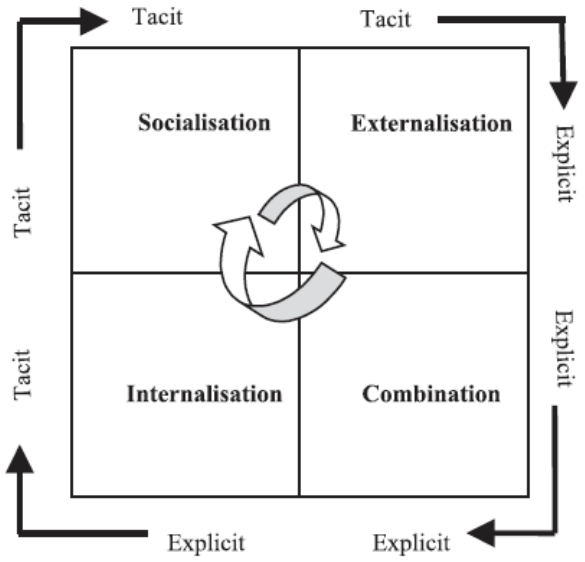


**Fig. 1.** Source: (Nonaka, Toyama, & Nagata, 2000, p. 12)

**Socialization - From Tacit to Tacit.** Socialization involves the sharing of tacit knowledge between individuals. In this case, sharing is understood in an experiential context. Nonaka & Takehuchi (1991, p. 99) exemplify this process by comparing it to

a master-apprentice relationship, stating that, although extremely important, it is not enough to ensure knowledge creation: “True, the apprentice learns the master’s skills. But neither the apprentice nor the master gain any systematic insight into their craft knowledge. Because their knowledge never becomes explicit, it cannot easily be leveraged by the organization as a whole.”

**Externalization – From Tacit to Explicit.** As implied in its name this phase corresponds to the externalization of tacit knowledge by making it explicit. When this happens, knowledge crystallizes turning to a state that can be shared with others. In this regard Nonaka, Toyama, & Konno (2000, p. 9) state that “When tacit knowledge is made explicit, knowledge is crystallized, thus allowing it to be shared by others, and it becomes the basis of new knowledge”. Sharing makes the externalization process easier and involves two key factors. The first refers to techniques that can be used to make the tacit explicit: pictures, diagrams, mind maps, metaphors and narratives (Nonaka & Konno, 2005). The second factor is related to logical reasoning / inductive and even abduction (creative inference) to accomplish knowledge formalization (Nonaka & Konno, 2005).

**Combination - From Explicit to Explicit.** The combination involves the conversion of an explicit knowledge into a new explicit knowledge, more complex and structured. In this process one can identify two key factors: the first is related with communication and dissemination; the second one is systematization. Nonaka, Toyama, & Konno (2000, p. 10) recognize the importance of technology in this process: “Creative use of computerized communication networks and large-scale databases can facilitate this mode of knowledge conversion”.

**Internalization - From Explicit to Tacit.** As new knowledge is diffused in/within the organization, individuals begin to internalize it, identifying what they consider to be most relevant for their role, both in personal and organizational dimensions. As stated by Nonaka, Toyama, & Konno (2000, p. 10) “When knowledge is internalized to become part of individuals' tacit knowledge based in the form of shared mental models or technical know-how, it becomes a valuable asset”.

Knowledge is then created in a spiral process allowing expansion. The critical phases of the SECI model are those that involve conversions of knowledge between tacit and explicit. According to Takehuchi & Nonaka (1991, p. 99), the whole process relies on factors intrinsic to the individuals. Because they are highly uncontrollable and move beyond mental models, including beliefs and values, these factors require the involvement of the self, i.e. personal commitment, articulating the vision of each individual in a very fragile balance between what is and what should be.

### 3.3 The Ba Explainded

Nonaka & Takeuchi (1995) retrieving a concept introduced by the Japanese philosopher Kitaro Nishida propose the concept of BA framed in knowledge management. BA can be translated as place and is defined as “a shared space that serves as foundation of knowledge creation” (Nonaka & Konno, 2005, p. 1).

The Kanji character for BA refers to the philosophy of Yin and Yang emphasizing the continuing transformation into a/of dynamic process (Bejinaru, 2011). The relationship between BA and knowledge is evidenced by Nonaka & Konno (2005, p.

41): "If Knowledge is separated from BA, it turns into information, which can then be communicated independently from BA. Information resides in media and networks. It is tangible. In contrast, Knowledge resides in BA, it is intangible". BA is therefore a space for the promotion of ideas and debates where new knowledge emerges (Clarke, 2010).

BA is characterized by the involvement of people interacting in a given space, what sets it apart from ordinary human interaction, the main difference relying on the goal of these meetings: BA aims at creating knowledge (Nonaka, Toyama, & Nagata, 2000).

Previously it was considered that knowledge is context-dependent and must be framed in a certain place and time: BA is the privileged space where the information takes on meaning by becoming knowledge. Nonaka, et al. (2000) support the absolute need for BA when they claim knowledge cannot be understood without framing the thought into action. Another feature of BA is that, despite being considered a place, it does not mean a physical place/it doesn't necessarily have to be physical: it can be mental or virtual. Von Krogh et al. (2012, p. 242) reinforce this feature by stating that: "Ba can take the physical form of business space and offices; the virtual form of mailing lists, intranet, meetings and social events; and a mental form, such as ideals or ideas". For Nonaka et al.(2000, p. 8), BA is profoundly dynamic, "provides energy, quality and places to perform the individual conversions and to move along the knowledge spiral", renewing itself as needed.

The relationship between BA and the SECI model is presented by Nonaka & Konno (2005) according to the following figure (figure 2).

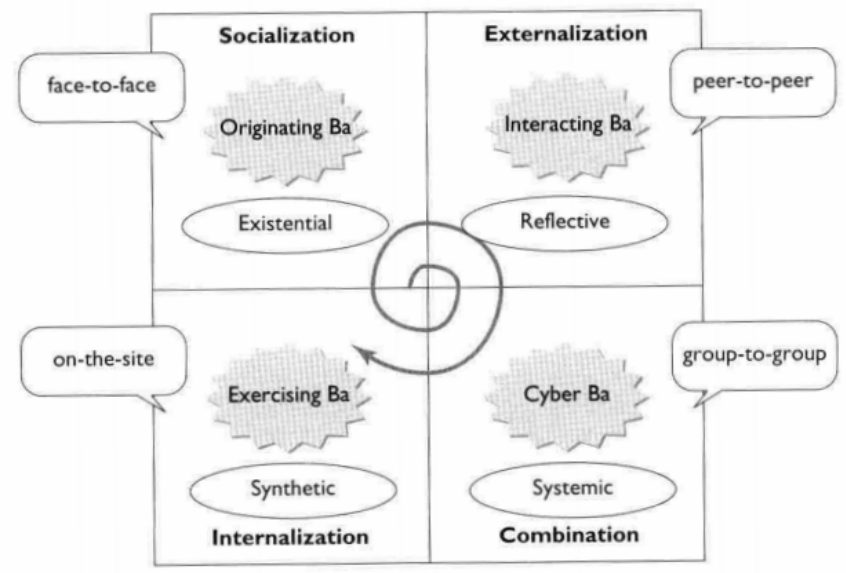


**Fig. 2.** Source: (Nonaka & Konno, 2005, p. 44)

"Originating BA" is the starting point for knowledge creation (Clarke, 2010) where individuals share the emotions, feelings and mental models (Nonaka & Konno, 2005). It corresponds to the more emotional and personal space, leaving the Cartesian

rationalism of the "cogito ergo sum" to the Nishida vision "I love therefore I am" (Nonaka, Toyama, & Nagata, 2000). From the "Originating BA" emerge not only feelings but also commitment and trust, key issues in the creation of knowledge. The correspondence between the socialization phase of the SECI model and the "Originating BA" arises spontaneously, focusing on physical approaches to potentiate the knowledge conversion from tacit to tacit.

The "Cyber BA" is where explicit knowledge is combined with other explicit knowledge to create new knowledge overlapping the combination phase of the SECI model. Nonaka & Konno (2005, p. 46) gave "Cyber BA" a virtual dimension recognizing the potential of online environments in this process: "The combination of explicit knowledge is most efficiently supported in collaborative environments using information technology. The use of on-line networks, group-ware, documentations and databases has been growing rapidly over the last decade, enhancing this conversion process."

The "Exercising BA" is the place where explicit knowledge is transformed into tacit knowledge, through the implementation of new ideas and experiences, corresponding to the internalization phase of the SECI model (Nonaka & Konno, 2005)
The "Interacting BA" is the place where tacit knowledge is transformed into explicit knowledge, through dialog and formalization of information (Clarke, 2010).

The understanding of the different types of BA and the close relationship with the SECI model may potentiate the creation of knowledge. Nonaka introduces yet another variable in the process of knowledge creation - knowledge assets, which are defined as a set of resources (tangible or not) that are indispensable to create value (Von Krogh, et al., 2012). Knowledge assets include the results of the articulation of explicit knowledge through images, symbols and language: "(…) knowledge assets are outputs, inputs, and moderating factors of the knowledge creation process" (Von Krogh, et al., 2012, p. 3). There is another dimension of knowledge assets (Seidler-de Alwis & Hartmann, 2008; Von Krogh, et al., 2012) with a tacit and intangible nature as trust, commitment, skills, values and norms.

## 4 SCS as a Possible Educational *BA*

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

In SCS, each school establishes its own network, using elements of their community. This option appears as a limiting aperture, but is related with privacy issues mostly due to the age of the target audience. Nevertheless, users are given the opportunity of building their own personal network including people from other schools, using their school's network. SCS thus opens the possibility for open innovation, which advocates the establishment of intra-organizational networks in the search and construction of new knowledge. SCS adds a set of typical web 2.0 services that enhance communication, sharing and collaboration and create conditions for knowledge creation and innovation to emerge, as stated by Angehrn, et al. (2009, p. 207):

It thus appears that innovation is progressing to an open model as the latter is better able to face current challenges (e.g. repository and passivity syndromes) by better

fulfilling community members' social needs, and by stimulating the access, re-use and transformation of diverse knowledge assets by harnessing collective creativity thanks to new authoring tools which go beyond text-based communication.

Angehrn, et al. (2009, p. 207) identify some characteristics that a platform that supports and sustains innovation process should incorporate:

"Collaboration, knowledge sharing and exchange, reciprocal trust, recognized ownership, reinforcing and enlarging innovation stakeholders' networks, clear network visualization, simple and reliable technology (…): all these factors need to be taken into account to develop effective IT tools aimed at supporting and boosting innovation processes."

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

Each member of the school community registered in SCS has access to a wide range of services that allow them to store, organize and share resources in different formats. The publication of images and videos (the latter service still under implementation) is free and has no limitations. The creation of blogs and wikis (the latter still in implementation) is not controlled and any authenticated user can create as many blogs as he/she wants or invite others to manage them, not needing technical or institutional approval.

Within the group of potential users of SCS, most will be under 18. There are issues related to the use of the platform by minors that require that the concept of openness be based on a legal framework that cannot be ignored. Access to content published by minors will only be possible by authenticated members of the school and, in certain circumstances, for authenticated members of other schools. This philosophy has direct implications on how "openness" is understood in this context. Within a school, hierarchies and other members of the school community have the same privileges and therefore the same responsibilities. On the other hand, by allowing content to be produced by all members of the school community, enabling broad participation, the school opens itself.

Associated with the sharing and openness, key concepts of SCS, there are two compelling questions: one related to copyright and other, more sensitive, with privacy, which particularly relevant taking into account the fact that the platform will be used by children and young people. With regard to copyright, it is considered that this issue is partially protected, since all users at the time of registration, must accept the "terms of use" which include a "Creative Commons" license where it is made clear that, by default, all content will be freely available except for commercial purposes. Another beneficial effect of this license fits in with the mission of the school as a promoter of education for digital citizenship. As stated Pitler (2006, p. 4) " by talking about Creative Commons in both K-12 and college classrooms, teachers can engage students in a much-needed conversation about online ethics. " As mentioned earlier, the concept of openness is adapted to the specific target audience with regard to visibility between schools. Nevertheless, within each school, full and open participation and collaboration are encouraged either by the dilution of the hierarchies or through a common place - the wall - where all the activity gains a public dimension.

The possibility of interconnection/interaction between different schools' networks is preserved, making it possible to expand the network to users of other schools. This will make it possible to cross between different networks, fostering a climate of trust,

essential for the development of innovation processes. The possibility of each user seeing who has established relationships and the nature of the interaction between members of different networks has also a clear visualization. SCE is based on simple and reliable technology. The assumption that the technology is reliable is supported by the fact that some of the core services result from the partnership established with the SAPO, the biggest web portal service in Portugal. The interface design of the SCS, integrating some of the typical services of Web 2.0, was designed so that the user experience could be both familiar (since many users already use this type of environment) and also appealing and distinctive, trying to make it even easier to use of the technology, thus increasing the rate of utilization.

The features underlying SCS have from early on, made it a tool where new knowledge and creativity can emerge, giving rise to an innovation process.

## 5 Final Remarks

Based on these propositions, this paper analyzed SCS, identifying the elements that aspire to reach the knowledge creation Ba, and provide a way to a disruptive innovation.

Having schools promoting the mechanisms of knowledge management through the creation of institutional learning spaces where everyone can share and create knowledge, making it visible, may be an approach of innovation. Cheng & Chen (2008, p. 383) illustrate how this process can occur in an implicit reference to the processes of conversion between tacit and explicit knowledge.

For instance, if the teaching methods (implicit and personal knowledge) of the best teacher can be identified and converted into written documents (explicit) as a reference for other teachers, they can be used to improve or be internalized as other teachers' teaching skills (implicit) and enhance the overall effectiveness of the school (organizational knowledge).

A prerequisite for transformational processes that occur between tacit and explicit is the existence of an open space that can serve as the ground for innovation (Seidler-de Alwis & Hartmann, 2008). The four types of BA proposed by Nonaka and Tackechi mentioned before were revisited, considering BA as something flexible and to be considered in other contexts Frédéric (2001, p. 15):

"Plusieurs formes de «ba» existent; qu'ils soient de nature «générique», «spécifique», voire «dominante», certains de leurs fondements semblent toujours être similaires. A l'intérieur de ceux-ci, plusieurs catégories de connaissances sont identifiables et peuvent émerger; plusieurs phénomènes se dégagent également."

With a tangible or intangible nature, physical or virtual, BA provides other approaches, like the "Connecting BA" proposed by (Bejinaru, 2011, p. 221)
Originating and exercising 'ba' are physical spaces, interacting 'ba' is mental, and cyber 'ba' is virtual but "connecting 'ba'" is a positive mix of these and technology.

SCS can provide the foundation and support for this space; BA may be what schools are looking for to create new knowledge, giving rise to sustained processes of creativity. As Cheng & Chen (2008, p. 383) state "schools are the cradles of innovative knowledge, and they have a rich collection of intangible assets".

Hargreaves (cit. in (Ferrari, et al., 2009, p. 29) points out that the idea behind disruptive innovation is the opposite of that of sustainable innovation. Figueiredo (2009) doesn't share this vision as he states that despite the high level of failure associated

with sustainable innovation in education, it can be explored. However, "[t]he promising path to innovation in education systems is through disruptive innovation that quietly grows in the margins of the system, unobtrusively until starts changing it, irreversibly" (Figueiredo, 2009). SCS can perhaps be a vehicle for this innovation combined with institutionalization. Miles (1998) presents institutionalization as a change to be taken as normal, as something part of organizational life; and has unquestionable resources of time, personnel and money available. The apparent paradox in the SCS conception - dualism institutional versus personal - may actually be another catalyst for change.

Throughout the paper, the importance of innovation in education was widely shown. Providing a space where knowledge, information and experiences can be shared by eliminating the barriers of an institutional hierarchy is, from a technological standpoint, the easier task. Making this space, in which Ba leads to a disruptive innovation, is the challenge that the team of the SCS and all schools that will be part of this network of networks are facing.

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# Pedagogical Practices, Personal Learning Environments and the Future of eLearning

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**Abstract**. Historically, elearning has adopted the most common pedagogical models in Distance Education and it has been gaining increasing importance, as Higher Education Institutions are offering more and more online degrees. However there is a gap between theory and practice. What are the actual pedagogical models followed by the teachers online? Do they follow the theoretical models or do they adopt a mix of different models? What is the role of the services and tools available in the pedagogical practices, namely the Personal Learning Environments (PLEs)? How are Higher Education Institutions adapting themselves and which are the future trends for elearning? This paper tries to shed some light on these questions based on two interviews: one to Prof. Graham Attwell and the other to Prof. José Lagarto. Showing some skepticism about the adoption of elearning by Universities, the interviewees consider that PLEs are indeed capable of bringing a quality increase in the learning process. They also consider it is necessary to adopt several pedagogical models in elearning.

**Keywords:** elearning, pedagogical practices, personal learning environments, future of elearning, lifelong learning

## 1 Introduction

In one of the tasks of the curricular unit "Pedagogical Processes in Elearning", of the 5th edition of the Master's program in Elearning Pedagogy of Universidade Aberta, Portugal, under the supervision of lecturer José Mota, the students were challenged to do an interview to an online teacher or trainer. Based on that interview, they should then write an academic paper on pedagogical practices in elearning, adding other resources that had been studied in the curricular unit. The group of three students who are presenting this paper invited Graham Attwell (Wales) and José Lagarto (Portugal) to get a wider perspective on elearning practices in different contexts. After having outlined the scripts of the interviews, these were sent to the interviewees, who answered by video (Graham Attwell) and in writing (José Lagarto).

Graham Attwell is an Associate Fellow, Institute for Employment Research, University of Warwick and a Gastwissenschaftler at the Insititut Technik und Bildung,

University of Bremen. His recent work has focused on research and development of new applications and approaches to e-Portfolios and Personal Learning Environments.[1]

José Lagarto is Professor and pedagogical coordinator of the master's degree in educational sciences, specialization in educational computing (informatics) at Universidade Católica Portuguesa. He is the author of several books and papers related to issues of the teaching and training in distance learning contexts.[2]

The full interviews are available online (see references).

## 2 Pedagogical Practices in eLearning

The way an online course is pedagogically designed cannot be similar to the organization of the traditional classroom approach. Gautreau, Street & Glaeser (2008) remind that in the latest years there are many studies comparing classroom learning with online learning. The results prove that the differences between the learning outcomes in both contexts are not significant. The challenge lies in finding out how knowledge is acquired or produced. The distinctive feature of online learning is the existence of a learning community which works in collaboration/cooperation. Some important studies support the idea that the virtual learning communities are essential in the building of effective online courses (Hiltz, 1998; Johnson & Johnson, 2004, in Mason & Rennie, 2008; Garrison & Anderson, 2003, Palloff & Pratt 1999, 2005).

However, none of these contributions solve the problem: which pedagogical models should be used to design an online course or study program? Andersen & Dron (2011) identify three generations of pedagogical practices in Distance Education: cognitive-behaviorist, social-constructivist and connectivist. The behaviorist and cognitivist theories usually lead to distance teaching models which are based on the teacher centered transmission of knowledge and on the subject matter. The teaching processes are strongly structured and learning is an individual process where social interaction is limited to scarce communication, synchronous or asynchronous, between the teacher and the learner. Constructivist models of distance teaching highlight the social interaction based on synchronous or asynchronous communication through the diverse technological means available to the teacher and the students. The learning process is more important than the contents and experimentation is assumed as the primary source of knowledge acquisition. Learning is an active process and the acquisition of new knowledge is based on the already acquired knowledge. The connectivist approach depends largely on the students' access to knowledge networks with frequent and intense social interactions. Learning needs are defined by the students themselves according to their goals and expectations. Teachers and students are simultaneously responsible for the production of content and learning results from diversified connections in networks and the recognition of emerging patterns within them.

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[2] Universidade Católica Portuguesa, Faculdade de Ciências Humanas - Corpo Docente - José Reis Lagarto. Available at http://www.fch.lisboa.ucp.pt/site/custom/template/ucptpl_popup.asp?sspageid=885&artigoID=4847&l ang=1

Attwell (2012) considers himself a constructivist, but he adopts a critical view on all these approaches: "these days I can state that I follow a constructivist model although I am quite critical about all these models". Lagarto (2012) follows the same view, stating that he has his own communication style with the students, adapting his message to different contexts. He considers that "the reasons for these approaches are related to the personal perception that everybody learns in different ways but we learn better certain contents by doing and collaborating with others, while in other situations a more functional learning is more effective and makes us attain our goals faster without losing quality."

Attwell (2012) adds that he is interested in mixed or combined models, which can be placed somewhere between behaviorism and constructivism, quoting as example the CBLM (Collaborative Blended Learning Methodology) based on the concept of webquests 2. 0 and which has been developed by Maria Perifanou at Pontydysgu (Attwell, 2011). He clearly states that the processes are far more important than the models: it is not worth following a specific model if you don't give the students the freedom and the support to achieve autonomy. Moreover, according to Attwell (2012), "PLEs are not a mere tool, they are part of a process of learning practice."

## 3 The Influence of PLEs in Pedagogical Processes

The concept of PLEs may have been born in 2001 (Mota, 2009) in a paper by Bill Olivier & Oleg Liber, who proposed the integration of the learning institutional contexts with a peer-to-peer model, which would be centered on personal learning and lifelong learning. With the evolution and the complexity of Web 2.0, there has been an enormous advance in the working environments, in the communications and in the publishing and sharing of resources. One of the consequences of this evolution is the availability for anybody to access a huge volume of information, whether through the consultation of online documents and media or through direct or indirect communication with others, thus increasing exponentially the learning opportunities.

The concept of PLE has also evolved and, although it can be seen in a technological perspective, i.e. a set of tools and services that each one personalizes, organizes and makes the most of for one's learning, it is also an ecosystem of relationships, interactions, cultural and social values. No two PLEs are equal. According to Mota (2009) the notion (or notions) of Personal Learning Environment *represents, in a way, the embodiment of many of the aspects which characterize the social and cultural changes provoked by the technological development, namely with Web 2.0, and which inevitably have a strong impact on education and on the conception of learning*.

Terry Anderson (2006) lists some of the advantages of a PLE, highlighting the identity and the availability, the social presence and the capacity and quickness of innovation. To Anderson, the PLE can be used in both formal and informal learning and even in lifelong learning. In a conceptual map designed by Adell (2010), the author underlines that a PLE is not an application or a learning platform, not even a way of teaching, it is a way of learning. Unlike many others who place the user in center of the map, Adell stresses that learning is the focus or the center of all activity and the reason of being of the PLE. Downes (2008) refers that the PLE can be a world of resources for the students who, at the

same time, have the roles of information consumers and content producers, while the teachers will have a crucial role as mentors and learning facilitators.

How can PLEs be relevant in the construction of knowledge and enable effectiveness of learning processes? Attwell (2012) has no doubts that PLEs are crucial for any learning process involving technologies: PLEs represent the way in which we take advantage of technology, how we shape it and the learning opportunities it offers. The German word is *gestalten,* this is how we design and shape the PLEs for our own learning process. Attwell adds that the PLEs, as he understands them, are part of that process of shaping and taking hold of the things that were not conceived for the learning process, and use, design and develop them for that goal, cooperating with others while we are doing it. For him this is the future of online learning; he even wishes again that in 2012 we get rid of the "e", the "b" and the "i" which we place before learning.

But there is another advantage in PLEs: the democratization of the access to knowledge, that supports lifelong learning of an ever increasing number of individuals. Attwell (2012) strongly believes that education should be considered a right and not merely a business, that is, a profitable activity like any other. Well, if this happens, the fact prevails that technology can give more opportunities to the ones that already have them, leading to social inequalities. The introduction of technologies in education can lead to the appearance of some info excluded with little access to formal education and even less access to technologies in education, thus opposing them to the ever socially privileged.

Bearing this in mind, and as long as technologies are affordable and widely used, Attwell (2012) considers that PLEs could be extremely important since they may be a "part of the change in the learning process". He adds that "technologies, in the workplace and in the community, allow everyone to have access to ideas, knowledge and online spaces to debate and increase their own knowledge". Thus, "the learning process and, therefore, education becomes a full part of society as a whole instead of hiding itself behind the walls of the institutions of our schools and universities".

## 4 Preparation / Adequacy of Institutions of Higher Education to eLearning

António Dias de Figueiredo (Miranda, 2009) underlines that online education is a "strategic process" for the future because the trend will be an increase in the demand of distance or combined (b-learning) courses mainly for Master students who are already working and have little time to attend face-to-face classes. Simultaneously, Higher Education Institutions will be fully interested, he states, in moving forward to teaching projects and online training as there are several trends which point to that direction, such as the need of lifelong learning, the changing of the social profile of the students, the increasing use of technologies to support learning and even the financial viability of the universities. Gautreau, Street & Glaeser (2008) also believe so: in the last few years, the number of enrolments in online courses outnumbered the enrolments of students in regular courses. Therefore universities need more and more to conceive online courses to attract new students.

José Lagarto (2012), however, is more skeptical about the needs of implementing

online courses, considering that only a minority of higher education institutions are aware of this problem and that fact will restrict the effectiveness of the Bologne Process. He also stresses that it is necessary to change the paradigm, which implies "a big effort of all the actors involved", in a context where he believes students themselves are less used to autonomous work and to self regulation of their learning processes. He also questions if today's students, as online natives, can keep on learning with the use of technologies of the 19th century.

Attwell (2012) doesn't seem very optimistic either, saying that students are "less confident and competent than it would be expected in the use of technologies, which ruins the concept of digital generation and the concept of a new generation with a completely different interaction with technologies", showing difficulties in the use of those technologies to develop learning processes.

## 5 The Future of eLearning

We are going through some big changes. Fueled by the rapid technological development, our social and cultural patterns are evolving, with a strong impact on our daily life: the ways we communicate, deal with information and learn. But do we realize how dramatically and how fast the world has been changing? And do we realize that, 10 years from now, our students will consider many current technologies obsolete? The "top ten" jobs of 2010 didn't exist in 2004 (IBM & IEEE, 2010); will many of the skills learned or developed today at school be still relevant in a few years' time?

The number of jobs people have throughout their lives is increasing and will continue to do so, including more career changes than in the past. Education must adapt to this new context: learning in the 21st century needs to be adapted to each learner, student centered, available 24 hours a day, seven days a week, continuous, with a strong social dimension, and PLEs are a key element in this process.

The role of the teacher also needs to change, becoming more diversified and spanning across a variety of functions (Downes, 2010) - model, mentor, facilitator, moderator, curator, enabler, to name a few – along with the traditional function of instructor and evaluator. Teachers need to make the most of the affordances of these technologies and be aware of the emergent pedagogies that can effectively support learning in this new context.

Lagarto (2012) also refers to these trends, believing that "the teaching strategies are gradually changing their paradigms and today they already offer a wide range of options". The teacher will probably have the function of being a good manager of online contents conceiving at the same time learning environments that fit his or her students: case studies, project-based learning, webquests, guided research, contents created by the users (user-generated content) are just a few examples of the ways of supporting learning processes in controlled environments, technologically enriched and run by the teacher.

As it was already mentioned, online teaching seems to have a major role not only at the level of education / training strategies but also at the level of training models. José Lagarto (2012) states that "under the perspective of Rosenberg, in his book *Beyond Elearning,* elearning will be useful for both formal education and training approaches as

well as to self–learning processes tied to the leisure activities of each citizen. The enormous versatility of elearning systems will be the paradigm of future learning, even if it is not called elearning". Attwell (2012) has a similar view: the future of elearning may not include necessarily or exclusively formal education. One of the most promising areas seems to be, without a doubt, lifelong learning. Attwell refers that he is at the moment working with a group of counselors whose corporations "are looking for new ways of providing access to learning opportunities to their workers and that are particularly less expensive to fulfill."

## 6 Conclusion

Both Attwell and Lagarto are open to different pedagogical approaches in elearning and critical of the use of only one methodology. They prefer to give more importance to the adaptation of the message to the contexts, as there isn't only one pedagogical model for elearning: one should adapt the strategies and methodologies according to the contexts. Therefore they both emphasize the processes and the specific contextualization of each learning community.

The same with PLEs: more than simply a tool, they are part of the learning process and have the necessary potentialities to fuel change in the learning communities. There is, however, some discussion about whether they may be part of the solution or part of the problem when it comes to promoting digital inclusion. If they constitute part of the solution and not of the problem, PLEs have the necessary capabilities to promote effective change in learning communities.

That is not an easy process as universities tend to stay inside their own walls. Although elearning is strategic for the universities, both interviewees are quite skeptical about the immediate generalization of elearning. These institutions have difficulties in realizing the importance of elearning and the students lack, in many cases, technological competences. In spite of the difficulties and the natural setbacks in the process of changing paradigms, elearning, even if it isn't called that, has a promising future mainly in the context of lifelong learning.

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# The Impact of Culture on Personalization of Learning Environments
# Some Theoretical Insights

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**Abstract.** In an increasingly competitive environment, universities around the world are opening their doors for international students due to economical and legislative (e.g. Bologna Agreement) considerations. This process of Internationalisation and Globalisation has made the Universities increasingly multicultural. There are two current trends in higher education: an increase in the use of open and personalised online learning technologies, and a significant internationalisation of the student cohorts. Therefore, the barriers associated with the cultural differences in learning environments and specifically emerging learning environments (e.g. PLEs) become more and more important with the increasing globalisation of education. In this paper the authors explore the impact of various cultural aspects on learning within open and personalized learning environments instigating future pedagogical and technological debate.

**Keywords**: culture, personal learning environments, pedagogy

## 1 Introduction

Traditionally technology facilitated learning is delivered within Universities and commercial organisations utilising a Learning Management System (LMS) or Virtual Learning Environment (VLE). These traditional systems are centralized, usually monolithic and fail to address the individual needs of today's learners or simply are not flexible enough to do so [1]. The plethora of Web 2.0 technologies now available means that the learners are increasingly escaping these traditional walled gardens and are involved in creating and consuming content using these disruptive technologies. Propelled by these developments and the need to meet the ever-increasing demand of learning needs within informal, non-formal and life-long settings, new generation learning environments are emerging which offer breakthrough level of personalisation. These learning environments are broadly categorised under the umbrella term Personal Learning Environment (PLE). The pedagogical advantages of PLEs and associated technological debates are already well documented [2–5] along with the challenges they pose.

Despite some of the known pedagogical drawbacks, the centralized and monolithic systems (LMS/VLE) had one major advantage wherein the instructors and designers

could ensure that the learning environment is pedagogically sensitive to their needs. Authors [6-8] outlined a number of pedagogical dimensions that can be utilised by instructors to design interactive multimedia tools and learning environments. Among these dimensions the aspect of 'cultural sensitivity' was mentioned, which is explained as follows: 'Web-based instruction should accommodate diverse ethnic and cultural backgrounds among the learners expected to use it'. With the technological advancement the ability to assemble personalized learning environments is now a reality. As 'One-size-fits-all' doesn't hold true for eLearning anymore and learners can assemble, personalize, curate, organise their learning environments without the involvement of instructors or course designers. One might assume that the learner being in control of their learning will implicitly assemble a culturally sensitive learning environment. However, there is no current evidence to suggest that such an implicit outcome is possible. Based on the literature the authors opine that lack of cultural sensitivity will impede wider PLE adoption and deprive learners of the numerous pedagogical benefits PLEs offer. Hence, this paper attempts to highlight some of these challenges that may still be carried over from the e-Learning 1.0 generation and hopefully will instigate a discourse among the pedagogical community around these issues.

## 2 Culture: Some Definitions

Culture has been defined in many ways. According to Kroeber and Kluckhohn [9], "culture consists in patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols; the essential core of culture consists of traditional ideas and especially their attached values". Hofstede [10] treats culture as the "collective programming of the mind that distinguishes the members of one group or category of people from another". This author argues that from the many terms used to describe culture, the following three together with values, cover the total concept rather neatly: symbols, heroes and rituals.

- "Symbols: are words, gestures, pictures and objects that carry often complex meanings recognised as such only by those who share the culture.
- Heroes: are persons, alive or dead, real or imaginary, who possess characteristics that are highly praised in a culture and thus serve as models for behaviour.
- Rituals: are collective activities that are technically unnecessary to the achievement of desired ends, but that within a culture are considered socially essential" [10].

## 3 Cultural Considerations and Potential Impact on PLEs

### 3.1 Individualistic and Collectivist Cultures

Dupraw and Axner [11] noted that "cultural boundaries are marked by differences in a) communication style, b) attitudes towards conflict, c) approaches to completing tasks, d) decision-making styles, e) attitudes towards disclosure, f) and approaches to knowing, learning and teaching". Some of the differences relate to pedagogy and others to technology. These differences can be broadly attributed towards differing na-

tional cultures and categorized under Individualism and Collectivism. “Individualistic cultures such as those of Western Europe and North America emphasise autonomy, individual initiative, emotional independence, primacy of personal goals over group goals and a right to privacy” [12]. “In contrast, collective cultures such as those of China, Japan, Korea, South-east Asia, Africa and South America emphasise collective identity, emotional dependence, and primacy of in-group goals over personal goals and in-group cohesiveness and harmony” [12]. Individualist and collectivist societies perceive the purpose of education differently. In the former, the purpose of learning is not so much to know how to do, as it is to know how to learn. The assumption is that learning in life never ends; even after school and university it continues. In a collectivist society, “learning is more often seen as a one-time process, reserved for the young only, who have to learn how to do things in order to participate in society” [10]. In the collectivist classroom, confrontations and conflicts with fellow classmates and teachers should be avoided while in an individualist classroom it can be part of the teaching-learning environment. Qian and Pan [13] compared 11th and 12th graders’ epistemological beliefs in the USA and China. Their results indicate that, “Chinese students were more likely to view knowledge as simple, certain and ability innate, whereas US students were more likely to view learning as quick or not at all” “The Chinese e-learner may feel that they are subservient to a teacher and this could prove problematic when no physical tutor exists” [14].

From a cross-cultural perspective, the literature suggests that different cultures conceptualise the role of language in communication differently [15]. For example, in an individualistic culture such as dominant Anglo-American culture, verbal language is a primary means of communication and of transmission of information. People in the individualistic culture therefore value explicit language and tend to stress the importance of accurate expression. In contrast, in a homogeneous, collective culture such as the Korean, verbal language is often unnecessary to share ideas and feelings with others because people may assume shared knowledge and background. In this case, articulate language is less required than in the case of the individualistic culture, and the collective culture tends to stress the importance of good understanding instead, i.e. receptive language skills. Asian cultures emphasise the listener’s role and responsibility in assuring successful communication, whereas Western cultures place the responsibility primarily on the speaker. This pattern suggests cultural differences in language development, such that Asian children may develop higher-level receptive skills and Western children may develop higher-level expressive skills. Collectivist cultures often depend upon informal and non-transparent chains of communication, which challenges existing conception of PLEs. Predominantly learner centred environments (e.g. PLE) require participatory and collaborative outlook without any formal top-down structure and may represent a totally new way of learning to students where previous education experiences in their home country may have featured only the traditional, lecture-based, teacher centred approach and hence these students may be reluctant to participate actively online.

### 3.2 Long Term vs Short Term Orientation

Cultural value of time orientation may influence on how learners approach PLEs. In Long Term Oriented cultures, perseverance is valued and sacrifices of short-term benefits are typically justified by the long-term rewards [16]. "Long Term Orientation stands for the fostering of virtues oriented towards future rewards, in particular perse-

verance and thrift. It's opposite pole, Short Term Orientation, stands for the fostering of virtues related to the past and present, in particular, respect for tradition, preservation of 'face' and fulfilling social obligations." [10]

Learners from long-term cultures may value the meta-cognitive elements of PLEs much more and would be much more open to use them with the hope to gain greater adaptability to learn in future. On the contrary learners from short-term cultures may seek immediate enhanced cognitive benefits when using PLEs as compared to VLEs/PLEs. If these learners do not see any added advantage in the immediate scope then they will not look positively towards the notion of PLEs.

### 3.3 Uncertainty Avoidance

Hofstede [17] analysed the nature of teacher-student interaction styles in US. He found out that the "teachers in US tend to allow the students to initiate and control their learning experiences (student – centred approach) and they also allow the students to contradict and criticise the teachers and the teachers regard such disagreement as a stimulating exercise and do not take the criticism personally". Jehng et al [18] showed that "learning beliefs are a product of the activity, the culture and the context in which they are cultivated". Hofstede [17], for example, observed in his research that "the students in US are open-minded, try to reduce uncertainty and integrate new and old ideas and change their belief system accordingly". In contrast, according to Hofstede's analysis, the teacher – student interaction style in South East Asian, especially in Korea, is teacher-centered, where the teacher student relationship tends to be binding and personal. Students are expected to follow structured instructions from the teacher. That is, it is the teacher and not the student who initiates students' learning experiences. This phenomenon is referred to as uncertainty avoidance [10] and described as "the extent to which the members of a culture feel threatened by ambiguous or unknown situations".

PLEs are inherently unstructured environments and potentially full of uncertainties for learners who come from a culture where uncertainties are avoided as much as possible. These learners may soon feel disconnected and demotivated and provisions should be in place to ensure such learners are gradually exposed to the concepts of personalisation and openness with appropriate pedagogical support.

### 3.4 Power Distance

"Power distance is the extent to which people in a society accept the fact that power in institutions and organisations is distributed unequally among individuals" [19]. Throughout their history, for example, Chinese have shown respect for age, seniority, rank and family background, so what an elderly person says carries more weight over the opinions of younger people. To an American, youth is often prized over age [20]. In the large power distance system the quality of an individual's learning is virtually exclusively dependent on the excellence of his or her teachers. "In the classroom there is supposed to be strict order, with the teacher initiating all communication. Students in class speak up only when asked to, teachers are never publicly contradicted or criticised. In the small power distance situation, students make uninvited interventions in class and are supposed to ask questions when they do not understand something. They argue with teacher, express disagreement and show no particular respect to teachers outside the school. The education process is student-centred and the quality of learn-

ing is to a considerable extent determined by the excellence of the students rather than teachers" [10]

Let's consider a scenario where a PLE container and its associated ecosystem are developed by some developers/designers from a low power distance society. Their culture may have an impact on the user access restrictions (privacy), which they employ in their system; i.e. who has rights of access and to how much information. The design may include liberal access mechanism if not completely open which may not suit the needs of a high power distance society. The former will most likely want to keep access more transparent with implicit freedom given to everyone to move around the site and the later will most likely aspire a less transparent mechanism.

## 4 Discussion and Conclusion

The aforementioned text represents some of the cultural aspects that the authors find most relevant and are not exhaustive. The intention was to highlight that there are cultural differences that will have an impact on emerging learning environments in a multicultural setting. One of the limitations in current instructional design models is that they do not fully contextualise the learning experience, and are themselves the products of particular cultures [21]. The actual process of assembling and curating a learning environment itself may not be culturally neutral, but instead based on particular epistemologies, learning styles and goal orientations of the infrastructure, services and content developers.

Therefore it is vital to understand, adjust and propose appropriate pedagogical and technical solutions. Reeves & Reeves [6] introduced the pedagogical dimensions related to cultural sensitivity and the academic community should start looking at this to improve PLE adoption level before the predicted 5 year timeline by the NMC 2012 horizon report [22].

Developers, designers, researchers and teachers should be made aware of the inter-cultural design issues that may arise in a personalized online environment. Instructional designers and academics may sometimes therefore have to incorporate not one, but multiple pedagogies, for example both instructivist and constructivist depending upon the cultures they are providing resources for, and be aware of the multiple ways in which each culture could interpret the instruction and content. This paper has identified some important questions that need to be investigated further and be addressed to better utilize and diffuse PLEs among learner from different cultural backgrounds.

- How can we overcome any cultural bias implicit to PLE infrastructures and associated ecosystems developed within one culture and utilized cross-culturally
- Are PLEs (as conceived by [1], [2]) more suited to individualistic cultures?
- How can the learners (from individualistic cultures) be motivated for group work and learners from collectivist cultures be motivated for taking control on their own learning?
- What about organizational and domain specific cultural impact on PLEs?

'One-size-fits-all' doesn't hold true for eLearning with regard to culture and it is suggested that E-learning in its current form needs to be further enhanced using new and appropriate pedagogies in the context of multicultural educational setting in order

to overcome some of the stated cultural barriers. It may be impossible to find a perfect solution (as evident from the various cultural barriers associated with it) to remove the cultural differences from the E-Learning environments but ensuring cultural sensitivity may help improve adoption among learner with different cultural backgrounds. Theorists have long argued for a cultural dimension in the design process and the need to provide culturally sensitive learning environments [6], [23]. Hence, it can be suggested that PLEs in their current form needs to be further enhanced improving existing pedagogies in the context of multicultural educational setting in order to be culturally neutral and thus help neutralise some of the key cultural barriers.

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# Psychological Ownership and Personal Learning Environments: Do sense of ownership and control really matter?

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**Abstract.** New power relations and the shift in control have been some of the key topics driving the discussion about Personal Learning Environments (PLE). This paper explores the role of sense of ownership and control in use of technology-enhanced learning environments. The paper is rooted in the theory of psychological ownership and reports on empirical findings from a joint study conducted at universities in Berlin and Augsburg (Germany). The study encompasses the results of an online survey with 50 students from three different university courses, exploring multiple relationships between ownership, control and learning in context of web-based ePortfolios. The results of the study indicate that control of intangible elements of ePortfolio, such as control of content or personal data, is more related to the feeling of ownership of one's ePortfolio than control of tangible elements, such as technical tools. Based on the example of web-based ePortfolios, the paper argues that the perception of a learning environment as a Personal Learning Environment is related to perceived ownership of intangible elements.

**Keywords:** Personal Learning Environment, ePortfolio, psychological ownership, control, web 2.0, TEL, autonomy.

## 1 Introduction

Personal Learning Environments emerged as a concept related to the learner-controlled uses of technologies for learning (Downes, 2007; Attwell, 2007a). Similarly, the discussion on ePortfolios in education has emphasised the shift from teacher control towards greater learner control of learning, at the same time addressing the tension between self- control and external control in ePortfolio practice (Mayrberger, 2011). From this perspective, both Personal Learning Environments and ePortfolios can be seen as alternative approaches, highlighting the shift from the view of students as recipients of knowledge to active participants, autonomously taking control of their learning. The view of students as recipients of knowledge has been replicated in the design of externally controlled learning environments, be it classic textbooks, technology-enhanced systems and other uses of educational media "in which all learners follow a specified path

established by the instructional designer" (Lawless & Brown, 1997). One of the most prominent examples of education technologies based on the principle of external control have been early Learning Management Systems, which focused on central administration of learning content, activities and assessment rather than supporting open collaboration and active learner participation. Such systems have been also termed as "institutional walled gardens in cyberspace" to emphasise the underlying principle of isolating formal and informal learning contexts and posing authoritative constraints on what learners can do in digital environments in terms of activities, resources and tools (Attwell, 2007b). Alternatively, learner-controlled uses of technologies, as embodied in the concepts of Personal Learning Environments and ePortfolios, have been postulated as means of crossing and merging multiple learning contexts by learners themselves, giving learners greater control of their learning experience in terms of learning objectives, activities, resources, tools and outcomes (Downes, 2007; Attwell, 2007b). In fact, learner control and ownership of the learning environment have been identified as core defining attributes of Personal Learning Environments (Buchem, Attwell & Torres, 2011).

This paper explores the role of ownership and control linking current discussion on Personal Learning Environments to the theoretical framework of psychological ownership by Pierce et al. (2001, 2003), exploring how individual perception of possession and control of the learning environment may influence ePortfolio practice. The paper is based on the outcomes of the review of current PLE literature (Buchem et al., 2011) and on the explorative study on control and self-control in context of ePortfolios (Mayrberger, 2011). It reports on the empirical findings from a joint study conducted at the Beuth University of Applied Sciences in Berlin and at the University of Augsburg at the beginning of 2012. The study encompasses the results of an online survey with 50 students from three different university courses, exploring the multiple relationships between ownership, control and learning in context of web-based ePortfolios.

Due to the low maturity level of the current theoretical discussion related to the role of perceived control and ownership of a learning environment for learning, as well as to the small sample size, the study has an explorative character and does not claim to be representative. The results merely demonstrate some general tendencies in the sample population linking psychological ownership to the notion of "agency" in terms of the human capacity to make choices and to impose those choices on the world. From this perspective, psychological ownership is associated with such concepts as autonomous and self-directed learning. The theoretical foundation and the empirical results of the study presented in this paper aim to further research on Personal Learning Environments.

## 2 Ownership and Control

The issue of learner control as the underlying principle of Personal Learning Environments has been discussed in terms of changes in ownership and control in comparison to previous educational uses of technologies. The shift towards greater learner control encompasses learners taking on responsibility for creating and using own learning environments, being more independent in their choices related to the goals, process and outcomes of learning, as well as being able to take decisions about connecting to different

communities and forging social relationships as part of the learning process (Attwell, 2007a, 2007b; Schaffert & Hilzensauer, 2008; Buchem et al., 2011). The existing literature, however, provides little clarity about what types of ownership and control, and in relation to what elements of the learning environment may be effective and meaningful for learners (Buchem et al., 2011).

In general, ownership and control can be seen as related concepts, both linked to the notion of agency in terms of the human capacity to make choices and to impose those choices on the world (Buchem at al., 2011). While "control" is associated with the (perceived) possibility to manipulate an environment, "ownership" expresses the feeling of being an owner of an environment. The learner can be "an owner" of a learning environment in a technical sense (e.g. uses an own server), in a legal sense (e.g. has legal rights over data and content) and in a psychological sense (e.g. has a feeling of possession). The learner can also "control" an environment without actually owning it, be in in technical, legal or psychological sense (e.g. can select sources of information, reuse and remix content within an externally controlled service). In this sense, managing an environment within certain, externally imposed constraints can be associated with personalisation or adaptation of a system rather than ownership and autonomy as proposed by the Personal Learning Environment approach (Buchem et al., 2011).

This paper focuses on the psychological perspective of ownership and control of a learning environment, exploring how the feelings of possession and perceived control of ePortfolio, in sense of a learning environment, may influence the ePortfolio use and perception of this environment as a Personal Learning Environment. The understanding of ownership and control and the relation between the two concepts underlying this paper is rooted in the theory of psychological ownership by Pierce et al. (2001, 2003). The next two sections discuss the concepts of ownership and control in context of Personal Learning Environments, and introduce the theory of psychological ownership as the theoretical foundation of the conceptual model (Section 3) and the empirical study (Section 4).

### 2.1 Ownership and Control in Personal Learning Environments

The varying degrees of control and ownership and the relationship between the two concepts are seldom distinguished in current literature related to Personal Learning Environments. There is also little clarity about what type of ownership and control (e.g. technical, legal, psychological, social) and over which elements (e.g. information, resources, data, services, etc.) are inherent to Personal Learning Environments. Some of the first attempts to analyse the concepts of ownership and control related to PLE have been undertaken by Attwell (2007b) and later by Buchem et al. (2011).

Attwell (2007b) examined the issue of ownership for different processes of ePortfolio development. The proposed threefold distinction is between (a) ePortfolio processes which are clearly "owned" by the learner (such as recognising, reflecting and presenting learning), (b) processes which are "negotiated" between learners, teachers, educational organisations (such as planning, validating, assessing and recording learning), and (c) processes which are "owned" by educational organisations and systems (such as accrediting and certifying learning).

The comparative PLE literature review by Buchem et al. (2011), based on the analysis of over 100 publications related to Personal Learning Environments, explored different conceptualisations of PLE in current literature and showed that ownership and control emerge as core categories explaining stable, latent patterns in current PLE research and practice. The study examined the concepts of "ownership" and "control" within the activity theory framework as different degrees of learner autonomy. The study distinguished between five analytic dimensions of both ownership and control in Personal Learning Environments, i.e. control and ownership of (a) learning objectives (e.g. being able to determine own learning needs, goals and outcomes), (b) learning tools (e.g. being able to can select, exploit, aggregate, organise, modify, orchestrate learning tools), (c) learning rules (e.g. being able to establish rules for storing information and content, can decide about copyright and reuse), (d) learning community (e.g. being able to create and join communities and networks), and (e) learning tasks (e.g. being able to plan own learning activities).

The conceptualisation of ownership and control as different degrees of learner autonomy have been revised for the purpose of the current study. As it appears, the five dimensions may relate to the varying degrees of control of different elements of a learning environment. Therefore, for the purpose of the study presented in this paper, the five dimensions of control related to Personal Learning Environments distinguished by Buchem at al. (2011) were used to establish a measure of perceived control. The ownership measure, however, was based on the theory of psychological ownership.

### 2.2 The Theory of Psychological Ownership

The theory of psychological ownership has been originally developed and applied in the organisational context exploring the "feeling of ownership" among employees and the link to employee engagement. Psychological ownership is defined as the psychologically experienced phenomenon in which a person develops possessive feelings for the "target" (Van Dyne & Pierce, 2004). Psychological ownership relates to the sense of possession and control (it is "mine"). Targets encompass a range of "objects of psychological attachment", such as an organisation someone belongs to, a set of tools and technologies someone uses, designs or ideas that someone has developed (Avey, et al., 2009). As such psychological ownership has a symbolic character as it develops through the connection between the self and tangible and intangible targets (Dittmar, 1996). Psychological ownership can be also viewed as a cognitive-affective state of the human condition rooted in the Western culture, in which possessions are part of the extended self (Pierce et al., 2003). From the perspective of the developmental psychology, the close connection between 'me' and 'mine' is viewed as an innate human motive to control objects, demonstrated in experiencing a psychological connection between the self and various targets of possession such as home, territory, objects, and other people (Pierce at al., 2003).

Psychological ownership as concept related to the state of being an owner and having the feeling of possession has received increased attention in a wide variety of fields, including organisational development and leadership, child development and consumer behaviour (Van Dyne and Pierce, 2004; Jeswani and Dave, 2011). A number of authors

addressed the links between psychological ownership and self-identity, self-adjustment, well-being, organisational accountability, sense of belonging, association with organisation and organisational citizenship (Pierce at al., 2001; Van Dyne and Pierce, 2004). Psychological ownership has been viewed as a positive resource for impacting attitudes (e.g. higher commitment, responsibility), self-esteem, self-efficacy, motivation, accountability, performance, sense of belongingness and self-identity (Avey, et al., 2009; Pierce et al., 2001, 2003; Van Dyne & Pierce, 2004). The results from a number of studies conducted in organisations demonstrate positive links between psychological ownership towards the organisation and employee attitudes, such as organisational commitment, job satisfaction and self-esteem, as well as positive behaviour, such as improved performance and organisational citizenship (Pierce et al., 2001, 2003; Van Dyne & Pierce, 2004).

The theory of psychological ownership conceptualises control as a prerequisite of ownership (Pierce et al., 2001, 2003). Based on the control model of ownership by Furby (1978), it is assumed that the greater the amount of control a person can exercise over certain targets, the stronger psychologically experienced ownership for those targets (Pierce et al. 2001, p. 14). Controlling targets is seen as one of the three mechanisms through which psychological ownership can emerge, besides "coming to know the target intimately", and "investing the self into the target" (Pierce et al., 2001). The theory of psychological ownership explains the motivation to control an environment in an innate need for experiencing self-efficacy: "Due to the innate need for feelings of efficacy and competence, individuals are propelled to explore and manipulate their environment. These person environment interactions may result in the exercise of control and subsequent feelings of personal efficacy and competence." (Pierce et al., 2001, p. 10).

The theory of psychological ownership considers ownership as a multi-dimensional construct encompassing (1) sense of responsibility, (2) sense of identity, (3) sense of accountability, (4) sense of self-efficacy and (5) sense of belongingness (Pierce et al., 2001). These five dimensions of psychological ownership are described below:

- Sense of responsibility for a target is viewed as an inherent part of a sense of ownership. As Van Dyne and Pierce (2004) point out, possession causes individuals to protect and defend their ownership rights. Protecting and enhancing possessions are closely related to the sense of responsibility, which may include improvements and controlling or limiting access by others. This can be observed in the organizational context, where employees having a strong feeling of ownership in an organization tend to engage in certain protective behaviors driven by the sense of responsibility (Avey et al., 2009). When people feel responsible for a target, they invest themselves into that target through energy, time and concern: "When an individual's sense of self is closely linked to the target, a desire to maintain, protect, or enhance that identity will result in an enhanced sense of responsibility" (Pierce et al., 2003, p. 30).
- Sense of identity is viewed as part of the self-concept and manifestation of psychological ownership (Avey et al., 2009). Avey et al. (2009) point that self-identity is established, maintained, reproduced and transformed through interactions with tangible and intangible possessions. Targets of ownership are often used as descriptors of self-identity, e.g. "this is my profession". In context of organizational identity, the feelings of ownership related to such targets as a job or a work team, are

closely linked to establishing identification with an organization and thus gaining a sense of meaningfulness and connectedness (Avey et al., 2009). Also possession rituals, such as displaying and personalizing own possessions, transform the culturally prescribed meaning of objects to the self-identity (Pierce et al., 2003).

- Sense of accountability defined as ''the implicit or explicit expectation that one may be called on to justify one's beliefs, feelings and actions to others'' (Lerner & Tetlock, 1999, p. 255 cited in Avey et al., 2009) is considered as an important component of psychological ownership. Accountability is manifested in expected rights and responsibilities (Pierce et al., 2003), such as the expected right to hold others accountable and at the same time in the expectation for oneself to be held accountable: "When targets of ownership are seen as an extension of the self, accountability for what happens to and with those targets has implications for what happens to and with the self" (Avey et al., 2009, p.6).
- Sense of self-efficacy, as originally defined by Albert Bandura, relates to the belief in own competencies enabling successful performance in a specific task (Bandura, 1997). The feeling of ownership is both rotted in efficacy, as the ability to control an environment gives rise to feelings of efficacy, and is accompanied by self-efficacy (Pierce et al., 2001). Avey et al. (2009) points to a number of conceptualizations of ownership and possession linking to the individual's need for self-efficacy and control of objects. In general, self-efficacy concerning a particular task, process and procedure promotes a sense of psychological ownership (Avey et al., 2009).
- Sense of belongingness is understood as a fundamental human need to belong. This encompasses both the need for a home or a place to dwell as well as the need for belonging to a group or organization (Avey et al., 2009). Feelings of psychological ownership are closely related to the attachment to places, objects and people (Pierce et al., 2001; Avey et al., 2009). Belongingness is viewed as a need to belong in the organization or in the work place: "When people feel like owners in an organization, their need for belongingness is met by 'having a place' in terms of their social and socio- emotional needs being met" (Avey et al., 2009).

Both the five dimensions of perceived control from the study by Buchem at al. (2011) and the five dimensions of psychological ownership by Pierce et al. (2001, 2003) have been used to develop the measures of control and ownership related to technology-enhanced learning environments. The conceptual model of the study is described below.

## 3 Conceptual Model and Hypotheses

This paper incorporates the concept of psychological ownership to educational context, focusing on the links between perceived control, sense of ownership of the learning environment and the quality of learning expressed in different forms of ePortfolio use. The concept of psychological ownership in Personal Learning Environments builds on the theoretical framework by Pierce et al. (2001, 2003) and on empirical studies related to psychological ownership, including Blau & Caspi (2009), Englisch et al. (2010), Gaskin &

Lyytinen (2010).

The conceptual model underlying the empirical study presented in this paper is an Antecedents-Consequences Model (ACM), in which psychological ownership is influenced by a number of factors (antecedents) and leads to certain outcomes (consequences). The AC model of psychological ownership has been successfully applied in a number of empirical studies, especially in context of organisational ownership (Mayhew et al. 2007; Englisch et al., 2010). In the proposed model, the antecedents of psychological ownership include students' perceived control of different elements of the learning environment including tools, content, design, planning and data. Thus "perceived control" is a measure of subjective perception of the degree of control of ePortfolio elements. This subjective perception is to a certain extent influenced by the instructional design of ePortfolios in formal educational settings. The consequences of psychological ownership in the conceptual model encompass different ePortfolio uses. The sense of ownership if ePortfolios is expected to be reflected in different uses of ePortfolio such as different levels of engagement and participation. At the same time higher levels of engagement, time and effort invested in ePortfolio development are considered as indicators of the quality of learning. Finally, the conceptual models is used in the study to explore the relation between the sense of ePortfolio ownership and perception of ePortfolio as a Personal Learning Environment.

Based on the assumptions described above, the Antecedents-Consequences Model, as visualised in Figure 1, encompasses three main groups of variables, i.e. (a) ePortfolio design influencing the level of perceived control (antecedents), (b) psychological ownership as a multi-dimensional construct, and (c) different ePortfolios uses indicating different qualities of learning (consequences).


**Fig. 1.** The Antecedents-Consequences-Model (ACM) of the study

The study presented in this paper focused on the three central research questions reflecting antecedents and consequences of psychological ownership in relation to Personal Learning Environments:

1. Can the measure of psychological ownership derived from research in organizational context be effectively applied to ownership of learning environments?
2. Can perceived control of the learning environment be considered as an antecedent of psychological ownership and to what extent is perceived control influenced by

ePortfolio design?
3. Can different ePortfolio uses be considered as a consequence of psychological ownership and to what extent can different ePortfolio uses indicate the quality of learning?

As the study attempts to empirically arrive at the answers to these three questions, six hypotheses were formulated:

H 1. The measure of psychological ownership derived from the field of organisational research can be effectively applied to the field of Personal Learning Environments to capture the ownership of the learning environment, such that the questions quality and reliability estimate for the survey show a good fit the context of the study.
H 2. ePortfolio design will be related to students' perception of control of the learning environment, such that learner- centered ePortfolio design will be positively related to perceived control of different elements of the learning environment.
H 3. Perceived control will be positively related to the concept of psychological ownership with its key five dimensions, i.e. responsibility, self-identity, accountability, self-efficacy, and belongingness, such that the higher the degree of perceived control, the greater the sense of ownership of ePortfolio.
H 4. Psychological ownership will be positively related to the uses of ePortfolios, such that the greater the sense of ownership of ePortfolio, the more time, energy and effort is invested in ePortfolio development and use.
H 5. ePortfolio use will be positively related to the quality of learning, such that the more time, energy and effort invested, the higher the interest and intrinsic motivation to learn.
H 6. The perception of ePortfolios as Personal Learning Environments will be positively related to the levels of psychological ownership, such that the greater the sense of ownership of ePortfolio, the stronger the perception of ePortfolio as a Personal Learning Environment.

# 4 Method and results

The results of the study presented in this paper originate from an online survey conducted at the end of winter semester, in February 2012, at the universities in Berlin and Augsburg. The survey employed items derived from the studies on Personal Learning Environments and Psychological Ownership in organisational settings. The measures employed in the study was adjusted to the context of ePortfolio use in higher education. The sections below summarise the information about study participants, measures of psychological ownership, its antecedents and consequences.

## 4.1 Study sample

The primary sample for this study was comprised of a heterogeneous sample of 67 bachelor and master students from three different courses in Berlin (two courses) and

Augsburg (one course). The two courses in Berlin[1] encompassed altogether 55 bachelor and master students of engineering and economics. The course in Augsburg[2] encompassed 12 master students of media and communication. 50 out of the 67 students invited to the survey (75 percent response rate) participated and completed the survey questions. Of those 50 participants, 45 provided information on their university course (35 from Berlin, 10 from Augsburg). 43 indicated their semester of study (63 percent studied in a semester range from 5 to 9, out of those 35 percent from 8 to 9 semesters), 43 provided information on their age (56 percent between 20 and 25 years old), gender (33 percent female) and mother tongue (93 percent German). 50 respondents indicated their highest degree (34 percent had a bachelor's degree, 32 percent a university-entrance diploma).

### 4.2 Psychological Ownership (PO)

Based on the multi-dimensional concept of psychological ownership by Pierce et al. (2001, 2003), a new measure of psychological ownership as the central concept of the study related to the sense of ownership of ePortfolios was developed using a measure proposed by Van Dyne and Pierce (2004). This instrument requires respondents to rate the extent they agree or disagree with a series of statements related to the individual employees' feelings of possession towards the organization (such as "this is my organization"). Item generation for the measure of psychological ownership towards ePortfolios was based on the comprehensive literature review on psychological ownership and discussions about the applicability of the concept in context of technology-enhanced learning.

The following five dimensions of psychological ownership related to ePortfolios were identified and measured: (1) sense of responsibility, (2) sense of self-identity, (3) sense of accountability, (4) sense of self-efficacy, and (5) sense of belongingness. The survey items were generated to represent the five theory-driven components of psychological ownership. Individual items were assigned to respective categories and five items were selected for the survey as best capturing the concept of psychological ownership in context of ePortfolio use. Students were required to indicate the extent to which they agree or disagree with a series of statements measured via a 6-point Likert-type scale (1 = strongly agree; 6 = strongly disagree). The table below summarises the five dimensions of psychological ownership (Table 1).

**Table 1.** The measure of Psychological Ownership (PO)

| No. | Dimensions of PO | Survey items |
|---|---|---|
| 1 | Sense of responsibility | 1.1 I was happy to take the responsibility for creating my ePortfolio. |
| 2 | Sense of self-identity | 1.2 I can identify with my ePortfolio. This is my creation. |

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| | | |
|---|---|---|
| 3 | Sense of accountability | 1.3 I am proud of my ePortfolio. |
| 4 | Sense of belongingness | 1.4 I have a feeling that the ePortfolio I created is mine. It belongs to me. |
| 5 | Sense of self-efficacy | 1.5 In my ePortfolio work I had the feeling I could handle difficult situations (tools, topics). |

Descriptive statistics reveal values indicating middle to upper levels of psychological ownership with the average value *m = 2.34* across all five dimensions of psychological ownership. The highest values were reached for "sense of belongingness" with *m = 2.10* and "sense of self-identity" with *m = 2.24* and. The lowest values were reached for "sense of accountability" with *m = 2.64*. In general, it can be assumed that students developed a sound sense of ownership of their ePortfolios and felt it was something that belonged to them and something they could identify with. In order to explore the underlying component structure of psychological ownership, bivariate relationships between all five items have been examined. All bivariate correlations proved significant at the 0.01 level (2-tailed). The five- dimensional construct was validated by means of the factor analysis, i.e. Principal Component Analysis based on Eigenvalues greater than 1 and Varimax rotation. Only one component was extracted. Extraction communalities were all high ranging from .783 for "sense of self-efficacy" to .947 for "sense of responsibility", indicating that the extracted component represents the variables well. This component (FAC1_1) was used as the measure of psychological ownership in further analysis. The alpha coefficient (Cronbach's alpha) for the scale based on the reliability analysis was $\alpha = .94$, indicating a high internal consistency of the psychological ownership scale.

### 4.3 Perceived Control (PC)

The ePortfolio design in all three courses participating in the study was learner-centered, strongly oriented towards granting a high level of autonomy to learners. The overall aim of working with ePortfolios in the three courses was to enhance self-directed learning and learner control of the learning environment. However, the intended learner-centered design may be perceived differently by different students. Thus perceived control of ePortfolios was measured to explore subjective perceptions of students. The concept of perceived control (PC) encompassed seven dimensions of control of a learning environment and was measured with items derived from the research by Buchem et al. (2011). The seven dimensions were: (1) control of technology, (2) control of objectives, (3) control of content, (4) control of planning, (5) control of design, (6) control of access rights, and (7) control of personal data. Originally, eight items were generated to measure the concept of perceived control. There were two items measuring access rights, i.e. "I could decide about who can read my ePortfolio contributions", and "I could decide you can see my ePortfolio". However, the second item was removed as it contributed little to the explanation of the overall variance. Table 2 summarises the measure of perceived control.

**Table 2.** The measure of Perceived Control (PC)

| No. | Dimensions of PC | Survey Items |
|---|---|---|
| 1 | Control of technology | 2.1 I could decide about the technical tools for my ePortfolio. |
| 2 | Control of objectives | 2.2 I could decide about the objectives of my ePortfolio contributions. |
| 3 | Control of content | 2.3 I could decide about the content of my ePortfolio contributions. |
| 4 | Control of planning | 2.4 I could decide about the when I post my contributions and how long I do ePortfolio work. |
| 5 | Control of design | 2.5 I could decide about the visual and structural design of my ePortfolio. |
| 6 | Control of access rights | 2.6 I could decide about who can read my ePortfolio contributions. |
| 7 | Control of personal data | 2.7 I could decide about what happens to my personal data in my ePortfolio. |

In general there were high values for all variables representing the construct of control and thus indicating that the ePortfolio design, which was aimed at supporting learner-centered and autonomous technology-enhanced learning, was reflected in students' perceived high control of the elements of the learning environment. The level of perceived control of ePortfolio was between high ("2" = agree) and very high ("1" = strongly agree). The average value (mean) across the seven items was $m = 2.1$ indicating a relatively high level of perceived control. The highest values were reached for "control of content" and "control of planing" with $m = 1.70$, and for "control of design" with $m = 1.84$. The lowest values were reached for "control of technology" with $m = 2.82$ and "control of personal data" with $m = 2.51$. These results indicate that students felt they could to a high degree decide about the planing of their ePortfolio work and the content of their ePortfolio contributions, but had less sense of control of the technical tools they used and of their personal data, which may be both related to one another.

This seven-dimensional construct was validated using factor analysis (Principal Component Analysis with Eigenvalues greater than 1 and Varimax rotation). In the first analysis two components were extracted, i.e. Component 1 related to the control of tangible targets (encompassing item 1.1 "I could determine the technical tools for my ePortfolio") and Component 2 related to the control of intangible targets (encompassing all other items, including objectives, content, planning, design, access rights and personal data. The new analysis indicated that the extracted Component 2 (FAC1_2) represents the variables well. The two components were used as measures of perceived control of tangible and intangible targets in further analysis. The alpha coefficient for the scale of control of intangible targets was $\alpha = .86$, indicating a high internal consistency of the scale. The calculation of Cronbach's Alpha indicated that no significant improvement in the internal consistency could be reached if any of the six items was removed from the scale.

### 4.4 ePortfolio Use (PU)

The Antecedents-Consequences-Model of the study considers ePortfolio use as a consequence of personal ownership. This is based on the assumption that the sense of possession or feeling an owner of a target contributes to the ePortfolio owner's engagement, creativity, intrinsically-oriented and interest-based motivation. The concept of ePortfolio use comprised six dimensions, i.e. (1) time invested, (2) engagement, (3) creative design, (4) interest orientation, (5) self- direction, (6) intrinsic motivation, (7) continued ePortfolio use, and (8) new ePortfolio use (Table 3).

**Table 3.** The measure of ePortfolio Use (PU)

| No. | Dimension of PU | Survey Items |
|---|---|---|
| 1 | Time invested | 3.1 I was happy to invest time and energy to my ePortfolio. |
| 2 | Engagement | 3.2 I worked more on my ePortfolio than was required by my course leader. |
| 3 | Creative design | 3.3 I was creative in designing my ePortfolio (e.g. realising my own ideas, trying out something new). |
| 4 | Interest orientation | 3.4 I worked with my ePortfolio based on my interests within the context of the seminar. |
| 5 | Self-direction | 3.5 I have a feeling, with my ePortfolio I was learning for myself rather than for the course leader. |
| 6 | Intrinsic value | 3.6 The ePortfolio work was more important for me that the grade at the end of the course. |
| 7 | Continued use | 3.7 I will probably keep working with my ePortfolio after the course. |
| 8 | New use | 3.8 It is probable that I will create a new ePortfolio after the course. |

On the average, the quality of ePortfolio use across all eight items reached the average mean of $m = 3.05$. The highest values were reached for "interest orientation" with $m = 2.33$, "creative design" with $m = 2.44$ and "self-direction" in ePortfolio use with $m = 2.63$. The lowest value was reached for the intrinsic motivation to use ePortfolio with $m = 3.79$ indicating that ePortfolio use in the context of the university course is guided more by external awards rather than by the inner value of ePortfolio work itself. The low value of $m = 3.61$ for the "continued use" indicates that students do not plan to use a course ePortfolio after the course is finished. The values for "new use" are not much higher with an average of $m = 3.33$, showing that it is not very likely that students will create new ePortfolios after the course. The reasons could be multifold, such as perceiving ePortfolios as time-consuming or missing motivation to create ePortfolios outside of the requirements of the course. However, these aspects could not be explored within the study.

The eight-dimensional construct of ePortfolio Use (PU) was validated using factor analysis. First, bivariate relationships between all five items have been examined. All bivariate correlations proved significant at the 0.01 level (2-tailed). The Principal

Component Analysis based on Eigenvalues greater than 1 and Varimax rotation extracted only one component with high communalities (Table 10). The alpha coefficient for the scale was $\alpha = .92$, indicating high internal consistency. The calculation of Cronbach's Alpha indicated that the internal consistency of the scale would deteriorate if any of the eight items was removed from the scale. Based on these results, the component FAC1_3 was used as the measure of ePortfolio use in further analysis.

### 4.5 Antecedents and Consequences of Psychological Ownership

The Antecedents-Consequences-Model of the study as described in Section 2 included a number of antecedent and consequence variables of Psychological Ownership (Table 4).

**Table 4.** Antecedents and Consequences of Psychological Ownership

| Antecedents<br>Perceived Control (PC) | Psychological Ownership (PO) | Consequences<br>ePortfolio Use (PU) |
|---|---|---|
| 2.1 Control of technology 2.2 Control of objectives 2.3 Control of content 2.4 Control of planning 2.5 Control of design 2.6 Control of access rights 2.7 Control of personal data | 1.1 Sense of possession 1.2 Sense of self-identity 1.3 Sense of accountability 1.4 Sense of self-efficacy 1.5 Sense of belongingness | 3.1 Time investment 3.2 Engagement 3.3 Creativity and design 3.4 Interest-orientation 3.5 Self-direction 3.6 Intrinsic motivation 3.7 Continued use 3.8 New use |
| Two Components: 1.1 and FAC1_2 | One Component FAC1_1 | One Component FAC1_3 |

The two central hypotheses related to the relation between Antecedents and Consequences of PO were:

- H2: Perceived Control (PC) will be positively related to Psychological Ownership (PO).
- H3: Psychological Ownership (PO) will be positively related to ePortfolio Use (PU).

These two hypotheses were tested using correlation and regression analysis. The results are discussed below:

**Perceived Control (PC) as predictor of Psychological Ownership (PO).** In the first step, bivariate correlations between the single variables representing the constructs "Perceived Control (PC)" and "Psychological Ownership (PO)" were computed to explore the relationships between the single dimensions. However, there were only a few significant correlations, such as between "control of content" and "sense of responsibility" (r = *.582),* "control of personal data" and "sense of self efficacy" (r = *.563),* "control of personal data" and "sense of belongingness" (r = *.542),* "sense of belongingness" and

"control of access rights" (r = *.567),* "sense of belongingness" and "control of planning" (r = *.560).* These results indicate that psychological ownership of the learning environment is related especially to the perceived control of content, planning, personal data and access rights.

In the second step, correlations of antecedent components and the combined measure of psychological ownership component were computed to explore the relationship between perceived control and ownership of the learning environment. The correlation between the component "control of intangible targets" (FAC1_2) and "psychological ownership" (FAC1_1) is significant at the 0.01 level with the correlation coefficient *r = .642.* On the contrary, the correlation between the one-dimensional component "control of tangible target" (technical tools) and "psychological ownership" (FAC1_1) is not significant at the 0.01 level.

In the third step, regression analysis with the measure of personal ownership as dependent variable (FAC1_1) and the antecedent components "control of tangible targets" and "control of intangible targets" were computed. The regression model explains almost 45% of variance (R Sq = .440). The component "control of intangible targets" alone explains 41% of variance (R Square = .412). The analysis of the scatterplot for the regression analysis of Model 1 with "control of intangible targets" (FAC1_2) and "psychological ownership" (FAC1_1) shows a clear positive relation between these two variables. The positive slope of the regression line indicates the positive relation between perceived control of intangible ePortfolio elements (content, planning, design, access right and personal data) and psychological ownership.

*Prediction:* The results of the correlation analysis indicate that control of technology does not have any significant effects on the sense of ownership of the learning environment. This prediction was tested using linear regression analysis. The results of the regression analysis seem to support this prediction, indicating that perceived control of technical tools used to create ePortfolios is a poor predictor of the sense of ownership of ePortfolio (R *Sq = .034)*.

*Key findings (1):* Given the data, it appears that Hypotheses 2: Perceived Control will be positively related to Psychological Ownership, can be confirmed only for perceived control of intangible ePortfolio elements such as content, planning, design, access rights. At the same time, there seems to be no significant relation between the control of the tangible targets, such as technical tools, and the sense of ownership of ePortfolio.

**Psychological Ownership (PO) as predictor of ePortfolio Use (PU).** In the first step, bivariate correlations between the single variables representing "Psychological Ownership (PO)" and "ePortfolio Use (PU)" demonstrate a number of highly significant positive correlations. Strong relationships were measured between the following variables:

- "Sense of responsibility" (PO) and "time invested" (PU) with *r = .817,* indicating that the more responsible students feel for their ePortfolios the more time they invest in ePortfolio work; "Sense of self-identity" (PO) and "time invested" (PU) with *r = .758,* indicating that the more students identify with their ePortfolios the more time they invest in ePortfolio work;
- "Sense of accountability" (PO) and "creative design" (PU) with *r = .786,* indicating

that the more students feel accountable, e.g. they take pride in their ePortfolios, the more creative they are designing own ePortfolios;

- "Sense of responsibility" (PO) and "self-direction" (PU) with *r = .753,* indicating that the more responsible students feel for their ePortfolios, the stronger the feeling that they learn to meet own goals rather than the requirements of the course.
- "Sense of self-identity" (PO) and "self-direction" (PU) with *r = .753,* indicating that the more students identify with their ePortfolios, the stronger the feeling that they learn to meet own goals rather than the requirements of the course.

In the second step, correlations of component "psychological ownership" (FAC1_1) and "ePortfolio Use" (FAC1_2) were computed to explore the relation between these two components. The result was a highly significant correlation coefficient *r = .845* at the 0.01 level.

*Prediction:* The results of the correlation analysis indicate that especially sense of responsibility, sense of self-identity and sense of accountability as components of psychological ownership contribute to the quality of ePortfolio use. In general, psychological ownership may have a significant influence on the quality of ePortfolio use. This prediction was tested using linear regression analysis. The results indicate that psychological ownership is a good predictor of the quality of ePortfolio use (R *Sq = .71),* explaining over 70% of variance.

In the third step, three linear regressions were computed for the variables of psychological ownership and ePortfolio use based on the strength of the correlation coefficients. The first model tested sense of responsibility, sense of self-identity and sense of accountability as predictors of invested time in ePortfolio use (R *Sq = .65)* The second model tested sense of self-identity and sense of accountability as predictors of creative ePortfolio design (R *Sq = .59).* The third model tested sense of responsibility and sense of self-identity as predictors of self-direction in ePortfolio use (R *Sq = .56).* These results indicate that there are a number of strong relationships between psychological ownership of the learning environment and the way this environment is used for learning.

*Key findings (2):* Given the data, Hypotheses 3: Psychological Ownership (PO) will be positively related to ePortfolio Use (PU), could be confirmed in the study. In particular, sense of responsibility, sense of self-identity and sense of accountability appear to be strong predictors of how much time is invested in creating own ePortfolios, creative design and self-directed ePortfolio use.

**ePortfolio Use and Quality of Learning (Hypothesis 4)**. In order to explore the relationship between ePortfolio use and the quality of learning, bivariate correlations were computed for the component "ePortfolio use" (eight variables) and the variables measuring the interest for the subject matter, perceived appropriateness of presentation of own competencies, demonstration of what one has learned, fairness of ePortfolio as an assessment method and perceived appropriateness of rate of personal investment to the personal benefit of ePortfolio use. The results indicate significant relationships, between ePortfolio use and (1) the increase of interest in subject matter (r = *821),* (2) the perceived possibility to present own competencies well (r = *.739),* (3) the possibility to demonstrate what one has learnt in an appropriate way (r = *.689)* and (4) the rate of personal

investment to the personal benefit of ePortfolio use (r = *587)*. Based on the results of the correlation analysis, four models were tested using regression analysis, with each analysis indicating a good model fit with R Sq > .580.

*Key findings (3):* The results indicate that the measure of ePortfolio Use proves to be a good predictor of the increase of interest in subject matter, perceived appropriateness of ePortfolio to present own competencies and demonstrate of what one has learned.

## 5 Discussion of results and further research

The research presented in this paper focused on three central questions in relation to the antecedents and consequences of psychological ownership in relation to Personal Learning Environments based on the example of ePortfolio use in higher education. The three questions were:

1. Can the measure of psychological ownership be applied to describe ownership of learning environments?
2. Can perceived control predict psychological ownership, i.e. to what extent is ownership influenced by control?
3. Can psychological ownership predict ePortfolio use and how is ePortfolio use related to the quality of learning?

The data obtained from a survey with 50 students in three different university courses was analyzed based on the Antecedents-Consequences-Model (ACM) of Psychological Ownership (PO). Based on this model, five hypotheses derived from the three questions were empirically tested by capturing perceived control of the learning environment as an antecedent and ePortfolio use as a consequence of psychological ownership. The results of the study and recommendations for further research are discussed below in relation to the five hypothesis tested in the study:

- **Measure of psychological ownership:** The first hypothesis was that the measure of psychological ownership derived from the field of organisational research can be effectively applied to the field of Personal Learning Environments to capture the ownership of the learning environment, such that the questions quality and reliability estimate for the survey show a good fit the context of the study. The five-dimensional measure of psychological ownership used in the study proved to be a reliable instrument capturing psychological ownership of a learning environment. The reliability of the scale was based on the measure internal consistency (Cronbach's alpha). The estimates for the scale of psychological ownership based on the reliability analysis was $\alpha = .94$, indicating a very good reliability of the scale. The scale was based on reliable research instruments already applied in the research related to psychological ownership in organisational settings. The survey items were adjusted to fit the context of the study, including the focus on ePortfolios, the target group of students and the context of higher education. In sum, the fit of the questionnaire appears to be very good and sufficient for the purpose of the study.

However, replication in further research and other measures of reliability would be necessary to validate the qualities of the proposed scale. In general, the results show that the measure of psychological ownership as applied in the study and derived from research conducted in organizational context can be effectively applied to capture psychological ownership of technology-enhanced learning environments such as ePortfolios in context of higher education.

- **ePortfolio design and perceived control:** The second hypothesis was that ePortfolio design will be related to students' perception of control of the learning environment, such that learner-centered ePortfolio design will be positively related to perceived control of different elements of that learning environment. This hypothesis could not be systematically tested in the study. However, the high values reached for all variables representing Perceived Control (PC) indicate that learner-centered ePortfolio design as intended by course leaders was reflected in students' perceived control of different elements of the learning environment. The single values and the mean across the seven items measuring perceived control (m *= 2.1)* indicate that students felt in control of their ePortfolios, especially in terms of content and planing (m *= 1.70)* and design (m *= 1.84)*. At the same time, students felt they had less control of their personal data (m *= 2.51)* and of the technical tools they used to create ePortfolios (m *= 2.82)*. As students in the three courses participating in the study used different web-based tools, such as externally hosted blogs (e.g. WordPress) and wikis (e.g. PBWiki) but also an ePortfolio system hosted at the university (i.e. Mahara), the results could indicate that students feel in general less in control of technology and personal data when using web tools. Further analysis, which is not included in this paper, will be conducted to explore differences in perceived control in relation to media used.
- **Control and ownership:** The second hypothesis was that perceived control will be positively related to psychological ownership, such that the higher the degree of perceived control, the greater the sense of ownership of ePortfolio. The results of the study indicate that there is a difference between control of tangible (technology) and intangible ePortfolio elements. On the one hand, the tangible ePortfolio elements such as technical tools that students used to create their ePortfolios (WordPress, PBWorks, Mahara), do not influence the sense of ownership of one's own ePortfolio. This means that students may feel owners of their ePortfolios, even if they do not feel in control of technology they use. On the other hand, the intangible ePortfolio elements, such as control of learning objectives, content, planning and design of one's ePortfolio have a significant influence on whether students feel as owners of their ePortfolios or not. This is an intriguing result, which is contradictive to the assumption that perceived control of technology influences the sense of ownership of a learning environment. This could mean that it is more important for students to be able to take decisions about planing, content or design of their ePortfolios rather than be able to decide which tools to use to create and develop their ePortfolios. In the present study, the control of technology was conceptualised as the ability to take decision about which tools to use to create ePortfolios. However, there are certainly other forms of control of technology in learning environments. Therefore the preliminary results indicating no significant influence

of perceived control of technology on the sense of ownership of a learning environment should be tested in further studies in order to cast some more light on what forms of technology control can be distinguished and whether they influence the sense of ownership of a learning environment and in consequence its use for learning.

- **Sense of ownership and ePortfolio use:** The fourth hypothesis was that psychological ownership will be positively related to the uses of ePortfolios, such that the greater the sense of ownership of ePortfolio, the more time, energy and effort is invested in ePortfolio development. The result of our study indicates the overall strong relationship between psychological ownership and ePortfolio use. Based on the theoretical ACM model of psychological ownership, it was assumed that psychological ownership can predict ePortfolio use. Indeed, the results of the regression analysis indicate a good fit in a number of postulated models. In particular, sense of responsibility, sense of self-identity and sense of accountability as dimensions of psychological ownership prove to be strong predictors of how much time is invested in working with ePortfolios, designing ePortfolios in a creative way and following a self-directed learning path rather than creating ePortfolio only to meet the requirements of the course. These results indicate that it is important for educators to support students in developing a sense of ownership of their ePortfolios in order to foster a more intrinsically- oriented and self-directed ePortfolio practice. Besides educational implications, there remains an open questions about whether it is psychological ownership that influences ePortfolio use. For example it seems plausible that both creative design influences the sense of self-identity and that the sense of self-identity influences creative design. It may be that these are reciprocal effects which cannot be measured using simple linear regression models. The fact remains, however, that there exist a number of highly significant relations between psychological ownership and ePortfolio use. The direction of influence should be tested in further research studies.
- **ePortfolio use and quality of learning:** The fifth hypothesis was that ePortfolio use will be positively related to the quality of learning, such that the more time, energy and effort invested, the higher the interest and intrinsic motivation to learn. The results show that the eight-dimensional component "ePortfolio Use" proves to be a good predictor of the increase of interest in the subject matter, perceived appropriateness of ePortfolio to present own competencies and demonstrate what one has learned. ePortfolio use was also related to students' perception that their personal investment was adequate to their personal benefit from ePortfolio use (i.e. positive "return on investment"). On the whole, the results seem to confirm the hypothesis indicating that the more time, energy and effort invested in ePortfolio work, the higher the interest in subject matter, intrinsic motivation to learn and personal benefit, be it in terms of presenting own competencies or demonstrating what one has learnt in an effective way.
- **ePortfolio as Personal Learning Environment:** The sixth hypothesis was that the perception of ePortfolios as Personal Learning Environments will be positively related to the levels of psychological ownership, such that the greater the the sense of ownership of ePortfolio, the stronger the perception of ePortfolio as a Personal

Learning Environment. The results indicate that psychological ownership of a learning environment is related especially to the perceived control of content, planning, personal data and access rights. Based on these results it can be assumed that students may perceive their ePortfolios as (part of) their Personal Learning Environments, especially when they feel in control of intangible aspects, e.g. when they can take decisions about the objectives and the content of their contributions, when they can decide about planning, as well as management of personal data and access rights. At the same time, the results indicate that students perceive their ePortfolios as (part of) their Personal Learning Environments even if they do not feel in control of the technical tools as tangible aspects of ePortfolio practice. This finding seems plausible, if we consider that in most cases the users of web-based tools do not in fact have full control over the technology they use. For example having an own blog at wordpress.com means being able to decide about such intangible aspects as content, access or frequency of contributions, but having less control over the system itself. Nevertheless, this finding should be tested in further studies in order to explore in more detail what types of technology control may influence the perception of a learning environment as a Personal Learning Environment.

To summarise, the research study presented in this paper demonstrated some significant relationships between perceived control, sense of ownership and uses of a learning environment based on the example of ePortfolios in context of higher education. To the best knowledge of the author of this paper, this is the first study which incorporates the research on psychological ownership from organisational to educational settings. In doing so, the study succeeds in adapting and applying the measure of psychological ownership to capture students' sense of ownership of ePortfolios. At the same time, the study employs two further measures, i.e. the measure of perceived control and ePortfolio use, both showing a good fit with the goals and context of the study. All three measures can be used and improved in further studies in order to progress research on Personal Learning Environments. Moreover, it is recommended to explore the role of psychological ownership for the perception of other technology-enhanced learning environment as (parts of) Personal Learning Environments. Further research should focus on the influence of psychological ownership of a learning environment on the use of this environment and consequently on the quality of learning.

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# PLE-based ePortfolios: Towards Empowering Student Teachers' PLEs through ePortfolio Processes

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**Abstract.** In this article, according to Cambridge, we try to argue building the networked self improve and empower the construction of eportfolios at the same time that they involve empowering the construction of each student's personal learning environment. As Barrett says, we posit that Web 2.0 tools are suitable tools for the creation of artefacts in the first step of the construction of eportfolios. As stated by Shepherd and Skrabut, we try to argue as well, that these tools that encourage networking and empowering students' PLE, contribute to eportfolio sustainability. Finally, we argue that eportfolios and PLEs have also their main processes in common.
We analyse the use of Web 2.0 tools for the creation of artefacts in our eportfolio case study. Although we cannot prove our students' eportfolio sustainability, at this point of our on-going project of eportfolios in Teacher Education, at the University of the Balearic Islands, Ibiza headquarters, we can still analyse our students' beliefs in the role of technology in their learning and in their teacher identity, which is still in construction. As we said last year, during the first school year of implementation, there was a large group of students with a negative attitude towards technology, although we can now say that most of them have evolved considerably. Some of them still think that technology fails to enrich their own learning process but in spite of this fact, all of them appreciate that the introduction of technology will have a positive effect on their teaching in the future.

**Keywords:** eportfolio, PLE, Web 2.0, teacher education, PLE-based eportfolios

## 1 Introduction

Zubizarreta does not see the influence of technology as disrupting for eportfolio methodology, as can be understood from these lines:

"The landscape of portfolio development has expanded astonishingly with the advent of multimedia, hypermedia, database structures, "mashup" applications, blogging and social networking, and more innovations in the digital word. Though the media have changed from print on paper to electronic hypertext and cyberspace the fundamental process of learning portfolio development remains steadfast" (Zubizarreta, 2009, 64)."

Cambridge argues that technology has a key role in the construction of eportfolios as can likewise be understood from these lines:

"Not only can technology contribute significantly to each stage of the composition and use of eportfolios, but it can also play a central role in the eportfolio as a composition, become part of its content, and shape the way readers use it to create meaning" (Cambridge, 2010, 188)

Other authors also consider the beneficial and critical influence of technology on the construction of eportfolios. For instance, Yancey (2004) and Tosun and Baris (2011) focus on the possibility for complex organisation and text composition that hypertext offers to the construction of eportfolios. But the influence of technology on the construction of eportfolios can focus especially on the empowerment of students' PLEs.

## 2 ePortfolios and PLEs: a Strong Relationship

### 2.1 Common Processes and Tools

It could be argued that the strong relationship of eportfolios and PLEs can be demonstrated both through the use of tools and through the learning processes involved in each.

On the one hand, the use of tools to document and collect learning in the construction of eportfolios can empower students' PLEs.

As Yancey (2004) argues that not all kinds of electronic portfolios can enhance the composition process of eportfolios, in the same way it could also be argued that these electronic portfolios do not enhance the construction of PLEs either. Therefore, it can be argued that both the electronic lineal documents and online assessment systems for the construction of eportfolios do not enhance either the writing process or the use of Web 2.0 tools. However, Yancey (2004, 750) claims that other software can work as a "gallery" empowering multiple and complex contexts, forms of display, connexions and relationships. Thus, this kind of eportfolio software, which can be understood as Web-based eportfolios, could also be considered a way of empowering students' PLE.

According to Barrett (2009, 2010, 2011) there are three different steps in the construction of eportfolios that develop in a continuum from a chronological to a thematic eportfolio. The first one is based on the construction of artefacts and the second step focuses on the chronological collection of these artefacts accompanied by a reflection based on that single learning. These two steps have learning as a main objective: documenting learning and reflection for learning. Finally, the third step is based on the activity of reorganizing all the collected evidence in new thematic blocks such as competence-based or goal-based topics. The aim of this last step is presenting learning, for example, for assessment, and this is why it is referred to as a showcase or assessment eportfolio. The reflection in this last step is not based on a single piece of evidence but learning process as a whole. Therefore, it seems that the first step, which consists of the construction of artefacts, involves enhancing students' PLEs. While she mostly talks about audio, video and other presentations tools, in this article it is argued, particularly, that Web 2.0 tools allow the creation of a wide range of artefacts.

Cambridge (2009, 42) argues that there are two selves in the construction of an eportfolio, the networked and the symphonic self. The first one is focused on networking, connecting artifacts and gadgets, quickly collecting evidence of learning and a brief reflection during the learner's daily life. The selection of tools for networking is in itself a process that communicates about the learner's owns identity. All these activities are integrated into everyday life, which means that this self is based on chrono-

logical documentation of learning, just like the first two steps in Barrett's model. The symphonic self reorganizes all this daily and messy activity into thematic topics so that learners can show authenticity and integrity (Cambridge, 2009, 2010) in their identity as learners, which is a challenging goal for eportfolio authors. This self needs time and calmness for deep reflection that can help to connect artefacts and evidence among themselves and give a global vision of the whole learning process, again just like the third step in Barrett's model. Therefore, while the second focuses on achieving "integrity" (Cambridge, 2009, 42), the first one focuses on the integration of blogs and social software in the eportfolio processes, which can be argued again as enhancing students' PLEs.

Moreover, Cambridge (2010, 199) also claims that "the tools that support eportfolio practice can be seen as a subset of the technology that supports learning more generally". Therefore, the selection of tools has to be made considering various eportfolio processes, which he considers to be five: capture, management, reflection, synthesis and analysis.

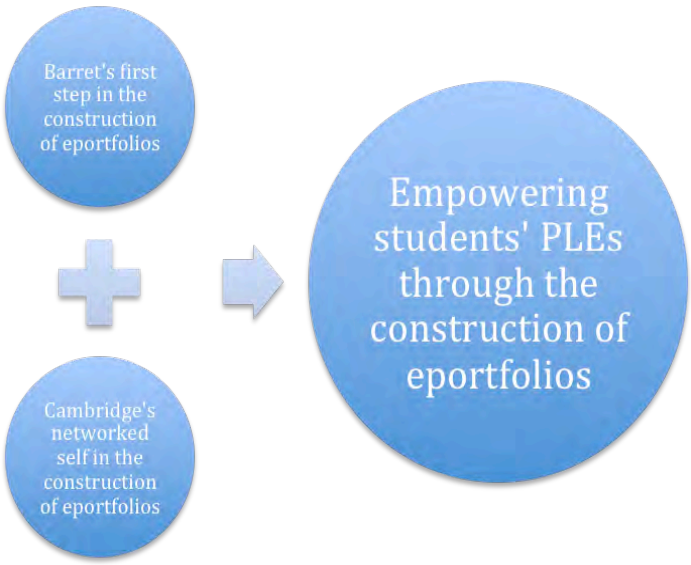



**Fig. 1.** Empowering PLEs through the use of technology in the construction of eportfolios

For Shepherd and Skrabut (2011, 34) a way to ensure eportfolio sustainability is through the integration of PLEs "to extend individual considerations into eportfolio tasks". PLE-based eportfolios can be more compatible with the ever-changing needs of education, and can also provide greater flexibility. However, some other problems have arisen due to the integration of PLEs into eportfolio tasks, such as anxiety about the instability of tools and privacy issues.

Nonetheless, there are some habits in the networked self that can also be drawbacks for the construction of eportfolios, especially the ones related to blogging habits that differ from typical eportfolio composition. Typical eportfolio composition is "updated less frequently" (Cambridge, 2010, 177) while blogging habits make users blog continuously.

On the other hand, the typical eportfolio processes can also enhance students' PLEs and PLEs can empower the construction of eportfolios. In fact, eportfolios and PLEs have their main processes in common as is argued in the following paragraphs.

Zubizarreta (2009) says that there are three main processes in the construction of portfolios, whether they are paper-based or paper-less portfolios: documenting, reflecting and collaborating. Adell and Castañeda (2010), following Attwell (2007), argue that there are three processes: reading, reflecting and sharing. So, firstly, reflecting on learning is a basic process which eportfolios and PLE have in common. However, some slight differences in both reflection processes can also be observed. In eportfolios, reflection is generally aimed at developing metacognition skills. In PLEs, reflection may also involve the processes of creating, writing, analysing and publishing. Thus, reflection in PLEs also includes the documentation process of eportfolios. Secondly, collaborating and sharing are also processes with a lot in common, although sharing might be something wider than collaborating, because sharing refers to publishing on the web whereas collaborating, in Zubizarreta's model, refers to the relationship between students and teachers through eportfolios. Finally, reading is the process that is part of the PLE process and not of the eportfolio process. Anyway, it is the key element for optimal reflection processes. Thus, the reading process of PLEs guarantees the access to the best sources of information that can enhance further learning processes.

The agreement of processes between eportfolios and PLEs is graphically demonstrated in the following figure:

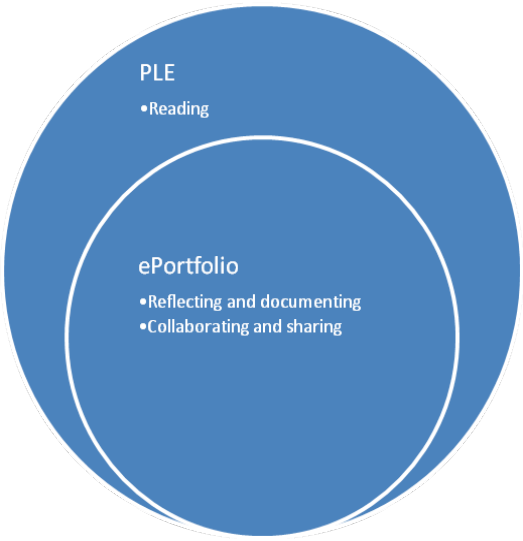



**Fig. 2**. Processes in common in eportfolios and PLEs

From this evidence of the similarity of eportfolio and PLE processes, it can also be argued that PLE tools enhance eportfolio processes as well. Starting from Adell and Castañeda's definition (2010) of PLEs, there are three kinds of tools: to access information, to create and edit information and to share with others. If tools to access information can support the reflection process in PLEs, they can also support the reflection process in eportfolios. Tools to share information in PLEs can also support the

collaboration process in eportfolio. And finally, although tools to access information do not support any eportfolio process directly, they are capital as they promote a greater quantity and quality of information sources than can improve documented learning in eportfolios. The following figure shows graphically how PLE tools can also improve eportfolio processes:

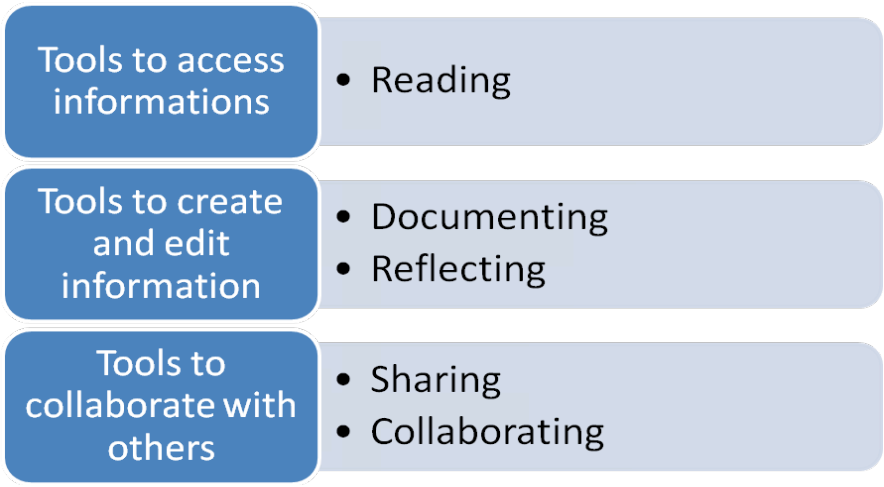



**Fig. 3.** PLE tools to support eportfolio and PLE processes

### 2.2 The Self-Regulated Learning Cycle: an Aim in Common?

There are two research programs that have attributed the same aim to eportfolios and PLEs: the self-regulated learning cycle conceptualized by Zimmerman (2000). Abrami et al. (2008) argue that eportfolios encourage self-regulated learning and Dabbagh and Kisantas (2012) state the same about PLEs. However, further research is needed to show more evidence, as the first research failed to prove its hypothesis with the data obtained, and the second was not tested empirically.

Zimmerman's self-regulated learning cycle has got three phases as Abrami et al. (2008) and Dabbagh and Kisantas (2012) have stated: the forethought phase, the performance phase and the self-reflection phase. Dabbagh and Kisantas (2012) developed a pedagogical framework of three levels to work on this cycle through the devolpment of students' PLEs. Their three levels are typically eportfolio processes as well. Level 1 is about creating a space for learning and managing content. The second one is about engaging "in basic sharing and collaborative activities" (Dabbagh and Kisantas, 2012, 6). Finally, the third level involves documenting learning and reflecting on it, as can be understood from this quote: "instructors encourage students to use social media to synthesize and aggregate information from level 1 and level 2 in order to reflect on their overall learning experience" (Dabbagh and Kisantas, 2012, 6). Therefore, as the main activity of each level of this theoretical framework of self-regulated learning in PLEs is based on typical eportfolio activities too, it could be argued that Zimmerman's cycle can be worked both from an eportfolio or a PLE point of view.

## 2.3 General Conceptual Revision

To conclude, a general conceptual revision of this relationship can also be argued. Ravet and Attwell (2007) define the eportfolio as the DNA of POLEs, acronym that joins together Personal and Organizational Learning Environments. ePortfolio is the identity card of people and organizations that manage their own learning in a distributed learning environment, beyond LMS. Ravet and Attwell (2007) defined and summarised the relationship of eportfolios and PLEs or POLEs as follows:

"To use a biological metaphor, one could say that the ePortfolio is the DNA of the PLE: it is what makes the PLE what it is. Without an ePortfolio a PLE is nothing more than a glorified LMS or VLE. The raison d'être of a PLE (POLE) is to create the learning space/landscape where the person (organisation) will construct his/her (its) identity, the ePortfolio being the synthesised representation of this identity leading to further learning and transformation. The ePortfolio is a DNA in constant mutation, reflecting the constant transformation that learning carries" (Ravet and Attwell, 2007).

Later Attwell (2007, 57) discusses the implications of this biological metaphor and states that eportfolios would be "on a developmental continuum, both technically and pedagogically".

Accepting the validity of these statements, we also claimed in the Master's thesis presented last year, that eportfolios are the central part of PLEs. PLEs are about reading, creating, connecting and sharing but eportfolios are about making all these processes significant for one's own learning. Therefore, following the biological metaphor coined by Ravet and Attwell (2007), it could also be argued that eportfolios are the heart of PLEs. The following graphic was designed to show this relationship between eportfolios and PLEs (Tur, 2011a):


**Fig. 4.** ePortfolios as the heart of PLEs. Tur (2011a)

# 3 Case study

Students of Teacher Education at the University of the Balearic Islands, Ibiza headquarters, are integrating eportfolios into the curriculum as a whole. It means that each semester, there is at least, one subject whose assessment is linked to the eportfolio. The eportfolio software is based on Web 2.0 tools, so students are at the same time, extending their PLE. There are two main aims for this project: the first is that students document their learning at University in their eportofolio, and at the same time, extend their PLE. The second aim is that students, while building their own eportfolio and extending their PLE, are developing positive attitude towards technology in their current learning and future teaching.

## 3.1 The Group of Students

The participants are a group of student teachers consisting of of thirty students in the first year and twenty-five in the second. They are all studying to become Infant Education Teachers.

## 3.2 Research Questions

We have various research questions regarding both students' eportfolios and PLEs. However, we will only focus in this article on the research questions related to PLEs:

- Will students expand their PLEs through the construction of eportfolios based on Web 2.0?
- Will students develop a positive attitude towards the integration of technology in their current learning at University and their future teaching at schools?

## 3.3 Method and Data Collection Instruments

We follow their digital prints in their eportfolio to see which Web 2.0 they are using and the progressive extension of their PLE, and every year, we collect data both quantitative with questionnaires based on a Likert scale developed by Lin (2008), and qualitative with interviews and group discussion.

## 3.4 Findings

The findings about the number of students using Web 2.0 tools and the number and variety of tools used by students uncover a positive evolution during the first two years of eportfolio implementation. While during the first school year of implementation only a few students consistently started their eportfolios and used some tools of the Web 2.0, during the second school year all students definitely started their eportfolio and expanded the number of tools used. This increasing usage of tools can be deduced from the following data about the two school years:

**Table 1.** Web 2.0 tools used by students during the school year 2010-11

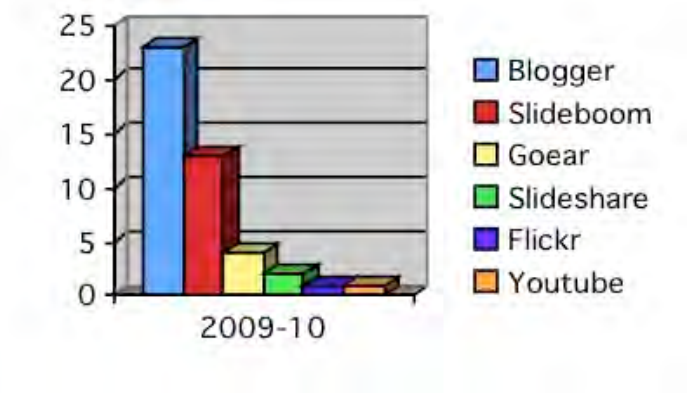
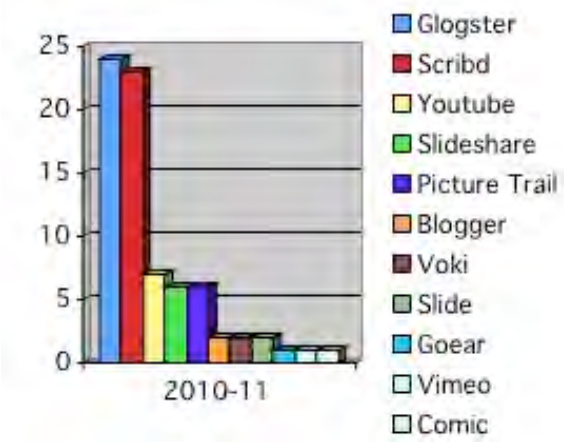



**Table 2.** Web 2.0 tools used by students during the school year 2010-11




As can be seen, most students opened their blogs during the first year, but only a few students started using a few tools. A year later, the last two students who still had to open their blogs, finally were able to do so, and what it is important is that many students started using many more tools too. Glogster was a successful learning tool used with creativity by many students as we have already highlighted (Tur, 2011a).

As for students' attitude, the data also uncover a positive evolution. After two school years learning with technology, documenting their eportfolio and expanding their PLE, students developed quite a positive attitude towards technology. They answered a questionnaire about their attitudes towards the construction of a learning eportfolio and towards technology in their current learning and future teaching. The survey was based on a Likert scale which was created by Lin (2008) for an eportfolio research. Students had to answer choosing the option they considered most appropriate from 5 (strongly agree) to 1 (strongly disagree). We have only selected seven questions (2, 7, 11, 12, 14, 16 and 17) which had to do with the use of technology both

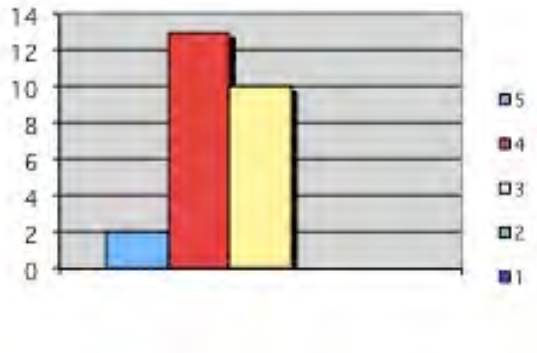
for learning and teaching and which have some kind of relationship with PLEs, which is the main aim in this article.

There are questions asked in a positive (questions from 1 to 3 and 6) and in a negative sense (questions 4, 5 and 7). It can be observed that students' answers are coherent, and so questions formulated in a positive style receive a higher positive rating, whereas the same questions formulated in a negative style receive a higher negative rating by students.

After the process of constructing my eportfolio, I …

a) gained greater confidence in learning new technology applications such as working with hypermedia software.

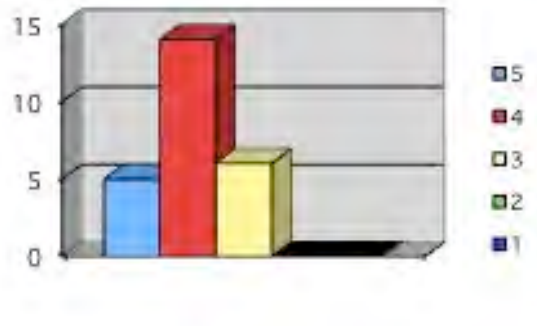
**Table 3.** Students' greater confidence in learning ICT new applications




The vast majority of students think they have developed greater confidence in using new technology tools.

b) gained greater confidence in integrating new technology in future classrooms.

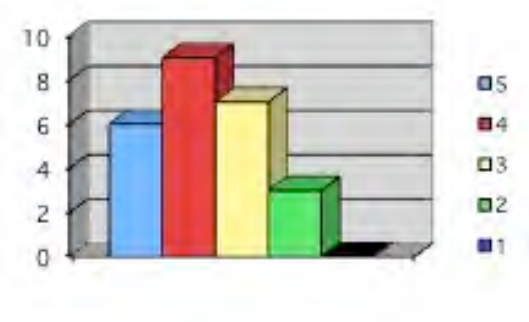
**Table 4.** Students' greater confidence in integrating ICT in future teaching




This question is crucial for our study as one of the main aims of the whole project is that this learning experience be useful for them as future teachers. Therefore, it is hopeful that the majority of the students feel sufficiently confident to integrate technology in their future teaching.

c) was able to review my existing technology skills while gaining additional ones.

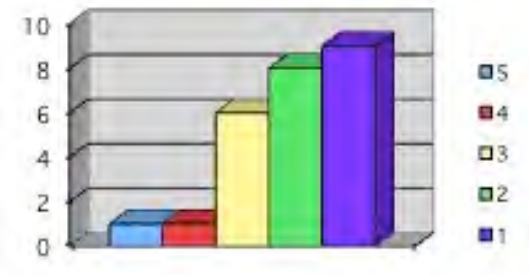
**Table 5.** Students' technology skills




Students admit learning new skills in the use of technology.

d) became less confident in integrating technology in future classrooms.

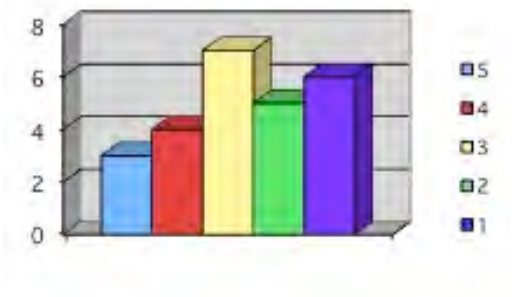
**Table 6.** Student's decreasing confidence for technology integration in future teaching




The vast majority of students strongly disagree with this question, which is coherent with the answers to question 2. It is also very important for this research that the results are coherent so we can have valid data about students' beliefs of their future professional use of technology.

e) felt challenged and overwhelmed with technology.

**Table 7.** Students' negative feelings towards technology

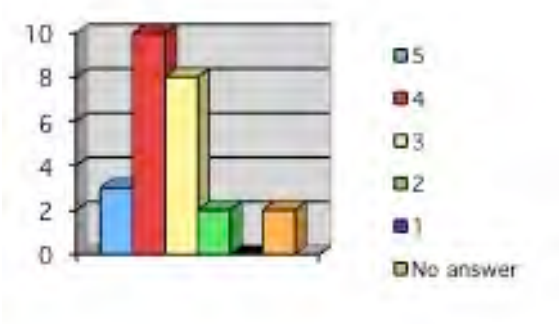



This question is also coherent with the rest, because the number of students who answered negatively is higher than the students who answered positively. However, there is an important number of seven students who agreed with overwhelming feel-

ings. Actually, this was also observed last year as most students did not start in a their eportfolios in an adequate way (Tur, 2011b) due to anxiety and other feelings stated through qualitative research.

f) learnt a lot from communicating, interacting and collaborating with peers.

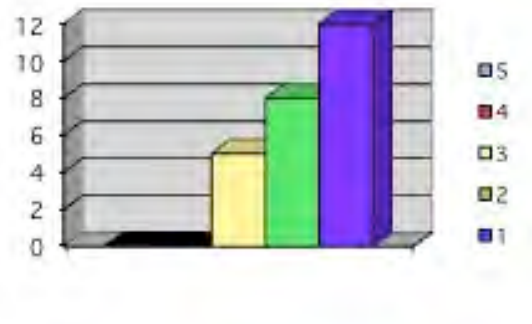
**Table 8.** Students' learning through collaboration




Collaboration is a common process in eportfolios and PLEs, as has already been argued, and a key competence for teachers of the 21st Century, so it is positive that students value learning by collaborating with others through the use of technology.

g) did not learn any additional technology skills.

**Table 9.** Students' failure to learn new skills technology learning




Finally, this question is absolutely coherent with question 3 with most answers in disagreement with the statement.

## 4 Conclusions

Nowadays, students are building their networked selves, in Cambridge's words, or in Barrett's words, they are in the first and second step of the construction of their eportfolios. Thus, they are also especially devoted to expanding their PLEs through the use of Web 2.0 tools. To answer research question 1, as can be observed from the evolution of tools used by students, it seems that through the construction of eportfolios students are empowering their PLEs, despite the fact that this expansion of tools is going slowly than was planned, due to some negative attitudes observed at the beginning of the project (Tur, 2011b).

Also, we can answer in a positive way research question 2. It has been demonstrated that most students have developed quite a positive attitude towards technology, which allows us to expect a certain sustainability of their eportfolios during their professional careers.

These results are not final, as the project has not yet concluded, and the data was collected as a reference of students' beliefs halfway through the project. Furthermore, we think that these results could be indicative of the final results to be obtained in two years time. Although we still hope that the vast majority of student teachers integrate technology in their teaching careers, it could be that students who have not taken this step so far will not do so during their remaining time at University.

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# Analysis of Personal Learning Networks in Support of Teachers Presence Optimization

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**Abstract.** The activities of teachers in social networks have a certain place in their personal advancement and professional progress. Studying the organization of Personal Learning Networks (PLN) could support the optimization of teachers' efficacy and productivity. For this purpose, an analysis is performed after a literature review and taking into consideration the opinion of the international educational society including teachers from Primary schools, High schools and universities. The received data shows very different PLN structures consisting of preferred and favorite social networking sites, online authoring tools, search engines, software for communication and collaboration, socially-oriented learning management systems. Most often used and very popular among teachers are the social networks Facebook and Twitter that are studied in detail in the form of friends number, reasons for adding/excluding someone from friends' list, frequency and directions for usage, influence on personal efficacy, impact on teaching practice. All gathered data and performed analysis result in a created model for social teachers' presence optimization.

**Keywords:** social networking, personal learning network, personal learning environment, teaching practice, optimization

## 1 Introduction

Social networks appeared as an opportunity emerging as a result of the progress of information and communication technologies and as a need of reliable connection and successful dialog among people with similar interests. The geographical boundaries are removed and the gates for huge knowledge are widely opened. Everyone could be a founder and moderator of social networks thanks to Web 2.0 developed tools and social

software with flexible user interface. In our society a culture of sharing, promotion of new ideas and connection is realized. The process of socialization is facilitated through different forms of web-based communicative and collaborative activities. In the same time the instruments for personalization are enhanced giving a chance for the construction of the individual nature of every single person and the expression of personal capabilities. The phenomenon of a networked world with personalized features has a strong impact on teachers' behaviors who grab this possibility for self- elaboration, improvement of teaching activities and collaboration.

As a consequence of supporting learning and satisfying personal requirements, the terms Personal Learning Environment (PLE) and Personal Learning Network (PLN) arise. The term "learning network" is come to describe the gained experience of students and teachers when they utilize computers for learning [1]. The practice shows that social software and social networking sites are often utilized for the organization of learning networks. Thus social interactions among participants could support learning process in social environments specially created or utilizing the functionality of existing social sites and software.

Another term "personal learning networks" has recently emerged to describe "the sum of all social capital and connections that result in the development and facilitation of a personal learning environment"[2]. The author depends on social media, software and sites like blogs, wikis, social bookmarking sites, photo and video sharing sites, microblogging to assist teaching and learning via the formation of an effective personal learning network. Obviously, the social interactions of every one person in a socially-oriented online environment in support of his/her currently emerged or future planned needs for learning play a very important role for the shaping of individual features.

In this paper a detailed examination of the process of personal network building at the teacher's workplace is done as a basis on empirical data and studies. At this moment such analysis is not performed and there is a necessity of understanding the static and dynamic view of different personal learning networks through their transition states and final effects. Thus, the main research questions are formulated as follows: "Whether and how a personal learning network could facilitate the teacher's practice?", "What is the dependence between network structure and the teacher's efficacy?", "How a personal learning network could be optimized to stimulate the teacher's productivity?"

## 2 Used Method

To gather answers to the posed research questions we started with literature exploration about the impact of social networking and social media on personal and professional development. We are especially interested in research reports and scientific papers with experimentations focused on teachers' online presence forming and its benefits.

A tool for data collection from teachers is created in the form of a survey to understand teachers' engagement and motivation for participation in social networks, to comprehend the ways of personal learning network building, to catch up the purposes of use. The received research data is utilized for a model creation to support the teachers practice in the directions of personal learning network optimization and further

elaboration. The specific networked structures and variables related to members' profiles, relationships, connections, generated content, produced artifacts, time of existence are examined.

## 3 Literature Review

A report of collaborating organizations like: edWeb.net, IESD, Inc., MMS Education, and MCH, Inc. summarizes the findings about personal and professional usage of the social networks Facebook, Twitter, MySpace and LinkedIn and platforms like Ning, Google Docs, Wiki, Moodle by school principals, librarians, teachers and students. Among the benefits of social networks for education are: information and resources sharing, professional learning communities' creation, improvement of school-wide communications with students and staff [3]. 70% of the librarians, 62% of the teachers and 54% of the principals participate in one or more social networks.

Relationship between professional development of educators and social media use is examined in [4]. The social media potential for improvement of teachers' quality and performance is identified through case studies and through presenting the social media benefits for business.

Higher education adopts social networks too making various good practices weaving learning scenarios, social software and sites in different educational forms. For the purposes of distance learning, Ning is utilized to support topics discussion in the framework of each one of the courses, community of practice forming and students' social presence building [5]. The results from this study point to the advantages of social network for engaged educational community ranging from "increased levels of communication and collaboration to deeper levels of reflection".

Exploration of social media personal and professional use by higher education faulties is done in [6]. Findings reveal that educators in personal context are active users of Facebook, YouTube, LinkedIn, blogs, wikis, Twitter, etc. In support of profession- al progress and teaching practice 90% of them have a stake in social media. The first most used social media sites in personal and professional aspect are Facebook and Youtube.
The role of microblogging for personal development and organization of social networking is being researched in [7] and several possible learning scenarios are pro- posed.

These and other good practices that are not included in this review show that the teachers are active participants in social networks striving for new knowledge and connections on one hand and on another hand they like social software and success- fully apply it in their teaching practice.

We also have to remember the importance of scientific events dedicated to the PLE/PLN concepts like the conferences from Barcelona, Spain (2010) and Southampton, UK (2011) where an impressive number of scholars from whole over the world participated.

## 4 Personal Learning Network Analysis - Survey Results

Social network analysis (SNA) is a method for understanding the formal and informal relationships in a social network (its structure) and how connections could facilitate or cumber knowledge gathering and learning occurring [8]. There are a wide variety of methods for SNA and one or other is applied according to the characteristics of a given network, context and situation. For example, the web crawling method is utilized for analysis of online social networks like Flickr, YouTube, LiveJournal and Orkut. It is suitable in the situation when the users' data is not directly accessible and only the available public interface of sites is reachable [9]. Content-based SNA is chosen in [10] for the reaching data from mailing lists. In this method a network is divided in subgraphs organizing participants according to the discussed topic. Person- al network analysis is performed in [11] to explore the structure of relations among young people and to find the connections in personal networks and discourses.

In our study we have teachers who participate in different social networks, who use a wide variety of social learning platforms and who have specific individual interests. Hence, the above mentioned methods for SNA differ from our situation where we have to study every PLN consisting of several social networks. For this purpose we prepare a survey with questions grouped into three categories related to: current PLN structure, its dynamic view and regular usage for personal development and for educational purposes. This survey is distributed to teachers from Primary schools, High schools and universities over the world.

41 educators (59% female and 41% male, with average ages of 43) from 12 nationalities responded to our request and took part in this research. Concerning the field of teaching disciplines, 39% of the teachers present subjects related to Computer Science, Information Systems and Mathematics, 17% teach Educational Technologies and eLearning, 15% are teachers in Language learning as a foreign language. Even the percentage of teachers in Natural Science, Humanities, Social Science, Entrepreneurship and Business, Journalism and Primary school teachers was low, they also expressed their willingness to participate in the survey, presenting their interest to social software deployment in educational settings and declaring their coherence to the PLN topic. The results show that 98% of surveyed educators use social networks in their personal learning networks as follows: 78% utilize Facebook, 76% like Twitter and 68% have accounts on LinkedIn, with smaller percentages of interest are Classroom 2.0, Tuenti, Goggle + and others (Figure 1).

As it seen the main ingredients of educators' PLN are social networks with Facebook (93% of the educators have mainly one Facebook account and several of them possess two accounts - respectively for personal and for professional use) and Twitter (90% of the educators benefit from the Twitter stream) on top. Thus, the importance of these two social networks for the teachers' practice is explored in detail to unders tand whether and how they support personal and professional development.

The major group of educators opened their Facebook (39%) and Twitter (32%) ac- counts three years ago. Nowadays, the use of these networks is routine: 26% of the educators daily visit their Facebook journals, 24% continuously stay on Facebook, 16% several times a day check what happens on the Facebook wall, 27% of educators

continuously trace the Twitter stream, 19% participate several times a day and another 19% daily tweet. A small part rarely uses Facebook (8%) and Twitter (14%).

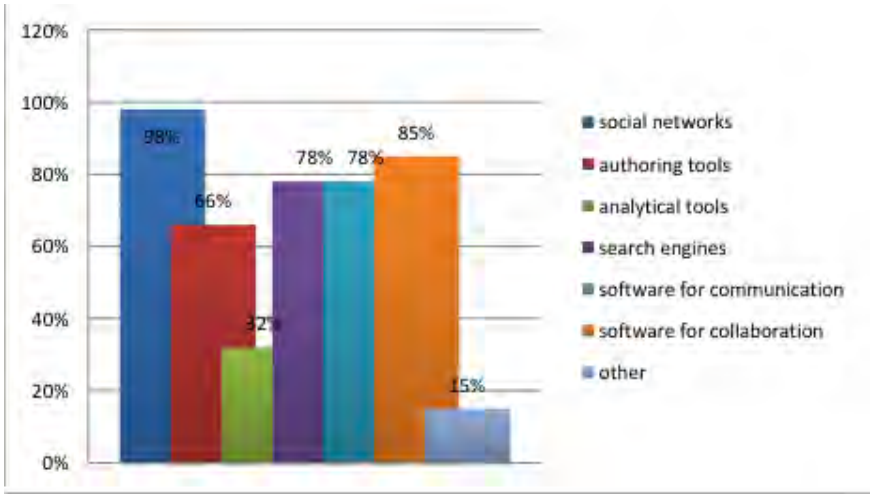


**Fig. 1.** Social software use in PLN

The main purposes of Facebook and Twitter utilization are related to sharing (63% for Facebook and 81% for Twitter) and learning new things (50% for Facebook and 81% for Twitter). Other reasons are related to: making friendships, keeping connections with family and friends, self promotion, opening channels for communication, events following, networking.

The created personal networks' societies are not so big: on Facebook 20% of educators are connected with 301-400 friends, 15% possess between 201-300 friends, 15% have 101-200 friends, other 15% communicate with 51-100 friends; the number of friends that educators follow on Twitter are among 100-200 (in 18% of cases), 201- 400 (18%), less than 11 friends (18%), more than 900 (12%). The Facebook educators' network is mainly built from real people who they know or have met in real life, colleagues and family members. The Twitter network in common line consists of colleagues, real friends and interesting people in a professional aspect who are not known to them in real life. 45% of the teachers rarely extend their Facebook network with a new friend and 42% of them sometimes decide to do that through search tool (37%), recommendation tool (34%), web sites functionality (34%) or just accepting somebody else's request. On Twitter the network expansion occurs with bigger frequency: 58% of teachers sometimes follow a friend, 19% rarely do that and 17% often connect with a friend using the recommendation tool (54%), search tool (43%), web sites functionality (41%), cascade following mechanism (following people from re-tweets and following people followed by someone important person). Educators like to follow interesting people for them: authors of scientific papers and articles, professionals and keynote speakers met at conference places, new people found through re-tweets and stream line, people that are recommended by someone else. The reason for Facebook network expansion in 71% of cases is keeping the

contact of an interesting person that is met. The Twitter network is extended when a person is interesting in 62% of cases and when there is a need for learning something new (49%). On the two networks Facebook and Twitter, the friends are rarely or some- times removed. On Facebook it happens when a friend is annoying (34%), when a person is not interesting anymore (29%), in the case when anything new cannot be learn from this friend (18%), "when a friend continually offensive posts on the wall", "when a person is responding badly", "when the academic relationship with students/ex-students ends and it does not extend into friendship". Twitter network is shrink in 46% of the cases when something new is not learnt, when the friend is not yet interesting (30%), the person is annoying (30%), "when a person tweets too much," "if the person is a sales-based entity," if the messages are in languages that the educator does not know, if the messages are spam, after unfollowing, when the tweeted opinions start to feel uncomfortable for the educator. The number of friends and the basic type of friends in networks as well as the frequency of friends' adding and removal are evidence for the not so big dynamics in teachers' PLN. Many of them prefer to very carefully select and accept friendships, taking advantages of their knowledge in the long term, avoiding their removal in rare situations. The educators do not consider that the number of friends in PLNs could influence on their efficacy as a person and as a teacher.

43% of surveyed teachers agree that Facebook could support their personal and professional development (Figure 2) and 62% of them share that Twitter is a suitable network for both personal and professional capabilities improvement (Figure 3). The question about social networks usefulness for personal life and career progress is left opened for 4 choices to gather the all views of teachers. According to that, the Face- book is pointed as a preferred network for a personal development (by 19% of the educators) and Twitter is defined as a tool for professional development (by 35% of the educators). Anyway, 32% of the Facebook users and 16% of the tweeting educators suppose that these networks could not facilitate their development in personal and professional aspect.

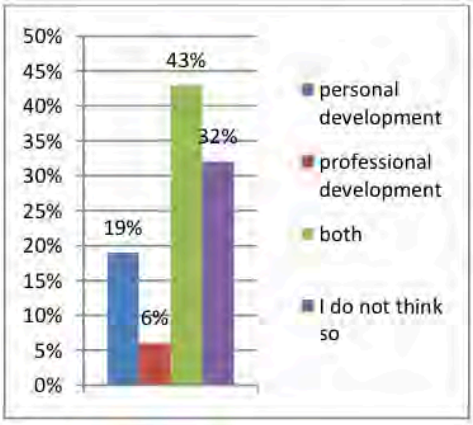


**Fig. 2.** Do you think that Facebook supports your personal or/and professional development?

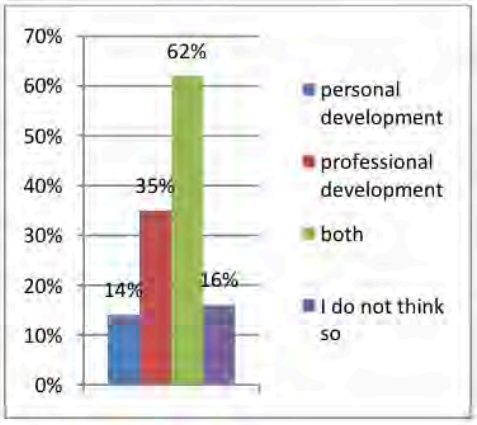


**Fig. 3.** Do you think that Twitter supports your personal or/and professional development?

The teachers are asked to evaluate the social networks' importance for the facilitation of the teachers' practice and students' learning. 51% of them agree that Facebook could be used for educational purposes and 70% recognize Twitter as a powerful tool for teaching and learning. Resources and links sharing, announcement of class events, giving opinion, stimulation of class discussion, communication, polls taking are among the performed activities on Facebook and Twitter. 53% of the educators using Facebook and 68% of the twitting educators like active participation as well as observation and tracking. 32% of the educators share that they are more observers than contributors on Facebook. The gathered opinion about Twitter divides the educators in equal groups of observers (in 14% of shared vote) and contributors (also 14%).

Some of the advantages and disadvantages of the explored two networks in a personal and professional context according to surveyed educators are summarized in their own words in Table 1. Among the advantages most cited are found: the possibility for connection and community of interests forming, sharing, ideas exchanging, learning, communication and collaboration. Disadvantages address the issues related to ethics, behavior culture, privacy, overload of information and time consuming. It is obviously that social networking possesses positive and negative characteristics and educators have to endeavor to balance them taking the power of benefits. Educators need to optimize their online social presence to be successful in their personal being and professional practice.

**Table 1.** Advantages and disadvantages of social networking

| Facebook Advantages | Disadvantages | Twitter Advantages | Disadvantages |
|---|---|---|---|
| "I can connect w ith people far away and whom I cannot approach through phone calls" | "Lack of integrity a nd ethics in the ownership of the company" | "Growing as a learner / a better communicator / improving my teaching styles" | Time consuming / missing important information / too large the PLN |
| "It helps me to share my proud/emotional moments (personal and professional) with my loved ones" | "The disadvantage I see on my "teacher site" is that young people feel free to say rude things" | "Brings down barrers between student/teacher, which can be both beneficial or not, depending on the respect and the relationship" | "Can be addictive" "Overflow of information" |
| "It also helps me to exchange ideas with each other" | "I don't like Facebook - lack of privacy" | "It is very easy to learn so many new things and communicate with inspiring teachers from around the world" | "It can be very time consuming" |
| "I create a group , share information and find resources" | "There's too much information and not all of it is appealing; | "Instant communication" | "Spams, at times" |

| | | | |
|---|---|---|---|
| | sometimes I just waste time browsing and I feel gossipy and I don't like it" | | |
| "I learn a lot from and about my friends" | "I have no control; can't use it as a way of getting students to focus" | "Immediate feedback to followers and friends" | "Can't keep up with tweets" |
| "Good for swapping ideas, and mutual support though" | "Privacy issues; questionable corporate culture and practices; breaks the web; silo; navigation issues; bad archiving" | "Connect to interesting people" | "Addictive, consumes much time" |
| "It is a creative way of sharing, communicating, and collaborating" | | "Connecting, net-working, sharing; just-in-time, updated information" | "Lack of a good archive; poor conversational potential; 140 character limit; URLs in message and not in metadata" |

So, the participants are asked to suggest the directions for their social networks optimization with aim to be more effective and productive persons and professionals. The gathered opinions are summarized in Table 2 and they prompt the following methods: (1) using the automated functions of social networking sites and related to them client software; (2) self-control of individual behavior (in connections making, groups joining, spending time); (3) recognizing the characteristics of learning (learning by suitable behavior, continuously learning, learning in social environment).

**Table 2.** Suggestions for social networks' optimization

| Facebook | Twitter |
|---|---|
| "Looking for interesting groups to follow" | "Creating lists, using hashtags to follow, imposing a time-discipline in following the informational stream, follow only interesting for me people" |
| "Regular checks on posts by others, block a few sometimes" | "Use twitter lists and email notifications", "instant communication", "Use hashtags", "post everyday" |
| "Add interesting people" | "I always use a column system like Tweetdeck I create columns to follow certain hashtags and certain people" "Feed it to Flipboard in iPad where I can flip through and read the tweets magazine style" "I follow educators and look to see who they follow" "I try to find new, interesting people to follow, I use Hootsuite to manage the Twitter stream" |

## 5 Discussion

Findings point out the potential of PLN and social networking for the development of teachers in a personal and professional perspective. PLN supports their learning and teaching through the possibility for resources and links sharing, learning through activities or through observations, class events announcing, class results announcing, and stimulation of class/group discussion. For the optimization of teachers' social presence we created a model allowing continuous PLN improvement according to the changing personal and learning requirements with items connected to individual behavior, social networks functionality members' profile, characteristics of teaching/learning process, spending time (Figure 4).

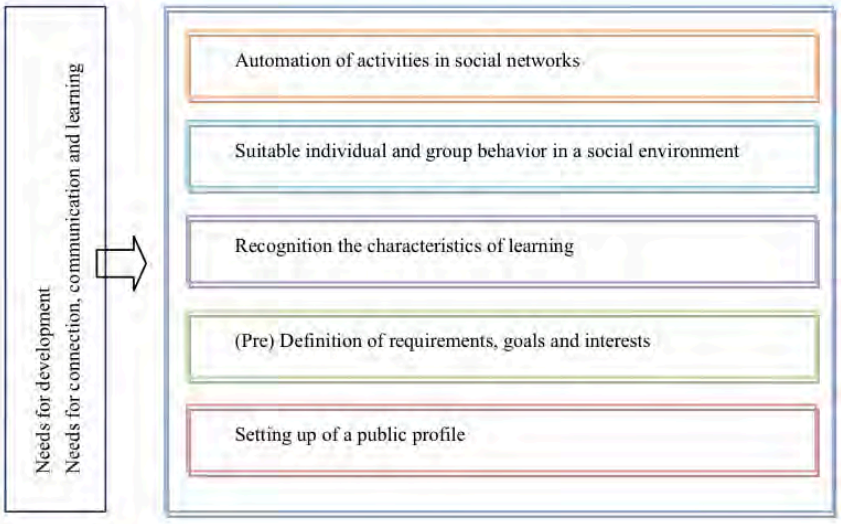


**Fig. 4.** Model for PLN optimization in a teachers' presence

This model includes five main criteria that could be referred as starting points in PLN evaluation and optimization. They take into consideration: (1) the importance of a well defined public profile that could facilitate educators in their connections making, promotion and suitable friends' recognitions, (2) the identification and definition of current requirements, goals and interests in networks participation as well as these in a long term in a clear manner that could save time and energy in doing aimless activities, (3) the characteristics of (social) learning, what kind of learning best suits his/her nature, mood, style, background and how this is related to social possibilities of net- works, (4) the appropriate model of individual and group behavior rendering the networks' dynamics and specificities, (5) the opportunities for automation of several activities in information and friends searching, selecting, filtering, tracking, and management.

## 6 Instead of Conclusion

This research including PLN study of teachers is the first step of future explorations concerning the analysis and optimization of PLN in support of efficacy use and productivity improvement. Most of the teachers like the networked world and wish to develop a sustainable social presence. It will work for them only if their personal preferences and social behaviors in networks are well studied and understood. It also influences other PLN factors like static view, structural dynamics and taking time. The model is created in order to indicate the opportunity for PLN advancement and to support the quality of the teachers' participation.

Furthermore, a PLN remains a personal choice for most of the educators. However, the authors strongly believe that to use or not to use PLN for personal and profession- al development will soon become an obsolete phrase for the large mass of educational actors.

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# Future Teachers Looking for their PLEs: the Personalized Learning Process Behind it all

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**Abstract.** This paper reports the results of a naturalistic study obtained from a teaching experience in higher education with first year students of the Primary School Teacher degree. In this study we want to analyse how they are organizing their activity for learning (reading, reflecting and sharing knowledge) and how those learning processes are integrated on their PLE.
In order to achieve that, they have been reflecting about the learning basic "components" of their course activity: reading (in a multimedia way, or not only by text), doing (reflecting and creating cognitive artifacts), and sharing (discussing, showing, and providing and receiving feedback from and to a community of reference), they have made relationships between those components and technological tools, if there is any, and using those they have created mind maps for representing their PLEs. The idea is try to understand how are PLE organized and perceived by learners but not starting from the technological point of view but from the learning processes perspective.

**Keywords:** PLE, thinking process, formal learning, integration, learning processes, learning components, metacognition.

## 1 PLEs and the Thinking Processes Behind, the Next Step

In the last years, the majority of the approaches to PLEs analysis have been centered on the analysis of diagrams of PLEs (Leslie, 2008a & 2008b; Scott, 2008; Castañeda & Soto, 2010). Nevertheless, even when the approaches to the PLEs as a technological structure have provided us with very interesting perspectives around PLE building, and around beliefs and worries behind PLE concept from our point of view this specific approach is already over and –despite the use of this method for analysing some specific cases- we have to move forward, in order to test new approaches and methodologies that could show us more angles of our object of study.

This paper reports the results of a naturalistic study obtained from a teaching experience in higher education with first year students of Primary School Teacher degree. In this study we want to analyse how they are organizing their activity for learning (reading, reflecting and sharing knowledge) and how those learning processes are integrated on their PLE.

It is almost a common place, the idea that the current technological environment (Web 2.0 , mobile technologies, and so on) provides learners with the opportunity of building a technology enhanced environment, networked and enriched by with the interaction of other people and basically controlled by themselves (Attwell, 2007; Buchem, Attwell &Torres Kompen, 2011). In this environment the person could include, organize and manage their informal, formal and non formal learning resources, tools and experiences (Adell & Castañeda, 2010). This is, surely, the main idea that has supported underlies our interest in the study of Personal Learning Environments during the past decade.

Nevetheless, from the practical point of view, even when we have already analysed how learners integrate technologies on their PLE and how they use those technologies (Salinas et al, 2011; Casquero et al., 2011, Castañeda & Soto, 2010; Castañeda, Costa & Torres Kompen, 2011; among others) in order to try to better understand the processes behind PLE structures, actually those studies only give us technological perspective of our object of study. Nevertheless, if we understand PLEs as a pedagogical approach with a strong technological base, this technological perspective of analysis that we have used is far from being enough in order to study it.

With this perspective, in 2010, Drexler (2010a & 2010b) proposed the idea of analyzing the networked students learning environment. On her proposals, the author remarks the importance of understanding the processes of learning that are behind the educational process, because those processes are the fundamental structure of the learning.

Then, taking advantage that we are working with a small group of students (the normal ratio of students in this university are 100 by group), and continuing with the strategy of introducing them to the "Web 2.0 world", we tried to explore how they have integrated their processes for learning into their PLEs and built their PLEs taking into account the tools they use but specially using, as a base of building, the learning processes carried out on each activity and during the whole course.

Consequently, following the Drexler, and taking advantage of the extraordinary teaching conditions we have on this period, we decided to explore a different way of PLE analysis. The idea is try to understand how are PLE organized and perceived by learners but not starting from the technological point of view but from the learning processes perspective.

## 2 The Study

### 2.1 The Sample

For this experience we have tried to analyse the learning processes behind the course activity of students in the first year of Primary School Teacher degree at the University of Murcia (Spain) in the second part of the period 2011-2012. We are going to analyse the learning activities that configure the complete course "School Organization and Educational Resources" that is carried out completely face to face.

In total we are working with 30 students from 18 to 43 years old, with only 6 men in the lass (20,68 %), and they all are working only with one teacher (one of the paper authors) on this course.

Although the students do not have any technological training before –apart from some course in the high school and secondary education, and this course is not directly related to ICT- they have been already introduced to the PLE concept and Web 2.0 impact on education in other course that is organized by the same teacher and in which all of them are involved.

Students are divided into 6 different groups formed in a complete naturalistic way (voluntary), and some of the have worked together in other courses, during the first semester of this year.

### 2.2 The Course Structure

The course has been structured on 6 activities that have configured the dynamic inside and outside the classroom, the organization of the lectures, the resources as well as –of course-, the assessment processes. All those activities have been organized by groups and documented by students using a Course Diary done through a group blog.

Some of the activities are completely developed in the classroom, and the others must be completed by students between sessions; all of them have a final task or product that could be analogical or digital; additionally all the activities start with an introducing lecture provided by the teacher and only one of them was introduced by a guest teacher. The LMS used in the University of Murcia is SAKAI so the resources and material provided by the teacher are included in a course on this LMS.

All the activities, but one, are 2 weeks long and weekly participants have 2 face to face sessions, one of 2 hours and the other with 1. In total, 3 hours.

### 2.3 A simple method of data collecting

As we mentioned, students have been working on 6 learning activities that structured their learning process.

In the final part of the course, each group had the task of creating its assessment ePortfolio, and had to include on it mind maps for representing the learning process followed on each activity. Additionally, groups had to include a mind map that summarizes the general learning process of the course. The idea –explained by the teacher- was that they include on the mind map the thinking processes behind each learning activity and the tools (technological or not) related to this process.

This extra activity is included as a part of the metacognitive strategy of the ePortfolio (Kitchenham, 2008), understanding that this reflection could help students to understand better their learning processes and maybe, help them to be aware about ways for improving this.

According to the PLE literature, and trying to help them to start their reflection, we have provided students the definition of PLE (Adell & Castañeda, 2010), and we have remarked that any learning process could be configured basically by three basic "components" (Attwell, 2008; Adell & Castañeda, 2010): reading (not only text but multimedia), doing (reflecting and creating cognitive artifacts), and sharing (discussing, showing and providing and receiving feedback from a community of reference). We hope those “parts” could help students to start thinking on and structuring their maps.

In order to improve the understanding of the representation we have asked for, students made a first attempt in the classroom (in other course conducted by the same teacher), and on it they could ask for the teacher about the details to be included on

their maps. We strongly encouraged them to include on those maps formal, non-formal and informal processes that they considered as a part of their learning process.

Once we have collected the maps, we have made a formal general analysis of them, and further, a content analysis of each of them. Additionally we have analysed the learning activity mind maps by groups, by activity, and in a general vision.

We are aware that this is not a strictly Personal Learning Environment study, firstly because they are working in groups. Nonetheless, we think the group work could help students to reflect about their learning process. At the same time, the inclusion of a complete course in the analysis could give a more global perspective of a learning process, as well as this group exploring would be easily extrapolated or projected to an individual level.

## 3 Data Analysis

We have finally collected a total of 36 mind maps (1 by each activity and group, 6 activities, 6 groups) related to the learning process behind each activity. Therefore, there is a collection like the following for each group:

Illustrating Words

TPCK

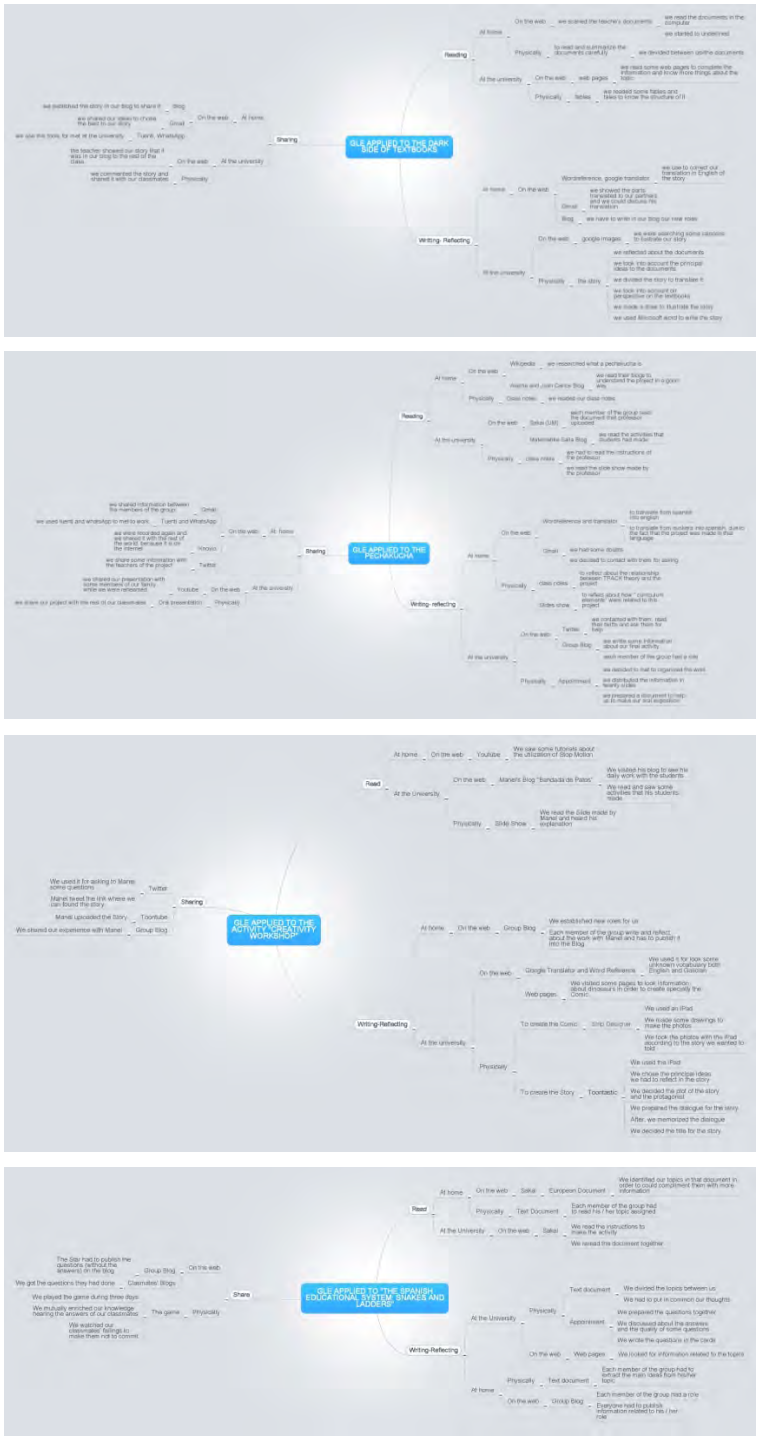
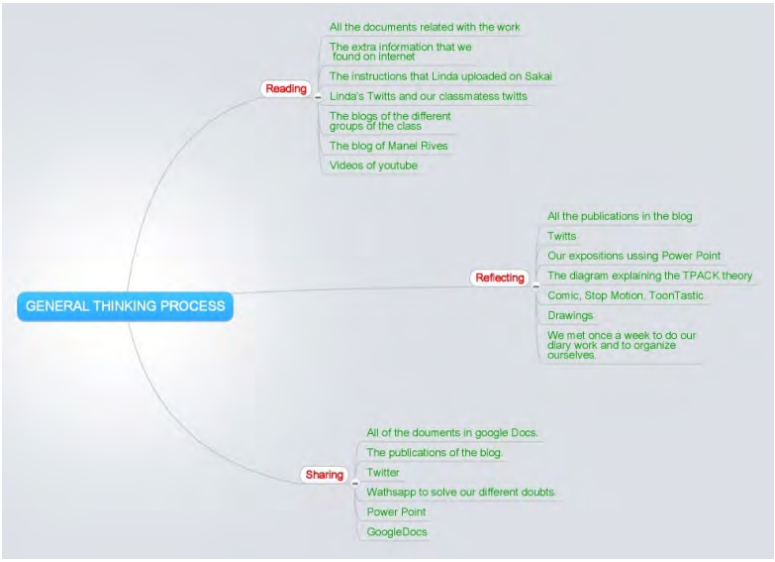
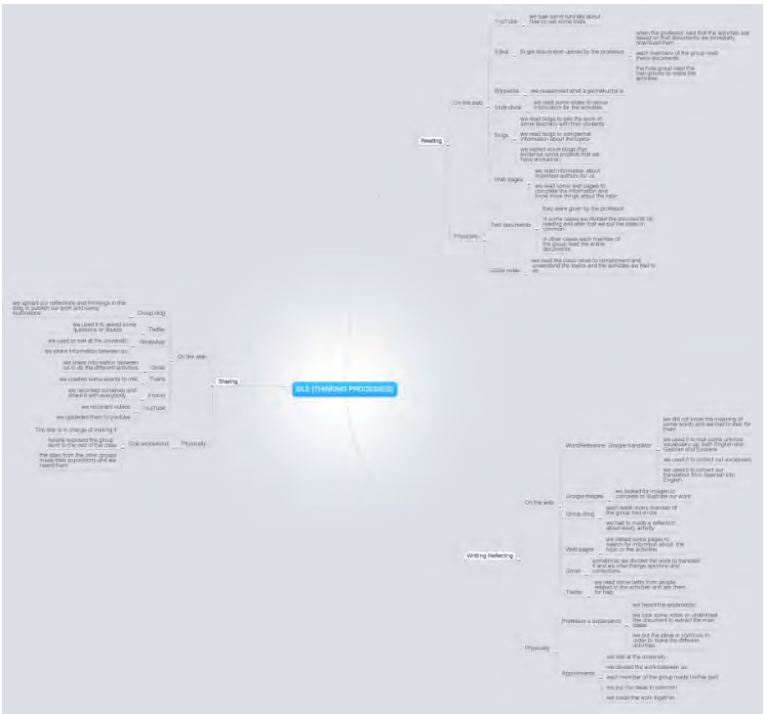



**Fig. 1.** *Group CHD*. Learning processes mind maps by activity.

In addition we have collected 6 general learning processes maps, one from each group, as follows:




TBB Group



CHD Group

**Fig. 2.** General Learning processes. *Group TBB and CHD*

Taking into account this amount of data, we think that showing here the analysis of the 36 diagrams does not give us much information. Therefore, doing a content analysis of those diagrams but in categories, as so as we can show in the following sections some of the data they show us basically at two levels:

- By groups: In two ways, the first where we have analysed the diagrams one by one and also we have analysed the tendencies observed in all of the diagrams of the same group, and the second, where we see if there is any difference trend shown by the general learning processes diagram of each group.
- The general level: where we have used two ways for analysing. Firstly, the vision provided by the union of every activity mind map in a general one. And secondly, the general perspective studied from the union of the general learning processes mind maps of each group in one more general.

On each level the basic focusses of analysis will be, basically, two:

- The learning basic "components" shown on the mind map: reading (in multimedia way), doing (reflecting and creating cognitive artifacts), and sharing (discussing, showing and providing and receiving feedback from a community of reference).
- The supporting of technological tools shown for each learning process, so we have analysed each component on its version technologically supported and only physically supported.

### 3.1 Analysis by Groups

**TBB Group.** Firstly we have to say that this group perceive the importance of the technological support of learning processes in a different way depending on the learning component that we analyse; this importance is also different if we see all the mind maps from the different activities, or if we see the general learning process mind map.

We start this part analysing the mind maps with the learning processes and tools for each activity.

From the *reading* point of view, the main source showed in diagrams is the teacher and the resources provided by her via SAKAI and on her lectures. It is interesting to remark that the majority of the access to information is done with technological support where the group focus, apart from reading the documents provided by the teacher, on the process of "looking for information about the topic" in "Websites ", the "internet".


**Fig. 3.** Word cloud of the *reading* technologically supported processes[1]. Group TBB

[1] Linda is the name of the responsible teacher of the course

It is interesting to remark that in the learning processes associated to recover information (reading) without technological support, students only includes the lectures (done by the teacher or by one guest teacher) as part of their learning environment, do not include any complementary resource.

In contrast, once we analysed information about *Doing* for learning on their maps, the majority of processes are related to the group activity and they remark their activity around "creation" "writing" and "drawing" using principally pencils and paper. Even when there is some activity supported by technologies in this component (specially the production of some specific artifacts slideshows in Power Point or Slide share) this activity is much less than the physically supported.

In the case of processes related to *sharing*, in the mind maps this component is more associated to technological tools and, in the majority of the cases is not associated to verbs of action, only directly to the tools, and definitively the most used tool used for sharing is the group blog developed in Blogger. Additionally it is remarkable the use of multimedia tools, social networking sites (from here on SNS) and the use of instant messages tools as Whatsapp for sharing.


**Fig. 4.** Word cloud of the *sharing* technologically supported processes. Group TBB

Sharing without technological supported is limited to the activities of exposition and presentation in the classroom.

We have to remark that in the case of this group, the results showed by the analysis of the activities mind maps give us a different perspective of the technological support of each component. As we have mentioned, in the processes exposed in the activity mind maps, the *Doing* component is basically supported in a non-technological way, nevertheless, if you see the general learning processes mind map, it showed almost the same amount of processes technologically supported and non technologically supported.

**BD Group.** In the case of this group it is interesting that they include on their diagrams not only processes and associated tools, but reflections about those processes. It help us to understand, for example, that in the normal activities the learning process start with the lecture provided by the teacher, but in the case of activities that start with the lecture from an invited lecturer, students decided to start reading some materials from the Internet in order to prepare the activity. In addition it is quite interesting the importance that they give to the non technological process of thinking before starting using tools, expressed as:

*"people used pencil and paper to write first reflects about the activity and to start thinking about the questions" BD Group*

In the three components of learning (reading, doing and sharing) that this group includes on its maps (activity learning processes maps and general learning process map), the technologically supported processes are the most important.

About *reading*, as in the case of the previous group, students remark the importance of getting from the Internet information complementary to the information provided by the teacher, and they use generalistic tools for searching it: Google, Blogs, Websites, Youtube and Twitter. In the case of non technologically supported learning processes, they only *read* documents and information directly provided by the teacher.

In relation to *doing*, they usually include on this component processes related to the process for completing the tasks: reflecting, describing, developing, correcting and deciding. Nonetheless, the processes are expressed individually and not in terms of working together. It is interesting to note that is on this group where we see included on its process the verb "thinking" related to the *doing* component but without a technological tool related.


**Fig. 5.** Word cloud of the *doing* technologically supported processes. Group BD

Finally, there is worthy of note, that this group includes SNS as technological tools that support the reading, doing and sharing components of learning, and understand the Blog as the greatest tool of sharing not only with classmates but friends and colleagues.

**CL Group.** Related to the importance of the technological support of learning processes and in the different components, in this case -as in the TBB Group one- there are differences between the information they give us in the activity mind mpas than in the general learning process diagram that we can resumen on the following table:

**Table 1.** Technological Support Vs. Non Technological Support in the Three Components of Learning, differentiated by data source. *CL Group*

| | Learning Process by Activity | | | General Learing Process | | |
|---|---|---|---|---|---|---|
| Reading | Tech Support | > | No Tech S. | Tech Support | > | No Tech S. |
| Doing | Tech Support | = | No Tech S. | Tech Support | = | No Tech S. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sharing | Tech Support | = | No Tech S. | Tech Support | > | No Tech S. |

They specially read using technology and it is remarkable that, apart from the sources provided by the teacher (that continue being crucial and, even more, exclusive in the non technological supported modality) and other complements looked on the Internet, this group read habittually blogs from their coursemates.

In the processes related with the *doing* component, as in the previous groups we have analysed, they concentrate their processes on the creation of artifacts. Moreover, it is very interesting to see that in this case they not only include individual processes of creation but they also include the process of "listening to classmates about the topic" (without technological support), so they really include process related to collaboration in the dinamic of each activity.


**Fig. 6.** Word cloud of the *sharing* no technologically supported processes. Group CL

In the case of this group they concentrate all their work related to sharing -almost exclusively- in the Blog and in the compulsory classroom dinamics for putting in common the activities (expositions and presentations).

**CHD Group.** In their representations of their learning environment and processes this group not only differentiate between technologically supported or not, BUT between inside and outside the classroom.

The data provided in the two ways (by activities maps and the general learning process diagram) expressed that they develop the majority of their process of learning (in the three component: reading, doing and sharing) supported by technologies.

In relation to processes of *reading* (completing, reading, looking for, and so on) they prefer to use the sources included in the institutional LMS -SAKAI-, and general Webpages, as well as Wikipedia and some specific Blogs from experts. Nonetheless, when we see the not supported by technology processes, the importance -where not the exclusive use- of the teacher provided resources (lectures, classnotes) is more evident that at any group.


**Fig. 7.** Word cloud of the *reading* no technologically supported processes. CHD Group.

When we analyse the processes related with *doing*, it is interesting to see how the majority of the technologically supported processes are related to the correcting of the work done without any technological support, specially with translation (usign Google translator, Wordreference, and so on). In addition, in the non technologically supported processes they reveal that they need to be together (f2f) in order to develop those processes (drawing, dividing, preparing, etc.).

In the case of the *sharing* component related processes, apart from almost the same situation as the rest of the groups, it is remarkable that this component shows the widest diversity of technological tools to be developed and. in the case of this group specifically, they also think on the possibility of sharing with their families.

**IKWYD Group.** This group presents differences between the information they give us in the activity mind maps than in the general learning process diagram, related to the importance of the technological support of learning processes and in the different components. We can resume on the following table:

**Table 2.** Technological Support Vs. Non Technological Support in the Three Components of Learning, differentiated by data source. *IKWYD Group3*

| | Learning Process by Activity | | | General Learing Process | | |
|---|---|---|---|---|---|---|
| Reading | Tech Support | < | No Tech S. | Tech Support | = | No Tech S. |
| Doing | Tech Support | < | No Tech S. | Tech Support | < | No Tech S. |
| Sharing | Tech Support | > | No Tech S. | Tech Support | > | No Tech S. |

It is very evident, on every mind map developed by this group, that verbs related to mental processes (thinking e.g.) are habitually non related to any technology, in contrast more "manual" verbs and processes are related directly to technologies.

As we have already seen in previous cases, the teacher is the principal source of information and materials for *reading* (reading, listening, extracting), and it is interesting to see –as in the other groups- how in the technological supported processes related to reading there are some multimedia sources, normally video tutorials.


**Fig. 8.** Word cloud of the *reading* technologically supported processes. *IKWYD Group*

In relation to the component of *writing* there is not much to say, apart than the most common verbs related to technological supported processes are Recording, editing digitalizing and contacting; but the verbs that are not related to technology are choosing thinking and organizing.

In the case of the processes related to the *sharing* component of learning, the data on this group remark the same as in the other groups, as so as the Blog is the principal tool for sharing and the only processes related to sharing without technologies are related to the classroom compulsory dynamics of presentation.

**NTL Group.** Finally, in the case of this group the majority of trends observed in the rest of the groups are also present.

We only see that, even when the other groups see the *sharing* component as the final part of activity and not much related to learning, in the case of this group they include in the *sharing* component some actions to be done during the process itself. Additionally the not only share things about the task included on each activity, they also see as learning processes, sharing about their feelings, behavior, and so on.

For this group, the learning processes related to the *reading* component are technologically supported as well as non technological at all. But, again, the only source of information not necessarily supported by technology is the teacher.

In the learning processes related to *doing*, the majority of the activity is concentrated in the non technological supported activities, but, in the processes related to *sharing*, the majority of the activity is hardly technologically supported.

### 3.2 General Analysis

**Based on the Union of Activity Learning Processes Mind Maps.** As we have said previously, we have also made the union of every part related to any learning component, in order to see the general trends that these diagrams could show us. Some of this data follows.

*About processes related to the reading component of learning.* Firstly, we have to say that, in the joint view of activity diagrams, the huge majority of learning processes related to this component are technologically supported.

Students read the information that teacher includes on the course LMS and look for some complementary information in the generalistic Internet tools (Google, Websites,

Blogs from other people). Moreover, this searches are multimedia and lot of them look for videos in order to understand better concepts and visions.


**Fig. 9.** Word cloud of the *reading* technologically supported processes. *All the activity mind maps together*

However, in the *reading* related processes the source is almost exclusive and "looking for" outside the technology could be considered marginal in our students. Students do not look for almost anything no technologically supported as complement to the information provided by the teacher.


**Fig. 10.** Word cloud of the *reading* NO technologically supported processes. *All the activity mind maps together*

*About processes related to the Doing component of learning.* In the cases of the learning processes related to the *doing* component, the distribution between non technologically supported and technologically supported is very similar.

We can see processes related to designing, developing, writing, reflecting, among others on this part, and in relation to the widest diversity of Web 2.0 tools in almost any format and using very different codes (always dependent of the task asked in the activity).


**Fig. 11.** Word cloud of the *doing* technologically supported processes. *All the activity mind maps together*

Learning processes related to the *doing* component but not directly related to any technology are more around taking decision processes, putting in common, thinking, making drafts and writing in the F2F context.

*About processes related to the Sharing component of learning.* The vast majority of learning processes related to this component shown into the group activity diagrams are related also with a technology. Nonetheless, the sharing tool by definition is the group Blog.

On it, and complementary to other Web 2.0 tools, students publishing, presenting and uploading their artifacts and show them in the final version (they remark a lot the final character of their productions for sharing, they do not share anything in process) to their colleagues, friends and the world.

Therefore, SNS also acquire a crucial role supporting these processes.


**Fig. 12.** Word cloud of the *sharing* technologically supported processes. *All the activity mind maps together*

**Based on the Union of the Group General Learning Processes Diagrams.** Additionally to the previous analysis, we have made a join vision of the general learning processes mind maps (see fig. 2) in order to have a complementary perception about the learning processes.

Nevertheless, once we have finished the analysis, the results we have obtained are exactly the same we have already shown on the immediate previous section. So we understand that there is not necessary –even desirable- repeat them.

## 4 Some Conclusions and Questions

Even when we are aware about the limits of this study related to sample size, the fact of our students are in a very formal learning environment, they are speaking not about Personal Learning Environments (PLEs) properly but about Group Learning Environments, and some others, we appreciated some interesting conclusions that could give us some interesting ideas in order to think about the PLEs nature, the implications of PLEs in formal learning processes, as well as the mutual relationship between formal and informal learning and how it could be seen in PLEs structures and representations.

Therefore, according to the data we have exposed in the previous sections of this paper we can conclude, firstly, that PLE includes, at the same time, technologically supported processes and a non technologically supported processes, and in the majority of cases they have being revealed as mutually complementary. This fact actually remarks the nature of PLE not as a technological tool but as a pedagogical approach with a hard technological base.

Additionally, learning processes more related to thinking and reflecting personally are habitually not related to any technological tool, but learning processes based in actions or active roles of the learner are strongly related to technology. This relation could support very much the trend of including active learning methods as a crucial part of the emergent (in terms of Veletsianos, 2010) pedagogies in the current technological era.

The data we have shown support the idea of a very "uncritical" student. In the process of getting information, students base their activity on the information provided by teachers and, surprisingly, the only complement this information using technological resources. It implies do not search for books, or papers, and off course do not go to the library in order to complement or contrast the information. In consequence, the teacher role as expert exceeds this characteristic and become almost infallible, with all the bad implications of this fact in terms of become critic citizens and so on.

Apart from that, if the teacher IS considered as the ONLY source, also students don't see their peers as sources for recovering information or as complements to the lecturer sources in order to understand better anything. This could be a problem in the long term; not in vain, peers (colleagues, friends, and so on) are one of the most important learning resources of any person on its lifelong learning process and start to appreciate them would be a crucial part of their education.

In the case of processes related to *sharing*, we are worried about the lack of importance students give to this component of learning. In the diagrams, *sharing* is always the final part of the process, and is almost only related to the artifacts that are part of the course assessment, so probably they will stop sharing their works once the assessment of any course will be finished. As a result, we consider that it will be very difficult that students include on their PLEs peers and networks (PLN) for sharing their work in order to get valuable feedback and discussion to learn more.

Also following with the data, "components" of learning we have used as organizers of the learning processes included n the diagrams -*reading, doing* and *sharing*- are easily appreciated by students as crucial parts of their processes, so they could be very helpful in order to structure these kind of explorations. Nonetheless, the kind of verbs related to each one of them, the unidirectional character of all of them, as well as the

publishing character of processes related to *sharing*, have suggested to us that they are not seen by students only as components that could be take part in any moment of the learning process, they seen those as a sequence, something like "*for learning you first recover info –from an expert-, then you have to do something and finally –remarked- you show it to others"*.

This perspective reveals a specific way to understand the learning process that is also the result of the kind of activities we have developed with our students in education in the past years. And those activities have been supported by our educational, epistemological and cultural beliefs around learning and education (Petko, 2012; Prestidge, 2012). Therefore, in order to implement any new perspective of learning it is crucial to make a deep change in the nature and development of learning activities that understand learning as a cycle of processes, more than a unidirectional sequence.

Once finished the analysis, it has been surprising for us to see that there is not any group that includes on their learning processes –even the general one- the processes related to the elaboration of the mind maps, even when the teacher have explained the "metacognitive" intention of the activity.

## 5 More Questions and Possibly Future Steps

We are pretty aware about the limits of this study. Nevertheless we consider than its weaknesses would give us some ideas in order to go in-depth of the PLEs research and it is also a good point to take into account.

Definitively, once we have explored this method, we need a more qualitative collection of data –probably interviews with individuals in order to complete a more individual and complete analysis.

In addition we think that there is also a very promising way of study, the analysis of the didactic activities used in the course with students, their nature, features, pedagogical beliefs behind in relation to the approach of students to the process for developing the task; as off course, their relation to different perspectives of PLEs.

Even so, we hope this study could help us effectively to open other ways–more based on pedagogy than technology- to understand the study or Personal Learning Environments and could contribute at least only in a small way, to enrich the debate that we have to continue in order to improve the transversal application of this approach to every educational context.

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# “Tips for Making a Movie”, a Learning Object for Autonomous Learning

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**Abstract.** The paper accounts for a developmental research in the area of courseware production for personal, and self-directed learning. A complete learning object was developed in the context of a master program in Technology and Digital Art. The aim is to make this course available through an online platform, using existing social networks to add social learning features. It is considered by the authors to be a kind of Personal Learning Environment, with a specific purpose.

**Keywords:** Learning Objects; Personal Learning Environments; Autonomous Learning; Cinema; Web 2.0

## 1 Background

The learning object developed was as a final assignment for the class "Concepção de Objectos de Aprendizagem" in conjunction with the class "Realidade Virtual e Aumentada". Both classes are from the masters program "Mestrado em Tecnologia e Arte Digital " at the University of Minho. Its content originates from the course “Curso de Realização Cinematográfica” (2009) designed by Prof. Lia Oliveira.

The main purpose is to make the content of this course available through an online platform and use existing social networks to add social learning features. The theme is cinematography and the subject is cinematic direction, which includes introductions to the cinematic language, screenwriting, digital post-production as well as practical tips and general information regarding video cameras.

The target audience for this Learning Object is wide: thanks to its accessible vocabulary, the provided glossary for terms specific to the subject, it can be of interest to school or university students, adults or senior citizens.

## 2 Description of Approach Used

Our main inspirational source in developing this learning object is the free online course

by the Stanford University, entitled "Introduction to Artificial Intelligence", described by its authors as a bold experiment in distributed education [1]. The term experimental is probably due to the fact that the use of social networks and online forums (for educational purposes), moderated by Artificial Intelligence algorithms is still in its infancy, subsequently it cannot draw on measured facts to sustain its validity, we can anticipate that in a few years this might change. In further analysis, interconnections between various models can be detected, a Distributed Learning Model [2], a Social Learning Model [3], with, at their base an ADDIE development model [4].

In this context the Social Learning Model refers to the extrapolation of a traditional classroom to an online collaborative platform that increases the student´s engagement by providing social network interaction [5]. Hard (2009) presents three different Social Learning Models, our learning object implements two of those three: the warp-around model and the collaboration model [5].

As for the design of our LO, we follow a specific design philosophy termed as user-centered design (UCD) or pervasive usability. UCD´s focus is on the user's needs [6]. Lin (2005) describes it as "The significant change is the learning paradigms shift - from instructor-centered to learner-centered" [21].

The five steps that constitute the ADDIE model are: analysis, design, development, implementation and evaluation. According to these five ADDIE steps for the development of our LO we went straight to step three since steps one and two were implemented by the actual content creator Prof. Lia Raquel Oliveira. At this third step of the development process we implemented a Learning Authoring Template [7] which we designed from our previous assignment, hereby proving its reusability.

The classic definition of a Learning Object is "any entity, digital or non-digital, that may be used for learning, education or training" [8]. This definition does suffer some criticism [9] for being too broad, thus carving the way for several other definitions, from which we find a few applicable to our LO, such as " each piece of content we store in a larger platform, and the platform itself that can contain other learning objects".

Some of the characteristics [7] we wanted our LO to reflect are: digital and deliverable over the internet, networked environment, re-use-able with different content, interoperable, easily adapted, granularity and durability. In order to make our final decision on which framework or platform to use, we tested a few[1] by using them to actively implement small segments of our content, our initial selection of frameworks and platforms to test were: eXe, RapidIntake, Calugo, Wordpress, and Campus Pack.

From this selection eXe, was the most accessible to developers since it is open source and easy to work with. Nevertheless, we were not satisfied with the options it offers to customize the final look and feel. RapidIntake and Campus pack offer more options, their drawback is that they are proprietary systems which carry a very hefty price tag. Calugo is still in the Alpha stage of its development process, therefore still quite buggy, which makes it not a viable option yet to implement a working LO.

In Wordpress we found all the characteristics we were looking for. Initially Wordpress

[1] The platforms explored were eXe http://exelearning.org/wiki, RapidIntake http://www.rapidintake.com/, Calugo http://calugo.com/, Wordpress http://wordpress.org and Campus Pack http://learningobjects.com/

was a Blogging framework. Nowadays thanks to a large community of open source developers it has grown to a fully functional Content Management System (CMS) with a proper MySQL database. Compared to eXe, Wordpress does require a little more work and coding skills to achieve a working LO. This extra work does pay off, as the final product can be fully open source, heavily customized and instantly available to the millions of internet users through any web-browser.

The first step we took to implement our LO was to install the Wordpress framework on a web-server owned by us, by doing it this way rather then using an externally hosted implementation, we can guarantee its durability, since we are not dependent on a third party service to keep it running. Quite often it happens that such services close their doors or change their way of operating and as a result its users are subject to loosing their hard work. Even though we rely on external services, like the micro blogging social network Twitter, the social networking service Facebook and the online video hosting service Youtube, the core of this Learning Object does not.

Once the framework installed, we started to design and implement a skeleton by creating all the sections and pages needed. With the skeleton in place, we were able to have a clear view of what was missing in terms of functionality to guarantee a comfortable navigation to all the content to be offered by the learning object. Implementing an easy navigation was achieved by choosing and installing the right Wordpress Theme [coraline], and customizing its CSS and PHP files to our needs. Our next step was to add all the textual and visual content, at this stage we did not add the actual videos instead we used placeholders to mark their locations in the LO. The formatting of all the textual content is a laborious task and requires a lot of attention to detail, by using placeholders for the videos we could concentrate on just this task and not get distracted with the technicalities of embedding and uploading videos.

We noticed that some of the textual content blocks were rather extensive and thus compromising the navigability of the LO, to avoid this we used a Wordpress plugin [10] which makes large text blocks collapsable and expandable by the user. The navigability of the LO was also increased by implementing a Tag Cloud [11] to give emphasis to all frequently used words in the LO.

To be able to embed all the videos pertaining to the LO, we created a dedicated Youtube account to upload all our videos to. Once all videos uploaded we replaced the placeholders with the correct videos. As an extra feature we added an interactive virtual three-dimensional camera, which we developed in Unity 3d, as part of our assignment for the “Realidade Virtual e Aumentada” class. To be able to interact with a virtual 3d object does add a certain value regarding user motivation. This object does compromise the LO´s mobility, something easily remedied by offering a static alternative to users who are not able to run the Unity Webplayer plugin [12] and by doing so we do not compromise the general usability and mobility of this LO as a whole.

### 2.1 Learning Object Structure

The LO follows the same structure as the original content, as-well as offering the user full control on how to navigate this content (Figure 1). A user can choose to sequentially follow the course by following the numbered sections, or a user can choose to navigate

straight to specific words via the Tag Cloud, or look up a specific term by using the search engine. Also the user can just view the videos on the LO´s Youtube channel. Each video does show to which section it belongs to in the LO, thus offering the user the possibility to consult the accompanying textual content, after or while watching the video.

These features enable the users to explore the learning object in the way they think is most appropriate to their needs.

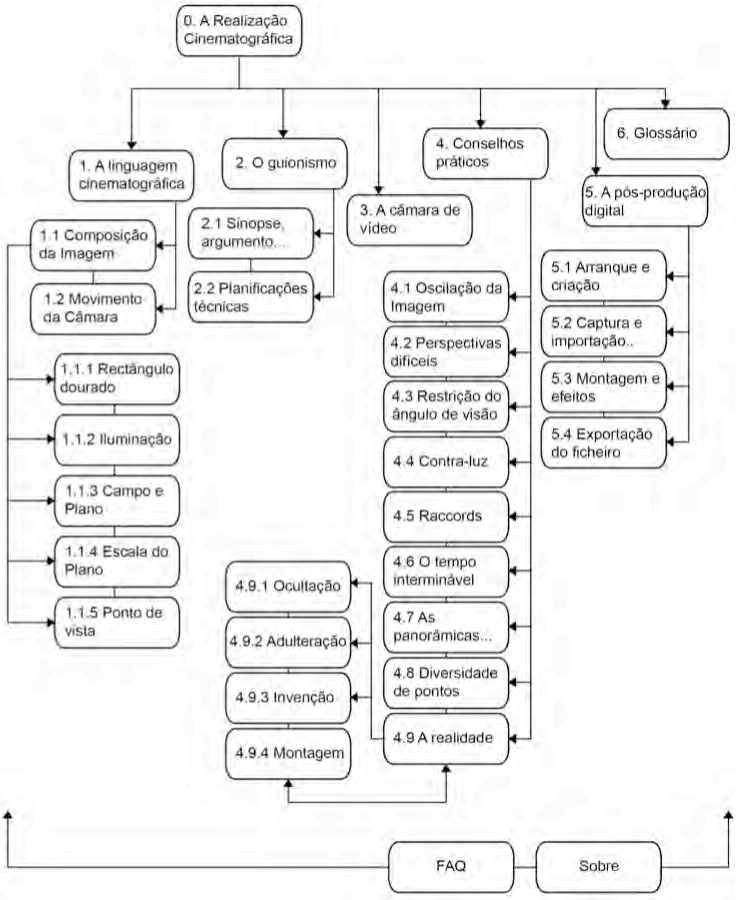


**Fig. 1.** Learning Object Content Components

## 2.2 Interface Characterization

For the implementation, as stated above, we opted for a three-column layout: Sidebar-Content-Sidebar. This particular layout was achieved by implementing the Coraline Wordpress theme.

We followed light and clean guidelines [13, 26] to give major emphasis to the principles of shortcuts and coherence, as well as considering the visual weight of the elements and the relationship between them in order to establish a visual hierarchy. Hereby taking into account some principles of perception: proximity, similarity, continuance, and closure. All these are aspects pertaining to the field of visual communication [20].


**Fig. 2.** Generic page hierarchy [20]

As the Stanford Guidelines for Web Credibility [22] points out "People quickly evaluate a site by visual design alone", as such, it is really important to consider the interface design of an online product.The major features of this learning object are highlighted in the next scheme.

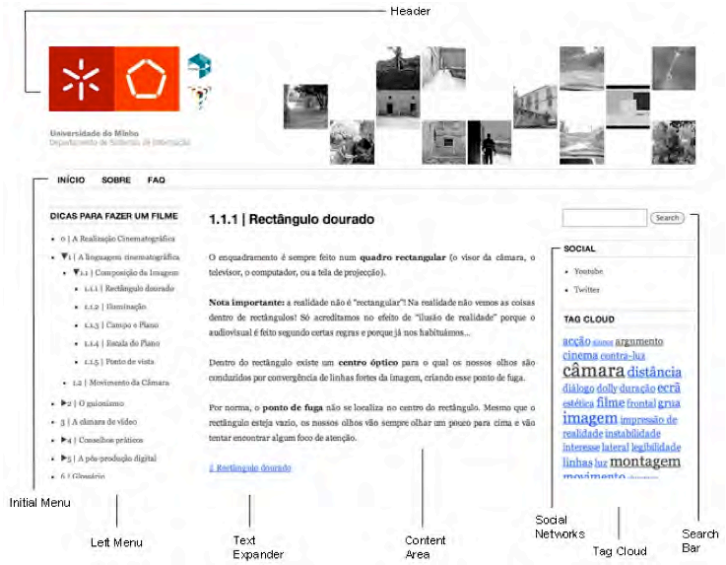


**Fig. 3.** The Learning object layout and its main sections

## 3 Results of Work Done

In order to evaluate the final result two sets of heuristics were considered: the ones advocated by Nielsen [14] and the ones by Bastien and Scapin [15]. We applied a mixture of both sets, from each set the most useful heuristics to our context, where seven were chosen. They are the following ones.

- Immediate *feedback:* In order to create a more appealing experience, the platform should respond quickly to any user input.
- Use of accessible language: To obtain an intuitive navigation the work should communicate with the user in an effective way. In other words: keep it simple.
- Consistency: Homogeneity of the elements used, according to the specific contexts.
- Prevention of errors: Quality of the error messages and the alternatives given to the user to find himself in any point of his exploration.
- Distinction by location: Association with other items by their localization/organization
- Aesthetic and minimalist design: Absence of non-useful animations, secondary information or unnecessary sections that could compromise the navigation.
- Compatibility: The capacity to maintain the same interface and behavior when using different environments.

The chosen heuristics allow us to conduct a user test during the project´s development phase. The test consists in the elaboration of one task using the CMS created, and three questions about it, then another task and the same questions referring to the second task. After that, there was four questions about general aspects of the experience. It was done in a quiet room with us and the testers (one at a time). We invited the testers to share their thoughts [16] during the test, because that way we could understand what they were thinking in specific key moments, and that's useful to discover errors we could eventually make.

The sample considered was two men and two women, with the ages between 20 and 40, from non-directly related areas of activity, with a medium degree of technological literacy, and with no previous contact with the project. They're not representative of our main target audience, however they correspond to the rest of the population we wanted to make this course accessible to, so to say, everyone. We chose a relevant range of ages, because that fact reveals different levels of life experiences.

The methods [24, 25] adopted were the participative observation and the inquiry. In the first one we used the recording of videos, the think aloud protocol and annotations on paper as techniques [17, 18, 19]. In the inquiry we chose the semi-structured interview constituted by open, dependent and closed questions with a nominal scale that ranges from 1 to 5.

Based on the interviews we found some aspects that could be improved:

- The tags in the camera are few: This can be easily solved by adding more tags with all the camera's parts discriminated.

- The lack of an introductory text before the camera's object: Include a short text in that place.
- The position of the search bar isn't right, because it isn't easily found: Change the position of that object to somewhere above, in order to be shown since the first contact with this work.

## 4 Conclusion

As a final conclusion to this assignment, we can iterate several useful findings which can be helpful for future productions involving Learning Objects. Creating worthwhile Learning Objects is definitely something that requires a multidisciplinary team. It is not just a product to be designed by designers or produced by programmers. It is of uttermost importance to have content specialists as well as generalists onboard and direct feedback from representatives of the target group at which the Learning Object is aimed at. Granularity is key for making content easily available through online platforms like our Learning Object. It allows the user to pick and choose which content is most useful to him or her, at any given time. This is also where the functionality of meta- tags and hyperlinks is shown in their best light, these are some of the key-principles and corner stones of the online medium. Granularity is not easily achieved and should not be left to the sole discretion of a graphical designer, but rather it is something to be achieved through tight collaboration between the team members.

It is worth noticing that at the time we started this assignment and took the Stanford Course as our main inspiration, we knew we were on to something, but we did not expect that today that particular project would evolve from one course to a staggering fourteen available courses, we think that this does show that there is an interest in this particular approach.

We also realized that our final product[2] only has the look of our inspiration, as it lacks the algorithms to moderate online social interaction in order to facilitate the personal access of the teacher to classes that consist of thousands of pupils worldwide.

In the context of Personal Learning Environments (PLEs) our Learning Object carries several features that help its integration into a PLE. The built-in social networking features (Youtube, Twitter and Facebook) allow the learners to increase their learning engagement by interacting and collaborating with the course and amongst themselves, thus adding layers of information to the original content. As stated by Jennifer [26] "the learner's role becomes both producer and consumer of knowledge".

The LO also carries all the needed information and links to all the elements to create it, thus offering the learner the ability to reuse the LO´s structure with different content. The LO itself responds to one of the challenges of the academic institutions that Gillet and Chatterjee [27] highlight. That challenge is to support the students in their informal learning practices and in the construction of their learning environments and networks as a next step in increasing digital literacy.

The LO also offers a high degree of flexibility slowing it to adapt rapidly to a user's

[2] The learning object is on-line in the following link: http://lodiy.org/

individual needs [28]. Since the LO is online and accessible on various platforms (Laptops, Smart Phones, Tablets, among others) its accessibility [29], aims to encourage mobile learning to occur in any place and at any time without physical location barriers.

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# 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.

[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.

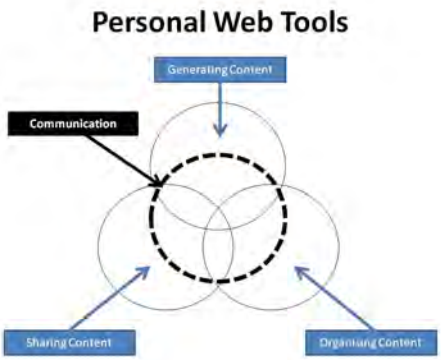


**Fig. 1.** Physiology of a PLE (S. Wheeler) http://steve-wheeler.blogspot.pt/2010/07/physiology-of-ple.html

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.

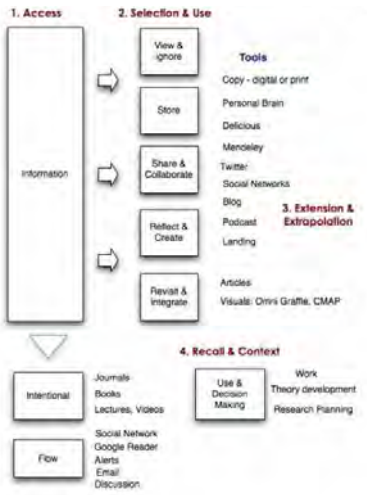


**Fig. 2.** How do you manage your information? (G.Siemens) https://landing.athabascau.ca/pg/blog/read/19803/how-do-you-manage-your-information

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.

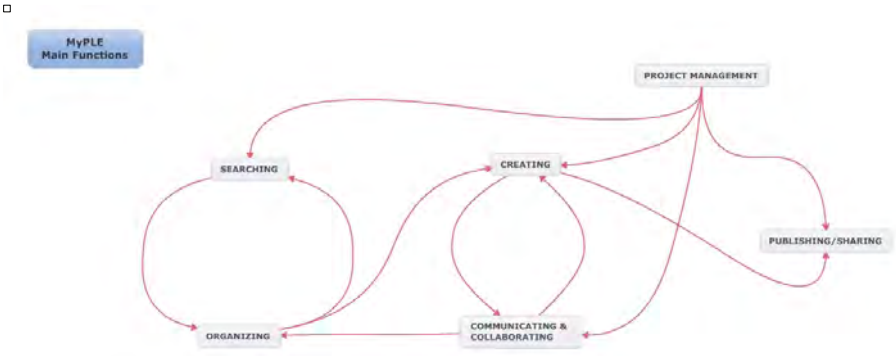


**Fig. 3.** The PLE Main Functions Model[8]

**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.<br>*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.<br>*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.<br>*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)<br>*Examples of applications' categories: agenda, project management tools* |
| PLE Interface | Interface to enable access to the tools, services and people<br>*Examples of applications' categories: personal pages, aggregating services* |

### 3.1 Students PLE's Results

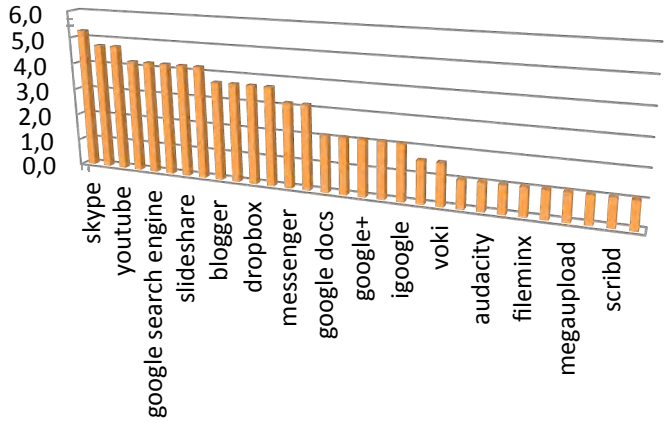


**Fig. 4.** Most referred tools in students' PLEs (%)

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.

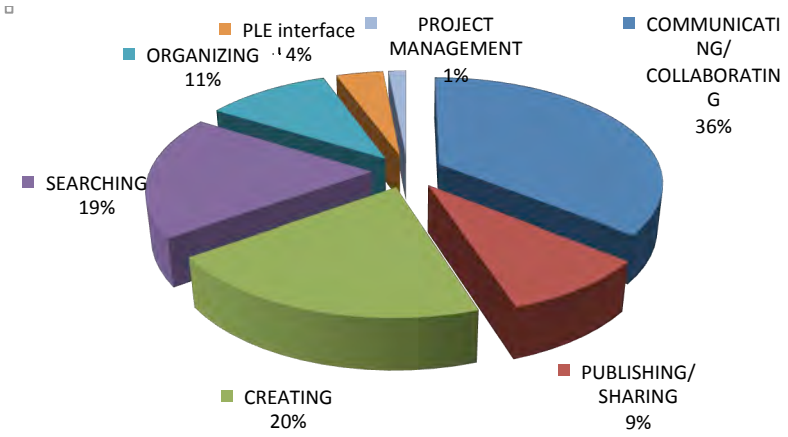


**Fig. 5.** Students choices assuming only each tool main function

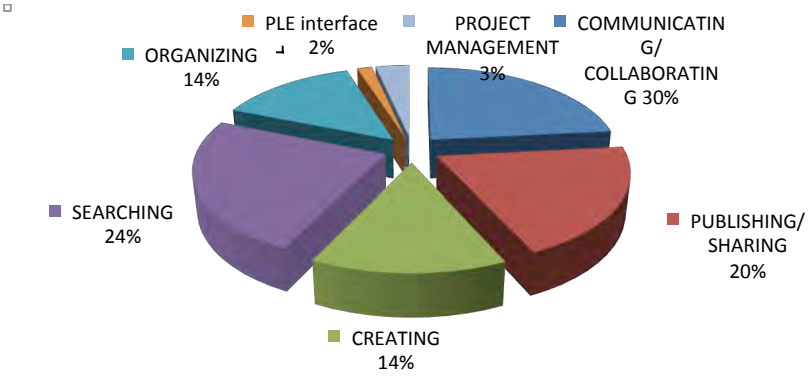


**Fig. 6.** Students choices assuming multiple functions of the tools [9]

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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# Building Personal Learning Networks through Event-Based Social Media: a Case Study of the SMiLE Project

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## 1 Introduction

In this paper we report on early findings of our SMiLE project which is evaluating how effective various online social networking channels can be in supporting how people network and learn from a major 'live' conference. The event took place at the University of Southampton in March 2012. We consider the dynamics of the relationship between 'real' and 'virtual' communities in the development of personal learning networks, for example how social networking impacts upon participants' interaction and engagement before, during and after the event as the community of practice develops. Assessing the impact of social networking activity on 'real world' outcomes has historically been a difficult task, but we argue that recent developments in social network visualisation and analysis now enable valuable insights to be generated for the benefit of both event organisers and attendees seeking to build their subject knowledge and extend their networks.

We begin with a brief review of networking theory and the emerging role of the online backchannel at 'live' events, before describing the approach we took to the collection and analysis of social media data from the CAA Conference. We then discuss the implications of our findings for people looking to build learning networks through the increasingly blurred boundaries of 'real' and 'virtual' networks. We conclude by highlighting some lessons learned and possible directions for future research. Our findings also have relevance to the PLE conference itself – which this year has the added dynamic of two face to face locations for the conference operating at the same time to pose new multi-channel communication and learning challenges for participants.

## 2 Theories of Networking

Research in a number of academic fields has demonstrated that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved, organisations are run, and the degree to which individuals succeed in achieving their goals. Nearly half (49%) of all UK Inter-

net users have used social networking at least once in the last year and over 70% of people and households are now Internet users (IMRG, 2011). According to research by Experian Hitwise (www.hitwise.co.uk) social networks in the UK received more visits (11.9% of traffic) than search engines (11.3% of traffic) for the first time in May 2010. Facebook is now the second biggest source of traffic online, closing in on Google's position as the most visited website in the world. Online social networks are accessible at any time of day and provide instant access to a diverse global network of individuals, thereby overcoming many of the limitations of traditional face-to-face networking such as small network size and lack of diversity (Zontanos and Anderson 2004).

A fundamental insight in understanding the Internet was the 'small world' discovery which proposed that everyone in the world was connected to everyone else in 6 jumps (Milgram 1967). However, not all of the individuals were connected equally because some were very much more densely connected than others. In the original research carried out by Stanley Milgram, he sent letters to 160 people asking them to forward the letter to Stanley Carnap, a colleague of his in New York. All the letters arrived in less than six steps, the last step being through only three separate individuals who were close contacts of Carnap. Interestingly, a modern application of this research focusing on Facebook connections suggested there are only four degrees of separation between any two network members (Backstrom et al 2012)

It is the 'strong versus weak ties' concept originally pioneered by Granovetter (1973) that still dominates modern thinking on the best way to leverage networks. He showed that those individuals or nodes of a highly clustered network that lacked weak ties were deprived of the latest thinking and knowledge, and tended to be characterised by fragmented and incoherent communication. The pioneering work of Granovetter in delineating the network effect has since been popularised by a number of writers, notably Gladwell (2000), author of the best seller 'Tipping Point'. Watts and Strogatz (1998) integrated the work of Milgram and Granovetter with their discovery that introducing a few random links into an otherwise structured network caused a dramatic reduction in the degrees of connection needed to link all the members.

Misner (2008) noted that there can be a tendency when networking to focus on people who have similar experiences or perspectives, making it difficult to obtain new business connections. Instead, cultivating a more diverse personal learning network enables people to increase the possibility of including these connectors or 'linchpins'. Linchpins are people who in some way cross over between two or more clusters or groups of individuals, allowing them to link groups of people together easily. A recent study by Bakshy et al (2012) of activity on Facebook, the world's largest contemporary social network, found that weak ties could play an important role in information sharing and network building. Although an individual strong tie was clearly influential, people who conversed infrequently through a series of weak ties often had more diverse social networks resulting in access to more novel information, allbeit on an ad hoc basis.

## 3 The Growth of the "Backchannel"

Ross et al., (2011) define a digital backchannel communication as a 'nonverbal, real-time, communication which does not interrupt a presenter or event' In a backchannel,

the individual tweets combine to form a powerful Twitter stream that can change presentations from stagnant to flowing and from slow to fast moving (Atkinson, 2011). 'These digital backchannels rise in importance as social information spaces, in which people complement and co-create large-scale events,' (Dork et al., 2010). Since Twitter is a public and potentially a global space, 'people on Twitter have their own audiences in the form of their followers, so whenever they post something they open up a new communication channel that extends outside the room' (Atkinson, 2011:54). According to Atkinson (2010:17): 'A backchannel is a line of communication created by people in an audience to connect with others inside or outside the room, with or without the knowledge of the speaker at the front of the room. Usually facilitated by Internet technologies, it is spontaneous, self-directed, and limited in time to the duration of a live event. A backchannel can be constructive when it enhances and extends helpful information and relationships, and it can be destructive when it articulates and amplifies counterproductive emotions and sentiments.'

DeVoe (2010:167) notes the importance of Twitter at conferences; 'Participating in conferences online via Twitter has growing appeal for conference enthusiasts, regardless of whether they are physically attending. For those who are unable to attend in-person, tweets after the conference help give a sense of "being there" while still catching the salient points of presentation talks. For on-site participants, contributing and commenting on tweets aids in creating rich, multi-threaded conversations that span the length of the conference and beyond.' (DeVoe, 2010:167)

In summary, 'the backchannel dismantles the pedestal and gives everyone equal access to the same information' (Atkinson, 2010:207). It is clear from this brief review that online network building and engagement can offer significant value over and above what attendees derive from the event itself. From a learner's perspective, the increasing efficacy of video and twitter channels in providing such opportunities for remote attendees means that decisions have to be taken on whether physical attendance is worth the time, inconvenience and cost of physically travelling to an event. In the next section, we describe how we collected data from 'actual' and 'virtual' conference attendees and analysed the impact of social networking activities on the networking and learning opportunities presented by the event itself.

## 4 Methodology

We monitored the use of a range of established and experimental social media tools to track how they were utilised by both 'real' and 'virtual' delegates before, during and after the conference. We expected that such activity would include information recording and sharing, network building, profile raising and contribution to the development of a sustainable community of practice. During the event, we carried out a number of interviews with conference participants about their individual experiences and interactions via Twitter, Storify, Flickr, Vimeo, and groups on LinkedIn and Facebook. We used tools such as the #caasoton WordPress site to share information with delegates, and many other platforms, including Corkboard, to reflect real world activities at the conference, including a drive to collect delegates' memories of past events where physical records were converted into a digital timeline. We used platforms such as delicious to automatically collect URLs to resources, and saved tweets to an online archive to curate and then share in the future. We also set up projects to

extend beyond the conference including a Wikiathon event and a blogging competition, organised as part of the international Day of Digital Humanities event. We were fortunate because all delegates (over 450 people) were required to complete a survey in order to register for a new membership website, and we included relevant questions about their social media usage at the event in this document for later analysis. More details of our online and offline data collection processes are available in the Appendix.

# 5 Early Findings

## 5.1 Use of Social Media

So how did it go? We have been overwhelmed by the continuing use post-event of the social media set in place during the conference. There are so far over 12,000 tweets that have used the #caasoton hashtag, with more discussions continuing on Twitter. To date, over 430 photos have been uploaded to the #caasoton Flickr group and our Vimeo videos have been viewed over 2,100 times, with viewers from 47 countries. Nearly half of the 450 conference delegates used #caasoton on Twitter before, during, or after the event, and there were many new converts to the tool. There was an active group of 'virtual' contributors (over 70 people registered with the event as 'virtual attendees') on Twitter, with some 20 additional users joining in the conversations from elsewhere.

Figure 1 below taken from our post event survey highlights what people were mainly using social media for:

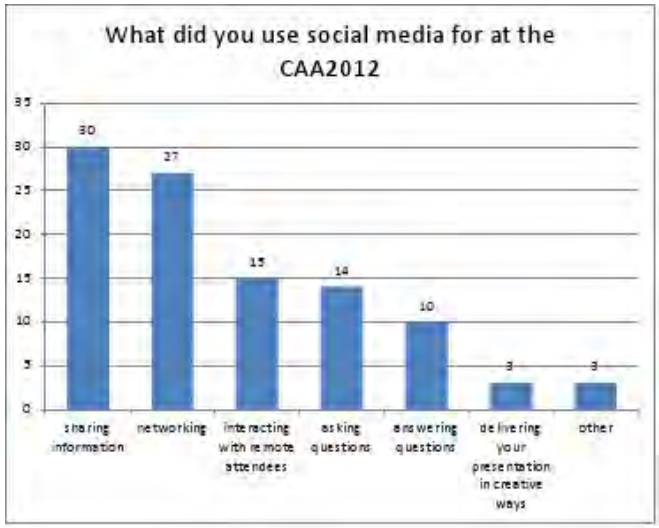


**Fig. 1.** Uses of social media at the event

From the specific comments delegates made about the value of social media at the event, we observed that tweeting during sessions allowed people to make connections and curate what was going on in different rooms, in real time. Some of these discus-

sions could even be considered as defining new online 'sessions' or themes, as delegates' comments from the post-conference survey show:

"The virtual interaction across sessions was interesting and added to the sense of the conference as a single event. Often 'themes' are fragmented with little cross pollination…this was reduced at CAA12 by social media."

"It was great to be able to follow a discussion taking place during the paper being delivered"

"It was possible to follow something of the interesting parallel sessions you could not attend and to pick up interesting urls and so on."

"I felt the comments enriched the discussion and help bond some delegates more quickly than by happenstance in the social events"

"It was extraordinary. It helped me gauge the general response to papers I was attending and not attending. Fantastic."

And from real-time Twitter comments:

"Almost everyone in this session has tweetdeck open or is tapping away on a phone. And it's totally appropriate"

"Amazing use of social media, accessability, connectivity. Set the bar VERY high for all future conference"

A number of challenges were also highlighted that need to be considered for the future. Some people who were not active social media users felt excluded from the conversations that were happening within the online platforms that delegates were using:

"If you have no social media account you are no one."

And of course the opinions expressed online can only reflect the views of one segment of the total population, which is not necessarily representative of the community as whole:

"I think just looking at the twitter stream gives a skewed idea of what people really think is interesting or noteworthy."

This last point is perhaps of most interest. The same respondent went on to comment that the Twitter stream had provided an idea of what others at the event were finding interesting but that they felt that this was not necessarily representative of the whole delegation which may not have been a representative sample of the attendees. Looking at the Twitter archive, this is a fair comment, as from a delegation of 420, there were 184 users using the #caasoton hashtag. Just under 44% of the delegation were present in Twitter. Similarly, in our ongoing analysis we are exploring the extent to which twitter encouraged specific forms of communication within the conference, perhaps concentrating on discrete ideas that were clearly expressed in papers rather than complex syntheses and ambiguous conclusions.

There were also concerns expressed about the public nature of the activity and the extent to which photos or comments were being shared without specific permission, for example in blog posts or via Storify. While there was significant enthusiasm to archive the whole collection of online materials for the benefit of researchers or the organisers of future CAA events, other delegates felt that the data should first be anonymised, or indeed not kept at all. This dilemma is being addressed in ongoing discussions about the development of a code of conduct for the collecting and then archiving of social media data in an appropriate way.

### 5.2 Archiving Issues

There were some interesting comments from delegates about potential uses for the Twitter archive. The issue is not just saving the data, but preserving it in a way that is meaningful and useful for learning purposes. Particularly thought- provoking were those comments that considered how real value could be added to the 12,000 tweets available online. One survey respondent said: "Who's going to read all those 12,000 messages?" And another: "Basically there is no use saving it all. Making informed selections and processing it into a desirable and accessible format would be best." Specific suggestions for making the data more useful included linking specific tweets to papers as they were presented, and also incorporating later tweets and feedback relating to individual papers. Similarly we are considering the many possibilities of data mining, although again in the context of wider ethical considerations. Of particular significance here is the ethical relationship between making thoughts public (i.e. tweeting) and making broader interconnected narratives and opinions public (i.e. via data mining of tweets).

Research by Costello and Priem (2011) evaluated the opinions of twitter users about the archiving of tweets. The results were quite negative - although most people interviewed said that tweets should be archived, particular concerns were expressed about 1) institutional archiving (as being analogous to the recording of phone calls by one's boss) and 2) the possibility of individual comments being taken out of context and used against the author in the future. The authors noted that the decision by the US Library of Congress to archive tweets (which took place during their data collection) had a notable positive impact on the acceptability of tweet archiving to their interviewees. These two concerns resonate with our own plans for the tweet archive.

Firstly, in partnership with the JISC DataPool project based at Southampton, we are exploring possibilities for a University-wide system or procedure for archiving tweets. Such a system would work on request i.e. a member of the University would request particular @ and # tags to be archived over a given period, rather than the University implementing a blanket policy of harvesting tweets generated by members. The datapool project is producing policies and frameworks for research data management across the University. One case study in this project relates to the archiving of social media content created relevant to ongoing research projects. We are exploring the ethical and legal issues for this in the SMiLE project as described above, so DataPool is concentrating on defining a policy framework for management of such content by UoS researchers, advice on social media use for research activities (in partnership with Digital Literacy initiatives and the Student Digital Champions), and evaluation of social media archiving and mining platforms. The latter has involved discussions with the Web Observatory and Eprints, both of which provide solutions for harvesting and

interconnecting very large volumes of social media content. We are currently working with them to develop tools for UoS researchers to generate such archives.

Secondly, we are very keen on expressing context through mechanisms such as timelines and network visualisations. Such expression of context is itself not without its problems as by representing context it becomes much easier to see trends in discussion, for example about individual papers, whether these are positive or negative in tone.

As part of the preparations for the depositing of the archive with the ADS, all users who had used the #caasoton hashtag were contacted and asked to complete an opt-out form for any tweets that they wished to have removed from the twitter archive. No users came forward, and so the twitter archive will at present be submitted to the ADS for consideration complete. The archive will undergo a standard collection and retention evaluation at this stage and we will continue to develop a long-term deposit strategy with the ADS. Separately, within the post-conference feedback process, all delegates were asked to comment on what they thought the future of the twitter archive should be. 151 responded to the survey. The majority of respondents preferred that the archive be kept, with most preferring submission to the ADS. Out of those participants who wished for the survey to be submitted to the ADS, over half wanted twitter users to be given an option to opt-out of the archive. Figure 2 below gives an overview of the results:

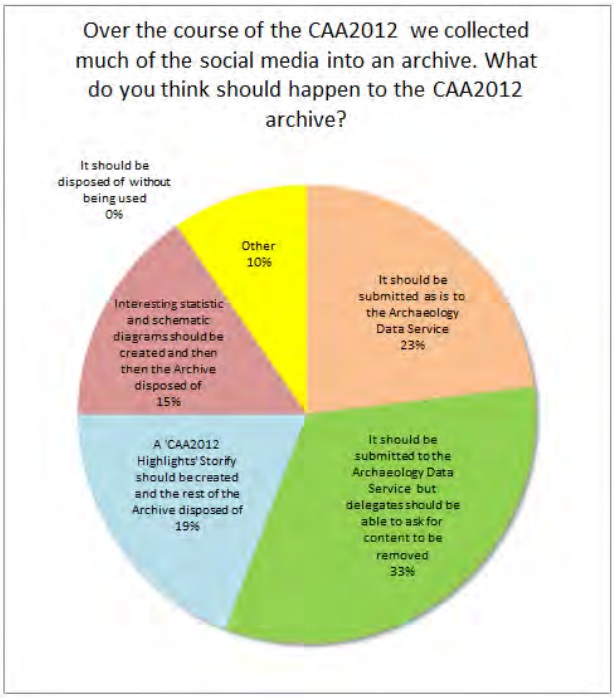


**Fig. 2.** Survey respondents' ideas for #caasoton social media archive

15% of respondents wanted to see visualisations of the data, which will be discussed in another paper. 56% felt that the archive should be kept, with the majority of

that percentage preferring to be given an option to remove their content from the archive.

## 6 Learning Benefits for Participants

The SMiLE project has provided data with which we can begin to test the extent to which social media can support people with network building, the development of subject knowledge, and the experience of a live event generally. Through post conference feedback delegates have evidenced that social media can support the development of specialised networks for individuals, and this is supported by the work carried out by Reinhardt et al., that noted how Twitter could contribute during conferences to building ties within soft communities (2009: 153). Respondents told us that:

- Social media allowed them to 'meet' people at the conference that they would not have had time to meet if those tools were not being so extensively supported,
- Circles of contacts were strengthened and extended through conversations occurring on Twitter around a common topic,
- They had identified new contacts with whom a connection was not apparent before engaging with their social media user profiles,
- It provided a way to find out more about delegates who were at the conference, in order for new possibilities for connections to be explored,
- Increased interest in sessions being run at the conference therefore broadened the group participants,
- Social media gave additional information about delegates away from their CAA presence, which led to new relationships being instigated at the conference that would not have been pursued if only the information available at the event had been available.
- Social media also provided a new way to support the development of subject knowledge. Delegates told us that through the support of social media at the event the following learning had occurred:
- Twitter provided a safe environment to ask 'silly' questions that delegates would not be comfortable asking within the conference,
- The social media was a platform for conversations to occur between individuals that were not together at any point during the course of the event (because of differing interests),
- Online interactions made the subject matter more accessible for newcomers to archaeological computing,
- To a certain extent, following conversations happening within the social media individuals were able to gain an idea of topics that other delegates found interesting,
- Additional tools and resources were referred to and linked to through the social media,
- The social media provided opportunities to follow up things that were happening at the event and therefore lead to the discovery of further information, and quicer,
- Following conversations happening on social media platforms meant that individuals were able to identify more relevant sessions that were running and therefore ensure that the most useful parts of the conference programme were encountered.

Delegates were asked to comment generally on how social media contributions had added to their experience of the CAA event, in almost all instances responses were positive. Overwhelming opinion was towards the usefulness of Twitter as a platform for following what was happening elsewhere at the conference, joining up separate sessions and topics. Some of those comments are highlighted below:

"Being able to "follow" more than one session at a time, getting immediate feedback from the audience spread to thousands of people and cultivating a geek approach to discussion are all parts of the good #caasoton experience."

"Enhanced feeling of connectivity, excellent networking tool to meet delegates', ability to monitor multiple sessions, increased dialogue outside session presentations."

"The virtual interaction across sessions was interesting and added to the sense of the conference as a single event. Often "themes" are fragmented with little cross pollination this was reduced at CAA12 by social media."

"It was possible to follow something of the interesting parallel sessions you could not attend and to pick up interesting urls and so on."

"Allowed me to follow what was going on in parallel sessionsand allowed me to participate in discussions during the sessions I was in."

"It was extraordinary. It helped me gauge the general response to papers I was attending and not attending. Fantastic."

"I felt the comments enriched the discussion and help bond some delegates more quickly than by happenstance in the social events."

"Increased awareness of others using the same tools to discuss networking more freedom to discuss questions outside of the room and in multiple rooms remotely- at the same time!"

"Many ways- hard to describe as this was my first conference where social media has hit the saturation point needed for it to be useful & stimulating. I felt more engaged because I was able to discuss themes and questions with people not in the session. I was more aware of the general themes of the conference, the bigger picture was easier to grasp but I was also keenly aware that I was missing very cool papers in parallel sessions!"

"As expected it allowed me to see what people were saying both in sessions I was attending and other sessions going on as well as different events at the conference."

One comment regarding the use of a daily hashtag to stimulate discussion is interesting; the delegate comments: "The daily hash tag events were thought provoking even if I didn't actually take part in them." The daily hashtags had a very low uptake, and this comment highlights how difficult it is to measure the success of such an intervention; until this feedback it was assumed that the hashtags had had little impact, but instead it seems that they were noticed, and created discussion, but were not used explicitly within tweets.

The online channels provided an additional space for conversations to continue after sessions dedicated to particular topics had ended, as one survey respondent said:

"It was interesting to see discussions develop on twitter after presentations."

Delegates felt frustration that the conversations that were happening in Twitter were not then brought from that platform into the real world event, as the comments below evidence:

"I saw comments from other people and added my comments, however these were not directed to the presenter which was a shame."

"For me not much. I don't have a Twitter account which seemed to be the main activity going on and some of which was visible on Facebook."

"It was hard to follow since so much posting was going on. I also felt like some folks were tweeting at the expense of hearing the presentations or discussion effectively."

One respondent summarised the issue of there being so much activity occurring at a live event within an online channel:

"…. I just think people aren't good at multi-tasking even though they think they are."

This highlights that there is a need when implementing a strategy for supporting social media at such a high level to provide ways to experience the vast amounts of information being produced that are in addition to the those provided by the tool itself. From the post-conference survey, we know that over half of the delegates who responded were using a device other than a laptop or PC to access the social media, and more support could have been provided to ensure that other means to access data were available at the conference. For instance, the Twitter feed was streamed live onto one plasma screen at the event, and more screens showing alternative live Twitter searches could have been set up, with additional screens for other social media content, such as the Flickr photos being submitted by delegates, could have been showcased. For us, this tweet from a delegate summarises the challenge of the event's use of social media:

"At least before twitter I could dwell in blissful ignorance of all the cool pertinent stuff I was missing #caasoton"

The challenge now is to work on designing interfaces that allow users to investigate the data in the most useful way. By far the richest social media data is the Twitter hashtag archive. Our initial visualisations of the Twitter data uses network analysis to illustrate the relationships that exist between Twitter users, through linking different information together, such as shared hashtags, or retweets.

## 7 Next Steps

The team hopes also to analyse the content of the #caasoton tweets to begin to provide information that will contribute to the planning of future events. It is anticipated that the information will provide useful insights into the requirements of this specialised network. For example a high percentage of the tweets using the #caasoton hashtag contained URLs. The top ten online resources will be identified and shared with the

network and in addition to this, types of sites referred to by the URLs included within tweets will be analysed using a categorisation method similar to that put forward by Weller et al. in their paper investigating Twitter citation analysis for scientific conferences (2011). This categorisation will aid the identification of the most popular kinds of resources used by the network.

Since the conference, we have recruited a number of MSc students who are drawing upon the social media data from the conference to write dissertations over the summer. Their topics include bridging the 'tweeting divide', managing online communities in the context of live events and the opportunities and challenges posed to researchers by data visualisations. When completed, we plan to publish summaries of all these project findings as freely available downloadable resources. We will also be developing resources for other institutions planning live events who wish to use social media to enrich the delegate experience, as we believe that these platforms and tools have real potential for increasing opportunities for sharing knowledge that research events already foster. We are also working with the Oxford e-Research Centre to develop a code of conduct and best practice guide for the collecting, curating and archiving of social media data based on our experiences so far, and to publish in greater depth on the ethical considerations for such activity. Finally, we have noted how the SMiLE project is forming a case study for the JISC DataPool project and we will contribute to its final report and recommendations. A SMiLE team member, Nicole Beale, has been co-opted onto the CAA steering committee as the social media advisor and is currently designing a social media strategy for the next CAA conference, due to take place in Perth in 2013. This next event will provide an opportunity to test findings from the initial stages of the SMiLE project.

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# Sharing Personal Learning Environments for Widget Based Systems using a Widget Marketplace

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**Abstract.** Presently, there are multiple web and mobile application stores on the market providing various tools and supporting creation of mashup spaces. However, only some of them concentrate on offering learning tools and necessary guidance in constructing Personal Learning Environments (PLEs) by the users. This paper represents a marketplace focusing on educational applications and their categorisation according to functionalities, learning phases they support, and learning domains the tools refer to. The represented approach aims at assisting users in selecting applications supporting their particular learning goals and needs. Besides interoperability and technical issues, the actual use of the technology and further research questions are discussed.

**Keywords:** Personal Learning Environment, Self-Regulated Learning, application store, mashup, widget, learning bundle, recommendation

## 1 Introduction

In the last years, a lot of research has been conducted in the area of Personal Learning Environments (PLEs) covering two aspects: PLE as a concept and as a technical solution. As a technical solution, PLEs can be seen as mashups of (small) software components, which are brought together and organised to fulfil specific (learning or teaching) goals. Both the assembling of PLEs as well as their sharing is supported by multiple well known platforms (e.g. iGoogle[1] and netvibes[2]). Most of these solutions are widget based.

The existing application stores established on the market provide a wide range of tools and (in some cases) may support creation of mashup spaces and their sharing with a community. However, they have only few tools and content focusing on learning, as well as little guidance to find applications for a specific learning purpose, such as categorization of tools. Further, existing platforms allow only assembling tools used in a platform itself (e.g. widget based systems do not allow adding web or mobile applications in their spaces).

[1] http://www.google.com/ig
[2] http://www.netvibes.com

This document describes a learning application marketplace, the ROLE Widget Store, which is a part of the EU project ROLE infrastructure [3]. The Widget Store addresses the issues identified above providing various learning applications categorized based on functionalities, learning phases, and learning domains.

Also, the Widget Store offers services allowing platform independent PLE sharing, thus, supporting the development of a community of practice to exchange learning tools as well as composed templates of learning tools and artefacts (the so-called learning bundles).

Concentrating on the concept of learning bundles, this document describes how they can be applied and shared across different learning platforms. The paper describes not only interoperability and technical issues, but also actual use of the technology, as well as further research questions, e.g. types of tools that could be offered for (mobile) PLEs in the future.

## 2 Related Work

While multiple application stores (especially in the mobile sector) are available, platforms focusing on educational applications are still rare. Two of them, besides the ROLE Widget Store, are represented below.

The open source project Edukapp[3] founded by JISC and used in the EU project ITEC[4] aims at providing cross-university widget stores. It includes W3C and OpenSocial widgets and plans to offer recommenders and social functionalities. The ITEC project will use the developed applications to provide a widget directory for secondary schools.

Edshelf[5] is a directory of learning applications and offers educational, mobile web and desktop applications. Currently, a beta version is published which is already filled with applications for different platforms. The applications are categorized by several functionalities: teach, make, communicate, find, assess.

## 3 The ROLE Widget Store

### 3.1 Overview

The overall goal of the ROLE Widget Store is to provide a repository for education related applications to create flexible Personal Learning Environments based on open technologies. This includes a wide range of tools, support in finding applications for a specific learning goal (e.g. by a community, automatic recommenders, and predefined compilations of applications), as well as simple mechanism to add widgets to a PLE (see Fig. 1. ).

[3] http://code.google.com/p/edukapp
[4] http://itec.eun.org
[5] http://edshelf.com

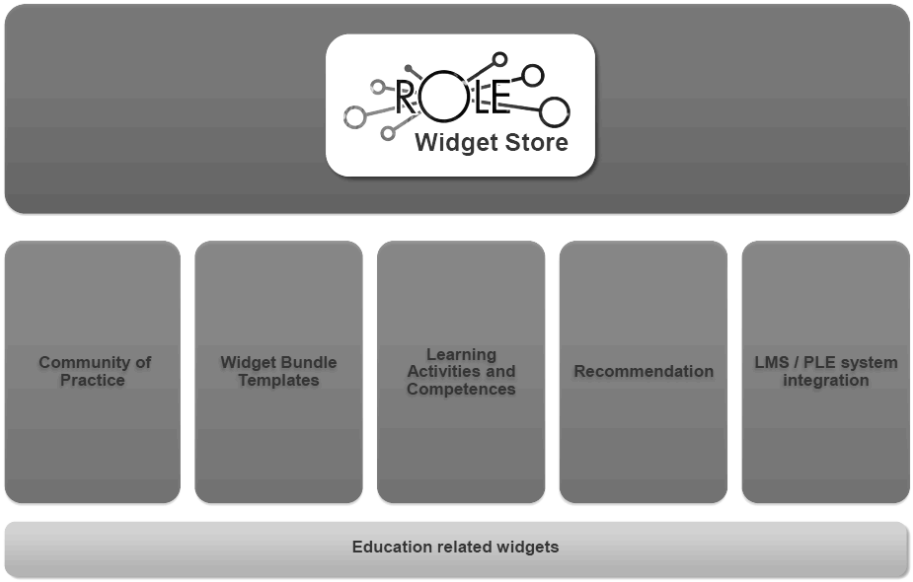


**Fig. 1.** Overview of the Widget Store components

As widgets allow flexible mashups by providing, on the one hand, a small set of functionalities and, on the other hand, the possibility to communicate with other widgets, they were chosen as the software type to be supported in the Widget Store.

Inter-widget communication can be realised either between widgets in a browser (local inter-widget communication) or remote between two users (remote inter-widget communication) [3].

Widgtes, both the W3C [1] and OpenSocial specification [6] can be integrated into several CMS, PLEs and LMS (e.g. Moodle[6], Liferay[7], CLIX[8]).

### 3.2 Widgets

The developers registered in the Widget Store are able to add either self-developed widgets or widgets based on a licence allowing further distribution. Currently, W3C and OpenSocial Widgets can be added to the repository via upload or reference respective their specification.

Metadata, which is already available in the widget manifest, is extracted and automatically added to the system. The widgets can be enriched with additional metadata (e.g. author contact details and licence) and media (including screenshots, screencasts and use cases).

Once a widget is uploaded, its quality is checked by a ROLE developer (acting as editor). An additional important quality indicator is users' feedback by rating and commenting. Further, a detailed usage report can be added to the widget.

6 http://moodle.org
7 http://www.liferay.com
8 http://www.im-c.de/germany/de/solutions/learning-management/clix-2012

### 3.3 Bundles

Bundles are templates for PLEs containing learning tools and content. The idea of bundles is to exchange good practices of working with learning environments. Bundles are not intended to model a structured course (IMS Learning Design[9]). Instead, they are intended as a fast and simple way to provide learners with tools, content, and a detailed description of how to use these to complete a specific learning task.

A bundle targets particular learning needs that are described in the bundle itself. Using the categorisations (see section 3.4) bundle designers can choose several tools from those available in the marketplace to create a set of applications supporting learning goals. Additional references to learning content can be added.

For each tool and content bundle designer are able to add a learning activity in order to describe what should be done using the tool or working with the learning content. Once a bundle is created by a learner or instructor, it can be shared to be discussed and refined by the community (see Fig. 2).

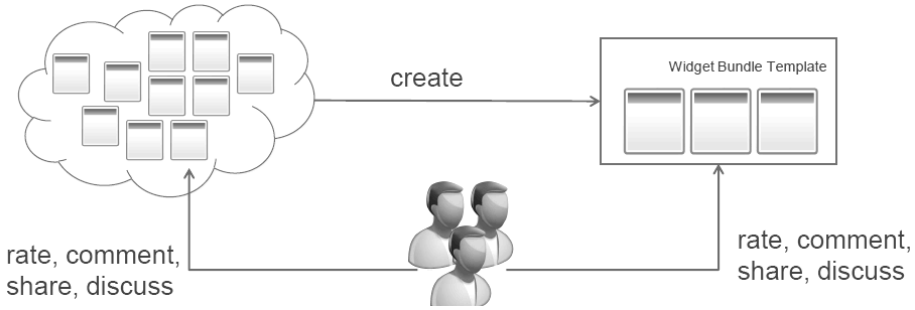


**Fig. 2.** Creating and improving bundles

### 3.4 Categorisation

In order to support learners in selecting applications for their PLEs, a tool categorisation describing purposes of the widgets is offered. The introduced categories allow users to choose widgets supporting different learning phases and can be used for recommendations to complement a PLE.

The tool categories were derived from the Psycho-Pedagogical Integration Model (PPIM) [2], which has been developed in the ROLE project to support the concept of personalised self-regulated learning. Fig. 3 demonstrates mapping of categories (grey) and phases of the PPIM (white).

[9] http://www.imsglobal.org/learningdesign

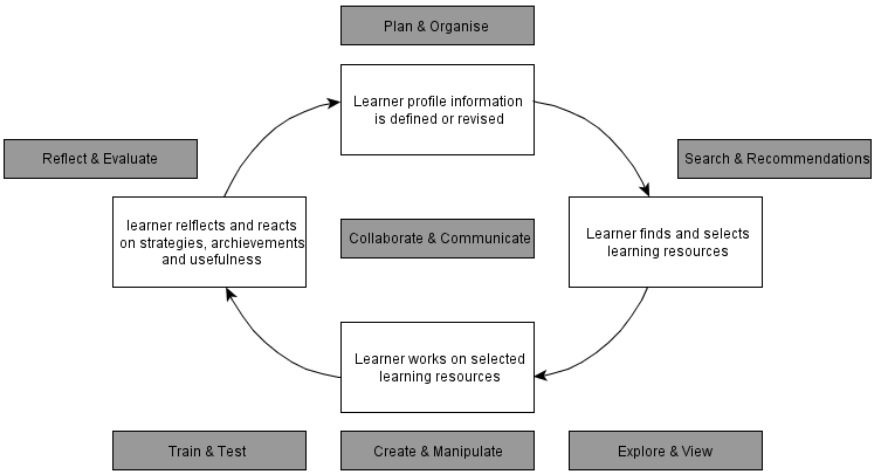


**Fig. 3.** Mapping of PPIM phases and tool categories

In addition to the tool categories, functionalities described in an ontology[10] developed in ROLE are introduced. These functionalities represent features of widgets (e.g. text editing, video chat), whereas the ontology includes also tool categories represented above and defines mapping of the categories and functionalities to support recommendation systems.

Widgets can be either generic (e.g. text editor) or targeting specific learning domains (e.g. French language). It is also possible that widgets only provide some specific learning content. As these widgets can be hardly described by tool categories or functionalities, a categorisation based on learning domains is introduced. The service of dbpedia[11] is used to allow users tagging widgets by learning domains so other users can find them more easily.

The categorization of bundles differs from the one of tools. A bundle can (and should) be designed to cover several phases of the PPIM model and thus refers to several tool categories. Also, a bundle does not provide functionalities by its own. The approach of the Widget Store is that a bundle automatically inherits functionalities of tools it contains and can be tagged manually by learning domains from the dbpedia.

### 3.5 Integrating Widgets in (Personal) Learning Environments

To allow users adding widgets to their preferred learning platform, the Widget Store provides several possibilities.

Firstly, the store offers a button available for a limited number of platforms to add a widget directly to the target platform.

Secondly, the store provides an embedded view, so it can be integrated in learning platforms using an inter-widget communication library. This approach is used in the test implementation of the ROLE project [7].

[10] http://purl.org/role/terms
[11] http://dbpedia.org

Finally, the store offers web services allowing other platforms receiving information about the tools and bundles and processing this information to support learners in assembling their PLEs.

Several more PLEs and LMS already support manual integration of widgets, making it possible to manually add widgets from the marketplace. For this reason, it is possible to download the widget code from the store or get the reference to the widgets. For platforms, which do not support widgets yet, an embed code is provided.

### 3.6 Actual Use and Evaluation

Currently, around 90 learning tools contributed by the ROLE project consortium members and external developers are available in the Widget Store. These are equipped with categories, functionalities, and learning domains and can be filtered by relevancy, type, name, author, and date. In addition, community features, such as connection to Facebook and Twitter with "Like it" button, as well as rating and commenting of widgets are available.

The applications available in the Widget Store can be added to PLEs, such as iGoogle, Graasp[12], and ROLE test environment SandBox[13]. Furthermore, the tools can be used to populate learning spaces of a Personal Learning Management System (PLMS) [8] aiming to extend curriculum-based learning in an organisation with self-regulated learning activities.

The Widget Store has been used and tested in several project workshops and courses at universities. An evaluation of widget usage in conjunction with ROLE PLMS has been conducted at one of the ROLE test-beds [8].

## 4 Conclusion and Outlook

Presently, the ROLE Widget Store provides web based learning applications and recommender tools (e.g. mashup recommender [9]) supporting construction of PLEs and PLMS by the users. Planned future work are to add further tools, such as desktop and web based tools, as well as mobile applications to be used in mobile learning environments.

This wide spectrum of tools will allow learners to create, share and refine platform independent learning bundles. Also, more PLE hosting platforms will be integrated with the Widget Store; support for representation of external tools and learning artefacts on such platforms will be provided. This includes examining the possibilities to bring content to mobile devices by transforming web widgets into mobile applications.

In order to enrich learning experience of the users and support pedagogical aspects of the learning processes, the integration of a pedagogical recommender developed in the ROLE project is planned. In addition, a bazaar for social requirement engineering [5] (in development) will be integrated in the store as soon as it is released. Future work concerning fostering of a community of practice around the marketplace as well as detailed evaluation is foreseen.

[12] http://graasp.epfl.ch
[13] http://role-sandbox.eu

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# Just4me: Functional Requirements to Support Informal Self-directed Learning in a Personal Ubiquitous Environment

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**Abstract:** The aim of this paper is to present the results of the first phase of a project called Just4me. The project proposes the design, and development and pilot test of a technological platform that supports a ubiquitous personal learning environment (PLE) designed for lifelong learners across different professional, social and training contexts. In this paper, we define functional requirements that might support informal self-directed learning also taking into account mobility factors (related with ubiquitous learning) from the standpoint of a practitioner in any field.

**Keywords:** PLE, self-directed learning, informal learning, lifelong learning, user requirements, online platforms.

## 1 Introduction and Project Aims

The Just4me project is funded by the INNPACTO Program (Spanish Ministry of Science and Innovation), and developed by a consortium composed of the Universitat Oberta de Catalunya, several technology and software engineering companies (ICA, BDigital and CIMNE) and the Official Medical Association of Barcelona (COMB). The innovation of our proposal is mainly based on the idea of developing a PLE that allows ubiquitous access from mobiles devices, and also on the integration of learning tools and patterns that might be of help to direct practitioners' learning across the continuum between informal and formalized learning scenarios and contents.

Our proposal is based in a conception of a PLE as a learning facilitator, when learning is considered in a holistic sense and from the learner perspective, throughout life in virtual and physical contexts, rather than the idea of a PLE as a technological platform that integrates a number of network services for this purpose. Thus, we believe the concept of a PLE is not delimited by a given technological solution, but is much broader and has to do with an "expanded" way of understanding learning. The Just4me PLE should support the lifelong learner in self-planning and self-structuring his or her learning pathways.

## 2 Background and Theoretical Framework

In order to elaborate the theoretical framework of the project, we have reviewed the main current research on the conceptualization and implementation of PLEs, i.e. [1-6]. Furthermore, a literature review has been carried out with the aim of defining the theoretical conception about learning that is underlying our PLE. With this purpose in mind, we have focused on concepts and theories around lifelong learning, informal learning and self-directed-learning from a sociocultural perspective. Our approach incorporates both dimensions of autonomous and social learning in the framework of a continuum from informal towards "formalized learning". Finally, we take also into account the connectivist view of networked learning [7] which stresses the importance of connections among people and knowledge objects.

Our conception the user profile is based on a professional adult, responsible for his or her own development. This responsibility leads to the need for learning throughout life, something that brings into play his/her ability to organise, plan, self-regulate, and engage jointly with others in this learning process. From a sociocultural perspective, any subject learns continuously through their participation in different contexts, whether more or less formalized, depending on the competences that he/she is able to deploy. We should therefore remember that the competences for learning throughout life are defined as a combination of knowledge, skills and attitudes to develop appropriately in a specific context. The DeSeCo Project [8] classifies key competences in three broad categories: to use a wide range of tools (both physical and socio-cultural) for interacting effectively with the environment; to engage with others and to interact in heterogeneous groups; and to take responsibility for managing own lives and act autonomously.

Autonomous learning and self-directed learning have been addressed by different authors as the pillar for professional development and lifelong learning [9]. It involves being able to use one's own competences and resources to strategically formulate goals, to organize and structure information and to build knowledge that is meaningful to one's aims. It also involves controlling, regulating and assessing consciously and intentionally one's learning process. This requires using different self-regulation strategies [10], including metacognition as the awareness of one's mental processes and the ability to reflect on these processes.

However, autonomous learning takes place in a wide sociocultural context, which involves relations, actions, shared objects and discourses, both in physical and virtual spaces that may belong to formal and confined institutions or to informal and extended communities and networks. In this case, and for the purpose of designing a lifelong PLE, we focus on informal learning contexts. Informal contexts offer opportunities to cultivate communities and relationships driven by conversation around knowledge objects. Informal learning processes can take place in any setting and involve actions such as exploration, reflection, integration, elaboration, sharing, etc. Informal learning has been defined by the European Commission [11] as "*learning resulting from daily life activities related to work, family or leisure. It is not structured (in terms of learning objectives, learning time or learning support) and typically does not lead to certification*". It may be intentional or non-intentional (incidental), but control of learning rests primarily in the hands of the learner.

In the last decade, several authors have proposed definitions that resituate the boundaries between formal and informal learning [12-15]. Some of them advocate considering the intersection between formal and informal education as a continuous

process. For instance, informal learning is also part of the organizational and professional contexts, where it allows coping with the tasks and contextual requirements and facilitates problem resolution. Other authors consider that the concept of informal learning is redundant, arguing that all learning occurs within social organizations and communities with more or less formalized structures, and constitutes an inseparable aspect of social practice [16].

One way or another, it is increasingly evident that the boundaries and relations between the two concepts are not as clearly distinguishable and polarized as has been claimed. In today's society, the contours of formal and informal learning are blurred and become more diffuse and problematic. This process has been enhanced and has become more evident with the emergence of social technologies. As expressed by Jokisalo & Riu [17] more than a means of learning, the Internet has become a playground where people can search and find the tools and content they need to set up, to suit their own learning environment. Consistently with this approach, we have explored and built on Cross [18] "learning mixer", according to which learning processes always consists of a transition, a mixture of formal and informal components that are determined along different criteria. This pattern is dynamic since the degrees of informality/formalization may vary along time.

If we understand learning as situated/contextualized, we have to admit that learning supported by PLEs involves certain degree of decontextualisation of information objects from their original milieu and their subsequent re-contextualisation in the PLE. This requires putting strategies into play to recognize which information objects are relevant, to integrate them into actual knowledge related goals, and to build relationships between objects, goals and domains, extending the learning context beyond specific sites and spaces [19].

Here, we find the idea of boundary-crossing objects and activities very appropriate to refer to social practices and objects that act as learning mediators, but stressing the idea that those objects may be part of many contexts. This perspective emphasizes the relational and flowing nature of the learning context [19]. This concept has been previously proposed by Atwell [20] to understand the fluid, relational and not-context-dependent nature of PLEs. From this perspective, a PLE may play the role of a boundary object itself enabling the learner to move from one domain to another, making connections among information objects on the basis of social relationships and mediating learning in this way.

## 3 Methodological Approach

Currently, the project is in the stage of conceptualization and specification of the functional requirements of the PLE and the underlying learning approach. The main goals guiding the data collection and analysis have been formulated as follows:

1. Conceptualize the educational approach of the environment.
2. Identify users' needs in terms or information management and knowledge production.
3. Determine the functional and technological requirements of the environment.

In the previous section we have already presented our theoretical approach. Secondly, we have conducted a needs' analysis in order to have a better understanding

of the target group. For this purpose, we have conducted a questionnaire addressed to the target group: medical professionals. A snowball sampling method has been used to reach the respondents (N=26). The aim has been to gather general needs in the medical sector regarding search, organization and use of professional content and tools, participation in specialized networks, as well as in more formalized courses, etc.

The questionnaire has been structured in seven multiple-choice questions regarding the following issues:

a) Web 2.0 tools and resources useful to learn;
b) Strategies for organizing information;
c) Integration of different tools/services;
d) Main features of a PLE that allows connection to the commonly used Internet tools/resources and to support learning.

In addition, and as a means of contrasting the information gathered through the questionnaire, we have interviewed an expert in using Internet and social tools to carry out his professional activity in the field of medicine. In this case we have gone into greater detail regarding significant information searching, organizing and knowledge building in self-directed learning processes.

Following and with the aim of determining the functional and technological requirements of the environment, we have revised some prominent projects regarding the development and implementation of PLEs in three different contexts: professional and corporative contexts (EPERe-PORT Project[i], MATURE Project Services[ii], Aristotele project[1], APOSDLE Project[iii]), higher education institutions (JISC CETIS PLE Project[iv]; Leicester PLE Project[v]; PLE Project at University of South Australia[vi], Responsive Open Learning Environments[vii]; PELICANS[viii], TU GRAZ[ix]; SAPO Campus[x], Proyecto Dipro 2.0[xi]), and open environments for lifelong learning (Hort Digital[xii], Ten Competence Project[xiii], Grapple Project[xiv], MyPlan Project[xv]).

All these data have been triangulated and analyzed taking into account the following two axes: a) dimensions of technology use (access to information, content creation, planning and self-management, social outreach, and communication and social relationship) and b) learning context (professional, social or academic).

## 4 Results on Users' Requirements

The results of the questionnaire indicate that the most popular tools are e-mail (25)[2], search engines (23), word processor (21) and social networks (19) (i.e., Facebook and Twitter) while the lesser-known tools are LMS (4), video and audio editing and recording (4), social bookmarking (3), and virtual worlds (3).

Most of the participants search for information using keywords on search engines (25) or consulting paper (15) and online (12) journals, while few of them use social networks (9), presentations (5) or open book repositories (4). Regarding the way they organize the information, normally, they create folders on the computer's screen (23) or use the e-mail (19), just a few of them have a start page (2) or a virtual desktop (1).

[2] The number indicates the amount of people who have chosen this option (N=26).

The participants that integrate their social networks in the same environment (27%) do so through Twitter (3), Facebook (1), blog (1) or other tools (2). The participants usually learn by attending to conferences (18) and in face-to-face courses (18), however, just some of them do this through University courses (9) or web 2.0 content (8).

Regarding the features of an environment that allows them to connect the tools and resources used on a daily basis (see Figure 1), most of the participants imagined an environment that helps them gather and find information and plan work. Features like uploading their CV or presenting information in different formats are not essential to them.

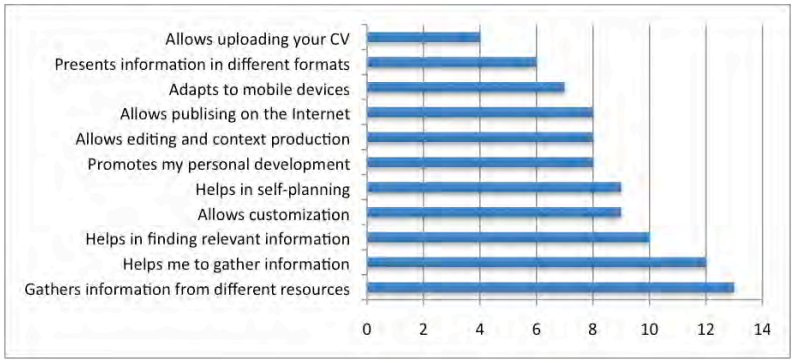


**Fig. 1.** Features of an environment that allows integrating usual tools/resources

Concerning the features that could support their learning processes (see Figure 2), the participants prefer an easy-to-use environment easy to use, which shows and guides the user how the tool works, helps them to make a critical selection of information and resources and offers a space to store their learning activities. Just a few of them request for features related to offering or receiving feedback on learning activities or assessment.

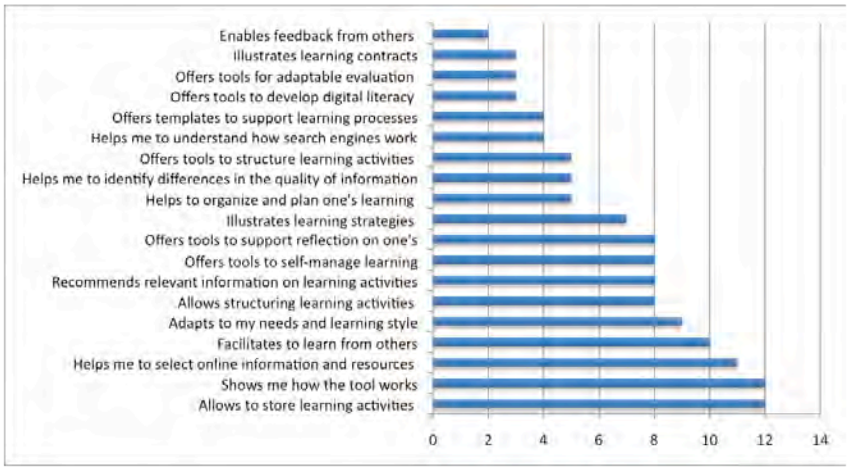


**Fig. 2**. Features of an environment that supports self-directed learning

Contrasting the information extracted from the questionnaire with the information obtained from the interview, we have identified the following as the key points regarding users' requirements:

- Information collection and sharing from/with different resources.
- Plan own work/activity.
- Customizable (can be adapted to personal needs and learning styles).
- Easy to use, intuitive (useful for users with different level of digital competence).
- Store and organize information and resources.
- Learn from others and help others to learn.
- Help in critical selection of information.

Thus, initial results have shown specific requirements in terms of personalization that can make the environment adaptable to the users' different levels of digital competence, learning style and needs. The platform should be close to everyday technologies, and in turn, be able to integrate and operate with other environments, tools and resources. It should also incorporate specific features and tools specially conceived to support learning, and to structure and plan the knowledge that learners acquire along and across their academic, social and professional pathways. Finally it should recommend relevant information to learners on the basis of their fields of interest.

This phase has allowed us to identify features and requirements of a PLE that integrates "knowledge services" used on a daily basis in different contexts (social, professional and academic), as well as to reflect on specific affordances that might support learning in the transitions between those contexts on the basis of the notion of boundary objects. Next, we define the uses and functionalities of the Just4me PLE organized in three final dimensions that are described in the following section.

## 5 Functional Requirements and Product Specification

Most of the research and projects on PLEs implementation is being done in higher education institutions where virtual campuses (LMS platforms) are being replaced by institutional PLEs (also called iPLEs). On the other hand, the developments in professional contexts tend to propose the use of virtual environments where the company organizes the training activity of their staff. In neither of these two cases, is the learner completely free to decide what, when and how to learn. Learning is still guided or promoted by an institution and therefore processes and activities supported by the PLEs are, to some extent, shaped by those specific institutional purposes.

However, adopting a learner-centered design implies taking the user point of view to conceive all the features of the environment in the design process. Users should feel this environment as their own and adapted to their needs in every moment and any place. In fact, each individual user through his/her personal selection and setting of objects, tools and connections builds the Just4me PLE. The technological environment provides the means to integrate all those elements, enhancing knowledge building through specific affordances.

More than a learning environment the idea is to build an integrated ecosystem for dynamic learning established by and among users, through their actions and the connections they create with multiple objects. Users decide which topics and issues are at the focus of their ecosystem (knowledge goal) and build a network of contacts, objects and tools around them.

The following table summarizes the three dimensions of activity/use that configure the design of the Just4me PLE.

**Table 1.** Dimensions of the Just4me PLE design

| | | DIMENSION 1: Information management | DIMENSION 2: Planning and knowledge creation | DIMENSION 3: Social connection and open publication |
|---|---|---|---|---|
| INFORMAL ↕ FORMAL | SOCIAL DOMAIN | Searching and accessing external information (docs, tools, videos, presentations, etc.) from different sources (networks, open repositories, blogs, etc.).<br><br>Tagging and classifying information objects.<br><br>Organising and storing information objects.<br><br>Searching and managing internal social contacts and followers.<br><br>Selecting recommendations of information objects and contacts provided by the PLE intelligent system.<br><br>Searching internal information objects (through a folksonomy system). | Managing tasks and events (agenda).<br><br>Making lists and annotations<br><br>Creating, editing and planning "knowledge goals".<br><br>Assigning objects to "knowledge goals".<br><br>Creating "knowledge maps".<br><br>Writing the "knowledge goal diary". | Connecting with social networks and web services.<br><br>Sharing information objects with contacts.<br><br>Sharing "knowledge goals" with contacts.<br><br>Communicating around "knowledge goals" with contacts.<br><br>Making recommendations and asking for advice<br><br>Editing and publishing own profile. |
| | PROFESSIONAL DOMAIN | | | |
| | ACADEMIC DOMAIN | | | |
| | | USER ACTIVITIES | | |
| | | TOOLS AND FUNCTIONALITIES | | |

As argued in the first section, a fundamental aspect of any learning process, either individual or in teams, both in informal and formal and highly institutionalized training, is self-management, planning and time regulation of daily activity. Those self-directed activities are understood in a broad sense, maintaining the idea of integrated learning from different contexts (social, professional and academic).

In Dimension 2 (*Planning and knowledge creation*) we identify issues regarding the organisation and planning of "knowledge goals". We define a "knowledge goal" as an aim related to a knowledge domain. This knowledge domain can be as specific or general as the user determines. It can either be associated with a period of time or with a knowledge map depending on the learning purpose. Knowledge goals are configured by related information objects that may take the form of activities (tasks, deadlines, events) or information resources (documents, videos, links, contacts, notes, etc).

This planning space should be fully configurable by the user. Thus, the user can create "knowledge goals", frame them in a specific period of time, assign them different type of information objects, label them and share them.

Information objects are units of information that the user collects. These objects may or may not belong to a "knowledge goal" or not, but any object added to the PLE is part of its knowledge network. This information network is labelled through an open tagging system generated by the users (*folksonomy*). Each type of object is represented by a different icon to facilitate its identification. Objects may also be signalled according to different criteria: done/pending, degree of interest or urgency, input/output, etc. They can also be placed in the timeline of a specific "knowledge goal". Users may remove, relocate in time, or change the configuration of any information object at any moment.

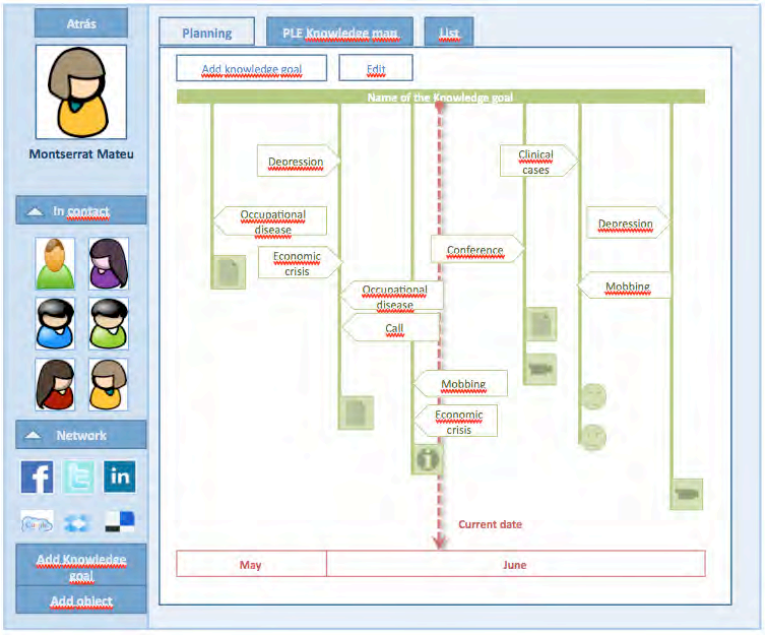


**Fig. 3.** Interface of the Just4me PLE: timeline screen

The system offers two visualisation metaphors of the PLE knowledge network: the timeline (which can embrace a long or a short period) and the mind map (which shows connections and interactions between objects and knowledge goals through the tags system). The timeline shows the degree of achievement of the knowledge goals, taken as a criterion. Therefore, the interface of the planning dimension operates through the following main screens: one screen showing all the "knowledge goals" in a given time period and a screen for each knowledge goal.

## 6 Conclusions and Future Steps

PLEs are a promising area that is gaining interest in the e-learning domain. In many institutions, the use of LMS is showing limitations for learners who need to manage an increasing number of resources both in formal and in formal settings. This is the reason why most of the efforts in implementing PLEs are supported by universities with previous experiences in online learning. Our proposal aims to complement this approach focused on the role of the practitioner as learner.

The idea of PLEs emphasizes the importance of continuous learning and recognizes the role of the individual in organizing his or her own learning. Moreover, PLEs are based on the idea that learning will take place in different contexts and situations and there is not a unique learning provider. For this reason, our proposal considers that it is important to provide support in three main dimensions, crossing informal and formal contexts: a) information management, b) planning and knowledge creation and c) social connection and open publication.

Just4me aims to provide special support to self-directed learning in information management and planning processes by using a visual approach that combines a timeline and a mind map view to show connections and interactions between objects, contacts and knowledge goals.

There are also many unresolved issues, including the development of technology services, automation of the recommendation system, enabling access from different devices or ownership and protection of learners' data that will be tackled in following phases.

The expected results, in terms of environmental design and their usage, may be transferable to other learning contexts, hybrid or blended learning, both in the formal education sector as in the non-formal and in any discipline. We consider that this work might contribute to the reflection on the relationship between informal and online learning through a self-directed learning approach. On the base of this analysis it also advances the functional requirements of a ubiquitous PLE platform.

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# Building a Shared Personal Learning Environment with SAPO Campus

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**Abstract.** SAPO Campus (SC)[1] is an institutionally supported platform of integrated Web 2.0 services that allows its users to publish and share content in a safe environment.
However, more than a space where people publish their content to, this platform allows its users to build the roots of their own PLE within the SC community.
The implementation of these principles resulted in the idea of a Shared PLE (ShaPLE). Starting with SAPO Campus' base features some new sharing features were added to the platform, which we can broadly classify as platform and user driven.
These two driven sources will contribute to an integrated digital curation mechanism that will allow users to have a more relevant learning experience.
This paper describes and specifies the solutions developed in order to support the creation of a ShaPLE, and reflect upon the impact the development of this concept might have in the field of PLEs.

**Keywords**: PLE, Web 2.0, Curation, SAPO, Campus.

## 1 Introduction

The increasing speed at which technologies are adopted and implemented in the educational and professional contexts has contributed to the reasoning that students and workers need to learn continuously throughout their life [1]. In this context, the informal learning – i.e., the learning experiences that occur at personal and social contexts - has been progressively appreciated in order to promote lifelong learning [2].

The growth of the social Web, or Web 2.0 [3] has contributed to the development of collaborative learning styles and new ways of interaction [4]. Based on principles such as openness, collaboration, free sharing of information and User Generated Content (UGC), O'Reilly first coined the term Web 2.0. The Web 2.0 could be defined as "(…) the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an "architecture of participation," and going beyond the

[1] http://campus.sapo.pt/

page metaphor of Web 1.0 to deliver rich user experiences" [5].

The Web 2.0 tools are based on features like collaboration, interaction and networking, effectively shifting focus from the end product to the process and how this process could be shared with others in order to significantly improve both: the product and the people involved with it.

According to Redecker, Ala-Mutka and Punie, the Web 2.0 comprises four main dimensions: content, creation, connection and collaboration [6]. This means that the Web is not only a reading Web but also a writing Web where users may interact, collaborate and "co-create" knowledge [7].

By empowering users to quickly and easily create and share content, the Web 2.0 tools and services have attained huge popularity. These new consumers who are also producers have been dubbed as prosumers, a term coined by Toffler in the early 1980s.

In this context, the concept of a PLE easily comes to mind. Although there is still no agreement on its definition, this idea seems to be accepted by the most experts: a PLE may be comprised of a multitude of different Web 2.0 applications and tools [1]. PLEs are typically flexible because, according to Attwell [1] "a PLE could allow a learner to configure and develop a learning environment to suit and enable his or her own style (and sources) of learning". Attwell and Costa also reported "PLEs can be seen as the spaces in which people interact and communicate and whose ultimate result is learning and the development of collective know-how" [8].

The dichotomy between PLEs as a concept and PLEs as set of applications, according to Attwell, is false: "If it is accepted that the PLE involves the use of Information and Communication Technologies then it necessarily involves applications. On the other hand any learning technology (…) facilitates or hides different approaches to learning and knowledge construction. In other words all educational technology contains or supports an implicit pedagogic approach. The issue is not a concept or an application but rather the process of researching and designing technological and pedagogical approaches."[9]

In this sense, PLEs are dynamic spaces for organizing tools and services, built and personalized by the users, allowing the development of their autonomy, reflection skills and self-directed learning [10].

In a context where it is recognized that learning occurs not only in formal spaces, and with the improvement of the Web and the development of learner-centered learning environments where the connectivity [12] and collaboration are predominant, institutions are facing a new challenge: to be able to apply the concepts of openness, collaboration and sharing in a true learner-centered environment. This challenge represents a new education goal, leading the way to a more open school. In order to respond to this challenge, the use of PLEs might be a valid option because they are dynamic spaces that enable the development of a "community of inquiry" [13].

In the next section we will describe and characterize SAPO Campus (SC), an institutionally supported platform of Web 2.0 services that aims to support the development of personal learning environments, promoting communication, sharing and collaboration skills in its users.

## 2 SAPO Campus: a Social Platform of Web 2.0 Services for Educational Context

The introduction and the development of Web 2.0 integrated platforms to support teaching and learning activities brings some challenges. These challenges are related, on one hand, with the choice of services or tools: what services or tools must be provided in order to attend to different agents that have different needs and preferences? Furthermore, other major questions arise, such as integration and management issues, architecture and scalability issues related with performance and maintenance costs and finally – and perhaps the more important ones – support, conceptual coherence and use assessment issues.

SAPO Campus is an integrated Web 2.0 services institutionally supported platform for use in educational contexts, resulting from a partnership between SAPO – a leading Portuguese IT Company – and the University of Aveiro. This platform is based in an independent and open set of social core services (photo and video sharing, blogs, status and comments), but also allows its users to build and develop it as an important part of their own personal learning environment.

In this context, there have been some challenges/concerns:

- How to provide sharing services and mechanisms respecting the privacy principles defined by the institutions?
- What is the best solution to optimize the process of selecting, analyzing and organizing information?
- How to provide some institutional management tools without affecting the principles underlying the PLE concept?
- What is the effective impact of the availability of this integrated platform and how its use may contribute to improve communication, sharing and collaboration between different community members?

In what platform services choice and availability is concerned, it was important to take into account that the set of available services should reflect everyday services used by the community and also its relevancy for broader and diverse institutional (in)formal learning activities. The set of institutionally supported services should ensure to the educational agents the possibility of building and customizing their own PLE based on commonly-used Web 2.0 services, while simultaneously not restricting the range of potential learning activities that can be carried out in a diverse environment as the educational context.

As Attwell (2005) cit. in Mota (2009) says the development of an institutionally supported PLE requires some flexibility from the institution without affecting secure publishing and content sharing [14]. In this sense, with the adoption of SAPO Campus, for instance, all registered users are equal and share the same privileges and responsibilities. This approach ensures that every user can access the same type of services as well as the same type of data. One important result from this assumption is that user tracking mechanisms cannot exist in this digital community, thus ensuring user privacy.

The SAPO Campus platform development is guided by a technological infrastructure, aiming to attend to users' interests and to allow them to build and develop their own PLEs based on the contributions of the community.

Fig. 1 presents the core services and privileges of SAPO Campus' institutionally

supported platform. We believe that by adopting the SAPO Campus platform an institution will be able to offer a set of high quality core services prepared for large-scale usage scenarios. The left side of the figure shows the authenticated members from the institution. Although with different profiles within the institution, all of them have the same privileges and responsibilities within the core services. This means that all authenticated users are able to freely create accounts and content in any service. This openness is not typical in educational information systems but it was an underlying and fundamental concept for the SAPO Campus platform. All the other Internet users are represented on the right side of the figure. These non-authenticated users within the institution could also have privileges that allow them to participate and consume some information published on core services but will not be able to create accounts. Due to the age of the main target audience of the SAPO Campus platform, it is the school administrator that will be able to set up the specific privacy rules of the institution.

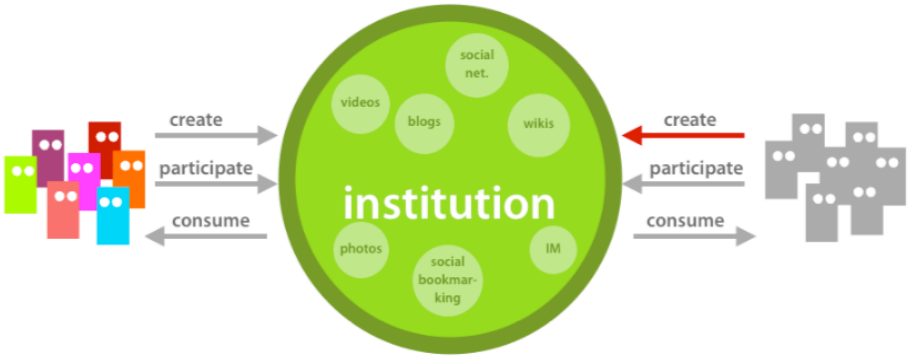


**Fig. 1**. Core services and privileges of SAPO Campus platform [15]

In this context, openness is one of SAPO Campus' key-concepts: this platform is open to people outside of the school walls, like family and other school' members that are able to participate and get involved in discussions. This means that everyone, everywhere can consume and talk about content, tearing down the metaphorical walls that typically surround the institutional digital space [16].

The personal dimension in SAPO Campus is closely related with the PLE core technology and aims to promote users' control of their learning process. This control, from our point of view, implies that users must be able to decide when and what to consume, create, save and share and with who they want to share it.

In order to promote the SAPO Campus' personal dimension and the construction of a digital identity and presence of the users, each registered user has his/her profile page (Fig. 2).

More, two timelines are automatically generated: one of them based on school members activity (Fig. 3) and the other based on the activity of the community members followed by the user (Fig. 4). This fact - that any user from the same institution and public users from other institutions could be followed - allows the construction of a connective network [17], enhancing the interaction and the connective knowledge construction [18].

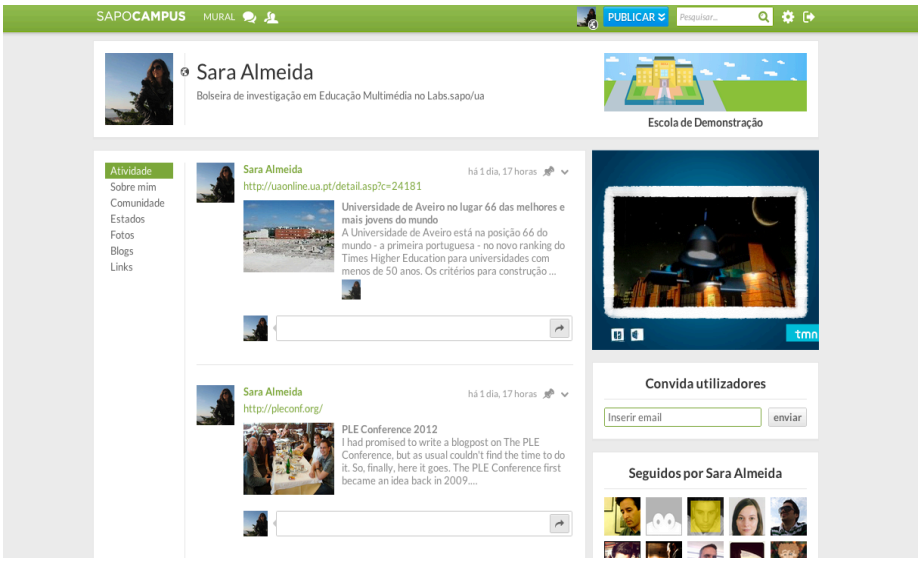


**Fig. 2**. User profile page


**Fig. 3**. The school timeline

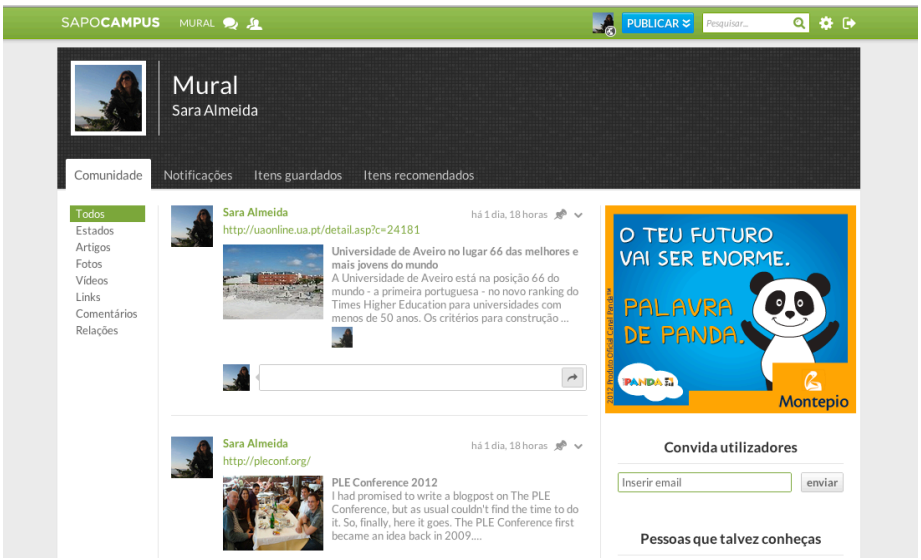


**Fig. 4**. The community timeline

The promotion of lifelong learning is also an important goal of SAPO Campus. Even in the end of their studies, the users will still be able to access and customize their PLE. This possibility brings to the educational institutions a different perspective about the temporal and geographical relationship they have with the community: on one hand, former students can keep in touch with the school colleagues and all the knowledge that is being shared and, on the other hand, institutions could use this relationship as a new kind of communication tool.

Taking into account the current social and economic context that requires from users an active, connective and collaborative role, technologies could help individuals to draw more connections and to collaboratively share contents and knowledge. SAPO Campus, more than a space where the users can safely publish diverse types of content, aims to enhance users' active participation in creating their own personal learning environment, made up of the content and content sources with the highest interest to them, allowing them to share these resources with other members of the community.

Building a PLE requires from the users a certain degree of commitment. SAPO Campus tries to ease the initial stage by exploring a context that is relevant to its users. The relation to an educational institution, independently of personal interests and preferences, guarantees that each user starts in a context that is relevant and safe to him/her. In this setting, users are free to create their own contextual communities based on interests and preferences, and follow contexts that arise from their role in the institution (courses, classes, school years, etc.).

In this context, the concept of a ShaPLE (Shared Personal Learning Environment) appears. In the next section we will describe this emergent concept that comprises all the characteristics of the PLEs but aim to emphasize the SAPO Campus' social sharing and interactive dimension.

## 3 Building Shared Personal Learning Environments with SAPO Campus

The concept of a Shared Personal Learning Environment (ShaPLE) appears in order to promote SAPO Campus' essential concepts like communication, sharing and openness. With this concept, we intend to improve the involvement and motivation of the community members through the implementation of new sharing services allowing greater customization possibilities of their PLEs.

As stated earlier, SC guiding principles are collaboration, participation, openness and sharing. However, a critical review of the platform functionalities allowed us to identify a major limitation in the practical implementation of these principles: a lack of an effective SC social openness to its users.

This limitation portrays the main research question that led the ShaPLE concept to arise. To promote the use of PLEs and lifelong learning, it is essential to enhance the openness, sharing and social interaction in the SC platform. We think that in this way we could engage users and promote a greater involvement and participation, resulting from the need to develop a digital presence [19] and to create or sustain the interaction with other community members.

Being an open learning platform, the SAPO Campus platform should not only allow its users to actively aggregate content and sources but also, and utmost, should allow its users to open and share their data and learning space with other community members. In this point of view, this platform should shift its main focus from the user to the broader community through an integration model that naturally blends personal and institutional profiles, content and services.

This revised concept resulted in a new sharing and social layer that we are now able to add to the SAPO Campus platform. From our perspective, SAPO Campus should possess all the features of a PLE, but should also include mechanisms enhancing the sharing and communication between members of a community.

Starting from the SAPO Campus' basic principles, and assuming the use of a shared technological platform, we can add to the features associated with a PLE an integrated mechanism with some characteristics of content sharing which can be classified as:

- Platform-driven: all user actions are anonymously and automatically analyzed by a mechanism similar to a recommendation engine. This mechanism will allow identifying and recommending content and users that might be relevant to other users, based on their usage profile.
- User-driven: by adding a content classification mechanism (similar to a social bookmarking system), all users will be able to contribute with meta-information about their shared resources, which empowers the platform-driven functions mentioned above.

We believe that the development of these new functionalities will allow a major upgrade of SAPO Campus features, setting up new possibilities for users and establishing new ways of communication, interaction and sharing in an actual learning community. Its members will be able to not only be knowledgeable of the learning community dynamics but also to contribute to that dynamics becoming knowledgeable agents of a participatory learning community [20]. We also believe that these two driven sources will simultaneous contribute to what we intend to be a powerful inte-

grated digital curation mechanism that will allow users to have a more relevant learning experience while using SAPO Campus technology.

Thereafter, we will discuss the importance of these two systems for the educational context: on one hand, the social bookmarking as an user-driven mechanism to categorize the content and, on the other hand, the recommendation engine as a platform-driven mechanism that analyses users' activity in order to recommend new content.

### 3.1 The Development of an User-driven Engine for Content Classification and Sharing

Social software applications can be viewed as pedagogical tools. As stated by Anderson (p.42), "the greatest affordance of the Web 2.0 for educational use is the profound and multifaceted increase in communication and interaction capability" [21]. In this context, users are not only consumers but also "co-creators" of information and knowledge [7].

Social Bookmarking Systems (SBS) are Web 2.0 tools that allow users to store, classify, organize, describe and share interesting links or resources [22].

According to Vuorikari (p.10) "social bookmarking is a Web-based service to share Internet bookmarks on websites and pages. Instead of saving the bookmarks or favorites to a local computer, the Web-based service is accessible from everywhere" [23].

In this context, the allocation of keywords (tags) to the Web sites stored by the users allows the adoption of new ways to organize and classify the resources [24], and also the expression of different perspectives about that particular information and resource, because each tag works as a link to other contents which were classified in the same way by other users [25].

In educational contexts, some teachers have recognized the importance of social bookmarking in developing and improving some fundamental skills as research, analysis, evaluation, organization, communication, collaboration and sharing [26].

These systems also allow the construction of a collective memory, because by assigning tags, users can freely manage the information and discuss better ways of using it [27], and encourage the collaborative work [22]. Additionally, according to a socio-constructivist point of view, the assignment of tags enhances self-regulated learning, through the conscious involvement with PLE construction and subsequently, their own individuality as learner and as person [28].

In addition to the aforementioned potential of social bookmarking tools in educational contexts, we foresee the integration of a user-driven engine of content classification in the SAPO Campus platform as an opportunity to rethink user interaction on the web. Instead of building just one more tool for our users, we try to position it as a structured context for user action [29].

The main goal of the development and integration of this tool in the SAPO Campus platform is to enhance users' participation in content curation based on meta-information produced by the community. Besides, from our point of view, the integration of this content curation mechanism will encourage the users' involvement in the construction of a common and relevant knowledge with meaning for each user.

These mechanisms also have some weaknesses. One of the biggest problems lies on the subjectivity - each different user can add different tags (some of them could be very broad or restricted) related with the classification of the same content and/or information source.

In order to mitigate this limitation, we're developing a content classification en-

gine with three pre-defined (non-compulsory) tags indicating action goals and intentions (Think & Learn; Watch & Listen and Laugh & Fun). With this model – far way from the conventional one based on the contents' thematic – the user will be invited to think about what for and why it is important to store or share certain information source, promoting the development of their metacognitive and content curation skills.

This type of interaction stays somehow in the middle between formal taxonomy strategies that are not suitable for informal spaces like social networks and folksonomy strategies that have been declined in recent years because of the difficulty to get relevant information from it.

Some users see social bookmarking as a mechanism that works like a forgotten archive of bookmarks. Adding new content implies from the users an explicit action, which, most of the times don't bring them or the community any useful consequence. To avoid this eventual limitation, in the SAPO Campus platform the use of the social bookmarking mechanism could not be only explicit but also implicit, which means that the bookmarks are automatically extracted from the users' sharing activity.

We don't intent to interfere with the user's dynamics of sharing and interaction. Thus, tags are assigned in a voluntary basis and the links can be shared through states and comments (Fig. 5).

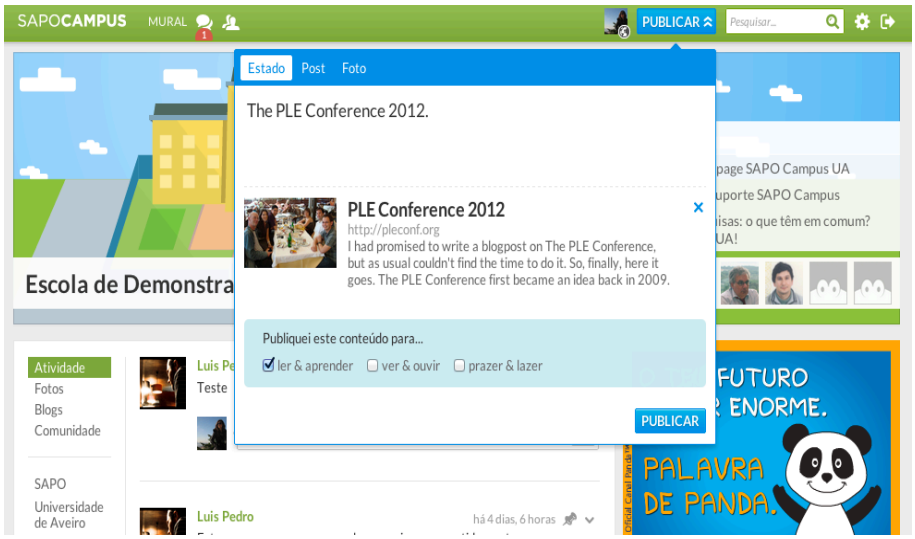


**Fig. 5.** Sharing links on SAPO Campus

All shared bookmarks are also available in a particular area of the user's profile page (Fig. 6). In this area, the social bookmarking system assumes a more traditional version, where the user can access a general page of the link and, if it does not go against the privacy rules, to the users who shared and commented the same link.

With the development of an integrated mechanism of content recommendation and classification we pretend to encourage the users' true involvement with the platform, allowing the construction of meaningful personal learning environments for each user.


**Fig. 6.** The area of all shared bookmarks

### 3.2. The Development of a Platform-driven Engine to Navigational Support

The existence of a huge quantity of information, in combination with the dynamic and heterogeneous nature of the Web, makes information selection a hard task for the average user, who is usually overwhelmed by the quantity of information retrieved. In this context of information overload, personalized information access is becoming essential [30].

In 1997, Resnick and Varian argued that recommendation systems could be useful because recommendations are necessary if users have to make choices without sufficient knowledge about a certain thematic [31]. According to Adomavicius and Tuzhilin (2005) cit in Drachsler (2009), the general purpose of recommender systems (RS) is to pre-select information a user might be interested in [32].

There are two main kinds of recommender systems: the collaborative recommender systems and the content-based recommender systems [30]. The collaborative recommender systems aim at predicting appropriate items based on interaction data of many users within the community with similar interests [33]. If this method enhances the recommendation of items in any category (films, images, texts, etc.), the arrival of a new user or a new item represents a problem called “cold-start problem” [34].

The content-based recommender systems are based on a single user's preferences. This technique aims to recommend items similar to the ones the user preferred in the past [32]. Within this approach, the “cold-start problem” may not happen so often but the over specialization problem could be hard to solve [30].

In order to reduce the “cold-start problem” in the SAPO Campus platform, each user starts in a relevant context – the school. In this setting the user will be able to, even in the beginning, easily receive relevant recommendations of people and content through the implemented collaborative techniques.

Recommender systems learn about the user’s preferences and build a personal profile for each user [35]. In this context, recommendations appear to be useful for empowering learners to set up their own learning environments [36]. The main features

of recommender systems (collective responsibility, collective intelligence, user control, guidance and personalization) fit very well into socio-constructivist learning principles. However, recommender systems should not be directly transformed from commercial to educational contexts, since they need adaptations with regard to learners as producers of data [37].

According to Mödritscher [36], from a learner perspective a recommender strategy for educational context could comprise these five entities:

- Interactions
- Media collections
- Single documents for a specific situation
- Peer learning or learning tools relevant for an activity
- Points to communities: people sharing the same environment

The navigational support created by recommender systems may help users to reduce time and costs involved in selecting suitable information. This will help learners in selecting learning activities according to their individual needs [38].

In this context, these systems could offer guidance to the learner without limiting his freedom. This can be achieved through the mediation of the relationship between real and potential knowledge [39]. In a constantly changing learning, economic and social context, the need of lifelong learning is evident. With recommendations, users can find their own way, being self-regulated and responsible for their own learning process [40].

According to Mödritscher and his collaborators, recommendations are powerful tools in a PLE context as they provide the opportunity to: "retrieve relevant information; find peers and/or tools and get suggestions and motivational support from interaction with peers" [34].

Designing and establishing the interaction between a user and a recommender system is challenging. The system needs to successfully adapt the user's profile and present him/her interesting items. For this to happen, the system criteria have to match the criteria that are relevant to the user [35].

In this context, is not hard to understand that developing a recommender system is not simple and there are many variables to take into account. The cultural context of the user is one of them: one user might be interested in a particular musician but not in his/her musical style and the inverse could happen with other user. Thus, the predictions made by these systems can lead to generalization or overspecialization issues [35].

The recommendation engines can adapt to the specific user's needs, however such adaptivity could bring some challenges such as controllability, privacy and predictability [35]. According to Cramer and his colleagues, these systems take (semi)-autonomous decisions on behalf of users, which may undermine the users' need to control. Besides, this platform-driven engines use some data about the users, which for privacy reasons, may cause some users' adverse reactions.

In order to facilitate the system's learning process and improve recommendations is important to gather users' feedback [35]. For that reason, we are developing an integrated mechanism combining a recommendation engine (platform-driven) and a social bookmarking system (user-driven). With the user-driven system we will have the opportunity to involve the users in an integrated digital curation process that will allow them, on the one hand, to contribute and feed the recommendation engine, and, in

the other hand, to have a more relevant learning experience while using SAPO Campus technology. We believe that with this integrated mechanism we will be able to surpass the aforementioned issues and promote the users' control over the PLEs' customization process.

The open source recommendation engine that we are using – easyrec[2] – produces the information that feeds the two recommendation based functionalities that we actually have in SAPO Campus. One of them is the widget of relevant users (of the same institution or public users from other institutions), which is presented to all the users of the platform (right side of Fig. 7).

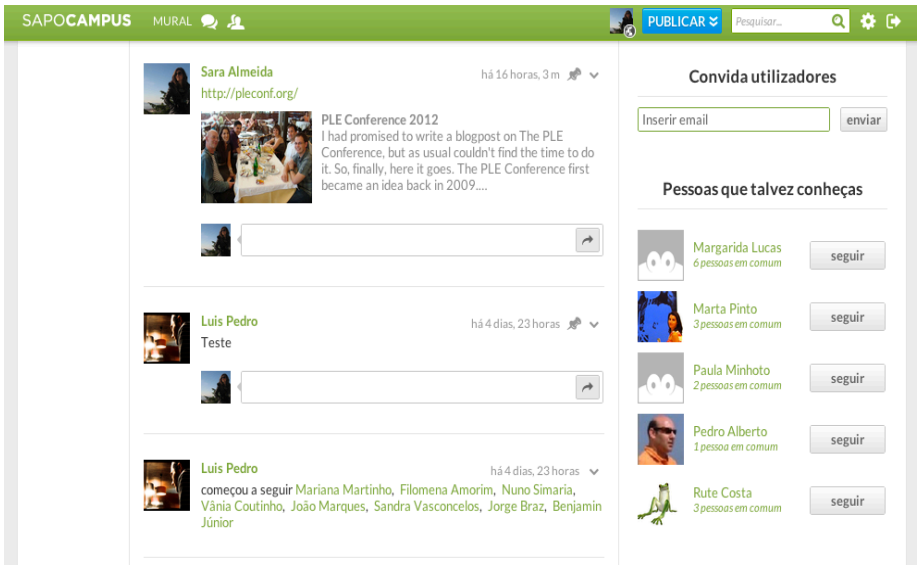


**Fig. 7.** Widget of relevant users

On the profile page, each user can access to a recommendation area that, initially, focuses on links and states (Fig. 8). For privacy issues, those contents can be presented without identifying the author of the recommended items.

In SAPO Campus, the recommender system does not represent the core of the interaction inside the platform. It works just like an additional element to support users' navigation and interaction. It is our intention that the core of the interaction between users of the platform to be essentially supported through sharing and community interaction. For that reason, we do not wanted to simply develop two disintegrated systems. Instead we tried to integrate the platform-driven engine with the user-driven system in order to provide a meaningful and personal learning environment to each user allowing them to enrich their learning experiences.

[2] http://easyrec.org/

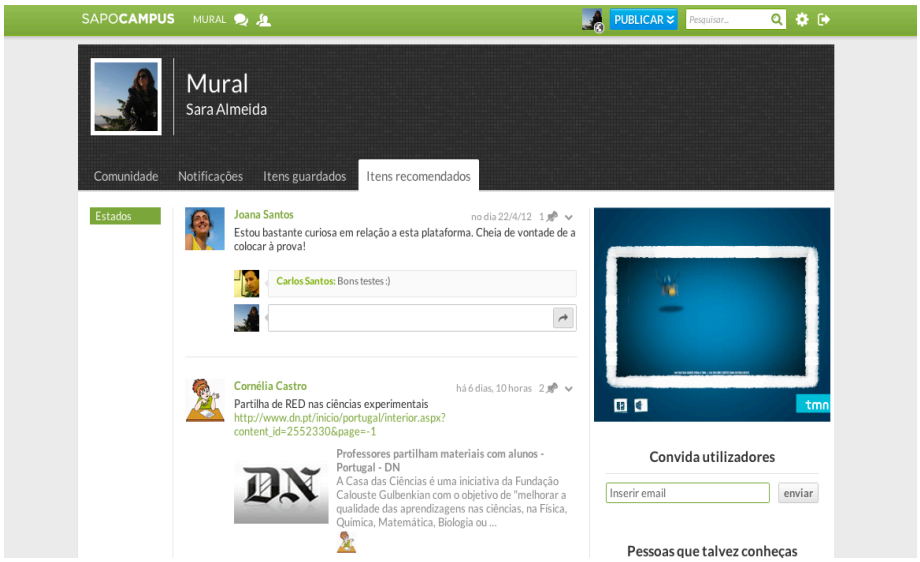


**Fig. 8.** The user's recommendation area

## 4 Final Considerations and Future Work

As we mentioned before, SAPO Campus is an institutionally supported Web 2.0 services platform for use in educational contexts. The development of this platform arose from an R&D project, taking place in a research laboratory that joins University of Aveiro and SAPO – a leading IT company in Portugal – researchers and developers.

Based on principles like openness, collaboration and communication, SAPO Campus tries to balance and compromise institutional concerns and responsibilities with an open, personal and social learning experience.

The concept of Shared Personal Learning Environment (ShaPLE) appears in this context to promote the aforementioned SAPO Campus' essential principles. With this concept, we intend to improve the engagement and motivation of the SAPO Campus' users by reinforcing their participation in the platform. We are implementing an integrated mechanism for content curation and sharing in order to launch an effective learner-based set of tools that supports contextual learning and also in order to promote an effective participation in this dynamic learning environment. This mechanism is two-folded including a recommender engine to support the users finding relevant people and content, and a content classification mechanism that will engage users as SAPO Campus' content curators.

We are aware of the potential and challenges that this integrated mechanism could bring to the SAPO Campus platform and users. In order to answer the users' goals and needs, these systems need to be constantly refined.

In this context, the adoption of an holistic approach seems appropriate, whereas the users might be involved in the developing and designing process. The first version of the aforementioned content curation mechanism will be tested soon by some users (teachers and students) in order to collect some relevant information and opinions about its strengths and weaknesses.

As a practical result of this project, we hope to improve the engagement of SC's users; understand the impact this new concept could have on the overall learning process and experience; and produce valuable contributions to the development of new features in the field of personal learning environments, which would readily be made available to all institutions that will adopt the SC platform.

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# Drupal as a Social Hub for Personal Learning

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**Abstract.** A Personal Learning Environment (PLE) focuses on the personal need of a learner. It refers to informal and self-directed learning and integrates different resources and services in a single environment. But learning can also be considers as a social activity. From the perspective of a formal master program, the article discusses the relation between social and personal aspects of learning and describes the design of a technological platform that connects the different PLEs of the students. Instead of using a traditional Learning Management Systems (LMS) for managing the program, the platform acts as a "social hub" between the PLEs to perform formal learning scenarios and to build a social space.

**Keywords:** Social Learning, Personal Learning Environment (PLE), Drupal, Community, Master Program

## 1 Learning: a Personal and/or Social Activity?

In Education, learning is situated in a social environment. Lectures and courses define social groups where students meet and develop interpersonal relations. These relations often surmount the formal context of the classroom and develop into mutual friendships and social networks. Typically, students use social platforms like Facebook or Twitter to stay in contact and to organize their social life.

Increasingly, learning management systems (LMS) are used in courses and lectures. While these systems most often are used to provide access and to disseminate learning materials to the individual they also provide tools for social interaction, for synchronous and asynchronous communication and collaboration, e.g. in forums, wikis and blogs, in chat and conference rooms. Learning management systems therefore provide an environment for individual learning activities as well as for social activities. Institutional practices typically focus on the process and results of individual learning activities and assessments of learning most often are based on the performance of the single student. The use of traditional learning management systems (LMS) often has neglected the social aspects of learning.

Recently, digital tools for social activities are increasingly being discussed in the context of social constructivist pedagogy (e.g. Lev Vogotsky), a theoretical framework that stresses the social foundation of human learning and development. They provide an environment that focuses on social activities of the learners for communication and the joint production of digital artifacts. Many current projects in E-Learning have focused on these social activities and tools. They demonstrate that learning is an activity

of co-construction, although an individual activity on the surface, always embedded in a cultural context. With this process of enculturalisation, the individual develops knowledge in the interaction between the learners, teachers and knowledge artifacts, thus participating in the cultural heritage.

Humans are social beings. In order to emphasize the role of sociality for learning and education pedagogy often refers to anthropologists that understand humans as in need for social relations. According to Arnold Gehlen, man alone is deficient by nature; in culture he benefits from the findings of his common activities. In trying to master the contingencies of his experiences in the interaction with his world, culture is a way to interpret experiences to make sense and meaning and to find stability in his interpretations and expectations. Hence, learning takes place by and shared between members of a community that is embedded in a cultural context [1-2]. So even if learning is perceived as a personal process, it implicitly refers to social concepts like culture, community and society. Learning includes access to cultural knowledge and contributes to societal communication [3-5]. The current debate on social learning is closely linked to the new development of social networking tools (like LinkedIn, XING, Facebook) and social media platforms (such as YouTube, SlideShare, Scribd).

This short discussion points out that learning is to be seen as a personal as well as a social activity. Whereas some theories as well as some institutional settings focus individual learning activities, others concentrate on the social side of learning. The technological infrastructure for learning should provide an environment that supports both streams of activities likewise.

Personal Learning Environments (PLE), on the one hand, refer to the environment the individual has setup to organize and execute his/her learning activities. Recently, these PLEs have gained attention especially in the field of informal learning: learning that takes place without the structures of a course or an institutional setting that guides (and restricts) the individual learner. In this context, the learner can deliberately relate to others' or not: It is his or her own choice if or how much s/he wants to exchange with other learners or look for others to support or guide one's learning activities.

However, for (online) learning activities that are organized and supervised in an institutional context the question arises if or how an institution should handle (online) social interactions? In traditional FTF-education, there are many chances for social relations to develop quite naturally. In online education, however, the learning environment the institution provides influences the scope and intensity of social interaction to a certain degree. In the following, we will discuss, how an online environment can be designed that explicitly integrates PLEs with an institutional environment that fosters social interaction, thus acting as a social hub for PLEs.

## 2 Personal Learning Environments vs. Learning Management Systems

Personal Learning Environments (PLE) include the digital tools and sources the individual learner has aggregated to satisfy his/her needs for learning. It typically consists not only of a single software or knowledge base but of a collection of tools and sources the individual has assembled over time.

The PLE focuses on the personal needs of a learner and it's configuration depends on the kind of learning activities learners are engaged with – independent of demands and infrastructures of an educational institution. Learning Management Systems (LMS) on the other hand typically are platforms institutions use to organize and to manage courses they offer [7-8]. They provide many sources and various tools that increasingly also are configurable to the learners needs. But essentially they most neglect the fact that the environment the learning activities take place in are *not* identical to the environment the institution provide: The PLE is never identical to the LMS. In some cases, students might spend a lot time "on" the LMS, but still will perform several activities apart from the institutional LMS, for example using a preferred tool for processing words or graphics.

To advance this course centered and organizational scope, PLEs increasingly are being considered as a tool to support self-regulated and informal learning. Although a PLE is widely discussed as a technological concept, it should direct the focus of attention from the needs of the educational institution (e.g. to disseminate learning materials) to the activities learners do perform to meet certain learning objectives. By focusing the individual learning activities, PLEs are associated with self-organized learning, lifelong learning and informal learning [9-11].

A PLE, however, typically is not a solitary island. In fact, the concept has many relations to the discussion of social software. It has emerged in close vicinity to developments labeled as "web 2.0" and typically, a PLE consists of a rich toolset that provides mechanisms to aggregate web content from others into the PLE as well as to publish content form the PLE to the net. By integrating external services into a personal environment, the PLE collects and aggregates activities and information from different networks and integrates them into the user interface.

To realize this, the software framework should rely on open standards and use accessible interfaces for the exchange of information. Beside RSS feeds, web applications can use mash ups for implementing this task. Mash ups can combine external information and services into a personal portal and hence build a technological basis for a personal portal and a PLE [12]. Turner considers the individual as the center of the social web similar like the PLE considers it at the center of a learning process [13].

Describing a PLE as an integrating user view to aggregated sources and tools leads to the particular understanding of PLE. According to this, a PLE is a tool like a computer program or a web application collecting information and services. Wilson stresses, that not only collecting but also publishing information belongs to such an application. According to his description of the "VLE of the Future", which can be considered as an early description of a PLE, the following features characterize a PLE [14]:

- it is not institutional but personal and it offers anyone the possibility to become a learning provider
- it supports formal and informal learning situations as well as social activities
- it collects user activities and also services and materials from learning providers
- it publishes content, invites other to this content and shares it
- it interacts with external devices (e.g. mobile phone, tv, guitar)

An early example of a PLE as a computer program is PLEX [15]. PLEX manages personal profiles and contacts, aggregates feeds and content from different sources and if

offers the possibility to shares content trough different and expendable conduits (see figure 1).

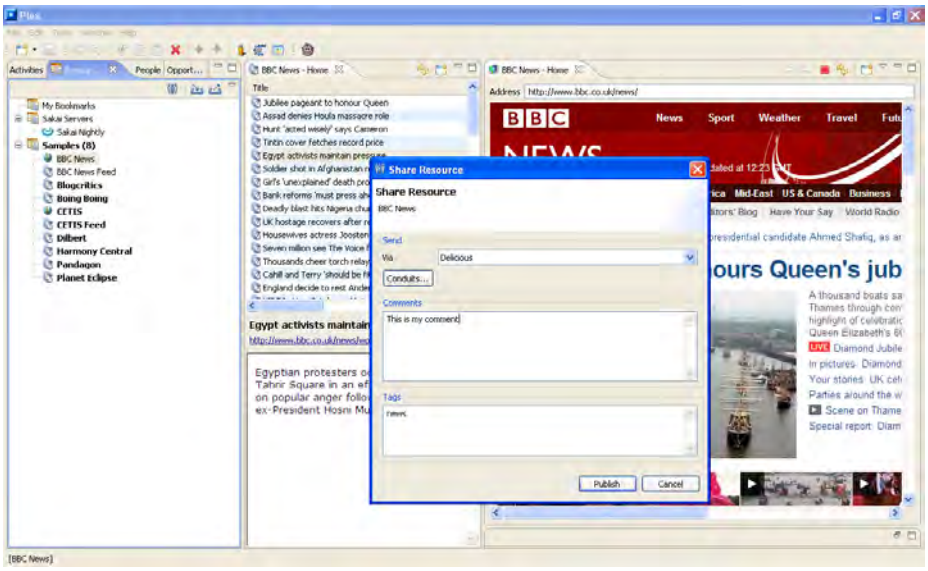


**Fig. 1.** PLEX Personal Learning Environment.

In a general understanding, a Personal Learning Environments cannot be considered as a single application or specific piece software. The most general understanding of PLE includes all technical (and even not technical) tools and applications a person uses for its learning progress [11]. Ranging from a word processor for writing papers, an email client and a web browser to a private weblog and further, a PLE denotes the heterogeneity of tools, the aggregation of different services and the integration in an environment for the personal learning propose. The personal computer of a learning person, its desktop, files, mails and programs are an example for this understanding of PLE as well as the personal weblog, mobile devices and even the books beside the laptop.

The relation between the general and the particular understanding of PLEs can be characterized as a vision and the realization of a vision. While the general meaning articulates the idea, a particular piece of software that denotes itself as a PLE is an interpretation of that idea and an approach of realizing it. For being part of that vision, a PLE has to be understood as more than a piece of software. A number of different approaches to and forms of PLE show heterogeneity in how PLE look like.

For designing a learning platform for a particular study program in higher education, the following discussion considers a PLE to be the multiplicity of tools and devices a student might use in his / her own learning environment. This understanding is rooted in the assumption that the development of technology and “web 2.0” offers a set of tools, programs and services on a high level of access that serves the needs of the *personal learning environment*. This requires the interoperability of different tools and devices. The study program presented here does not aim to design an all-encompassing PLE, instead it focused on connecting different pre-structured PLEs of

various learners with each other; the goal being to enable formal and informal learning processes between students and provide a social hub for these various PLEs.

## 3 Technology Enhanced Learning in the Masters Program "Educational Media"

The master program "Educational Media" is a two-year online program offered by Learning Lab of University Duisburg-Essen since 2003. On average around 100 students study together each semester in several courses. In addition to required courses students can select study modules to suit their interests. Each study module (course) is a formalized learning opportunity in which learning units have to be completed at certain times. An academic tutor accompanies learning activities. The semester schedule is divided into six units each of them offering learning materials like texts, videos or podcasts and an assignment that has to be submitted until the next unit starts. Each module ends in a formal exam which has to be taken local in Duisburg (Germany) where students meet face to face one time a semester.

Central element of the instructional design are assignments for groups of learners that are incorporated in all learning units. The environment must therefore allow the formation of groups and offer support to these groups as they work on the tasks. For communication and collaboration several suggested tools are provided, while on the same time students are given freedom to select tools they prefer on themselves. New students typically need more suggestions on how to collaborate together on the internet. As the study advances, students get acquainted with technology enhanced learning, they try different tools and configure a personal learning environment suiting to their needs. Asynchronous communication can be accomplished directly via the platform. For groups working on text documents an etherpad server is provided. For synchronous communication a virtual classroom is included. Other external tools, such as Skype or Google Apps, can also be used alternatively by the learner.

The management of the masters program requires the full range of traditional learning management capabilities. Providing content, managing access permissions, displaying the status of learning progress and managing grades are essential functions of a technical platform supporting the learning process. All these functions are, in principle, covered by learning management systems. However, with respect to the concept of PLE, the design of one basic, all-encompassing platform of the institution seems to be unfavorable. Instead the system should be designed as connecting different PLEs of students to a social environment while permitting formal learning scenarios. The demands for such a sophisticated learning platform can be recapitulated as follows: The environment should:

- implement courses for formal learning in the form of study modules, scheduled learning units and assignments,
- support social interaction and the formation of groups,
- provide a set of suggested standard tools for communication and collaboration,
- assure interoperability with external services as well as the integration of external tools,
- connect to the diversity of hardware devices, students use to access to their PLE.

The resulting platform is called “Online Campus NG” (OCNG). It is used in live operation since march 2011 in the online study programs of Duisburg Learning Lab.

## 4 Personal Learning Environments and Social Learning

When students join the master program community they can be expected to already have a history of previous learning experiences. They might already be a member of other social networks (eg. Facebook, Twitter), may be reflecting on their learning experiences in a personal weblog, use different tools to communicate with others and to create artifacts including texts. Therefore it can be said that all participants have developed some type of PLE even if the students wouldn’t call their environment as a learning environment. Although these PLE needs to be extended to fit the formal learning scenarios of a masters program, a university platform cannot replace these existing PLEs. Therefore the supporting technology platform should act more as a social joint that connects the PLE of the learners, supporting the social activities in the context of the study program.

One can distinguish a diversity of tools used in students PLEs. Some tools like synchronous or asynchronous communication are essential for providing social learning and therefore technology enhanced learning must assure that all PLEs contain these tools. Because the study program takes place mostly online, the usual social meeting places are not available to the students. A study group cannot meet in the library, nor can they exchange ideas in informal gatherings at the cafeteria. It is necessary to support these processes online. Some other tools are useful but not as essential as the first ones. For example writing a public microblog can be useful for staying in contact and sharing ideas with fellow students but needn’t be done in this way even if the development of social ties seems particularly important for the stability of the learning groups. Also the usage of tools in a PLE needs different level of knowledge. Creating a personal account on a social media platform is easier than connecting different social media tools together for sharing information and posts between them. At least some tools are more popular than others and therefore new students usually know them and have experiences in using them. In order to offer technology enhanced social learning as a social hub between different PLEs one has to look closer on the tools used in students PLE and offer standard tools for essential elements. But which tools can be regarded as popular and in use by the students and which tools have to be offered

As an example one can distinguish two significant tools of a PLE for social learning. At first social learning needs some communication tools. For providing direct interaction and group work synchronous communication tools are essential. For this propose the voice and video chat application “Skype” can be expected as a popular example. At second as mentioned earlier PLEs are discussed under terms of interoperability of tools and services. A key feature for exchanging posts and activities between different services is the RSS-feed. With feeds blog and microblog posts can be exchanged and aggregated between different platforms and applications. Both elements, Skype accounts and external feeds, can be included in the personal user account of a student on the OCNG platform. If a Skype user name is given, the platform displays the name within the personal profile so that other students can contact that person. If external feeds are specified in the user profile, the system collects the items offered by

these feeds and displays them on several pages. An external feed can be a personal blog but also a social media platform like “Twitter” or “Facebook”.

For understanding the structure of a student PLE at the beginning of the study and its development during the study it is interesting to have a closer look at the user accounts on the OCNG platform. Currently (17.08.2012) there are 173 active students registered at the OCNG platform. Because the platform is in use since march 2011 and new students join the masters program every semester, the age of the user accounts vary between 554 and 122 days. Figure 2 shows the percentage of user accounts with external feeds or Skype user name specified in relation to the age of the user account.

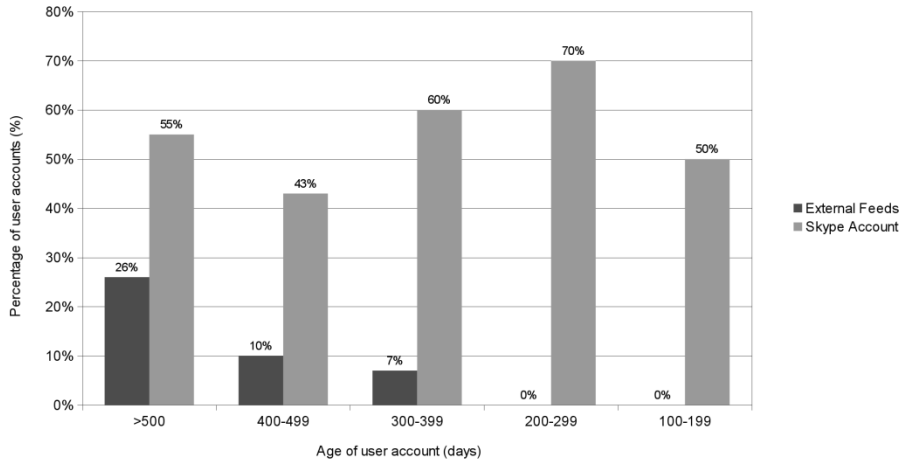


**Fig. 2.** Students registered at the OCNG platform with external feeds or skype user name specified in their user account

The figure offers two different interpretations of the development of students PLE. At first as expected Skype seems to be a popular tool that is in use by around half of the students from the beginning of their study. Regarding all ages of active student user accounts, 51% of the students specify a skype user name. The variation during the age of the user account can be regarded as less important to that analysis. At second including an external feed to a user account seems to be more complicated. The increase of user accounts with external feeds during the progression of the age of the user account can be analyzed as a learning curve. The knowledge of exchanging information and resources with feeds between different applications is itself subject of the study program.

Of course the offered technology enhanced learning environment has to be customizable for all students that want to incorporate elements of their own PLE in the environment, while at the same time offering pre-structured elements for those learners that have little experience with at least essential tools for social learning. As this interpretation of user accounts suggests, writing and aggregating posts in a social context within the learning platform should be a pre-structured element offered to new students by the platform. The exchange of posts between different platforms is a demanding task that should be possible but we can expect that new students likely do not use this feature in their PLE. On the other hand, we can expect that new students use tools

for synchronous communication. So concerning this tool for social learning, the platform can refer to external tools.

## 5 Connecting Personal Learning Environments with Drupal

Building a system to enable distance learning for an online degree program is an issue that faces the aspects of personal learning environment discussed above. It needs to be sufficient open to collect and connect the personal learning environments of the participants but it should not be without a central place, so that it can offer a structure for the degree program. It should support a formal learning scenario but also support opportunities for informal learning. All those demands raise the question which framework to use for realizing a system like that.

In recent years the content management system "Drupal" has attracted attention [16]. It is a software project with close ties to the web 2.0 movement. Unlike other content management systems it does not distinguish between a backend and a frontend with the corresponding user accounts for editing and viewing the site. It only uses one user database table for all accounts with different roles. This circumstance can be considered to represent the shift from users to authors of a website. It also offers a wide range of modules and extensions for integrating external services like other social networks. With the use of this extensions Drupal can be used in formal learning scenarios as a learning management system (e.g. https://elms.psu.edu/). So far Drupal has mainly been recognized as a system for editing, managing and delivering learning content that integrates social media features [17]. Beyond formal learning scenarios Drupal is able to export and to import content, applications and services according to open standards like rss-feeds, SCORM and various APIs. It also offers an extension to build personalized The "organic groups" extension allows users to build and manage own groups and to share content within it [18]. These features in combination with its community functions qualifies Drupal for informal and self-regulated learning scenarios and raises the question, in how far Drupal can be used as a framework for personal learning environments. The "Online Campus Next Generation" (OCNG) is our approach to use Drupal in sucha way for our degree program.


**Fig. 3.** Different elements of OCNG: a group (top), a river of news (bottom left) and external feed items rearranged according to a group (bottom right)

In Drupal, content and different content types are represented as “nodes” and “node types”. A simple post to other members of the community is also a node, just like a wiki page that can be edited in cooperation between multiple users. Even external content can be imported into the system as nodes. Custom node types can be modeled and implemented by a “content construction kid” as well as by other external modules. So nodes do not only represent content but also items of cooperative work and even external services integrated by mashups. The following list describes the range of node types we used in OCNG:

- Pages and articles to build the static content of a website to inform the general public about the program and conditions of study.

- Modules and informal learning groups are organic groups that can be freely created by teachers and/or students.
- Blog entries and posts in groups are content created by group members and students for social communication. Wiki pages are posts in a group that can be edited by all members of a group.
- Pads are nodes that integrate an external etherpad server. Pads offer the possibility to edit a text synchronously an cooperatively.
- Activitystream items are nodes imported from external social networks like Twitter, Facebook or Blogs.

An organic group implements a content access system allowing users to create groups and to share content within these groups. This module builds the basis for courses as well as informal learning groups. Groups do not even control the visibility of internal content. External content imported from other social networks can be rearranged according to these groups. As an example, the system can collect the posts of a user in the social network Twitter and display them to the members of the users group in drupal even if they are not followers in the generic social network of the user. In that way Drupal can act as a social hub for connecting and aggregating the activities of different persons on the social internet and rearrange them according to the social structure of a course or a group. Because we regard all tools and networks a student uses for their personal learning process as their personal learning environment, Drupal here connects different PLEs together. Like an ordinary forum, users can also post and comment content in a group within the drupal system. Every group offers a timeline of recent activities as a river of news.

The main difference between informal learning groups and courses, both implemented as organic groups in Drupal, concerns the additional function to distribute learning content and to assess the learning progress of students. Courses can be considered an extended learning group. The distribution of learning materials, videos and podcasts is scheduled by a timetable and content is successively made available to the members of a group. Assignments, including group assignments, apperar with the learning materials in the course. As mentioned before Wilson stresses in his “VLE of the future” that the PLE can collect institutional content from different insitutions. It is not sufficient for a social hub to collect the activities of the group members, the members must also be able to export the formal learning resources to their own PLEs. Drupal can export posts and comments of a group as RSS-feeds. This personalized RSS-feeds can then be used to trace the resources of the courses back to the PLE of the student, e.g. in a simple reader application on a mobile device (figure 4).


**Fig. 4.** Reading the latest posts of a course in a feed reader on a mobile device

## 6 Conclusion

The article outlines the design and implementation of the Online Campus NG, a platform for managing online master programs. The instructional design of the study program focuses on personal as well as social aspects of learning. Considering the students to be free to configure their own personal learning environment for supporting self-directed learning processes the platform focuses on connecting these environments for enabling social learning processes. The Drupal based OCNG is a step towards that vision of a social hub of connected learning environment, but does not realize the idea to its full extend yet. It can be critically compared to learning management systems to highlight the differences according to standard platforms. But one can also highlight not yet realized aspects in the concept.

In comparison to typical learning management systems, OCNG is designed more lightly, open and offers a different social structure. “moodle 2.0” is an example for a widely used and established learning management system, that tries to integrate a huge amount of tools for communication, cooperation and learning into a course room by often reimplementing them. In moodle student interactions are arranged by and within courses and building communities outside of courses is difficult.

OCNG, on the other hand, acknowledges the fact that the internet already offers a rich diversity of highly sophisticated tools. According to the instructional design of the master program, students are encouraged to use external tools as part of build-

ing and configuring their own personal learning environment. The system collects the artifacts of students in the internet and aggregates it in a social space. Instead of providing own tools, the focus is to collect activities and resources of external tools by using open standards like RSS-Feeds and APIs. That integration relies on open standards external tools need to be compatible with. If that is not the case, and because of the rich amount of freely chosen tools that case frequently occurs, students need to post a link to the external tools they use. From a pedagogical point of view, these gaps demonstrate the essential structure of the internet to the students and they can be considered to reflect the steps of the development of media competency. From a technological point of view, however, that integration could be more closely and for future releases more options for interfacing with external tools are currently considered. Furthermore, a more tightly mashup of collobaration tools like "Google Docs", whiteboards, virtual classrooms, instant messaging etc. into the system is being aimed for.

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# Designing and Implementing PLEs in a Secondary School Using Web2.0 Tools

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**Abstract** Although current and upcoming web technologies offer all kinds of new opportunities to support student-centered learning, there does not exist yet a clear roadmap to integrate these technologies into teaching and learning processes. In this paper a model is introduced in order to develop Personal Learning Environements (PLEs) consisting of Web2.0 tools and to integrate them into teaching and learning processes. Next to this, an example implementation in the context of a secondary school is described. Two questions framed this study. First, how do students integrate PLE tools into their learning activities? Second, what is the students and teacher's perception of the PLE project? Results show, among others, that web2.0 tools should be thoroughly integrated with active teaching and learning methods in order to realize a student-centered learning environment. It was also concluded that students need enough time and teacher's facilitation in order to get learning and pedagogical value out of PLEs tools and to be able to truly integrate them into their learning activities.

**Keywords:** Personal learning environments, Web2.0, Active teaching and learning, Student-centered learning environment

## 1 Introduction

Educational systems should mirror and support the values and priorities of an increasingly technological society and knowledge intensive era, and prepare students to live and act in a rapidly changing world [1], [10]. In order to cope with the needs and challenges of the new knowledge landscape, a radical revision of traditional pedagogical approaches, principles, and policies imposed by formal educational institutions is required [2], [3], [6], and [10].

Technology is a key driver for educational changes [3], [11]. Research findings indicate that the environment in which students are working is complex and multifaceted. Technology is at the heart of all aspects of their lives [13]. The role of technology can be viewed in several ways here: as a collection of tools to support knowledge construction, as an information vehicle for exploring knowledge to support learning, as a context to support learning by doing, as a social medium to support learning by conversing, and as an intellectual partner to support higher order thinking skills through mindful engagement and learning by reflecting [5], [10], [12].

In practice, existing and emergent Web2.0 technologies offer (new) opportunities for students to find and use rich sources of information, to connect to more capable people [8] outside of the class boundaries, and to analyze and synthesize information and knowledge. These technologies can enable students to have more control over their learning and can support them to become active, self-directed, and autonomous learners [5], [6].

The personal learning environment (PLE) concerns a new model of technology-enhanced learning that supports learner-centered approaches by allowing learners to create and develop customized learning environment with Web 2.0 technologies. "A PLE is a learner's gate to knowledge." [6]. Often the PLE is considered as a more natural and learner-centric model to learning that takes a small pieces, loosely joined approach, characterized by the freeform use of a set of learner-controlled tools and the bottom-up creation of knowledge ecologies [6], [11].

Understanding the potential benefits of PLEs, the question remains how they should be designed and deployed in order to support heterogeneous learning demands on new generation of learners. In this paper, a technology-enhanced, student-centered learning framework is introduced. This framework offers a model to incorporate PLE building into teaching and learning processes.

The remainder in this paper is structured as follows. In section 2, we provide the theoretical background of the proposed framework based on a review of related work. Next, in section 3, we introduce the new framework and describe its characteristics. In section 4, we explain research context, research design, and implementation of PLEs. Next, in section 5, the results of this research are explained. In section 6, we discuss our results. In section 7, we conclude and provide a short outlook towards future research.

## 2 Literature Review

A literature review taught us that the philosophy of constructivism provides a sound theoretical basis for our framework. Within constructivism, the main responsibility of learning should reside in the learners. This means that the learners should behave as active agents during the learning process by constructing their own knowledge and understanding, not by only mirroring and reflecting what they read [9]. Constructivist-inspired learning environments often provide resources for learners to manage their own learning through exploration, hypothesis formation, and student-relevant feedback. Knowledge is constructed while individuals engage activities, receive and provide feedback, and participate in multiple forms of interaction [11]. "Learning by creating and developing a PLE follows a constructivism approach to learning" [5]. Students learn through the process of applying technology with the goal of constructing a customized learning environment [5], [10].

The networked student model [5] has inspired this study. Networked students are "equipped with appropriate information management skills, Web2.0 technologies, and social contacts (i.e. coworkers, family, friends, classmates, teachers, experts) to build their own PLE and apply it to accomplish learning activities, deal with complexity and diversity of digital content", connect to more capable people [8], play an active role during learning process, and take control over their own learning [5].

Three dimensions can be identified to characterize a technology-enhanced learning environment: "the macrocontext that contains systemic reform and educational standards; the teacher community which includes physical or virtual context, where teachers share expertise and mentor each other; and the microcontext, which includes classroom context, where learning and teaching occurs". [12] The interactions among the standards, teacher community, and classroom contexts are key to exploring the role of technologies and it is not the innovative technologies per se that have an impact on students' learning, but, instead, the interactive and iterative learning environments [12].

## 3 A Framework for Constructing PLEs

Having sketched the theoretical context, the way has been prepared to introduce the new general framework and its characteristics. "Fig. 1" depicts the framework for constructing PLE-based student-centric learning environments. It is based on adapted versions of the networked student model [5] and the technology-enhanced teaching and learning model [12]. It is further assumed that knowledge is socially constructed, (i.e., that learning is fundamentally social in nature and resides in networks [20]), and that each student is owner of his (her) own learning. Based on these assumptions, the framework identifies and proposes contexts at school, and classroom levels that influence the teaching and learning activities within a student-centered PLE. We continue by describing these contexts in much more detail.

### 3.1 School Context

In our framework, the factors within the school boundaries that influence the design of learning environments are categorized as follows:

**Management Support.** Without willingness and active engagement of school's administrators, implementing a technology-enhanced student-centered learning environment is very difficult. Administrators' support is crucial to provide sufficient technological infrastructure, to define and enact necessary policy and rules, to motivate and support teachers and students, and to provide appropriate professional development for teachers.

**Technological Issues.** Technological issues and requirements include: providing sufficient technological infrastructure; providing sufficient access to Internet and web resources for students; enacting policies and rules to employ technology, efficiently and safely.

### 3.2 Classroom Context

The classroom context where students build their PLEs with Web 2.0 tools and resources is the central part of the framework and includes the following components:

**Instructional Model:** Our framework uses the Learning Cycle model as the instructional model. This inquiry-based model provides the active learning experiences based

on constructivism as its theoretical foundation [17]. The learning cycle follows Bybee's model in [16] and includes the five "E" steps of engagement, exploration, explanation, elaboration, and evaluation. The learning cycle begins with the active engagement of students in the learning's topic. In the exploration step, the teacher orchestrates a discussion period in which students share their observations with their classmates. Once the concept has been labeled, students engage in additional activities in which they apply their recently formed understandings to new situations [19]. It is a cyclic process with no end. After the elaboration ends by teacher, the engagement of the next learning cycle begins. Evaluation is not the last step and occurs in all four parts of the learning cycle.

**Learning Objectives.** Learning objectives define new knowledge, capabilities, and skills the students will gain, and tangible outcomes they have to deliver or present at the end of their learning. Although students, in a student-centered learning environment should be able to define and select their learning objectives, they may also follow the learning objectives as defined by the teacher [7]. It is important to share learning goals with students, receive their feedback, and engage them in order to define mechanisms for fixing learning goals.

**Assessment and Evaluation.** At the end of each step of learning cycle, students will be assessed and evaluated on how they achieved the defined learning goals for associated step or learning's topic. The assessment focuses on learning process and outcomes of the learning process. In our framework, methods used for the process assessment and evaluation include peer evaluation, e-portfolio, writing online reflecting journal [21], written essay, weekly assignment [5], and collaboration pattern. In a PLE-based learning, product assessment aims to investigate the quality of the final outcomes which includes rubric-based assessment of PLEs, the number and quality of widgets or gadgets in personal page, weblog writing, the number of written comments on other students' blogs, and the quality of the final project [5].

**Web Technologies, Learning Activities, and Social Contacts.** To achieve the learning objectives, appropriate elements of Web technologies, learning activities (e.g. group Storytelling, mind mapping or Brain storming), and social contacts (i.e. coworkers, family, friends, classmates, teachers, experts) need to be integrated into students' PLEs.

**Tasks, Guidelines, Assignments.** PLE-based learning is a new experience for many of students [5]. Therefore, they need to be supported by teachers in order to learn how to develop their own PLEs and to deploy them to support learning activities. In each step of the learning cycle, appropriate guidelines, tasks, and assignments should be defined by the teacher to instruct students how to build and use their PLEs. These guidelines and tasks are supposed to incorporate technology into the learning's topic. In the beginning, students may need to rely heavily on these guidelines. When time passes, they will learn to act more independently [5]. The defined guidelines, tasks, and assignments should address the following attributes:

- Orchestrate all students' activities around a topic;

- Explain the expectations and assessment criteria clearly;
- Promote self-expression by encouraging students to create and share personal voice and knowledge;
- Promote students' critical thinking and other higher-order thinking;
- Provide opportunities for students to take control over content, pace, sequence, and learning process;
- Promote collaboration and team working;
- Highlight features of technology which can support the learning process;
- Connect the current step to the next step in the learning cycle.

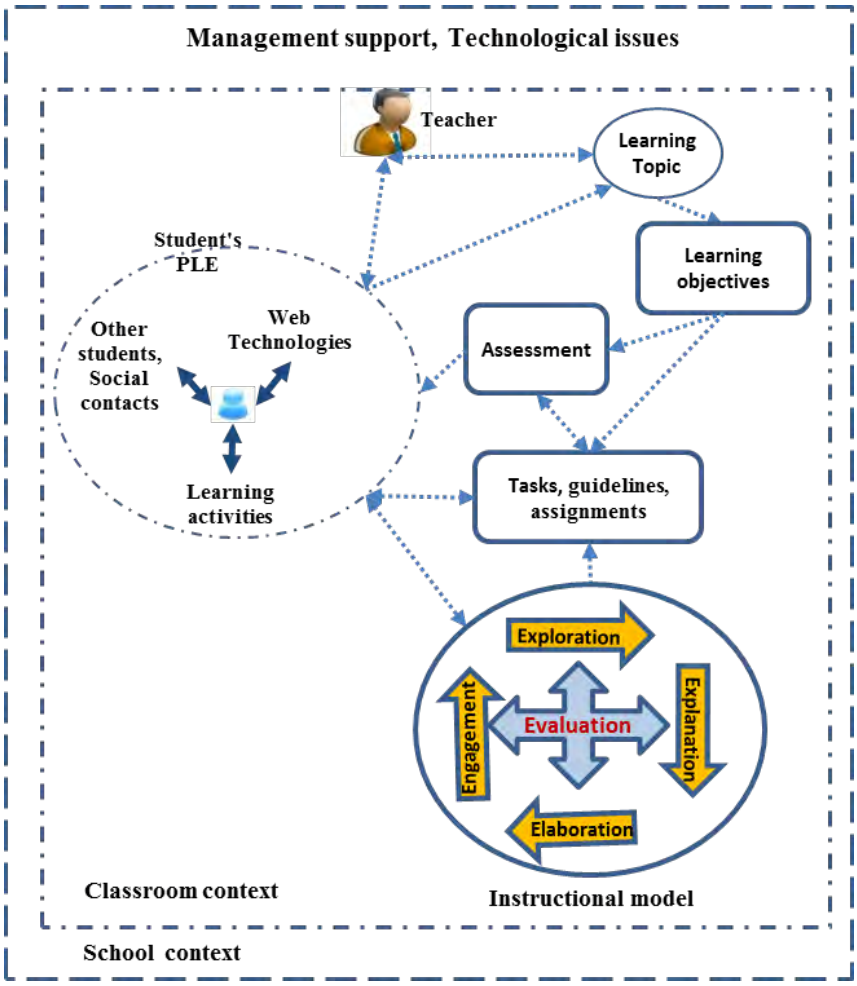



**Fig. 1.** A pedagogical-technological framework for developing PLEs and integrating them into the teaching and learning process

**A Model to Integrate PLE Building into Teaching and Learning Process.** Our framework adapts a model for ICT integration in classroom as proposed in [21] to de-

velop a model, Fig. 2, that provides a systematic procedure for designing learning activities by integrating and rounding different elements of the framework.

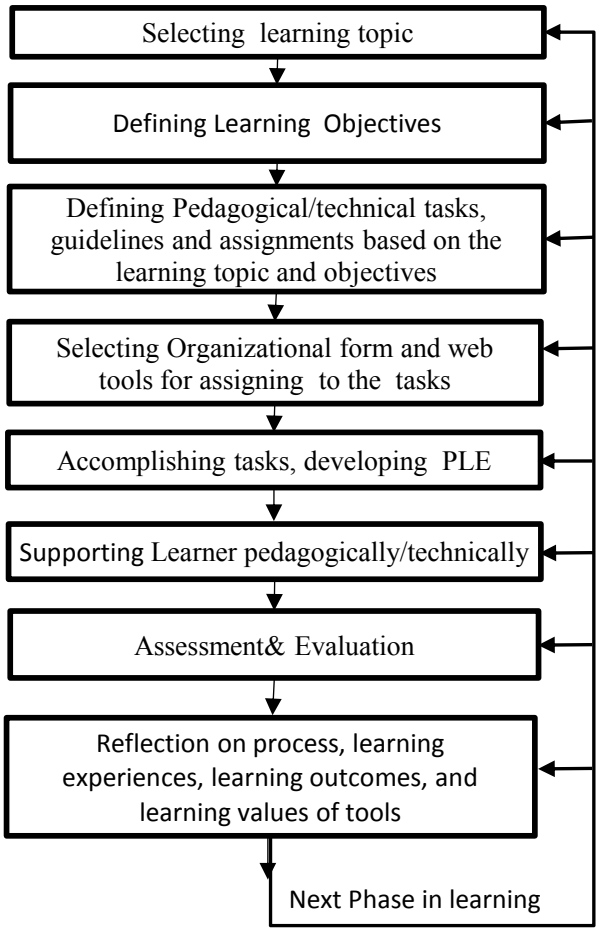



**Fig. 2.** A model to integrate PLE building into teaching and learning process

The above-given description completes our proposal for a pedagogical-technological framework to develop technology-enhanced, student-centered PLEs. While describing its components, which include the various contexts that are supposed to be of crucial importance for successfully creating and deploying PLEs, we have tried to be as complete as possible. The next parts of paper describe an attempt to applying this framework in a secondary school willing to pioneer in this field.

# 4 Project Description

## 4.1 Research Context

Amadeus Lyceum is an innovative secondary school in the Netherlands. Culture and art are the important subjects being taught in this school. Amadeus has chosen four

core values that constitute the basis of its educational system. These core values are: personal development, self-expression, creativity, and dialogue. Shifting from a "one size-fits all" approach towards individualized curricula is one of the educational goals of this school [23].

Amadeus has been using a Moodle-based CMS to store and retrieve course materials and assignments. The school has launched a new electronic learning environment with more functionality for teachers and students to work around the courses content. It provides a part for teachers to upload courses' material and to define assignments, and a part for students in which they can upload relevant content. The main challenge of this new learning environment is to make it a walled-garden, i.e., an internal-oriented and top-down course management system without enough functionality and flexibility (a) to support emergent and heterogeneous learning requirements of students and (b) to allow them to use their favorite learning tools and resource.

The learner-centric approach of PLEs suggests that PLEs can be used to design technology-based and learner-centered pedagogies to fulfill the emergent and heterogeneous educational needs of Amadeus students. To introduce the PLE concept and to realize how PLEs can be integrated into the school context to support learning activities of students, this design-based research has been carried out in order to address the following research questions:

- How do students use the Web to support their learning/non-learning activities?
- How do students integrate PLE tools into their learning activities?
- What is the students and teacher's perception of the PLE project?

### 4.2 Research Design

The research was conducted in a first year class of the aforementioned secondary school, consisting of 30 students of 12-13 years old. Related to their geography and society course, students were asked to design and develop a digital travelling guide for Egypt during the 5-weeks period of the project. Students were grouped in five-student teams and each group was asked to develop a separate travelling guide. In order to stimulate students to actively participate in project, no any pre-defined and recommended structure for the travelling guide was defined by the teacher. The students in each group were asked to think in group about the structure of travelling guide and to select an appropriate digital media to present it. To provoke their responsibility regarding to use of technology and to practice digital responsibility skills, all of the involved students in the project, were provided with extended access to Internet via their own laptop.

The design process was running smoothly based on close collaboration between the research team, associated teacher, and school administrators' representative. The design team held one meeting per week to design required learning tasks for the next week and to review and evaluate the process of the project.

**Used Web Tools.** The following list of web tools was selected and introduced to students to support their learning activities and to develop their PLEs. These tools were selected based on prior experience of the teacher with tools, appropriateness to the defined learning objectives, and technological affordances of the school. Initially, students were not familiar with most of these tools. Therefore, the first week of the pro-

ject was devoted to introduce these tools to the students. A fun approach was followed to introduce tools. For example, for introducing Blog, students were asked to write an English joke as their first blog's post, and for introducing iGoogle, students were asked to create a tab, entitled FUNTAB and add some funny gadgets in it.

**Table 1.** Used web tools to develop students' PLEs

| Tool | Purpose |
|---|---|
| iGoogle | Personal Start Page |
| MindMeister | Mind mapping |
| Google Docs | Document creating and sharing |
| Google Sites | Project wiki, students websites |
| WordPress and Blogger | Blogging |
| Twitter | Micro blogging |
| Prezi | Presentation |
| Free website building and hosting tools | Create final traveling guide |
| YouTube | Video Content |

**Data Gathering and Analysis.** To collect data a mixed approach, consisting qualitative and quantitative methods, has been used [22]. First, qualitative methods including group interviews with students, interviews with teacher and school administrators, direct observation of students working in classroom, and analysis of the content created by students during the project were employed to explore the fieldwork. The collected data were coded and categorized into several classes. Next, a questionnaire contained several questions associated with these categories, derived from the collected date and literature, was distributed among the students.

## 5 Results

**Question1.** How do students use web to support their learning/non-learning activities?
**Findings.** The main objective of this question was to realize some contextual information about the prior experiences of students in working with web tools for supporting their learning/non-learning activities. To address this question, the answers of students to associated questions were classified (Table 2) by using the categories proposed in [4].

According to Fig. 3, prior web experiences of students are mainly about using the standard web tools for searching information, access to school's CMS, gaming, sending and reading email. Their use of web2.0 tools is mainly focused on social networking with Facebook or Hyves (a Dutch social networking platform) and working with Twitter. None of them was familiar with any social bookmarking tool, RSS readers or worked with web discussing (e.g. writing to a discussion board or Forum, Commenting on someone else's blog).

**Table 2.** Web usage categories

| Web usage category | Included items |
|---|---|
| Standard Web use | Using the School's course management system, Searching the web by search engines, Sending and reading Email, Chatting, Using the school web site |
| Gaming | Online Computer Games, and virtual worlds |
| Web2.0 Publishing | Social networking( Facebook, Hyves, etc.), Micro blogging (Twitter, etc.), Web Discussing: writing to an discussion board or Forum, Commenting on someone else's blog post, Writing, reading, or Editing wikis, blogs, or Wikipedia |
| Media Downloading | Watching TV/Video clips online, Listening to online radio, Downloading different type of media |
| Other Web-based services | Shopping: buy something online, |
| Media Sharing in web | Finding a Web site or gadget related to your course topics, Introduce a new website or gadget to your friends, Using Google reader or any RSS reader, Social bookmarking/tagging(Diigo, del.ici.ous), Uploading to share: a photo, video, music, or other sort of files created by user |

**Question 2.** How do students integrate PLE into their learning activities?
**Finding.** Students accomplished several learning activities during the project. The following four themes have emerged through their learning activities:

- Dealing with tools to support learning activities
- Collaborative learning
- Practicing higher order thinking skills
- Taking control and responsibility over learning

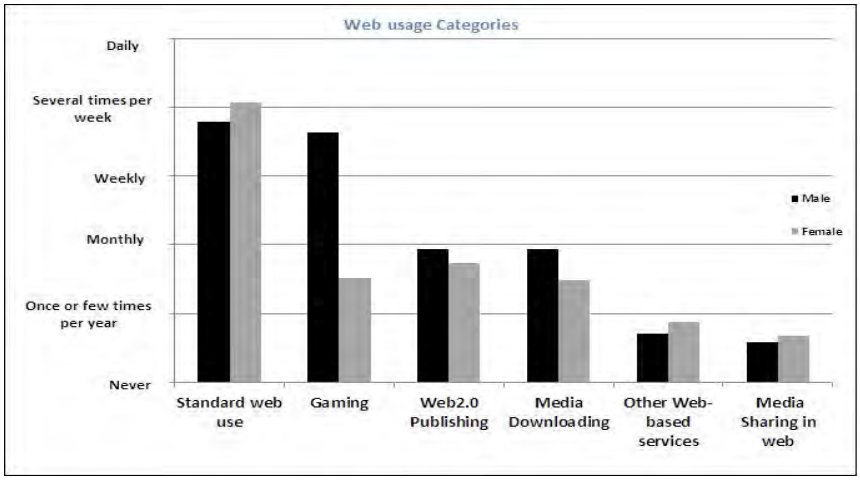
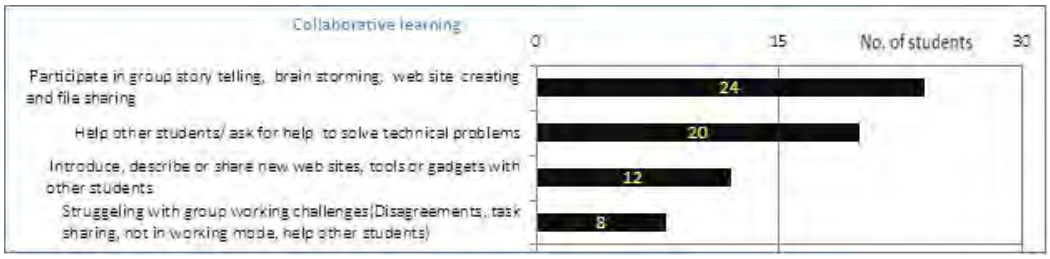


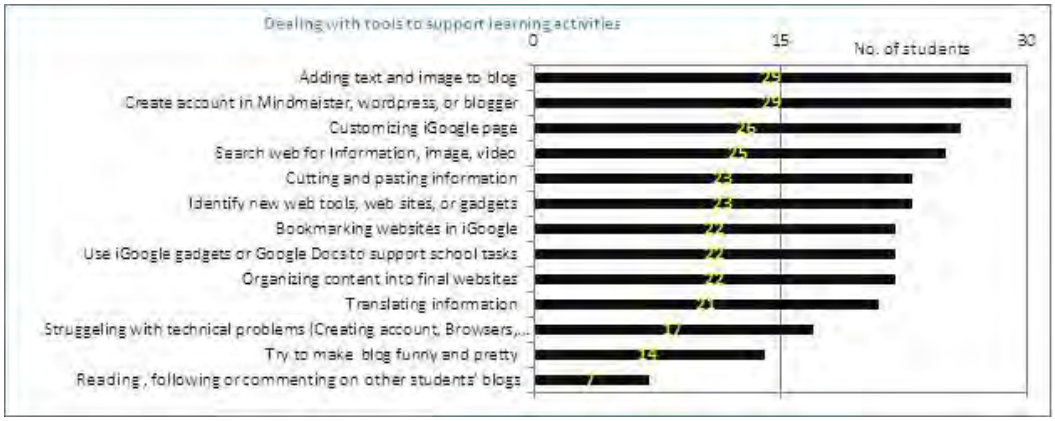

**Fig. 3.** Prior web experiences of the students

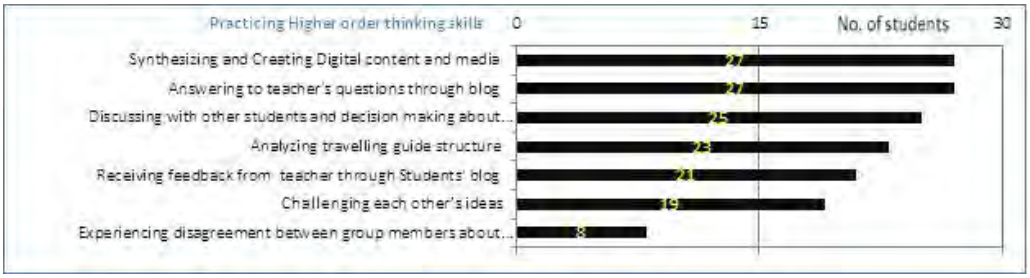
Whereas the activities' pattern shows that students, mainly, have followed the tasks and assignments instructed by the teacher, there is evidence as well for conducting some forms of informal and self-directed learning such as: asking question from social contacts outside of class; reading, following or commenting on each other blogs; using blog for non-school tasks; and continuing blogging after the project. Because a separate preparation phase was not planned before the project for introducing tools, creating account, and configuring tools, students have faced and struggled with a lot of technical problems to create an account for the selected tools during the first week of project. Sometimes, these technical problems were so stressful for teacher and students that it led to students' unsatisfaction.

During the project, students were using the Internet and the introduced web tools not merely for learning purposes. They were busy during the first and second week of the project to explore fun aspects of the introduced tools. Nearly all have played games by using iGoogle gadgets. The teacher has adopted a persuasive approach to negotiate about the learning value of a game with students at times he witnessed students gaming with the selected tools in the classroom.

**Table 3.** Accomplished activities by students during the PLE project







**Question 3.** What are the students' and teachers' perceptions about the PLE project?
**Finding.** Fig. 4. shows how the PLE-based learning has been perceived by the students.

The results suggest that students have recognized the personal benefits (i.e. having full access to Internet, feeling ownership) of web tools more than their pedagogical benefits. Surprisingly, whereas there is less agreement between students about the positive impact of PLE-based learning on understanding of course content, the full access to Internet during the project and taking control and responsibility over the learning process are the most favorite aspects of the PLE project, as perceived by the students.

During the project, the teacher and students struggled with technical problems, group working issues and the challenges raised by defining new teaching and learning processes. Covering the academic content of the course was not more emphasized by the teacher. During interview with the teacher he stated: "I believe that in this project the method or process of the project was more important than the content and quality of the final outcome, so it was not so crucial to put more emphasize on content. In their final websites, students were busy more with look and feels and visual aspects of websites than content. So they developed very nice and beautiful websites with less qualitative content within". Indeed when an educational innovation is introduced to classroom setting which requires to manage complex skills, "students first work to-

ward a process goal perfecting the form or procedure that the skills involves without regard to the final outcome, then shifting attention to the product goal once the procedure is more automatized." (Omrod, 2008, p. 526, cited in [15]).

In all items about one third of students have selected neutral option to state their perception about the raised aspects of the PLE project. Short duration of the project and limited number of course sessions per week (2 sessions per week) were stated as the main reasons for selecting this neutral standpoint, during interview with students and teachers.

One of the interesting results in this study is related to students' perception about the distraction by technology or peers. According to this graph, one third of the students stated that PLE-based learning can lead to students' distraction by technology or peers. Job sharing and group coordination were mentioned as faced problems in the PLE project, during the interview with students. This was first technology-based group working experience for most of them and they have been distracted by a student who was not in working mode, difficulty in task sharing, and group coordination. Technology was another source of students' distraction. Technical distraction mainly caused by occurred problems during setting up of web tools, i.e. creating MindMeister account, or incompatibility between a web tool's configurations and Microsoft windows as the default operating system of school.

Having full access to Internet during the project was interesting for the students and, simultaneously, a main concern for school administrators. One of the students explained their perception about it as below:

"When the degree of freedom to access to Internet or in your learning activities increases, you feel you have more independency and responsibility and you feel yourself as a person that owns his work. At the beginning, I might take pleasure of this free access to Internet for fun, but after a while I will use it for my learning".

Concerns of school administrators about providing full access to Internet for the students is explained by one of the school administrators, involved in this project, as below:

"Possible abuses of Internet freedom like gaming, seeking porno images, and hacking the system make some sort of concerns for school managers. Indeed, using the Internet for gaming, porno, or other outside-of-learning border is like late coming to school. In late coming we will show a restrictive reaction, so here for abusing of Internet, the same approach is necessary. Otherwise this abusing behavior might be spread and unmanageable. It is an important question for school managers, how much freedom in Internet access should be allowed and is sufficient for 12 years old students".

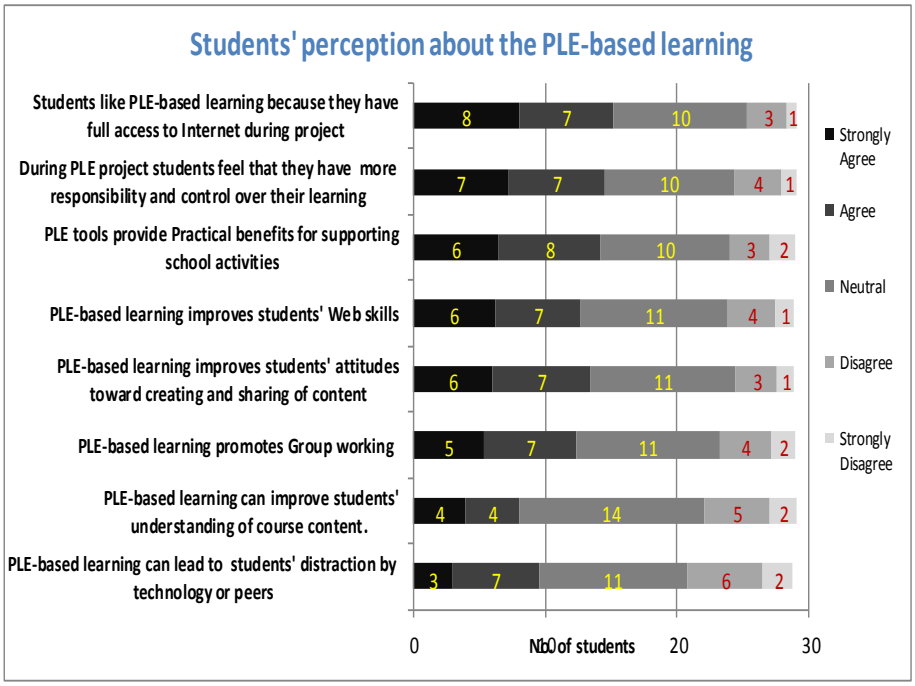



**Fig. 4.** A summary of students' perceptions about impacts of the PLE project on their learning

The PLE project was perceived by the teacher as a means to promote collaborative learning among the students, when he stated his viewpoint about possible benefits of PLE-based learning:

"Great collaboration, deep brain storming, and better and complex mind map. For example to help them to create a traveling guide mind map I provided a default and simple mind map for them, and you can see that their mind maps is really great and very complex. It is a result of real group working.
I think MindMeister is very useful tool for students and also for teachers. Compared to paper, in MindMeister you can add much digital stuff to your mind map including images, URLs, and links."

Another teacher describes PLE not simply as some web tools, but as a means to promote a scientific research process and as a change in the way that students learn.

"They already are learning how to do research and they are following a scientific process. It seems that a PLE is not only introducing some tools for students. By using a PLE everything has to be changed, like assignments, teacher's behavior, and students' behavior."

## 6 Discussion

There are several factors that influence the adoption and integration of PLE concept into teaching and learning process. First and foremost, students need teacher support and facilitation to realize learning benefits of web tools and to integrate them into their

learning activities. Web2.0 technologies, unlike LMS or CMS, are not ready-to-use learning tools. They provide some potential for learning and although students might be familiar with some technological and non-learning aspects of these tools, they are not more aware of pedagogical benefits of them. They need teacher's help and guidance to realize learning value of these tools and to tailor them to their heterogeneous learning requirements. Furthermore, many of secondary school students don't have prior technology-based group working experience. They need teacher support and facilitation to resolve faced group working problems.

Secondly, the ultimate objective of PLE-based learning is to give the control and responsibility over learning to students and to promote self-directed learning. Assuming PLEs solely as introducing some separate web tools to educational setting per se can't lead to a persistent active learning and self-directed learning.

Indeed, PLE tools should be positioned within a learning process comprised of active teaching and learning methods, like group brainstorming; collaborative storytelling; peer teaching; and group decision making, to integrate with them and to support underlying learning needs. A web tool to be adopted by students as a part of their PLEs in short term should, primarily, support their daily demands and activities while considering underpinning long term needs. In the conducted research, students were less inclined to use Blog than Google Docs because Google Docs helps student to work on the same document without sitting around a single computer and it was fun for them to do a collaborative storytelling, whereas using Blog as a learning tool didn't make sense for them in a short time.

Thirdly, where the introduction of technology in learning involves providing students with greater autonomy, this commonly conflicts with students and teachers' past educational experiences and requires a shift in their conceptions of what learning involves and what constitutes appropriate roles of students and teachers [18]. This shift will not happen spontaneously and rapidly and merely by introducing technology to educational setting. Involving students in learning design processes, delegating more control to students over their learning activities, employing active teaching and learning methods, employing technology to extend the contextual, physical and temporal borders of learning, and stimulating students to reflect on learning process can gradually construct teachers and students' perception about student-centered learning.

## 7 Learnt Lessons and Conclusion

This research taught us the following lessons which should be considered to extend next phases of PLE-based learning environment:

- Don't overestimate digital capabilities of students. They need preparation to be able to tailor web tools to their learning needs and activities.
- Don't overwhelm students with introducing a lot of web tools in short time.
- Involve students in the learning design process by allowing them to decide about their favorite learning activities or to select their favorite web tools.
- Explain the expected role of teacher and students in a student-centered learning environment.

- Clarify the considered values in a PLE-based learning environment (i.e. sharing of knowledge and learning resource, collaboration, improving digital identity, knowledge construction, and so forth) to students.
- Emphasize on the whole learning process, not only on the final outcomes in the assessment rubric.
- Put more time, effort and facilitation to increase integration of PLE into learning activities.
- Consider contextual information of the class (i.e. demands, prior experiences, technological issues, students' motivators and incentives, expertise, and so forth) for designing PLE-based learning environments.

This research shows that PLE-based learning can promote students to get engaged in technology-supported learning activities; students need support and time to realize the learning value of web tools, and to adopt and integrate them into their learning activities. PLE-based learning is context-based learning. Understanding the contextual information of the educational setting, teachers and students is crucial for implementing a learner-centric learning environment. It is important to involve the students in a participatory design phase in order to design appropriate and personal learning activities by using selected web tools. It helps students to be informed about technological and pedagogical value of the web tools.

Based on the experiences and feedbacks elicited from the first phase of the PLE project, the diagram depicted in Fig. 5 is proposed to design and implement a PLE-based learning environment. The running phase of this diagram is identical to the proposed framework in fig1. Further research is required to evaluate and improve this model.

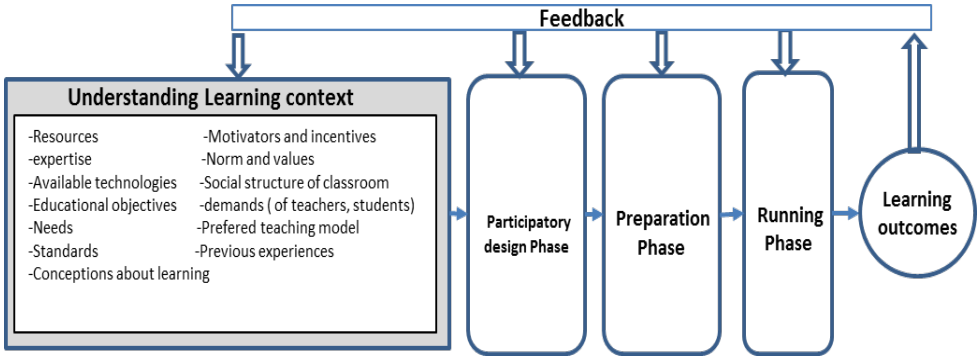



**Fig. 5.** Different phases for designing and implementing PLE

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# Online Learning Communities: from Personal to Social Learning Environments

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**Abstract.** Online Learning Communities have great potential in sharing experiences and creating a collective knowledge based on the interaction among members. This paper presents some our experience and conclusions of using PLE to mixing personal profiles with community building as a mean to exchange experiences from different stakeholders involved in learning activities. These results were applied in two different communities to promote the virtual mobility (Movinter), innovation and quality on Learning (Hextlearn). In these scenarios we explain the goals, the stakeholders and the results we achieved. The strategy chosen was based on social learning environments where each user has their own space, using PLE/PLN.

**Keywords:** PLE, Online Learning Communities

## 1 Introduction

Online communities are virtual spaces where people come together to obtain or share information, to learn, to discuss and to be with others online. Nowadays these communities are quite popular, and it may be analysed according to relevant factors such as: people involved, purposes, policies and rules to govern and promote the communication in the community [1].

These communities are based on a set of resources to facilitate communication, discussion, and the sharing of ideas and best practices. In many cases these resources are online facilities, such as mailing lists, forums or discussion channels. We have interested in the creation of online learning communities of stakeholders with the aim of the creation of a community of practice (CoP) in the sense of group of people who come together to learn from each other by sharing knowledge and experiences about the activities in which they are engaged [2]. We have selected two specific scenarios:

- CoP for the promotion of virtual mobility between Europe and Latin America Higher Education Institutions [3] to increase cooperation, structural links to internationalise curricula and fostering intercultural learning experiences. The purpose of community building is rooted on engaging institutions to promote international cooperation. Movinter project (Enhancing Virtual Mobility to foster institutional cooperation and internationalisation of curricula) is based on the understanding of the intercultural exchange based on virtual communities to enhance and complement physical mobility, internationalisation of curricula and intercultural exchange [5]. The main target audience are decision makers in Education Institutions, but also teachers, researches an students.
- CoP to increase the quality and innovation in elearning [4] by means of peer reviews methodologies, by offering a database of good practices and useful materials. HEXTLEARN project (Higher Education exploring ICT use for Lifelong Learning) aims to build a network of participants to increase the level of attention of the Higher Education Community on ICT strategic integration, by generating awareness, commitment and networking on quality assurance aspects and strategic integration of ICT in teaching, learning and innovation in Higher Education. In this case, the wider target audience based on experts and teachers/learners.

  The hypothesis based on these two communities were the same: the creation of a community of practice where everyone can learn and share their experience with the others and promoting interaction themselves to discover new areas of interest.

## 2 Theoretical Framework

### 2.1 Learning in the Knowledge Society

Nowadays Information and Communication Technologies influence any aspects of our daily life and especially, in the way we access to the information and we build the relationship with others. ICT support gives us the opportunity to build new scenarios to obtain information, transform it into knowledge, and to connect with people around the world and sharing this knowledge at the same time. Thereby, we can take advantage of these possibilities of interaction and knowledge building new digital learning spaces. These scenarios are based on the collaborative learning as a key issue. We can look for the basis of collaborative learning in the approaches of Vygotsky to the social learning and is related to the Social-Constructivism theory. It involves the development of learning and teaching strategies that provide significant learning in a mutual interaction environment. Best practices sharing are a good approach to interact and understand common issues. Members share, rate and discuss about a problem using a case study trough cognitive interchange and peer interaction. Each member achieves learning informally; each one is responsible for their own learning skills as result of the interaction in this group [6,7].

Besides collaborative learning another key issue in this approach is the building of communities of practice. This idea is strongly related with the collaborative learning that we described before. According to [8] communities of practice are groups of people who share a concern, a set of problems, interest about a topic, and who deepen their knowledge

and expertise in this area by interacting on an ongoing basis. There are three features that are crucial in the definition of the community o practice: the domain that defines its identity; the community made up of members engaged in joint activities and discussions, help each other, and share information; and the practice done by the members. In these cases, members are engaged with a clear role (stakeholders) in these communities, so they are interested and motivated in the sharing of experiences.

The use of ICT in Higher Education Institutions (HEIs) is widely spreading in Europe, and moving from a traditional profile to a new one, covering most of the areas of Lifelong Learning (covering from school teacher's education to adult education and training). Other areas such as corporate training, continuing professional development or prior learning assessment (PLA) for guidance and employment are growing so fast by their closer contact with the employment. Each of these frameworks may be considered as different territories with different stakeholders, rules and type of knowledge. The lack of synergies among territories is a drawback in order to collaborate and share good practices and closer cooperation. These communities of practices should be capable to interact each other in order to find closer cooperation and mutual understanding, and this is one of our hypotheses in the development of the Learning communities for Hextlearn project. On the other hand, Movinter project look for a better understanding of international cooperation based on ICT between Higher Education Institutions, finding new multilateral synergies to promote new achievements.

### 2.2 Towards Personalized Learning (PLEs and PLNs)

The theoretical framework is based on the principle that the learning process is continuous and that cannot be limited to a classroom environment. Learning is a lifelong process, made up of our experiences in different environments. In this context, the concept of "informal learning" represents a kind of learning that takes place during the daily life, at home, at work, etc. Informal learning is thus independent from structured materials; it is not formally organized and does not lead usually to a certification. With the ICT support, people become more independent and proactive, managing autonomously their own learning process, representing a smooth challenge towards "prosumers" instead of learners [9]. The learner as individual producer of knowledge is the main focus here: he/she is, at the same time, the origin and the target of knowledge.

PLEs can be considered as the methodological and technical enablers of this new cultural paradigm. While PLEs can be defined in term of the tools their offer, the concept behind them is probably more far-reaching than the simple technical aspects. PLEs can be seen as spaces in which people interact and communicate and whose ultimate result is learning and the development of collective know-how [10]. In terms of technology, PLEs are made-up of a collection of loosely coupled tools, including Web 2.0 technologies, used for working, learning, reflection and collaboration with others. Both PLEs and their more social version, PLNs, answer the need of managing the continuous workflow of information, communication and knowledge inside the community.

In particular, PLEs and PLNs are well suited for the following learning contexts:

- Informal learning, and also

- Communities of practice (CoP) and Knowledge Building Communities (KBC). Ence, PLEs allow individuals to monitor each other activities and works performed inside the community (the Hextlearn Case discussed in this article).

## 3 Movinter and Hextlearn Communities of Practice

The main goal of the Movinter and the Hextearn communities is to constitute as a meeting point to collect useful information related to these research topics. With this aims, the relevant features we should take on mind are the creation rich media-sharing repository of resources allowing the discussion. This goal motivates the design of a website as a social network. In this case, the site is built based on users (with a profile and the potential of content creation) and reflecting social relations among people, (sharing interests and/or activities). This is an informal user-centric point of view of the community. Users can freely choose their "friends" to share their state and resources. Figure 1 represents a preliminary sketch of a user profile. In the analysis phase, prototype sketching and preliminary design was done in collaboration with U. Aveiro. Implementation of both communities was based on the ELGG open source library [11].

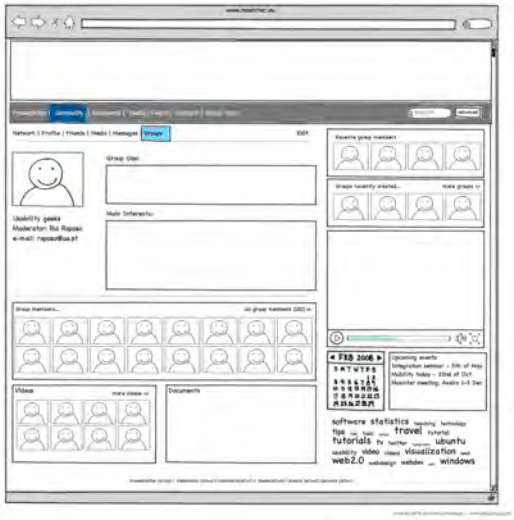


**Fig. 1.** User profile

The core of this approach is a PLE, where each user has their own learning space, describing their skills, preferences, profile, interests and motivations. On top of this approach, a second level is established, where groups and common knowledge are settled informally with members sharing common goals. These groups can be open or with some kind of restrictions. Sometimes, these groups may detect relevant topics of interest for other members of the community. Services for information sharing and cooperation have also included (for instance, sharing, suggesting and rating best practices examples).

Another additional issues in the development of these communities were the following:

- (Movinter) promote the collaboration between institutions, so therefore, one of the most important issues is to discover other user preferences and create new group with common interest.
- (Hextlearn) enhancement of quality assurance on different territories of Learning and their mutual visibility. So therefore, a peer review model of evaluation was included in the CoP, where "expert" groups of member can dynamically coordinate to evaluation process for one of the community member.

These additional issues are really interesting to understand the relevance of these two communities.

### 3.1 Movinter Community: Looking for Partnerships

This community (born in 2008) has grown up to 100 active users with 6 groups and 40 best practices of international cooperation between institutions. Members posted documents and events to share knowledge about good practices towards the virtual mobility cooperation between institutions. Contributions are the main outcome of the community, in terms of useful links, paper positions, videos explaining concepts, etc. This information (as shown in Figure 2) is relevant for decision makers for better understanding of this approach and also to generate group dynamics between members.


**Fig. 2.** Movinter video repository

### 3.2 Hextlearn Community: Experts vs Learners

This is an active community (born in 2009) with more than 750 active users, 36 groups and 76 best practices reported by users. Community is built around different learning territories, with a relatively high community of experts and several procedures to share best practices, to ask for a review and to prepare a (blind) peer review in the same community.


**Fig. 3.** Hextlearn community

This approach is opposite to other alternatives, where the experts have their own space and tools like LinkedIn, Facebook, Twitter and Blogspot for their professional or personal purposes. According to the principle "less is more", the HEXTLEARN website offers “low-scaled” community where it should be easy to subscribe and to use the website for information consuming and sharing. Another possibility is to post comments in the Discussion Board and the use of the WikiMendations section of the community. The platform is offering also the possibility to go through the self-assessment and review process online. That is an important step to create a demand for the HEXTLEARN quality label in the online community. The WikiMendations service of the portal is the individual component of our Living Toolkit of the HEXTLEARN project. The name is coming from the longer: Recommendations Wiki term, which suggests that you will read recommendations for ICT Good practices in a Wiki format as shown in Figure 4.

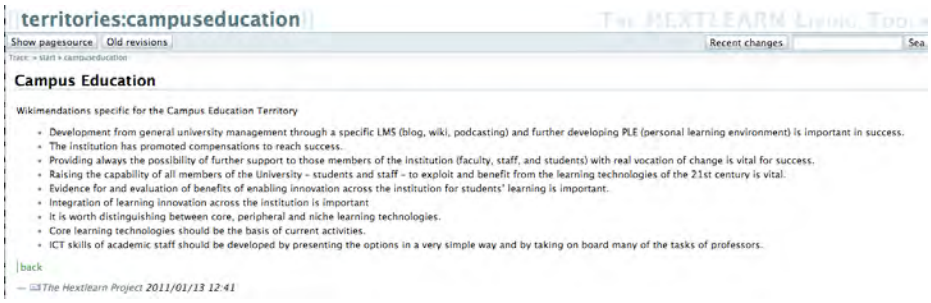


**Fig. 4.** Hextlearn WikiMendations

This is an effective tool to actively participate in the Hextlearn community by:

- Reading the recommendations we have prepared for you by analysing the good practices we have identified so far.
- Proposing your own recommendations to add them to the list we offered.

## 4. Main Outcomes of each CoP

The creation of these communities involved some developments to fit the different tools to suit these requirements. Extensions are needed to include other plug-ins such as forms, pages, tag cloud and create new widgets (such as "my practices") or modify existing ones. Although the goal is similar in both scenarios (enhance the interaction between stakeholders), the results we achieved were completely different.

Movinter community was less active and less participative. Regarding the language (Spanish-English Portuguese), one of the big problems were to find stakeholders really interested and motivated. Information was useful but we found low interaction level between members. The activity was more related to information and clarification of concepts instead of building project. The users didn't build their knowledge of interest. As a conclusion, few groups were created, and the interest decreased.

On the other hand, the Hextlearn functionality is more complex with different activities, and process (peer reviewing, self assessment, look for territories and activities, etc.), and member play different roles (experts versus learners). Member use their own PLE to describe their experiences and skills. Groups are more active and more productively. Activities and communication is more fluent and the information about territories is more updated by more members.

## 5 Conclusions

In this paper we have shown two online learning communities. These examples are also good examples of the opportunities and difficulties of using PLE/PLN to promote collaboration and knowledge building. Learning from others is a good methodology to

create a common understanding and a growing community to create a CoP. Although we are developing a social learning environment, in both cases, users collaborate from their own Personal Learning Environment. In one of the cases this activity is more evident and natural (to create the user's learning expert profile for Hextlearn). The size and motivation of the community is also important.

In addition to this conclusion, the development of added functionality on PLE/PLN is far from be easy. We used Elgg 1.6.X [11] and we found several (dramatically) difficulties to develop plug-in for new features, and the functionality is unstable. This is a problem that is solved (partly) with new versions, but is far from a good solution for developers.

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# Sapo Campus Schools: Network Learning, Teaching and People

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Sapo Campus is an integrated web 2.0 service platform designed to be used in Higher Education (Santos & Pedro, 2009). Having implemented it some years ago, the team responsible for developing the platform decided it was time to face a new challenge: to redesign the platform in a way it could be used in other school levels, thus creating Sapo Campus Schools (SCS). In this setting, and despite the fact that some of the demands and problems are the same as those found in Higher Education institutions, the adoption of web 2.0 technologies raises new questions and challenges.

The institutional adoption of SCS, a platform that is defined by its openness and is all about sharing, integration, innovation and personalization, is expected to prompt changes in schools, both in the way people relate to one another and how they teach and learn. More than that, it may also be revealing as to how students can integrate social elements in the learning process.

This is the background for the current research project that aims at:
Monitor the schools that take part in the Sapo Campus Schools project and analyse the impact it has on the teaching and learning process, as well as on the way students/teachers relate to this technology.

Bearing this in mind, two research questions were drawn up, one focusing on the impact on three key areas: institution, teachers and students, and the other on the interactions taking place within SCS.

Q1 - What is the impact of the adoption of SCS in the institutional, student and teacher dimensions?

This research question can be broken down into subsidiary issues consistent with the three different, yet complementary, dimensions of analysis. Concerning the impact on the institution, another two questions, looking to identify and assess the impact of the strategies adopted in each school for the appropriation of SCS and to understand how openness is conditioning the/its adoption were also formulated:

Q1.1- What is the impact of the strategies adopted by schools to promote the use of SCS?

Q1.2- To what extent does the institutionalization of a platform characterized by a high degree of openness affect its adoption by the school community?

In the teacher´s dimension it is important to understand what dynamics involving teachers are supported by dynamic SCS, as well as possible changes in patterns of

consumption/ production of information. Believing that these dynamics can become the starting point of a learning network, also based in SCS, it is important to understand the interactions that arise within this habitat and how they enhance the ownership of the platform.

Q1.3-What role can learning networks/the learning network play in the process of SCS's appropriation by teachers?

Q1.4-What changes can be identified in the practices of the teachers involved as well as in online dynamics and patterns of consumption and production of information?

The third dimension of analysis includes students, the core of this research. At first it is necessary to assess how and in what context students use the platform to build its/their digital presence. It is expected and even desirable that this process has a social component, and it is also intended to relate this digital presence with the learning process sensus lacto.

Q1.5-What elements characterize the presence of students in SCS?

Q1.6-How does the digital presence of students enhance the learning process (formal and informal)?

The second question concerns a holistic approach, going into the different groups of agents that are typically found in a school. Drawing from both an institutional and humanist perspective, these questions refer to the organization of the school keeping in mind the groups of people who share certain roles.

The three dimensions of analysis mentioned above (institution, teachers and students) are joined by intermediate structures, as well as by other groups of agents: parents and other school staff. We aim at studying the types of interactions within each of these groups and how those agents interact.

Q2-What kind of interactions enhancing communication and the sharing of resources are established within and between different groups of stakeholders?

The on-going literary review directly includes subjects related to Personal Learning Environments (PLE) (Attwell, 2007; Downes, 2010; Hongyu et al., 2010; Kompen et al., 2009; Qian, 2010), web 2.0 (Anderson, 2007; O'Reilly, 2007; O'Reilly, 2005; Richardson, 2006), learning networks and all the related conceptual body. Also important, stemming from the impact studies, are the issues concerning innovation processes and knowledge management (Christensen et al., 2010; Drucker, 2002; Nonaka & Takehuchi, 1991; Nonaka & Von Krogh, 2009).
Cooper (1985), Cronin et al. (2008) and Randolph (2009) express the need to set a time frame to delimit research as well as the importance of consulting references databases. As a consequence, when conducting a literature review, with the exception of major authors, it is reasonable to consider a five-year publishing period. However, in an emerging field such as PLEs, database references are somewhat scarce. For that

reason other reference authors, from other sources available in the internet latent corpus will also be considered/ were also considered.

Two groups of schools, chosen for specific and distinctive reasons, will take part in the study. In the first group (G1), which is made up by two schools with different surroundings (urban and rural setting), the research will be more interventional. As for the second group (G2), schools are yet to be chosen and will be selected from those that decide to join SCS.

Methodologically, this research stands on extremes, assuming both a positivist and a critical paradigm.

This approach, that sets out to combine two apparently opposing issues: depth and width, intersects two different methodological procedures: action research and survey. Regarding G1, action research will make it possible to understand the process more broadly, ranging from the administration and management levels to the classrooms. In G2 the focus will be on the adoption contexts, understanding the processes behind them, relating them amongst themselves and to the situation in G1, using the same research techniques and tools. Because it involves more schools, in this group research will be more longitudinal through the application of a longitudinal survey. Methodologically, it is important to point out that the data collect in both settings will be crossed taking into account the role and presence of the researchers, different in each group. As for the nature of the study it will be mixed, combining qualitative and quantitative methods. The techniques and data collection tools are also varied and were chosen keeping in mind the research questions: surveys (questionnaires and interviews), documental analysis (SCS's access data e literature review), as well as the researcher's diary.

The diagram below (figure 1) seeks to explain the relationship between the paradigms, methodological procedures and methods presented:

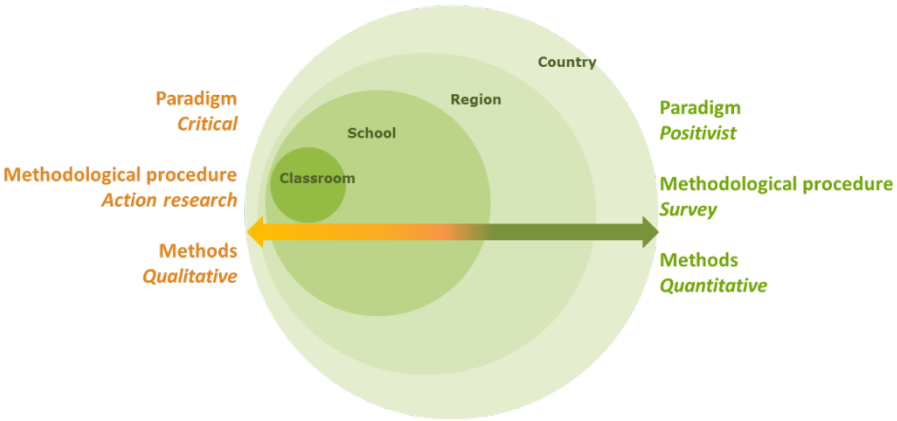


**Fig. 1.** Relationship between the paradigms, methodological procedures and methods presented

Insofar, the data collected makes it possible to draw a first profile of SCS's users, noting that these are all preliminary results based on the experimental use of the platform. Impact wise it is expected that this project will add on to the skills related to digital and information literacy, key 21st century skills. On the other hand, the project is in line with what Attwell (2007) entitles new content ecology, being that all SCS

users are potential prosumers. From a product development's standpoint, this project can provide information that reflects the schools' opinions and helps redesign the platform, creating constructive synergies between users and developers.

In this project issues related to digital citizenship and education for media are transversely and distinctly present. The use of SCS, which is intended to be responsible and encompasses social and shared dimensions, can become a catalyst for the necessary changes summarized by Figueiredo (2010) when he states that all of us must learn to live, cooperate, collaborate, lead, create, self-organize and co-organize self- and co-organize) in this world. Therefore it is necessary that citizens recognize that it is time to take the construction of knowledge that will ensure their independence and success into their own hands. That is the power and the freedom underlying the true concepts of web 2.0.

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# Diverse Knowledge Practices through Personal Learning Environments – A theoretical Framework

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**Abstract.** The paper discusses the relevance of facilitating knowledge practices and personal learning environments in higher education. It describes the practice-oriented view of personal learning environments and defines knowledge practices as a socio-cultural practice. The focus in this paper lies on the main theoretical key concepts which the research of facilitating knowledge practices and personal learning environments is based on. It outlines the settings of the research and the used qualitative methods to explore implicit and explicit practices and the existing personal learning environments of students.

**Keywords:** personal learning environments, knowledge practices, sociomateriality, constitutive entanglement, practice-oriented approach, concept development.

Over the last few semesters we observed that students need much more time to adjust themself to assignments, challenging new ways of thinking. Students struggle with a continuous and evolving progress of their work and it can be assumed that because of a lack of adequate practices it is difficult for them to solve ill-structured problems (e.g. developing collaborative learning environments). The outcomes at the end of a semester show that students are able to execute the given task with their existing practices, but this doesn`t mean that they questioned the underlying assumptions, explored or understood the problem. It only shows that they are able to address the anticipated expectations and instructions of a teacher to deliver an outcome. If we want to prepare students for the knowledge working areas and an emerging technology-oriented life, pedagogy should provide concepts which enable students to be flexible, autonomous and facilitates them to take responsibility for negotiating social practices [1]. But Technology enhanced learning environments alone don`t facilitate students to achieve the desired goals: Knowledge how to use tools don`t help students in emerging and complex situations, it only supports unquestioned and routine activities.

Therefore the aim of this research is to provide requirements for new course concepts in higher education which facilitates students to "co-produce and refine knowledge practices and with it an emergent Personal Learning Environments" (PLE) [2]. Therefore the research explores the latent needs of students which arise out of context situations and the use of technologies within the given constraints. In addition to that reflective processes are important to make these needs visible to students and to

encourage them to develop and transform their own PLEs. Torff [3] stresses that these aspects "influence what will come to understand, value, and use from courses (…)".

The research is also interested in the influence of perceived discrepancies on students` knowledge practices and on PLEs. Therefore the following propositions from a study in 2010, which explored the learning situation and the perceived discrepancies of students will be considered [2], [4]:

- "Students perceive learning as an externally determined process."
- "Learning communities differ from academic communities and the students perceive no connections."
- "Learning and scientific work do not appear as social activities. It remains unclear who is interested in student`s academic qualifications and their produced artifacts."
- "Professors are seen as facilitators of the absolute (scientific) truth."

The research is based on the following underlying assumptions [2]:

- "Actual teaching and learning situations (in higher education) are affected significantly by personal learning environments and incorporated knowledge practices.
- PLEs as activity systems are helpful for students to articulate knowledge practices."

Considering the underlying assumptions, this work is interested in finding answers to the following research questions:

- Is it possible to conceptualize a PLE as a sociocultural practice?
- Is a PLE in terms of the activity system a vehicle to make practices explicit and observable for empirical research?
- Which incorporated knowledge practices can become explicit?
- Which interventions facilitate reflective processes?
- Which kind of intervention is able to induce dissonance in specific situations to challenge practices and therefore the transformative development of PLEs?
- How do students recognize discrepancies between the systemic relations of an activity system and how do students deal with them?

Based on Barnes [5] practices are socially shared forms of actions which may develop as routines but also demands knowledge and experiences about the context conditions to be conducted by members, which is also the precondition of sense making. Furthermore he stated that it is important to know "what moves or inspires the human beings" to be involved in a practice. Human beings are defined as "interdependent social agents, linked by a profound mutual susceptibility, who constantly modify their habituated individual responses as they interact with others, in order to sustain a shared practice" [5]. Also Wenger understands knowledge practices as socially negotiated [1], [2].

The research and the definition of knowledge practices and PLEs are based on the following key concepts:

The sociological perspective of the ethnographer Garfinkel can be seen as a grounding intervention for this work [6]. He stated that utterances and activities are often unconscious and that how activities are produced and maintained can only be observed through disorganized interaction. Therefore he asked what can be done to make trouble to observe the underlying aspects of an activity. Based on Garfinkel it can be assumed that existing knowledge and latent practices can be made explicit through pedagogical intervention. This allows students not only to reflect their incorporated practices but also to refine them in each situation. But it implicates also that it is impossible to transfer practices from one person to another. Therefore this work don`t want to provide strategies rather than intervention challenging the existing practices and facilitating the situated reflection of practices.

The socio-historical activity theory (AT) model by Engeström [7] is helpful to analyze and to understand how and why students interact in specific situations to achieve learning goals. It allows also an understanding of the role of epistemic artifacts in such contexts [7], [8]. The model provides six components of an activity: subject, object, tools, rules, community, and division of labor which are relevant for an analysis of activities [9] and to explore social knowledge practices. Activities are situated in given tasks which give “meaning to a situation” [10] and they are influenced by context specific artifacts that act as a mediator between the subject and the object of an activity. The rules and division of labor are further components which mediate also the interactions between the basic components (subject, object, community). Engeström [7] stated that the analysis of mediators identifies systemic conditions and frictions and gives an understanding of the relations of the components. Hence, reflection and friction can initiate a process of rethinking [11], a precondition for finding requirements and refining knowledge practices.

Therefore this research argues from a practice-oriented perspective and considers PLEs neither as a technological-oriented nor as a pedagogical-oriented perspective [9] but rather than as an approach that sees both perspectives as interwoven [2]. This approach assumes that there is no dichotomy between these two foci, because cognition and the use of artifacts are mutually dependent [10]. It can be said that tools or artifacts are a possibility to gain experiences with practices in contexts. And PLEs as activity systems serve as a vehicle to articulate these practices.

Furthermore it becomes apparent that technology isn`t neutral: the use of technology produces cognition and culture and this in turn influences the development of technology. This is also Orlikowski`s intention. She understands social, cultural and material environments as "constitutively entangled" [12]. This means that materiality and social practices are embedded in an epistemic process which can be described as the co-evolutionary perspective [13]. This understanding of sociomateriality is important for this research, because practices are produced and refined by human beings through the use of material. Therefore PLEs are intrinsically tied to practices [2].

The theoretical framework of "Legitimate Peripheral Participation in Communities of Practices", based on Lave & Wenger [14], constitutes a fundamental vision of how learning takes place in a socio-cultural environment. Communities of practice (CoP) are defined as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" [1]. From Wenger`s point of view learning includes internalization of social norms, values and identities of a community of practice and is therefore a process of social participation and development

[1]. The interactions between members of a CoP can be described as epistemic processes. Therefore learning means becoming an expert in terms of novices are moving from "peripheral participation to full membership in a community" [14]. This requires that novices have to make themself familiar with used artifacts, existing tasks, activities, structures, rituals and values of a community. Hence, becoming an expert means "becoming a full participant in a sociocultural practice" [1], [15]. In terms of the sociomateriality this implicates that students have to transform their PLE in order to grow into a CoP and in turn the CoP is possibly changing its materiality.

In conclusion this research considers a co-evolutionary (practice-oriented) perspective to provide requirements for intervention which allows observing students` activities and facilitates them to gain a deeper understanding of their own PLEs. Hence, a PLE is used in terms of an instrument which encourages students to articulate and reflect their socially negotiated and incorporated knowledge practices. The study aims to engage students to gain a broader repertoire of diverse knowledge practices and based on the sociomateriality a reflected transformation of students` PLEs. To achieve the aforementioned issues the research takes place in two seminar settings: The students will be confronted with ill-structured problems. This study is conducted through qualitative methods which observe not only cognitive aspects but also the social and cultural environment in which practices and therefore PLEs are embedded:

- The AT will be used to analyze the relations between the components of an activity and to explicit the underlying motives.
- The artifact analysis will be used to explain the epistemic role of artifacts.
- The conversation analysis and a half-structured interview will be used to identify existing knowledge practices, analyze the initiating intervention of reflection processes, identify what becomes operative, and to clarify how students deal with perceived discrepancies and how they negotiate knowledge practices.

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