PERSONAL LEARNING ENVIRONMENTS BASED ON WEB 2.0 SERVICES IN SECONDARY AND HIGHER EDUCATION

by

RICARDO TORRES KOMPEN

M. Sc. Chemical Engineering, Universidad de Los Andes, Venezuela, 2000
B. A. Chemical Engineering, Universidad Central de Venezuela, Venezuela, 1991

THESIS

submitted in partial fulfilment of the requirements for the degree of

PH. D. EN ENGINYERIA MULTIMÈDIA

UNIVERSITAT POLITÈCNICA DE CATALUNYA – BARCELONA TECH
Barcelona, Spain

November 2015

Submitted by:

Ricardo Torres Kompen

Approved by:

Director
Josep Maria Monguet i Fierro

Co-director
Miguel Brigos

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola de Doctorat

Curs acadèmic:2015/2016

Acta de qualificació de tesi doctoral

Nom i cognoms
Ricardo Ignacio Torres Kompen

Programa de doctorat
Enginyeria Multimèdia

Unitat estructural responsable del programa
Expressió Gràfica a l'Enginyeria

Resolució del Tribunal

Reunit el Tribunal designat a l'efecte, el doctorand / la doctoranda exposa el tema de la seva tesi doctoral titulada PERSONAL LEARNING ENVIRONMENTS BASED ON WEB 2.0 SERVICES IN SECONDARY AND HIGHER EDUCATION.

Acabada la lectura i després de donar resposta a les qüestions formulades pels membres titulars del tribunal, aquest atorga la qualificació:

☐ NO APTE ☐ APROVAT ☐ NOTABLE ☐ EXCEL·LENT

(Nom, cognoms i signatura) President/a	(Nom, cognoms i signatura) Secretari/ària	
(Nom, cognoms i signatura) Vocal	(Nom, cognoms i signatura) Vocal	(Nom, cognoms i signatura) Vocal

_____, _____ d'/de _____ de _____

El resultat de l'escrutini dels vots emesos pels membres titulars del tribunal, efectuat per l'Escola de Doctorat, a instància de la Comissió de Doctorat de la UPC, atorga la MENCIÓ CUM LAUDE:

☐ SÍ ☐ NO

(Nom, cognoms i signatura) President de la Comissió Permanent de l'Escola de Doctorat	(Nom, cognoms i signatura) Secretari de la Comissió Permanent de l'Escola de Doctorat

Barcelona, _____ d'/de _____ de _____

Diligència "Internacional del títol de doctor o doctora"

- Com a secretari/ària del tribunal faig constar que la tesi s'ha defensat en part, i com a mínim pel que fa al resum i les conclusions, en una de les llengües habituals per a la comunicació científica en el seu camp de coneixement i diferent de les que són oficials a Espanya. Aquesta norma no s'aplica si l'estada, els informes i els experts provenen d'un país de parla hispana.

(Nom, cognoms i signatura) Secretari/ària del Tribunal

Abstract

The emergence of Web 2.0 has not only changed the available Web technologies, but also the way people communicate and relate to one another. The growing ubiquity of Web access, and the variety of devices that allow us to interact with it, have made it possible for users to choose the tools and services that better adapt to their needs, providing a means of personalising the learning experience.

This Thesis presents the results of my research on the construction and analysis of Personal Learning Environments (PLEs) based on Web 2.0 services in two different contexts, secondary education and higher education.

The methodology used was Design-Based Research, by carrying out interventions in practice settings at both secondary education and higher education levels; in the case of secondary education, the environment created fulfilled all the requirements to be considered a Living Lab.

These interventions and their successive iterations allowed for a continuous process of data collection and analysis, which was in turn used to modify or create new interventions. The analysis of the data provided evidence of PLEs as tools for learning and acquiring skills, strengthening social interactions, and improvement in the organization and management of content and learning resources, and also helped identify obstacles and barriers, and possible solutions.

My original contribution to knowledge is the development of guidelines for using Personal Learning Environments as tools for supporting formal learning, either by teachers or by the learners themselves.

Table of Contents

Abstract 2
Table of Contents 3
Acknowledgements 7
Dedication 9
Chapter 1 - Introduction 10
Background 10
Research Objectives 10
Scope and potential contributions 11
Rationale 12
Scholarly rationale 12
Personal rationale 13
Research method 14
Summary of chapter one 15
Chapter 2 - Theoretical Framework 17
Overview of Chapter 2 17
Theories of Learning 17
Connectivism 17
From e-Learning to Personal Learning Environments 18
Social constructivism and Personalisation of Learning 21
Dynamic personalisation 23
Web 2.0 24
Technology adoption 25
Digital natives and Digital immigrants vs Digital Visitors and Digital Residents 26
Personal Learning Environments 30
PLEs and Information Systems 34
PLE approaches: objects vs. frameworks 36
PLE as an object 36
PLE as a framework 36

Summary of chapter two 38
Chapter 3 - Methodology 39
Overview of Chapter 3 39
Design-based research 39
Challenges of Design-Based Research 40
Living Labs 43
Ethnography 45
Field notes 46
Unstructured interviews 47
Chronology of the research 47
A framework for developing Personal Learning Environments using Web 2.0 tools 48
The four-approaches framework 49
The PELICANS Project 59
Pilot study: 2008-2009 60
First and second iterations: 2009-2010 and 2010-2011 68
The Hort Digital project 71
1:1 initiatives 73
Pilot study: 2009-2010 73
A Personal information management strategy 80
First iteration: 2010-2011 82
Second iteration: 2011-2012 83
Chapter 4 - Results and Discussion 84
PELICANS 84
HORT DIGITAL 90
Teachers' point of view 90
Teachers survey 91
Students' point of view 97
The Hort Digital project from a Living Lab perspective 100
PLEs and lifelong learning 102
Chapter 5 - Conclusions, recommendations and future research 104
Guidelines for helping learners develop a Web 2.0-based PLE 104

Conclusions 108
Methodology 110
PLEs and innovation 111
Future research 113
Frameworks for developing Web 2.0-based PLEs 113
Digital Identity and PLEs 113
Activity Theory and PLEs 114
PLEs in the context of Information Systems models and theories 114
Technology Transience and PLEs 114
PLEs as information management tools 115
PLEs and lifelong learning 115
Final remarks 115
BIBLIOGRAPHY 117
APPENDICES 127
Appendix A. 127
Appendix B 136
Appendix C 137
Appendix D. 181
Appendix E 189
Appendix F 200
Appendix G 206
Appendix H. 209

List of Figures

Figure 1. A timeline of e-learning technologies.....18
Figure 2. Approaches to personalisation of learning.....21
Figure 3. Connectivity of Google tools.....47
Figure 4. A start page created using Google sites.....48
Figure 5. Facebook connectivity with other Web 2.0 tools.....49
Figure 6. A Facebook page showing Applications to access Twitter, RSS feeds, Google Docs and Zoho.....50
Figure 7. Netvibes connectivity with other Web 2.0 tools.....51
Figure 8. An example of a PLE based on Netvibes.....52
Figure 9. A Flock start page.....53
Figure 10. A start-page "Web diagram".....60
Figure 11. The Networked Teacher.....71

Acknowledgements

This has been a long road, but I have not done it alone. It does, indeed, take a (global) village. Naming names is a tricky proposition. At this point, it is very likely that I forget to mention someone that did actually play an important role. My apologies in advance.

My parents, Ricardo and Marcia, and my partner, Miguel, were key in this journey. They gave me support and encouragement, made sure I stayed focused and were understanding and patient.

Many organisations also played a role and supported this process:

ESEI, Escuela Superior de Estudios Internacionales, allowed me to conduct the PELICANS project with my students, and supported my research stay in England. Thanks to everyone there, specially all the students that willingly took part in the study.

Citilab and i2CAT supported the Hort Digital project and were instrumental in making it happen. Without Artur Serra, it would not have seen the light, and would have certainly not have been a Living Lab. Rafa and Alba, for putting all their energy and enthusiasm in the project and helping me shape it. And to all the participants, for their enthusiasm, their friendship and their commitment to the project.

The universities in which I have had the opportunity to teach and learn: Universidad Central de Venezuela, Universidad de Los Andes, Universitat Politècnica de Catalunya, La Salle Campus Barcelona, ESEI, ESERP and GBS. Special mention to my friends and colleagues at the LAM, Laboratori d'Aplicacions Multimèdia.

Teaching is my passion, and I knew I wanted to become a teacher when I was very young. Thanks to my role models for helping me realise the type of teacher I wanted to be: my parents, and my aunts and uncles; being able to watch you teach only made me more certain of my decision.

José Angel Sorrentino and Vicenta Giamporcaro de Roccaro, thanks for the inspiration. Richard Felder encouraged me to enroll in this PhD program, and helped me more than he probably realises.

Thanks to Josep Maria Monguet, my Thesis director and advisor, for supporting me, listening to my ideas and making sure that I had enough flexibility to try new approaches, but always keeping focus. My co-director, Miguel Brigos, which gave me the chance to re-discover my interest in programming and helped set the way to my involvement with all things Web.

Gilly Salmon and the amazing BDRA team; those months in Leicester are part of my fondest memories. I would not be where I am now had I not made the decision to go there and learn from them. Special thanks to Palitha Edirisingha for the guidance and support, and for helping me start writing and publishing.

The PLE research community, and everyone that made The PLE Conference possible. Cristina Costa, for being a great friend and for introducing me to amazing people. Linda Castañeda, for always being there. My co-authors, for allowing me the chance to work with you and learn from our writing together.

Thanks also to everyone that took their time and effort in going over this document and helping me improve it with their feedback and comments.

My friends, my family, my colleagues, coworkers, fellow researchers all have played a part at some point or other. Thanks to those that have helped me grow as a person and a professional, and be able to finish this journey. It has been great.

Dedication

To my parents, Marcia and Ricardo.

Chapter 1 - **Introduction**

This chapter outlines the research questions and the rationale behind them, as well as the scope and research method. This answers the *what*, *why* and *how* questions related to the research.

Background

The emergence of the so-called Web 2.0, which includes social software, Web services and applications, and other programs that allow users to interact, create and collaborate online, has made a huge impact on many areas of society, including education. As processes with a strong social component, it seems obvious that teaching and learning could benefit enormously from the use of Web 2.0 applications and services.

One of the concepts that have gained popularity in the educational field during the last decade is Personal Learning Environments, or PLEs (Adell and Castañeda, 2010; Attwell, 2006; Downes, 2006, 2010; Olivier and Liber, 2001). Although there is not yet a widely accepted definition, it refers to a group of Web technologies, with various degrees of integration and interaction, which help users and learners manage the flow of information that relates to the learning process, the creation of knowledge, and the development of skills.

The underlying assumption (Downes, 2006; Attwell, 2007; Taraghi et al., 2009; Castañeda and Adell, 2011) is that learners would regain control of their learning process by being able to choose and mix from several alternatives to (among other actions) capturing, storing, classifying, analysing, creating, sharing, disseminating and processing information, and thus create knowledge. In practice, there is still a long way to go before it can be agreement on which way, if any, is the best to implement and embed these kinds of technologies in the learning practice, and to what degree the freedom to choose actually benefits the learners.

Research Objectives

Personal Learning Environments are a relatively new concept that has entered the educational discourse during the last decade. As such, there is still no agreement on what the definition of

Personal Learning Environment is, and its application in a diversity of educational levels and areas is still under experimentation (Prendes et al., 2014; Santos et al., 2014; Torres et al., 2010).

The main objective of this research was to develop general guidelines for the implementation and use of Personal Learning Environments by learners, in formal education contexts, at both secondary and higher education levels. One of the limitations of these guidelines is that they are based on the data collected from two specific scenarios, which could be an obstacle for their application in different settings.

The questions that guided the research were:

- How can PLEs help the learning process in a formal education environment?
- How can PLEs help practitioners in a formal education environment, both in their teaching activities as well as in their professional development?
- How can PLEs be used by learners to support lifelong learning?

Scope and potential contributions

The research was conducted in two different scenarios, higher education and secondary education, by means of a design-based research approach. This involved the design and execution of two projects, which provided the scenarios in which the research was carried out and data was collected.

- **Higher education: the PELICANS project**

The PELICANS (Personal E-Learning In Communities And Networking Spaces) project ran from 2008 until 2011, and was a collaboration among the Beyond Distance Research Alliance at the University of Leicester, BarcelonaTech UPC, Citilab and i2CAT. Its main goal was to develop and test a framework for helping learners build Personal Learning Environments. The pilot test and successive iterations were conducted at the *Escuela Superior de Estudios Internacionales* (ESEI), in Barcelona, Spain, in the context of a Business Administration programme. In this case, I was directly involved by being the teacher leading the subject that provided the context for the project. This is one of the main reasons why I chose to write this dissertation in the first person.

My own experience helping my students build, and sometimes discover, their PLEs led to the proposal, design and implementation of a second project: a training programme for teachers, with the aim of helping them embed Web-based information and communication technologies in their practice.

- **Secondary education: the Hort Digital project**

  The Hort Digital (the original name is Catalan and the closest translation into English would be "The Digital Orchard") was a Living Lab project which ran from 2009 until 2012 at Citilab Cornellà, and was also a collaboration among the organizations that supported the PELICANS project: Beyond Distance Research Alliance at the University of Leicester, BarcelonaTech UPC, i2CAT and Citilab, which physically hosted the project. It was conceived as a learning space for secondary education teachers, loosely following the MediaZoo idea at the University of Leicester (MediaZoo, n.d.), and it complemented the 1:1 initiative that was being deployed by the national and regional governments of Spain and Catalonia at the time (eduCAT1x1, 2010).

Rationale

Scholarly rationale

Personal Learning Environments, or PLEs, are a relatively new concept (JISC, 2007) that changes the focus of the learning processes from the VLE (Virtual Learning Environment) towards a user-built, personalised set of tools - not necessarily digital ones- that are used to manage content and interactions, and support the learning experience.

There is a growing interest on PLEs from both practitioners and researchers, and from many levels of education. The 2009 Horizon Report (Johnson et al., 2009) mentions the personal web as one of the trends in the second horizon of adoption (Time-to-Adoption: Two to Three Years). Personalisation of learning is based on the idea that learning technologies should enable the various aspects of learning (the content, the mode of delivery and access) to be offered according to the personal characteristics of the learner, thus providing the learner with greater flexibility and options for learning.

Another factor behind the increased attention on PLEs is the emergence of and widespread access to the so-called Web 2.0 tools: a group of internet-based tools and technologies, with a strong social component. The term Web 2.0 was coined by Tim O'Reilly, and it captures a "trend towards greater creativity, information sharing and collaboration amongst internet users" (The Economist, 2008). Web 2.0 tools can have a central role in personalising learning, enabling the learner to take a more active role in the process.

There seems to be a widespread notion that the majority of the current generation of learners – usually referred to as Net Gen, Millennials or Digital Natives - are familiar with computers and internet-based technologies and are capable of using Web 2.0 technologies for learning (Prensky, 2001). Nevertheless, there is no strong evidence that suggests that they are familiar with using Web 2.0 tools for formal learning. Clark et al. (2009) note that learners' experience of Web 2.0 activity routinely cross the boundaries established by the school and institution, and use the term 'digital dissonance' to refer to the fact that the implications of such activity are still not well understood by institutions or even by the learners themselves.

It is a fact that students do use a variety of Web 2.0 tools and applications, as shown by the 2013 ECAR study on undergraduate students and information technology (ECAR, 2013). However, there is no strong evidence that students use these tools in an integrated manner suited to academic learning (McLoughlin, 2008).

As Prensky notes (2011), technology is "crucial for our kids' future", but the understanding that educators have of its role is not clear.

The main driver behind the research was to understand how learners appropriate these tools and how they can be used to enhance and support the learning process, providing learners with the freedom to choose and personalise their learning process, while at the same time helping teachers maintain a coherent approach to teaching within the confines of formal education programmes.

Personal rationale

My decision to start research in this area was based on both personal and professional reasons. On the personal side, and although I graduated in Chemical Engineering, teaching has always been a passion of mine. After I spent 5 years training as a petroleum refining engineer, I

decided to go back to university in order to get my M. Sc. degree. There, I had the opportunity to join the faculty and start teaching, and never went back to practice engineering. For the last 15 years I have been teaching in higher education institutions, first in Chemical Engineering and, for the last 10 years, in the areas of Mathematics, Information Systems, e-Business and e-Marketing.

As a teacher, I was first interested in learning styles, and how could technology be used to address the diversity of learner profiles in the classroom. But as my initial research progressed, and I went through several iterations of that first proposal, I started noticing how students would use and depend on computers more and more each passing year, mostly to access Web applications. I watched as they migrated from e-mail to Myspace, then to Facebook, some of them are adopting Twitter as their tool of choice, until smartphones became popular, and messaging applications with them. At some point it occurred to me that it would be easier for me, the teacher, to move onto their space and try to understand their approach to using these technologies, as opposed to telling them to shut down computers and mobile phones every time we had a class.

After a few sessions trying new approaches, I realized that although students were indeed knowledgeable and skilled with new technologies, it was not clear to them how to use these for learning; I also encountered resistance from other colleagues, which were not used to these tools and wanted to enforce a no-mobile phones, no-computers rule in order to keep their students' attention.

Research method

The methodology used was Design-Based Research (Design-Based Research Collective, 2003), a research paradigm for the design and study of instructional strategies and tools, involving the collaboration of practitioners and researchers, in order to produce meaningful change in contexts of practice such as classrooms. In this research, the interventions took the form of two separate projects.

Prior to the design of these projects, a theoretical framework was proposed for the development of PLEs based on Web 2.0 tools. The first project aimed to test this framework in practice, and for this purpose I adapted the methodology of one of the subjects I teach in

order to implement a collaborative approach for learning, by means of Web 2.0 services. The experience gathered in this project was then used for the design and testing of another intervention, which took the form of a training course for secondary education teachers.

The use of DBR allowed enough flexibility for working through consecutive iterations within each of the projects, while providing a structured approach to analyse the outcomes of each stage and implement the necessary changes and modifications required for the next one, based on the feedback and results. Each of the projects had a different approach, based on the profile of the participants and the characteristics of the project. Thus, in the first project (PELICANS) I was an active participant, being the teacher for the different groups that composed the sample. The second project (Hort Digital) followed a Living Lab methodology, involving both elements of action research and ethnography, and also fit the characteristics of the institution that funded the project, Citilab, which has a focus on social, participatory projects. In terms of production of knowledge, these two projects can be classified as Mode 2 (Gibbons, 1994) since in both cases multidisciplinary teams were brought together for a specific period of time to work on the project, and the knowledge production was not driven just by the sake of scientific knowledge alone, as is the case in Mode 1.

Summary of chapter one

This chapter addressed the *what*, *why* and *how* questions related to the research:

- What: develop clear guidelines for the use of Web 2.0 services and tools in the classroom and learning contexts, by means of the analysis of the construction and use of Personal Learning Environments by both learners and teachers.
- Why: both personal and scholarly motivations were presented, which can be summed up in need for finding ways to make the learning process more personal, efficient, participatory and collaborative, by means of Web 2.0 services and tools.
- How: using a Design-Based Research approach, the two projects benefited from each other's feedback and results, which allowed for the introduction of changes and modifications along the way. The use of a Living Lab methodology in one of the projects allowed for the active participation of users in all stages of the project, including the design, ensuring that its goals were aligned with the needs of the participants. The research questions are formulated as:

- How can PLEs help the learning process in a formal education environment?
- How can PLEs help practitioners in a formal education environment, both in their teaching activities as well as in their professional development?
- How can PLEs be used by learners to support lifelong learning?

Chapter 2 - **Theoretical Framework**

Overview of Chapter 2

This chapter provides an overview of the theories, technologies and developments that have given way to Personal Learning Environments as one of the newest concepts to have emerged in the area of e-Learning.

Theories of Learning

According to Driscoll (2005) learning theories may be categorized in three broad epistemological frameworks: objectivism, pragmatism, and interpretivism.

Objectivism proposes that reality is external to the mind, and knowledge and perception are acquired through experiences. Pragmatism suggests that knowledge is a negotiation between reflection and experience, inquiry and action. Interpretivism proposes that knowledge is an internal construction, informed through socialisation and cultural cues. (Kop, 2008)

Siemens (2005) proposed that learning theories align with these epistemologies; according to him, objectivism aligns with behaviourism, pragmatism with cognitivism, and interpretivism with constructivism.

There are two main strands of constructivism: cognitive and social. The name that is probably most associated with social constructivism is Vigotsky, who identified two key elements in the learning process: 'language' and 'scaffolding.' Vygotsky noted that verbalisation of problems (which he observed as self-talk in children) is useful as a way of obtaining self-guidance and self-direction. Scaffolding refers to providing support for learning and problem solving, by reducing complex problems to smaller elements, and helping learners by providing hints, support and encouragement (Woolfolk, 1995, p. 49).

Connectivism

Siemens and Downes proposed connectivism as a learning theory, and distributed knowledge as the epistemological framework to which it could be aligned. Kop (2008) notes that connectivism critics argue that it does not fit all the criteria to be considered as a learning

theory; for example, the lack of a large group of empirical studies that support it. Nevertheless, she recognises connectivism's potential for the development and emergence of new pedagogies.

Siemens (2008) points out three drivers of change in the way people process information:

- Traditional instruction does not sufficiently meet Millenials' needs
- The rapid growth of information requires new strategies to filtering information
- Advancing technologies allow learners to create networks of their own

The use of networks for learning fits Illich's vision of "community webs" (1971). Downes (2007) notes that the main characteristics that make networks adequate to support the development of knowledge are their diversity, openness, autonomy and connectivity.

Kop (2008) cites Kerr's assertion that "we are entering some sort of period of radical discontinuity," who also and further raises the question: "What is the nature of that radical discontinuity?" Kerr's points are that in the educational domain a multitude of Web applications are being used to enhance the learner experience, particularly in terms of collaboration and communication.

The evolution of technologies is thus a key element in the emergence of new approaches in teaching and learning, which will be discussed in next section.

From e-Learning to Personal Learning Environments

It is not easy to pinpoint the moment when technology started being used as an educational aid; it can easily be argued that paper, pencil, pens and blackboards all represent technological innovations.

To narrow down the discussion, we have to go forward to the 1960s, when the University of Illinois implemented the use of computer terminals to provide students with resources that complemented recordings of lectures that were available via television or radio; in the 1970s, other institutions tried this approach, and distance education courses were being delivered via television; one of the most known examples is the Open University, which started using

television for distance learning in 1971. During the 1980s, technology started to play a bigger role in the classroom, by means of projectors, calculators, and personal computers, and e-Learning (electronic learning) became a popular term. By the end of the 1990s, multimedia courses were being offered in CD-ROM and DVD format, and the Internet and the World Wide Web were providing increased and widespread access to information.

Through the years, several different names have emerged to characterize innovative approaches and technology-supported initiatives: distance education, technology enhanced learning (TEL), multimedia learning, computer-based training (CBT), computer-assisted instruction (CAI), internet-based training (IBT), web-based training (WBT), online education, virtual education, virtual learning environments (VLE), m-learning, distributed learning, computer-mediated communication, and more. The term e-learning encompasses all these, and it is used as an umbrella term. One of the common characteristics of these terms is the fact that information is distributed and transmitted following a one-to-many approach, using a combination of channels, devices and infrastructures. In essence, the same content is available to all students and technology helps teachers in delivering content to the learners and, to various degrees, the delivering of content from the students to the teachers.

Figure 1 shows a timeline of learning technologies (Conole, 2012) and developments that have provided the conditions for changes in the teaching and learning processes, such as access to the Web, and social and participatory media, amongst others.

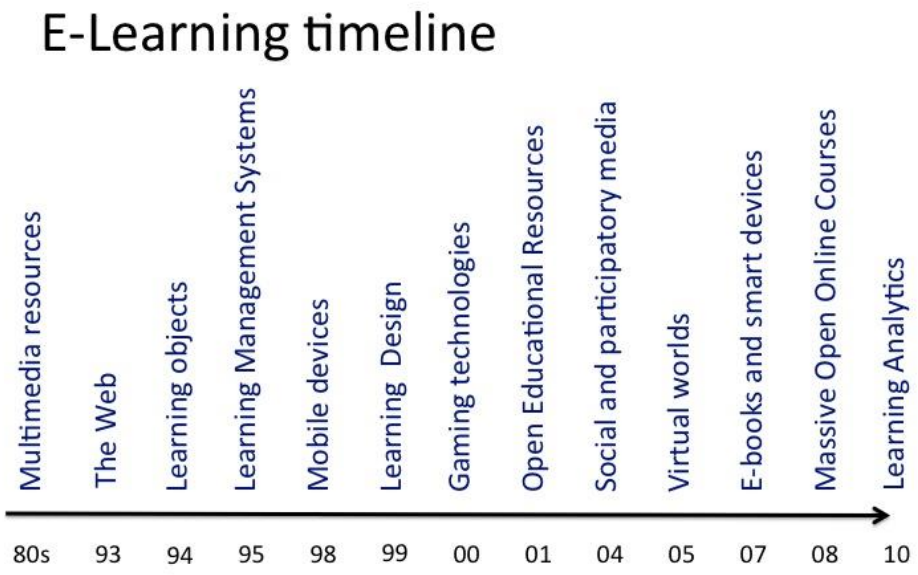


Figure 1. A timeline of e-learning technologies (Conole, 2012)

It is clear that technology plays an important role in the education field, although sometimes that impact tends to be exaggerated or at the very least generates high expectations which are not always met; a phenomenon that is by no means new. Take the following fragment:

"*Remarkable new technology is introduced into the school system and experts predict education will be revolutionized. The technology will, as never before, allow the widespread dissemination of new concepts and ideas that will stimulate young minds and free the teacher for more creative pursuits.*"

This paragraph could easily apply to personal computers, digital cameras, mobile phones or tablets; but it is actually referring to blackboards, and dates back to the 1840s (Lewis, 1988). Similar comments have been made regarding multimedia, Web 2.0 and more recently MOOCs (Massive Open Online Courses). In all these cases, technologies on their own will not change the educational field, but do play the role of disruptive innovations and as such,

have the potential to promote change as long as they are paired with a sound pedagogical discourse (Sangrà, 2013).

One of the applications of technology in the educational field, besides the actual delivery of the contents, is in the efforts for personalising the learning process.

Social constructivism and Personalisation of Learning

Social constructivism, as a learning theory, has taken centre stage in the last decade. Learning is seen as an experience (Dewey, 1938), Dewey's view is that experience arises from the interaction of two principles, continuity and interaction, and experience is thus a product of the interaction between an individual's past experiences and their current situation. The value of that experience will depend on the effect that it has on the individual's potential to contribute with society and add value to it.

Kolb's experiential learning theory (Kolb, 1984) also emphasises the role experience plays in the learning process, and it is related to the works of Dewey and Piaget. Two aspects of his theory are especially relevant: the use of concrete experience to test ideas, and the use of feedback to change practices and theories.

Under a social constructivism perspective, learning is a process that differs from individual to individual, and changes the focus of the educational system from the teacher to the learner; similarly, teaching is not understood as just the transmission of knowledge and information, but about helping learners along their own learning path and process. (Freire, 1970; Illich, 1970)

The popular phrase that states that teachers have changed from "sage on the stage to guide on the side" (King, 1993) exemplifies the spirit of social constructivism in the learning process.

Following this approach, the learning conditions and environment that the institution provides should be different for each student. The introduction of such an approach in an educational

system that resembles a mass production process, and for years has been modelled on factories (Attwell, 2007), has been revolutionary.

The main problem that arises in this scenario is the low ratio of teachers to students, which makes personalisation extremely difficult. Technology has been proposed as a solution for this issue, and several initiatives have been centred on technology-supported delivery of educational content that suits the needs of each individual. As Attwell (2008) points out, the traditional educational model is largely based on the industrial model: students wear uniforms, attend to sessions at the same place, at the same time, classes are compartmentalised based on sets of skills or concepts to be covered. It is a model that fit a time where resources, information and trained teachers were scarce. Attempts have been made in the last two decades to make the learning process more personal.

Fraser (2006) sums this up in a diagram (Figure 2) that looks at three different approaches to personalisation, and also compares them based on whether the emphasis is put on the institution or on the learner.

Adaptive Personalisation	(Implicit or Inferential Personalisation) - The availability of options is based on knowledge about users gained from tracking user activity and/or other sources of user information. The system identifies items of potential interest to the user and controls what is made available to the user. Note, this form of personalisation may involve varying degrees of user awareness of, and involvement in, the process. Personalisation in presentation services, Nicky Ferguson, Seb Schmoller, Neil Smith 15 July 2004	**institutional provision and procedure**
Customisation	(Explicit or Referential Personalisation) - The selection of options is under the direct control of the user who explicitly chooses to include or exclude options. Personalisation in presentation services, Nicky Ferguson, Seb Schmoller, Neil Smith 15 July 2004	**enabling the learner to engage with institutional provision**
Dynamic Personalisation	Production, reception and relationships are supported by the system but determined by the user - the ability to create original or derivative works, to collaborate, form networks and connections via the users choice of applications, locations, platforms	**the institution engaging with the learner**

Figure 2. Approaches to personalisation of learning.

The first attempts at personalisation were mostly based on "intelligent" or adaptive systems, which would provide learners with different alternatives based on their performance, their activity and their choices. Educational software thus intended to personalise the learning experience by creating a path which was best suited to the learners' characteristics. Some of these approaches were based on learning styles. This is what Fraser refers to as Adaptive personalisation: the institution offers different paths based on a set of rules, but the actual involvement of the learner on the creation of this path is limited to the interaction they have with the system.

Customisation goes one step further by involving the learner in the creation of the learning process. Learners select from a given range of options the ones that suit their needs, mood or preferences.

The last approach, dynamic personalisation, is mostly based on the user's choices of platform, tools and location.

Dynamic personalisation

In this view, it is the user who chooses applications, platforms and locations. It is related to the emergence of Web 2.0 and the transition of users from consumers to "prosumers": this is a term first proposed by Toffler in The Third Wave (Toffler, 1980), and it is a portmanteau from consumer and producer that has been widely adopted to signify the changing role of users in the context of the Internet and the Web. Users not just passively consume information, but are also able to create it, share it, and discuss it with other users. Jenkins (2006) called this phenomenon the participatory culture, characterised by low barriers to expression and engagement, strong support by the community with which users share their creations, informal mentorship in which the more experienced participants guide others, some degree of social connection among participants, and where members believe their contribution matters. The participatory culture concept is linked to the digital divide issue, which refers to inequalities in

the access learners have to technology. Initiatives to decrease this divide have been implemented with various degrees of success (educat 1x1, 2010; Vilaweb.cat, 2011).

The Web 2.0 concept also points to a personalisation of the users' space; in 2006, futurist Saffo regarded Web 2.0 as "the age of personal media". As pointed out by Thompson (2007):

"[…] students will soon arrive at college expecting a transformative form of education.[…] Changing to accommodate Web 2.0 students probably will happen in fits and starts, just as the integration of technology has occurred in the business world. No one knows yet what this new model will look like, but the variety of strategies examined above [wikis, blogs, podcasts, social networking tools] provides partial glimpses."

The number of Web-based services and applications is continuously growing. The Go 2 Web 2.0 (Go2Web20, n.d.) directory lists over 3000 services that can be considered Web 2.0.

Web 2.0

As a concept, Web 2.0 was first proposed in 1999 by DiNucci and popularised by Tim O'Reilly in 2004 (Graham, 2005) and collectively refers to Web-based tools and technologies with a strong social component. The term reflects the increasing participation of users in the generation, publishing and sharing of content, and the Internet as a two-way channel rather than a repository from which users are able to download files and applications.

From the point of view of infrastructure, the term Web 2.0 does not imply a separate network; it represents the evolution of the original Web and its services, with an increasing number of applications being developed by the actual users, as well as an important participation of users in the generation and sharing of content. In a sense, it is about the democratization of the Internet: users stop being just consumers to become producers, blurring the lines and embodying the idea of "prosumers". Prosumers thus choose the services and applications they need for generating or consuming content, and adopt them based on their needs.

Technology adoption

Many of the technologies that are eventually adopted for educational purposes were not originally designed with that objective in mind. The educational field appropriates services and applications depending on a variety of reasons, and it does not necessarily follow the pace and trends of other fields. The Horizon Report, published yearly by the New Media Consortium (http://www.nmc.org/, n.d.) is a widely quoted and respected resource that aims to help individuals understand the impact of new technologies in the fields of higher education, K-12 (primary and secondary education) and museums. First published in 2002, the report has become a useful resource that assists not only in identifying technology adoption trends, but also in describing the nature of these trends over the past decade.

The Horizon Report is structured into three "horizons," each based on time to adoption: the 1st adoption horizon- one year or less until adoption, the 2nd horizon -two to three years until adoption- and 3rd horizon -three to five years until adoption.

Without discussing in depth the content of each report, it is worth noting mentions to technologies that support Web 2.0-based PLEs, and even the concept of Personal Learning:

- in 2007, the 1st adoption horizon (one year or less) included Social Networking, while the 2nd horizon (two to three years) mentioned mobile phones.
- in 2008, the 1st horizon included Collaboration Webs.
- the first mention of Personal Learning Environments by the Horizon report may be found in the 2009 edition: "Armed with tools for tagging, aggregating, updating, and keeping track of content, today's learners create and navigate a web that is increasingly tailored to their own needs and interests: this is the personal web." Mobiles and Cloud Computing were in the 1st horizon.
- in 2010, there was Mobile Computing in the 1st horizon and electronic books in the 2nd.
- in 2011, electronic books and mobiles moved to the 1st horizon.
- in 2012, Mobile Apps first showed up in the report, in the 1st horizon.
- 2013 saw MOOCs and Tablet computing take the 1st horizon
- the 2014 report puts the Flipped Classroom concept in the 1st horizon. In the flipped classroom model of learning, the ownership of learning is shifted by rearranging how time is

spent inside and outside the classroom. Teachers do not use time class to provide information to students; this is done by the students outside class, so the time spent in the classroom can be used in activities or projects that allow the students to go deeper into the subjects covered, increase the interaction with the teacher and among classmates, and foster collaboration and teamwork. This concept clearly promotes personalisation: "After class, **students manage the content they use, the pace and style of learning**, and the ways in which they demonstrate their knowledge; the teacher adapts instructional and collaborative approaches to suit their learning needs and **personal learning** journeys."

- The 2015 Horizon report classifies Personalized Learning as a "Difficult challenge" and notes: "The goal of personalized learning is to enable students to determine the strategy and pace at which they learn. Though effective personalized learning strategies focus on the learner and not the technology, personalized learning may significantly draw on enabling technologies and tools. The underlying technologies needed to support personalized learning are relatively straightforward and readily available. For example, a person's smart phone or tablet and their personal collection of apps directly represents their assortment of interests"

This view of Personalized Learning is essentially a description of a PLE based on a mobile device.

The widespread popularity and access to these devices opens the way for pedagogical implementations based on or supported by the use of technology in and outside the classroom, but at the same time calls for a critical view at our students' skills and ability in adopting these technologies for their learning. Selwyn (2009) calls this the myth of digital natives.

Digital natives and Digital immigrants vs Digital Visitors and Digital Residents

In 2001, Marc Prensky wrote his "Digital Natives, Digital Immigrants" which supported a widespread perception that the majority of the current generation of learners, also referred to as Net Gen learners or Millenials (Oblinger and Oblinger, 2005), are familiar with computers and internet-based technologies and are capable of using technologies for learning. His claim was

that “digital natives” have approaches to learning that are markedly different from the previous generations, referred to as “digital immigrants”.

It is a fact that new generations have been born to a world where the Internet and the Web have been always present in their lives, and that has led to changes in the ways they process, acquire and manage information, whether it be for entertainment or for learning purposes.

As noted by Karl Kapp (2006), “*... these kids are already using Web 2.0 technologies comfortably and effectively. If we old folks (over 30) don’t figure out how to effectively use these tools to help the younger generation learn what they need to be successful in our baby boomer-run companies, government agencies and other large organizations then we learning and development folks will be irrelevant.”.*

While it is possible that a majority of current learners are familiar with technology tools, the evidence is not strong enough to suggest that they are familiar with using them to support their learning in a formal setting. This has been highlighted by studies on information literacy skills of NetGen learners (Lorenzo and Dziuban, 2008; Katz and Macklin, 2007; Selwyn, 2009).

White and Le Cornu (2011) proposed an alternative to Prensky’s Natives and Immigrants dichotomy: Visitors and Residents. In this typology, Residents and Visitors are the two ends of a continuum, which is based on the concepts of tool and place/space, as opposed to age. According to this view, Visitors approach the Web as a set of tools thay they use when the need arises, and then are set aside, with little to no digital footprint left behind. They may be considered as users of the Web, not members.
Residents, on the other hand, see the Web as a place, and the distinction between their offline and online lives is increasingly blurred. Quite often they feel a sense of “belonging” to online spaces and communities, and even when they log off, an aspect of them remains behind. They regard the web not as a collection of tools, but rather a network of individuals.

Visitor and Resident are not a binary opposition, but rather define a continuum; learners will play different roles and take different approaches through their learning process, and this will change based on context, motivation, needs and experience, among other factors.

While Prensky's typology predates social media applications, the Visitors/Resident typology does take social media applications and services into account. Prensky himself amended his views on the digital natives and digital immigrants dichotomy in 2009, by proposing that the difference between digital natives and immigrants has to do more with attitudes than with actual knowledge of how technology works. He calls this Digital Wisdom (Corwin, 2011); according to him, it involves "not only enhancing our natural capabilities with existing technologies but also continuously identifying additional areas where our natural human tools—even when they are developed to a very high level—cannot do the job unaided". It is also about actively seeking new digital tools, and investigate and evaluate their positive and negative aspects.

Learners nowadays experience a dichotomy of sorts: while it is true that they have grown in a world where computers, new technologies and the Internet itself are part of their everyday lives, those same tools and devices are excluded from the formal education process: videogames, mobile phones, net books, the Internet. To use the words of McLuhan (1964):

"The young student today grows up in an electrically configured world. It is a world not of wheels but of circuits, not of fragments but of integral patterns. The student today lives mythically and in depth. At school, however, he encounters a situation organized by means of classified information. The subjects are unrelated. They are visually conceived in terms of a blueprint. The student can find no possible means of involvement for himself, nor can he discover how the educational scene relates to the 'mythic' world of electronically processed data and experience that he takes for granted."

This points to several issues that are all too common in "traditional" approaches to education: isolated subjects, rigid learning paths dictated by the curriculum, homogeneity, and a disconnection between what is taught at school and what students face in real life. The so-called new technologies, of which Web 2.0 is just the tip of the iceberg, have pushed learners to develop new skills and competencies, yet there are very few initiatives toward the inclusion of these in the classroom, and the use of mobile phones or tablets continues to be considered disruptive in a classroom setting and has even been banned in some schools and universities (The Telegraph, 2015).

According to a BECTA report on the use Web 2.0 technologies (BECTA, 2008), "*relatively few learners are engaging in more sophisticated Web 2.0 activities, such as producing and publishing self-created content for wider consumption. In order to be motivated to publish content, learners must perceive that publication carries utility for the self or important others. In addition, learners may lack the technical knowledge and skills needed to publish content online. Learners may also be unaware of the potential applications to which particular tools are especially suited.*" It is also not clear how these tools can be appropriated for use in the classroom, and how can teachers take advantage of their students' social presence for academic activities. In many cases, this is also associated to the fact that teachers have less experience and knowledge of these tools than their own students.

Prensky (2005) has suggested that new technologies have the potential to radically change education, although this change might not be evident in the classroom, but in what he calls the After-School learning: all the ways in which students learn, using technology, outside the walls of the classroom. In today's world, teachers often feel "left-behind" regarding new technologies, and are seen by the students as "illiterate". The fact is, most students are more fluent in using new technologies than their teachers, and this creates a divide. But, as Prensky goes on to suggest, teachers do not need to be proficient in the use of technologies to take advantage of them in an educational setting. They should learn how to use them and understand them, but not necessarily master them. If teachers "divide the labour of learning", this might benefit all parties involved in the learning process: students probably do know more about the technologies and this could be acknowledged by teachers, by asking their students for help, involving them in the design of learning activities. Teachers, on the other hand, can evaluate the way students use the technologies, identify opportunities for these technologies to be used in the learning process, evaluate and compare different options, and offer advice on how to apply technology to real problems. In summary, our students' strengths are their ability to quickly learn new technologies, their fearlessness to try new things. Teachers' strengths should lie in their ability to teach lessons about and with technology, engage students, guide them. Both groups should work together.

As the aforementioned BECTA report points out, "Lack of significant sophisticated activity by learners that involves more than consumption and social networking suggest that there is a role for teachers in supporting effective learning using Web 2.0. This role may be to ensure that learners have the technical skills to use the tools effectively and the metacognitive, synthesis and critical reflection skills to use Web 2.0 applications to support learning wherever they are." The report also shows successful examples of implementing Web 2.0 in secondary schools, with teachers emphasizing the importance of communication and collaboration in participatory learning, and the role of technology as a tool to support the learning process.
The role of teachers has seen a shift from transmitters of information to facilitators and guides, the so-called transition from "sage on the stage to guide on the side". Most of the resources and content used in class are already available in some way or another on the Web, so teachers are no longer the "owners" of information and knowledge. This is not to say that they are no longer needed: it means, in fact, that their role becomes even more important, helping students develop their ability to sort, understand, analyse and use information creatively, inspiring them, guiding them in their learning paths.

Some teachers see the implementation of Web 2.0 approaches as key to personalising learning, and do not think technology will render teachers obsolete; if anything, it will make the role of teachers as moderators and facilitators become even more crucial.

The advances in technology and the emergence of Web 2.0, the increasingly widespread access to it, the learner as a central actor in its learning process and a social constructivism perspective on learning have allowed for the emergence of the Personal Learning Environment concept.

Personal Learning Environments

Personal Learning Environments as a concept are relatively new, dating back to 2001 (CETIS, 2007). According to Wilson et al. (2007), “the discourse of PLE began to emerge from conversations amongst a diverse group of educational technologists in early 2005”, and built

momentum with the publishing of a conceptual model for a new type of system, which at the time was dubbed "the VLE of the future" (Wilson, 2005).

One of the issues that arise when conducting research in the field of Personal Learning Environment is the definition itself. A number of definitions have been proposed through the years, and they vary from those firmly rooted in the technological (van Harmelen, 2006) to those with a more social orientation (Adell & Castañeda, 2010). Fiedler and Väljataga (2010) argue that emphasis should shift from the tools PLEs are based on, to the learners' patterns of control and responsibility.

Van Harmelen (2006) defines PLEs as "systems that help learners take control of and manage their own learning. This includes providing support for learners to:

- Set their own learning goals;
- Manage their learning; managing both content and process;
- Communicate with others in the process of learning and thereby achieve learning goals."

He also says that "a PLE may be composed of one or more subsystems: as such it may be a desktop application, or composed of one or more web-based services".

Downes (2006) states that "the heart of the concept of the PLE is that it is a tool that allows a learner (or anyone) to engage in a distributed environment consisting of a network of people, services and resources. It is not just Web 2.0, but it is certainly Web 2.0 in the sense that it is (in the broadest sense possible) a read-write application".

Terry Anderson (2006) defines a PLE as:

"[…] a unique interface into the owner's digital environment. It integrates their personal and professional interests (including their formal and informal learning), connecting these via a series of syndicated and distributed feeds. The PLE is also a portfolio system allowing the user to maintain their repository of content and selectively share that content as needed. It is also a profile system, exposing the user's interests in a variety of ways allowing automated, but selective search of the individual and their digital contributions. Of course, the PLE is a social as well as an information environment, connecting the user to individuals and cooperative events and activities throughout the Net.".

This definition shows a PLE as a technological system with the potential to bring together both formal and informal learning, occurring not only at a particular time but during the learners' life span, thereby supporting a lifelong learning process.

As part of one of the Unkeynote sessions for the PLE Conference 2012, Grainne Conole and I asked a group of researchers in the educational field about their view on PLEs. This helped in providing an updated view of how PLEs are perceived by a sample of researchers and practitioners that are closely linked to the topic. The interviews are available online, and collected on Conole's post about that unkeynote (Conole, 2012).

Helen Keegan compares her answer from a few years ago (Netvibes or iGoogle, as she still regarded the PLE as a "place") with her PLE today, which is essentially mobile and based on her phone. She then goes on to mention a long list of services and applications ("Wordpress, Twitter, Evernote, delicious,Posterous, Tumblr, [...], Google everything,..."). She concludes by saying her PLE is a browser – any browser.
Jane Challinor says her PLE is made of a variety of tools that she access both through her phone and her PC. It is portable, always on. She also mentions other people as part of her PLE.
Steve Wheeler mentions some of the tools and devices he uses, mostly in order to connect with people.

Gilly Salmon says her PLE is her brain, and the various tools and applications simply enhance and in some cases replace the functions it performs. In her opinion, creating a PLE for someone else is probably not desirable, but creating the conditions and providing the resources so others can build their PLEs is probably a better approach.

Cristina Costa recognises that there is learning in everything she does; when talking about PLEs, she thinks about the Web. She emphasises the fact that if not for all these tools and spaces, she would probably be doing something completely different, professionally.

Joyce Seitzinger also makes a point about the evolution of PLEs, from a group of websites she used to visit to her smartphone, nowadays. Ilene Dawn Alexander includes three main elements in her PLE: the people, the print material and the electronic aspect.

Stephen Downes contrasts the VLE and PLE concepts. In a PLE, the user is in the centre of the network, which is open (as opposed to most VLEs), fostering collaboration. You can choose how to establish these collaborations, and through which channels and applications. Users also own the data, something that is not always the case with VLEs.

The various existing definitions and perceptions show that there are different approaches to defining what a PLE is, ranging from the information systems view to a more organic perspective that takes into account not only the technological components, but also the data and information being processed and the knowledge that is generated from them, the non-technological components of the PLE, and the relationships with other learners, peers, and facilitators of the learning process. This is the wider definition used throughout this Thesis, and it also includes the Personal Learning Network (PLN). (Torres et al., 2009; Buchem et al., 2012; Ivanova, 2009).

A number of alternative terms have also been suggested for PLEs. One is Personal Work and Learning Environments (P-WLE) to show that learning and work are not separate areas, and that learning goes on throughout life. Another term that has been suggested, in place of PLE, is Personal Knowledge Environments (PKE). As pointed out by Lubenski (2006), a PLE spans through all the different learning and working experiences of an individual, who would connect their PLE to the appropriate learning or working environment (high school's or university's VLE, workplace learning and professional development facilities).

The concept of Open Learning Networks (OLN) has been suggested by Mott (2008) to describe the connection between VLEs and PLEs: 'The choice appears to be a centralized, enterprise "networked learning environment" on the one hand and open, customizable "personal learning environments" on the other. As we look to the future, it is worth considering the possibility of bringing these two worlds together in what we might call "open

learning networks" (OLNs). In an OLN, faculty, students and support staff would reap the benefits of enterprise, networked software for authentication, identity management, integration with [variety of software], etc. Additionally, they would be able to use a vast range of Web 2.0 applications, integrated into the OLN via web services and other sorts of integrations.' A similar approach is the Personal Learning Network, or PLN, which is often mentioned when referring to PLEs.

The connection between VLE and PLE is also considered in research on developing skills required to use Web 2.0 technologies for lifelong learning (Personal Knowledge Management (PKM) skills). Cigognini, Pettenati and Edirisingha (2009) offer a learning design model that incorporates learning to use Web 2.0 tools within a formal study environment. Their model of learning starts in a closed and structured environment (VLE), and progresses gradually, incorporating Web 2.0 tools and e-portfolios, towards personal learning environments and social networks, as learners develop their experience and understanding of Web 2.0 tools.

PLEs and Information Systems

When discussing Web 2.0-based PLEs, it is clear that most of the components of the learning environment are web applications and services, which means that the information technology element is present in all of them. The Adell & Castañeda definition proposes that "we create a PLE as a set of tools, sources of information, connections and activities which each individual uses on a regular basis to learn" (Adell, 2010). They also agree with Attwell in the sense that PLEs are structured around those tools and services that facilitate three basic cognitive processes: reading, reflecting and sharing. Thus, the resulting definition is explicit in terms of the actions users may carry out through their PLEs.

Alter (2008) proposed a definition for Information Systems that sought to include elements and aspects from a variety of definitions, proposed by several authors; a situation very similar to that of PLEs. Alter's definition for Information Systems is:

A work system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce specific products and/or services for specific internal or external customers.

An information system is a work system whose processes and activities are devoted to processing information, i.e., capturing, transmitting, storing, retrieving, manipulating, and displaying information.

Thus, an information system is a system in which human participants and/or machines perform work (processes and activities) using information, technology, and other resources to produce informational products and/or services for internal or external customers.

This definition could be used as the basis for a definition of PLEs from the point of view of Information Systems, with a few variations. The main one would be the "and/or" where the system actors are mentioned, since a PLE would always include human participants. The "informational products and/or services" would be information, learning and knowledge; and the internal or external customers would be reduced to the learner. It can be argued that other users could also benefit from the system, but that would happen through interactions with the learner, which are included in the "displaying", one of the six information-related operations mentioned in the definition.

In summary, PLEs may be defined as *An information system that supports the learning process of the user, and whose processes and activities are devoted to processing information, i.e., capturing, transmitting, storing, retrieving, manipulating, and displaying information.*

One of the consequences of defining PLEs through information systems is that some of the theories and models used in the Information Systems field may be applied to PLEs. This is discussed in Chapter 5, as part of the proposals for future research.

PLE approaches: objects vs. frameworks

The literature review and analysis helped identify two primary approaches to conceptualising and developing PLEs:

- A PLE as an object (environment or hub that contains, or connects to, all the applications and tools)
- A PLE as a framework for integrating a variety of Web 2.0 tools chosen by the learner, to support their learning.

PLE as an object

A PLE could be seen as an actual object, an environment, common to all users (although customisable to certain extent), that allows them to organize, collect, process and share information and knowledge. This is a more structured visualisation of a PLE, but one that raises many problems (mostly technical ones).

A common environment or platform is needed to bring together and support the different services and applications, by providing the necessary application programme interfaces (API). It needs to be available in the long term, be reliable, and flexible, to allow for changes and updates of the different components. Users should be able to easily customise or change the PLE structure. Some examples of PLEs based on this approach are the PLEW (server) and PLEX (desktop) applications (Wilson, 2007), (Hirst 2008); and the MUPPLE approach, Mash-Up Personal Learning Environments (Atwell et al., 2008).

PLE as a framework

In this case, the PLE is not a specific tool as such, but rather an approach to organizing a variety of Web 2.0 technologies; the "Environment" in PLE refers to the Internet itself and Web 2.0 technologies but not to any particular application. The PLE is unique for each user, and changes according to the user's needs and experiences. As Atwell (2006) wrote in his blog, 'Clearly any PLE application will be a perpetual beta.'

There is evidence that students do use a variety of Web 2.0 tools and applications (ECAR 2007), (Trinder, 2008). However, there is little evidence that students use these tools in an

integrated manner suited for academic learning (McLoughlin, 2008). Such integration would suit a constructivist approach, with students constructing their own personal learning environment and thus their knowledge. In this sense, the PLE will be the result of using and connecting all these tools and applications.

In this conceptualisation of PLE, each learner chooses their own Web 2.0 tools and connects them to collect, organise, process and share information, and manage their knowledge. Thus the sum effect of the tools, information, connections, storage and resultant knowledge is what actually creates the PLE.

Personal Learning Environments is a growing field in educational research, as shown by the number of position and research papers being published in the last 5 years, and the creation of The PLE Conference, also known as PLEConf (pleconf.org, n.d.).

I would like to close this chapter with two quotes:

"The PLE is what happens when we apply Web 2.0 principles to e-learning"
(M. Metcalfe)

This sentence highlights the essence of the Web 2.0 approach to PLEs: that there is a technological basis, but it is heavily influenced by "Web 2.0 principles", such as collaboration, openness, a sense of community. The same way the Web has evolved into Web 2.0, e-learning is changing, and PLEs are one of the results of this continuous change.

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

This quote is important for several reasons. Not only emphasises the "Personal" element in PLEs, and focuses on the learner, but it comes from one of the participants in the study. For him, it was a revelation that made him change the way he was looking at the role of technology

in his learning process, and started him on a path which led him to explore other applications of technology and eventually create his own start-up.

Summary of chapter two

This chapter shows the evolution of e-learning approaches and how PLEs fit in this timeline. It also covers the concept itself, and its connection with Web 2.0.

Chapter 3 - **Methodology**

Overview of Chapter 3

This chapter explains the methodology used in the research, which was based on the Designed-Based Research paradigm, and can be described as inductive, interpretivist (on an epistemological basis) and constructionist (on an ontological basis).

Design-based research

The Design-Based Research Collective (2003) defines design-based research (Brown, 1992; Collins, 1992) as an emerging paradigm for the study of learning in context through the systematic design and study of instructional strategies and tools, and argue that design-based research can help create and extend knowledge about developing, enacting, and sustaining innovative learning environments. In design-based research, practitioners and researchers work together to produce meaningful change in contexts of practice (e.g., classrooms, after-school programs, teacher on-line communities). This way, the goals and design constraints are drawn both from the local context as well as from the researcher's agenda, which in turn may help uncover relationships between the numerous variables that come into play in classroom contexts and help refine the key components of an intervention. Sustainable innovation requires understanding how and why an innovation works within a setting over time and across settings, and generating heuristics for those interested in enacting innovations in their own local contexts.

According to the Design-Based Research Collective, good design-based research exhibits five characteristics:

- First, the central goals of designing learning environments and developing theories or "prototheories" of learning are intertwined.
- Second, development and research take place through continuous cycles of design, enactment, analysis, and redesign (Cobb, 2001; Collins, 1992).

- Third, research on designs must lead to sharable theories that help communicate relevant implications to practitioners and other educational designers (cf. Brophy, 2002).
- Fourth, research must account for how designs function in authentic settings. It must not only document success or failure but also focus on interactions that refine our understanding of the learning issues involved.
- Fifth, the development of such accounts relies on methods that can document and connect processes of enactment to outcomes of interest.

It is furthermore suggested that the value of design-based research should be measured by its ability to improve educational practice, and the following areas are proposed as showing the most promise:

(a) exploring possibilities for creating novel learning and teaching environments

(b) developing theories of learning and instruction that are contextually based,

(c) advancing and consolidating design knowledge, and

(d) increasing our capacity for educational innovation.

Challenges of Design-Based Research

In Design-Based Research, objectivity, reliability and validity are managed in different ways than in controlled experimentation; researchers usually need to take a dual approach, both as advocates and critics, as they try to promote objectivity while facilitating an intervention. This is typically addressed by triangulating multiple sources and kinds of data, in order to connect intended and unintended outcomes.

Any intervention will involve numerous decisions in order to promote innovative practice; these will be taken by the researchers, the designers and the teachers. Although precise replications of an intervention are practically impossible, the reliability of findings may be promoted by the repetition of analyses across cycles of enactment.

The analysis of the data collected was conducted using a qualitative research approach. This matches both the epistemological and ontological positions of the paradigm

chosen, and suits the social orientation of both projects, since they were designed for an educational context.

There are several research methods associated to qualitative research, and most frequently a combination of them is used: ethnography, participant observation, qualitative interviews, focus groups, and collection of qualitative data based on language approaches (such as discourse analysis and conversation analysis).

A grounded theory approach was also followed, since both projects were based on recursive, iterative steps, and the collection of data and its analysis proceeded in tandem. (Bryman, 2012).

The steps followed in the research were:

- General research questions
- Selection of subjects
- Collection of data
- Interpretation of data
- Conceptual and theoretical work, which led to a tighter specification of research questions, and collection of further data (through successive iterations and editions of the projects). This step referred back to the previous step, interpretation of data.
- Findings and conclusions

The quality of quantitative research is established by means of reliability and validity criteria; in the case of qualitative research is harder to apply these concepts, as there is usually no measurement as such. Nevertheless, some strategies have been suggested, which were incorporated in the analysis of the data:

- External reliability: this involves replicating the study, which in the case of social research raises some issues. Replicating settings and circumstances is next to impossible, but a strategy that researchers may use is to adopt a similar social role to that of researchers in previous, similar studies.
- Internal reliability: this strategy applies when there is more than one observer in the research team, and it refers to the agreement reached among the team members in regard to the observations.

- External validity: it refers to the degree in which findings may be generalized across other social settings. As in the case of external reliability, replication of settings may prove extremely difficult.
- Internal validity: it has been argued by LeCompte and Goetz (1982) that this is strength of qualitative research. As researchers in ethnographic research participate in the social life of a group during an extended period, a high level of congruency may be achieved between concepts and observations.

Sampling

The sampling was of the non-probability form; specifically, convenience sampling. This means that the sample was self-selected, which makes it impossible to generalize the findings of the study. Nevertheless, this is not uncommon in social research, in particular research that matches a Mode 2 approach (Nowotny, Gibbons et al., 1994), as was the case for both of the projects from which data was collected.

The term Mode 2 has been taken from the sociology of science and refers to the way scientific knowledge is produced, in contrast with Mode 1. While in Mode 1 the knowledge production is driven by the sake of scientific knowledge alone (i.e. fundamental research), Mode 2 refers to those instances in which multidisciplinary teams are brought together for short periods of time to work on specific problems or projects. This mode matches the way funding is distributed in the research and scientific community; a good example of this mode is seen in the successive European Community Framework programmes.

Mode 2 has several specific characteristics (Nowotny, Scott & Gibbons, 2003):

- Applicability: knowledge is generated in a context of application. While mode 1 refers to theoretical or experimental environments, mode 2 takes place in an environment where problems arise, methodologies are developed, outcomes are disseminated and uses are defined.

- Trans-disciplinarity: in essence, the knowledge produced in mode 2 projects is reflected in the research teams themselves, instead of in more traditional objects, such as papers or patents. Problems are solved by applying a wide range of theoretical perspectives and practical methodologies.
- Diversity: diversity here is understood in both a geographical context (knowledge is produced in different sites, as a result of crossing national and cultural boundaries), and in reference to the types of knowledge that are produced and the organizations involved.
- Reflection: mode 2 is highly reflexive, as the research process has become a more intense, dialogic process, with a high degree of interaction between research actors and subjects.
- Novel forms of quality control: peer-review becomes more difficult as peers are harder to identify in a context where disciplines are no longer clearly codified; as research questions are broadly framed, more actors take part in the research process; and clear and unchallengeable criteria may not be available.

The idea of mode 2 knowledge has been developed in a number of contexts (Gibbons et al., 1994): the commercialization of research, the development of mass higher education, the role of humanities in the production of knowledge, globalization, the potential reconfiguration of institutions, and the management of mode 2 knowledge.

Living Labs

The Living Lab concept is based on the assumption that working collaboratively and closely with end users in real environments contributes to the validation of the solutions have been proposed and sheds light on the significance that these new technologies have both for individuals and groups of people. As of 2015, the European Network of Living Labs website recognises over 400 projects (ENoLL, n.d.).

Living Labs are based on participatory design. Jenkins (2006) proposed the idea of participatory culture as a conceptual framework for new forms of collaborative design. In this framework users become co-designers and co-developers, and any mismatches between their needs and the solutions provided by the system being designed may be anticipated and solved during the design stage. The framework is based on the following elements:

1. Changes must seem possible: users should feel capable of making changes and perceive them as possible, which makes them more willing to participate.
2. The changes must be technically feasible: the system needs to be open to changes and extensions.
3. Benefits must be perceived: the effort must be proportional to the benefits, justifying the participants' time and effort investment. The benefits may vary and include professional benefits, social benefits, and personal benefits (engaging in fun activities).
4. The environment must support the tasks that people engage in; and the activities that the environment focuses on must be perceived as adding value to them.
5. The barriers to sharing changes must be low: if participants can share changes, growth is accelerated. If sharing is difficult, participants may be unwilling to overcome the barriers and obstacles.

The protocol used for applying the Living Lab methodology to a project (CatLab Report, 2009), is described below:

1. Analysis of the project.

Each project must be analyzed in order to understand its goals, tasks, resources, management and budget. This provides the necessary data for the next steps.

2. Propose changes to encourage innovation by users (user-driven innovation).

Users should be included in all phases of a project; during the first stages of a project, lead users have a crucial role as they can help with the definition of objectives and the development of technological tasks, while average users are important in the process of dissemination of the results of the project. A project cannot be considered as having undergone this process if there has not been an effort to share the project with users.

User involvement can take different forms: focus groups, future workshops, interviews and surveys, among others; all these may provide ideas on how to develop the project, and suggest changes.

3. Assessing the impact of changes in project results.

It is important to evaluate the effectiveness of the approach by assessing the project results; for example, what are the benefits of involving users in the different stages that compose a project? One of the key actions is to present the results of the project through an open dissemination plan.

It is essential to organize the Living Lab so it involves real users in all steps of the value chain.

A Living Lab tipically has five main features:

- The users are co-creators
- Specific methodologies are used for integrating the user across the entire process of innovation (future workshops, crowdsourcing, knowledge cafes)
- The technological infrastructure necessary to allow user participation is available
- It has a local approach: it takes into account specific regional and social characteristics
- It is sustainable

Living Labs are based on Von Hippel's idea (2005) of democratising innovation: according to his view, it is the end users rather than the manufacturers who are responsible for a large amount of innovation.

Research in a Living Lab environment is based on qualitative research techniques such as case studies, ethnographies and action research.

Ethnography

Ethnography is a research method; the word is also applied to the result of that research. It is not just one specific method, but rather a multi-method approach; it may include participant observation as the prevalent research method, and other data-collection methods. Ethnography aims to integrate different methods into one holistic study, usually with a specific focus on the cultural characteristics of the group on which the study is focused.

The main characteristics of ethnography are, from the point of view of the researcher (Bryman, 2012):

- Immersion in a given social setting for an extended period

- Regular observations about the behavior of the subjects are carried out

- Researchers listen to and engage in conversation

- Interviews are carried out when additional information is required or when observations are limited

- Documents are collected from the group under study

- The researcher develops an understanding of the culture and social setting, and the behavior of the subjects in that setting

- A written account of the process is kept

Ethnography can be overt or covert, depending on the disclosure of the fact that the person participating or leading the activities is actually a researcher. There are privacy issues implicit in this decision, as well as negotiation of access to organizations and information the researcher might not be privy to. It can also be classified as open or closed, depending on the characteristics of the settings. The combination of these dichotomies produces four possible forms of ethnography. The distinctions are blurred, as ethnographers may move between overt and covert roles during the study.

Field notes

Field notes are an essential data-collection method in ethnography; they should be taken as soon as possible after interesting events or behaviours are observed. They should summarise context, time, participants, and be vivid and clear. They may include personal reflections and interpretations of the observations, and analytical thoughts that may be later used in the elaboration of the data. The strategies for taking notes vary with the settings and the number and role of researchers, for example. When referring to the result of an ethnographic research, the term "ethnography" implies a text that aims to convince readers of the reality of the observations and behaviours collected and described. From that point of view, different classifications have been proposed such as realist, confessional or impressionist tales, or classical, mainstream, postmodern and public ethnography.

Unstructured interviews

As opposed to quantitative research, interviewing in qualitative research is usually less structured, as the emphasis is more on generating research ideas and gather the interviewees' opinions and perspectives. This can provide insights into what the interviewee considers relevant and important. Interviewers can also ask new questions based on the interviewees replies, vary the order and even change the wording of the questions; in qualitative research, standardization of the interviewing process is not as important as in quantitative research. Interviewers look for rich, detailed answers, and interviews can happen on several occasions with the same subject. The style is more conversational, and the process is flexible. It also fits situations where the focus of the research has not been clearly defined yet, and when more than one person carries out the interviews.

Surveys may be considered, to some extent, as structured interviews.

Chronology of the research

In order to give an overview of the different phases that comprised the research, the following timeline is provided:

2008 – 2009: Proposal of a framework for creating PLEs
2008 – 2009: Proposal for the Hort Digital project. PELICANS pilot study.
2009 – 2010: Hort Digital pilot study. First iteration of PELICANS.
2010 – 2011: Hort Digital (levels I and II). Second iteration of PELICANS.
2011 – 2012: Hort Digital (levels II and III).

The framework proposal was the result of my stay as guest researcher at the Beyond Distance Research Alliance, University of Leicester, during the summer of 2008 and spring of 2009. This led to a research collaboration and the pilot study for the PELICANS project (which focused on students' experiences in building PLEs). After the test pilot and the preliminary analysis of the data collected, we decided to continue with PELICANS for two more iterations, and a separate project was started, Hort Digital. This project was aimed at helping

teachers develop PLEs and use them as part of their learning and teaching processes; this would provide an insight into the teachers' point of view regarding the use of Web 2.0 tools in their practice. Hort Digital ran for two iterations, additional to the pilot stage.

A framework for developing Personal Learning Environments using Web 2.0 tools

This section describes the proposal of a framework for building Personal Learning Environments based on Web 2.0 services and applications, in the context of the PELICANS project. The PELICANS (Personal E-Learning In Communities And Networking Spaces) project began in 2008, as part of the research projects carried out at the Beyond Distance Research Alliance (later known as the Institute of Learning Innovation), and ran until 2011 in three successive iterations based in Barcelona, Spain.

The main goals of the PELICANS project were:

− Help students incorporate Web 2.0 tools and services for formal studies. Although a large majority of students enter university with prior Web 2.0 experience, their use of such tools and services is usually confined to creativity and entertainment. Students need help to extend their knowledge of Web 2.0 for learning.

− Learning how to use Web 2.0 for lifelong learning. By helping students to develop a personal learning, research and networking space, they will be able to access and update their learning material regardless of their geographical location, and stage in their life and career.

− Preparing HE students for future employment. The role of learning and development is becoming more important in corporate and professional life. Students familiar with Web 2.0 tools and services hosting formal and informal content that is portable across the education/employment frontier will be well placed for future employment.

As a preliminary step, a framework was proposed in an attempt to classify different approaches to building PLEs that could be used to guide learners in the process of constructing their own.

The four-approaches framework

The framework was based on the idea that learners could manage the various components of their PLE by choosing an application as a "hub". Using such a hub as the central component of the PLE has many advantages: it makes it easier for users to access their collection of Web 2.0 tools; it facilitates the management of different logins and passwords; in certain cases, it allows the sharing of data between some of the applications that compose the PLE.

We identified four potential approaches to building a PLE with Web 2.0 tools according to the choice of hub. These were all chosen based on our experience and observation of the existing Web 2.0 ecosystem in 2008-2009:

- Wiki-based PLE (Google sites)
- Social network-based PLE (Facebook)
- Social aggregator-based PLE (Netvibes)
- Browser-based PLE (Flock)

Is is important to note that the PELICANS project framework was proposed and developed between July 2008 and April 2009; thus, several services mentioned throughout the discussion are no longer available (such as Flock, for example), and some services that are relatively popular nowadays (Pinterest, for example) are not included, as they did not exist at the time or its use was not yet widespread. Smartphones use was on the rise, but not yet as extended as today, so although mobility was explored as an emerging trend and we expected it to continue increasing its impact, smartphones were not considered as a hub in this framework.

Some implications of these approaches are:

- Users do not need to buy a license to use a PLE, since it is built with tools and applications that are available free on the Internet
- Support might vary between the different applications
- The learning curve for the applications will be different (some applications will take more time for the users to master them than others)

- There is a need for users to constantly update their knowledge of the tools, as the tools themselves are being improved and upgraded. This "learning how to use the tools" precedes any learning that might be done with the tools (JISC, 2007).
- The choice of a Web 2.0 application as the starting hub of the PLE means that the PLE depends on the availability and stability of this tool. Alternative paths should be provided in case this tool is not available at any given time. The "hub" should only be used for convenience of access and login to various applications, but not as the central repository of files.

A wiki-based PLE: Google sites

Barrett (2007) shows how some Google tools may be connected using a network diagram:

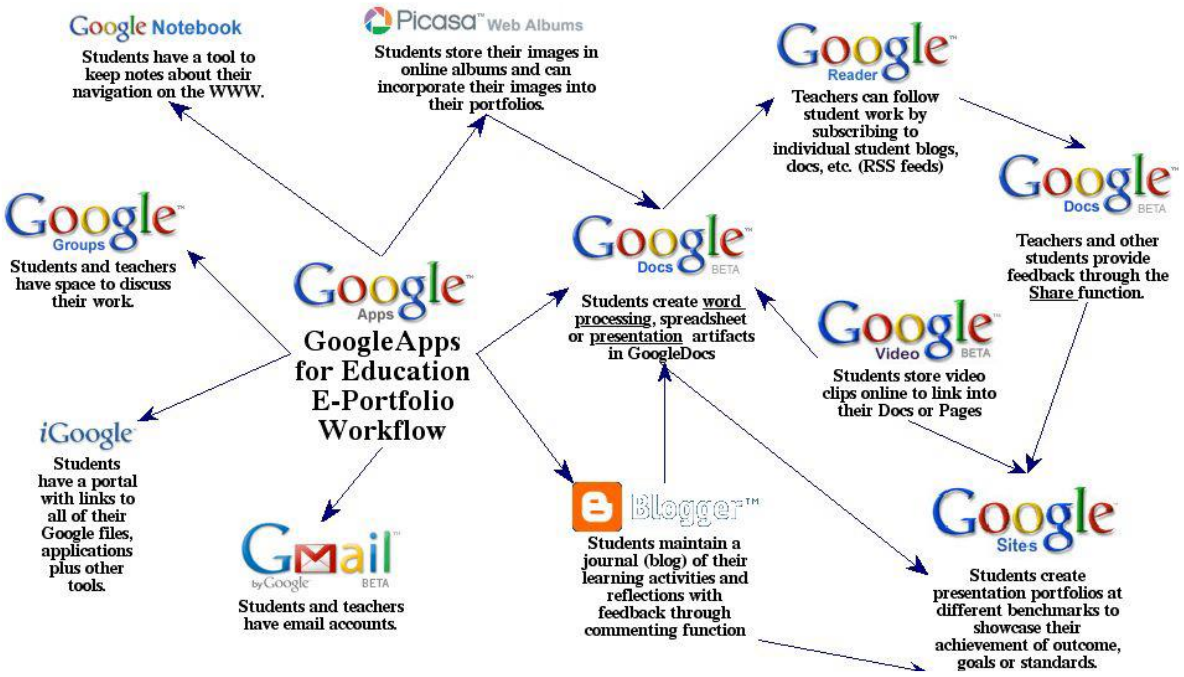


Figure 3. Connectivity of Google tools (copyright Barrett 2007, used with permission)

Barrett also explains how to add and connect these tools to create e-Portfolios (Barrett, 2009); the arrows in the diagram indicate the flow of information between applications. This

arrangement could be easily expanded to create a PLE, due to the intrinsic connectivity of the various Google services, using Google sites as a start page.

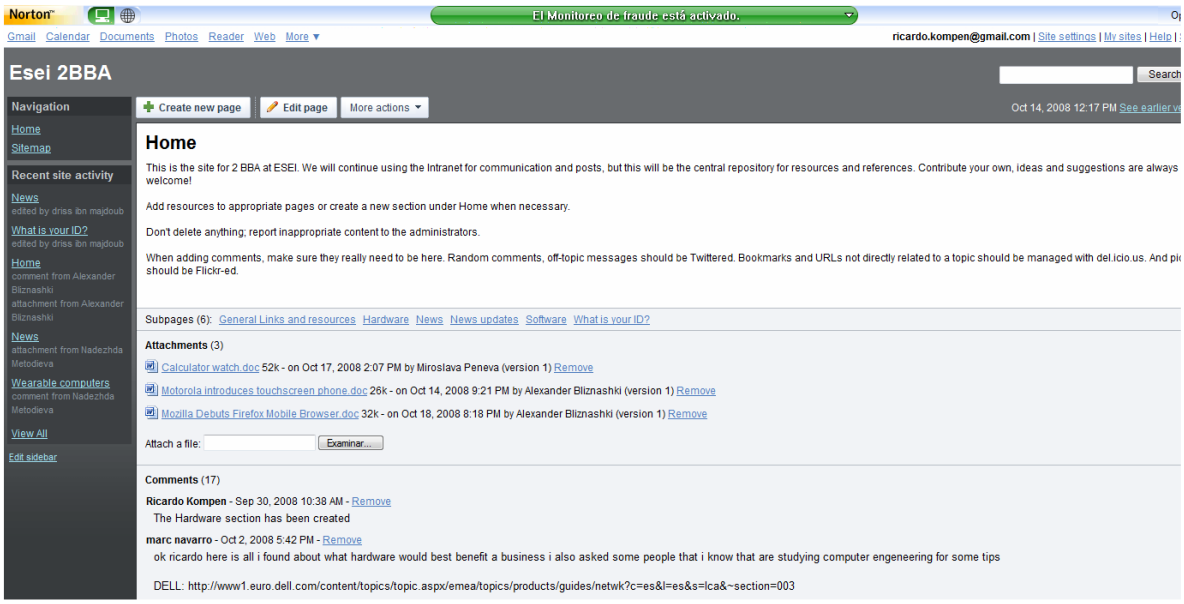


Figure 4. A start page created using Google sites

Figure 4 shows an example of a start page created using Google sites. The page provides access to an online office suite (Google Documents), an RSS reader, web search, blog creation and publishing (Blogger), pictures and some other tools.

Advantages of this approach are:

- Anyone who has a Gmail account has access to Google sites and its related applications
- Setting up the start page is a matter of minutes
- Files are easily shared; it allows users to collaborate online.

Disadvantages are:

- Connectivity is limited to Google applications (although links to external applications may be easily added to the start page)
- Apart from online collaboration there are no other social tools available

A social- network based PLE: Facebook

A Social Networking application (e.g., Facebook) could also be used as a hub for a PLE.

One advantage of this approach is that a high percentage of users are already a captive audience as regular users of Facebook. Facebook is popular with College and University students. According to the 2007 ECAR study (ECAR, 2007), more than 80% of the students that answered the survey use Facebook or some other social networking tool. As Ian Mcleod (2007) observes, 'Facebook is well on its way to becoming the ideal tool for the creation of Personal Learning Environments or PLEs.' As Tracy Mitrano (2008) notes:

'Let's "face" it: Facebook has built the site, and students use it; we in higher education should come to recognize that this universal commercial site is here to stay. We should use it for advertising and for communications—and certainly for emergency messaging. The race is on: may the first institution to forge this adventurous type of innovative collaboration win.'

Figure 5 shows how a number of Web 2.0 tools can be connected to Facebook APIs ("Applications"). Blogs can be accessed through RSS feeds, and some commercial VLEs are developing extensions for Facebook (Blackboard, for example, allows users to access it from Facebook, using the Blackboard Sync application, or through an intermediate application such as CourseFeed). There are also Applications to access Google Docs, Twitter, del.icio.us, Flickr, Picasa, wikis, SlideShare, Gmail and others.

Figure 5. Facebook connectivity with other Web 2.0 tools

Figure 6. A Facebook page showing Applications to access Twitter, RSS feeds, Google Docs and Zoho.

Advantages of a Facebook-based PLE:

- The target audience consists mostly of Net Gens who already use the tool. They only need to be shown how to take advantage of it and transform it into an environment for collaboration and work.
- Connections established by students could be carried on after they graduate, and be transformed into colleagues' networks (e.g., Linked-in)

Disadvantages:

- Users may dislike using for academic matters a tool that they perceive as related to their personal life.

Aggregator-based PLE: Netvibes

Netvibes is an aggregator that allows users to connect a variety of Web 2.0 tools and access them from one site. It has a wider range of tools compared to Google sites, and it adds the social element by providing connections ("Widgets") to Facebook, del.icio.us, Flickr and other applications.

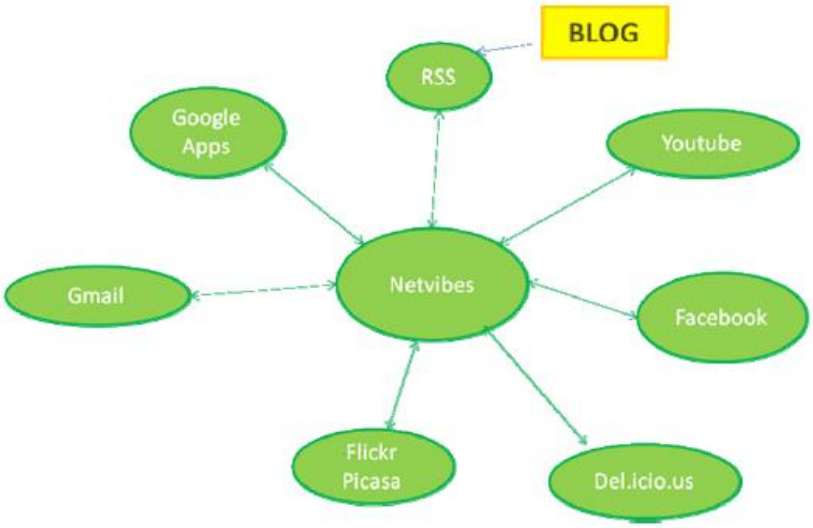


Figure 7. Netvibes connectivity with other Web 2.0 tools

Advantages of a social aggregator-based PLE:

- one-stop access to a wide range of Web 2.0 tools
- one-time login for supported tools and applications

Disadvantages:

- Users are required to create an account and set-up a start page, adding the necessary "Widgets" to establish connectivity with their selected Web 2.0 tools.

- When a Widget is not available for a certain tool, links must be added to the Netvibes start page instead.

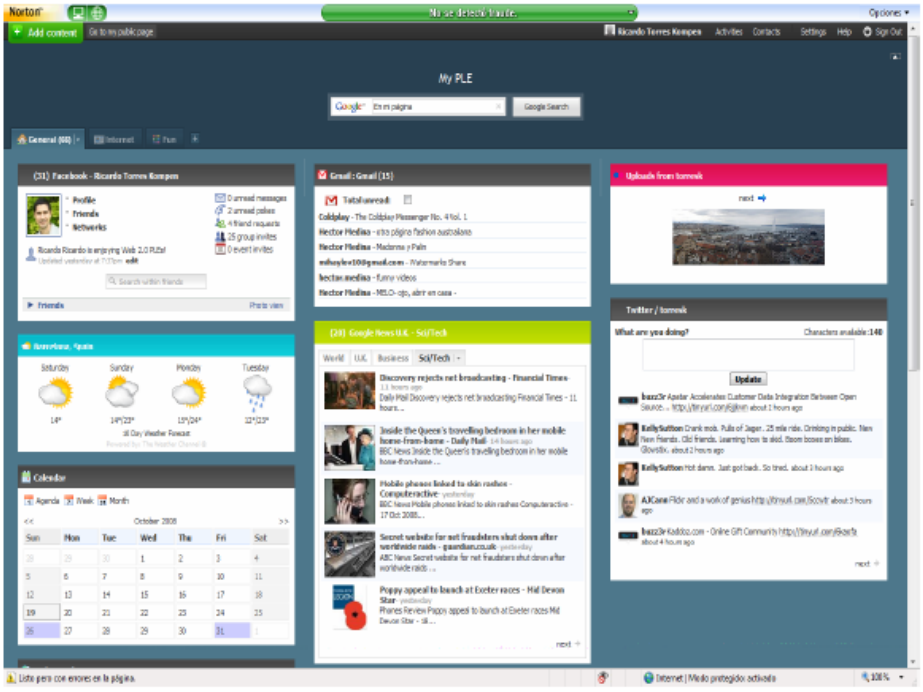


Figure 8. An example of a PLE based on Netvibes

Browser-based PLE: Flock

Flock was a Firefox-based browser that offered full integration with a number of social-networking sites, as well as with blogging tools. It could also collect information from feeds, allow users to share text, pictures and videos, and be integrated with bookmark and photo storage services. It was included in this framework as an example of a browser-based hub, but the site was effectively closed in 2011. Other examples of this type of tool are Rockmelt (which was acquired by Yahoo in 2013 and later shut down), Orbitum and Beamrise. The use of plug-ins also allow users to create social browsers based on Chrome and Firefox, for example. (Mashable, 2013).

Advantages:

- one-stop access to a wide range of Web 2.0 tools
- one-time login for supported tools and applications

Disadvantages:

- Requires user to install the program (administrator privileges are required)

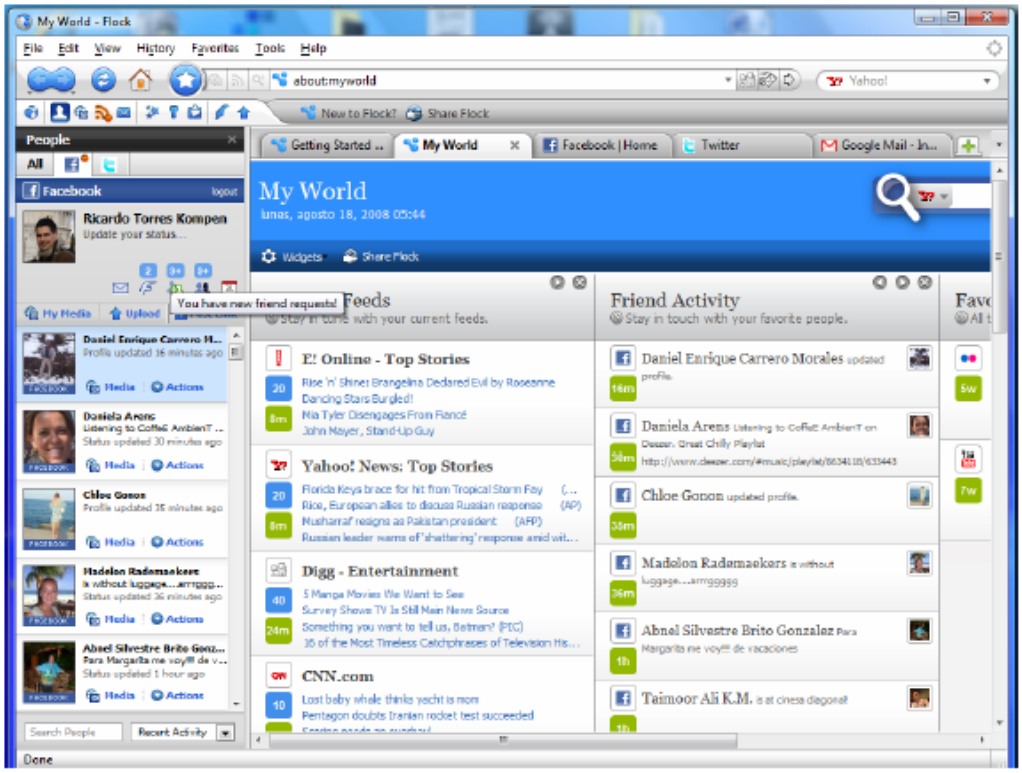


Figure 9. A Flock start page

A proposal for a fifth approach: virtual desktops

As it will be discussed in the next chapter, during the first iteration of the PELICANS project one of the students proposed a fifth approach that had not been considered in the original framework. This approach involved the use of a virtual desktop utility (Jooce) that allowed users to manage multiple desktops from one account, sharing spaces if they wish to do so, and having access to multiple working environments (Jaroszyńska et al., 2010).

This approach was to be included in a revised version of the framework, but in 2010 both Jooce and G.ho.st closed down, and no clear competition has taken their place. The reasons cited were the competition and the changes in the marketplace. It can also be argued that with the widespread emergence of cloud computing and online storage services, such as Dropbox, Google Drive and Skydrive, the desktop metaphor is no longer needed nor useful.

Web 2.0-based PLEs are by definition dependent on technology, which also means they are subject to the phenomenon of technology transience. One of the issues with so-called new technologies is the fact that there is no guarantee that a given tool will be available over a given period of time. Online services today are created and disappear at a dizzying rate, applications quickly evolve or are replaced, and new users follow early adopters as they move on from one big product launch to the next. This is nothing new: old models are replaced, new technologies make others obsolete and consumers crave the "best next thing". The Internet and the Web have simply accelerated this process.

The Long Tail Effect also means that users have more to choose from. The term was first proposed by Chris Anderson (Wired, 2004) to describe the retailing sale strategy of offering a large number of unique items, but selling relatively small quantities of each. The concept has been applied to a variety of scenarios, such as online business, mass media, social networks and many others. In the context of online applications and services, application of the concept may demonstrate, for example, that although there are a few "big" players, such as Facebook and Twitter, there are also a large number of alternative services, each with a relatively small number of users: go2web20.net, an index of web applications, lists some 3000 tools registered, in categories such as communication, management, search, blogging, collaboration, design and others. In such an environment, it is without surprise that one sometimes visits an application that was in operation the prior week (or month, or year), only to discover that not only the application is gone, but also the data stored in it, information, references, and so on, which in the end means that a considerable time and effort have been lost.

A particular case, that is linked to the "VLE vs PLE" debate (Conole, 2012), is what happens when the technology is still present, but the content has disappeared or is no longer accessible. Institutional learning management systems (LMS) or virtual learning environments (VLE), such as Moodle, are quite often "walled" environments, only accessible to those who are members of the community or institution. In many cases, as students graduate, their institutional email account is closed, and access to the VLE is no longer available. Although not directly a case of transience in technology, the availability of information and data are indeed affected by the access the individual has to such a repository or environment. In this sense, what is transient is not the technology as such, but the permissions the user has to access it – the availability of the information. A good example of this is institutional email addresses; usually, when the student's stay at the university is over (because they graduate or switch institutions, for example), they no longer have access to the VLE nor their email account. There is evidence that some high education institutions are no longer issuing institutional email addresses and allow students to use their personal ones instead (Educause, n.d.). This way, their emails go with them, which is not always the case with institutional email services.

My own experience with PLEs, which started in 2008, is that my PLE has been continuously changing, reflecting the changing nature of the technology context of today's world, and my own choices and needs as both a learner and a practitioner. Some of my PLE services have changed appearance, or even functions; some have completely disappeared; and a few have remained relatively stable during this period.

Services that once were an important part of my PLE but have since disappeared include Twine, Geocities, Flock and Google Reader. Of these changes, the only one that caused me major problems because of its disappearance was Google Reader; this service had become an integral part of my PLE and served as both an aggregator of information and a discovery tool. A migration to Feedly (an RSS feeds aggregator) solved some of the issues, combined with Zite and Flipboard which also aggregate information in a magazine-like format), and the adoption of Pinterest, which allows users to create boards and "pin" pictures on it, which are

actually links to the original sources of information associated to these pictures. Lately, the Save function on Facebook has proved useful for saving resources for later use.

Other services that I considered for addition to my PLE at various points, but were never included, are Google Wave, which in 2010 was heralded as the best "new thing," only to fizzle out and never deliver on its promise; and Ghost and Jooce, which were interesting interfaces that worked as virtual desks and allowed users to share information and files, but are no longer active.

Some of the services that have been a part of my PLE and have not changed in a major way are Netvibes, Facebook, Twitter, Google Drive (before known as Google Docs) and *delicious*. Together, these support a wide range of actions and needs: among them, aggregation of content and sources, social networking, collaboration, information discovery and social bookmarking. Nevertheless, they are still a part of a changing technology setting, even when they remain in operation, because these tools continue to change and evolve over time.

The impact of technology transience on this framework is clear: it makes it dynamic by definition. This was one of the main reasons why during the pilot stage of the PELICANS project we decided not to discuss the framework with the participants until after they had started creating their PLEs. The actual usefulness of the framework was to help us classify the approaches used by the students, identify the main advantages of each one, and pinpoint limitations and disadvantages.

The PELICANS Project

PELICANS (Personal E-Learning In Communities And Networking Spaces) was a research project, a result of the collaboration among the Beyond Distance Research Alliance, University of Leicester, UK and the Universitat Politècnica de Catalunya, i2Cat Foundation and Citilab, in Catalonia, Spain. It provided the context and the participants for the first part of the research,

which through a DBR approach led to the creation of a second project which helped in analysing a different context, secondary education.

The project focused on a group of HE students over a period of three years (2008 – 2011), and its main goal was to test the 4-approaches framework for building PLEs in a real-life setting. In this project I played a dual role as researcher and teacher, guiding the students in the development of their own PLEs, while gathering empirical evidence on the students' engagement with PLEs.

The PELICANS project started with a pilot study, which was conducted between September 2008 and May 2009, with a group of 33 students from the 2nd year of a Business Management programme, at the *Escuela Superior de Estudios Internacionales (ESEI)* in Barcelona, Spain.

Two additional iterations took place during the 2009-2010 and 2010-2011 academic years.

Pilot study: 2008-2009

The pilot study was originally thought as a means to test the conceptual framework in practice with students, by helping students develop their own PLEs using one of the four approaches, and to gather empirical evidence on students' engagement with PLEs. The study was carried out during the 2008–2009 academic year and involved a group of 33 students in the 2nd year of a Business Management program at ESEI, college level, in Barcelona, Spain.

The subject in which the project took place was called Business Information Systems. The learning outcomes of this subject were to help students understand the scope and range of information systems available to support business processes; show students the importance of digital literacy in today's business world; and introduce students to the development of web-based projects, and allow them to estimate the hours and efforts required for the successful completion of such projects.

The initial design was based on introducing the students to the PLE concept and the four approaches described in the framework, and then provide the guidance needed for them to build their PLEs using the various Web 2.0 tools as they were being discussed in the sessions.

Discussions with students at the planning stage of the pilot study revealed the students' interest in learning and using Web 2.0 tools, which gave rise to a bottom-up approach to introducing PLEs and changed our approach to testing the framework: students were gradually introduced to Web 2.0 tools, chosen by them, after they were given an introductory overview of Web 2.0 and the variety of tools available. This way, instead of following one of the four approaches in our framework, they were free to choose their own combination of tools, and had to make decisions about organising and managing them. This made for a more enriching experience, both for them as learners and us as researchers: students "discovered" the concept of PLEs, and used their own ideas and proposals to develop them.

Introduction of Web 2.0 tools and applications

During the first part of the academic year, a range of Web 2.0 tools were gradually introduced to the students. The first one was Twitter; it was the only one presented by me, as the teacher, and was suggested as a new channel of communications for the class. By the third week (the class was scheduled for a weekly, two-hour session), 90% of students were using Twitter as their main channel of communications, not only for academic purposes, but also for social and casual chat. The engagement and participation varied during the semester, showings peaks of activity around exams and school events.

After the first session, the Web 2.0 tools to be considered and discussed were suggested by the students themselves, either because they were already using them and thought they could be interesting for their classmates, or because they felt the need to learn a specific tool; it was made clear to the students that they were free to choose whichever tool they felt was the most appropriate for their situation. For example, Flickr was explored by one student as an alternative for sharing images, and in turn this motivated another student to present Picasa, which gave the class the opportunity to compare two different approaches and discuss

advantages and disadvantages. Clipperz was researched and explained by a student who felt overwhelmed by the number of applications available, and the associated logins and passwords. Thus, Flickr, FriendFeed, Clipperz, Jooce, RSS, Blip.fm, last.fm, MOG, Blogger, Picasa (among others) were all discussed and some of them were used in class activities or online e-tivities (Salmon, 2002).

Some examples of the application of these tools are:

- Twitter: topics were proposed or mentioned in Twitter, and discussions around those were then taken to the Wiki or to the blog. During examination weeks, questions were proposed or asked, and discussed through Twitter
- *delicious*: students created accounts and started collecting and sharing resources. Some adopted *delicious* as a source of references for essays and reports, while others used it for browsing and discovering information. There was a wide range of interests shown in the *delicious* accounts, which gave way to interesting discussions.
- Flickr: students created an account, and opened albums for sharing personal pictures. It was also used to share and comment on classwork during the image editing module.

Some of the students also carried out projects which in some cases involved learning and applying new tools. For example:

- Introduction to HTML, using screencasts (Webinaria) and podcasts;
- Student Council and Alumni websites, using Wetpaint;
- Wiki at Google sites, which was used as a main repository for resources and references for the class, partially replacing the institutional VLE.

Creating "Web 2.0 diagrams"

At the beginning of the 4th month of the academic year, students were asked to draw pictures of their "ideal" work environment, based on Web 2.0 tools, or any other tools they used: this was called the "Web 2.0 diagram", and was designed as an introduction to the concept of PLEs.

It was made it clear that this exercise was not limited only to the tools and applications that they had been using during the previous months, and it was also emphasized that this environment should not be restricted to tools, platforms or applications that they already knew: it was rather focused on their objectives, the way they used the tools, and their needs.

The participation in this activity was optional, which resulted on 10 students dropping out of the research study. After talking to them about these decisions, the most common reason was that this was no longer a graded activity, and thus there was no clear reward for them in investing time and effort on it. Two of the students said that they saw no point in working on the activity, as they were neither "heavy nor frequent" users of these applications and services.

This is directly related to the Personal dimension of PLEs, and it also points at the information system component of these constructs: usefulness and relevance are key factors in the learners' decision about creating PLEs or not, two factors that are part of the Unified Theory of Acceptance and Use of Technology, UTAUT (Venkatesh et al., 2003).

The group of students who did actively engage in developing their PLEs (which were still being referred to as "Web 2.0 diagrams") was then down to 21 students (three students from the original group transferred to another school, while an exchange student joined the class). Out of these, 6 submitted very simple diagrams, showing only the tools they used. On the other side of the spectrum, 8 students went so far as to attempt to establish links among the tools, and even checked which of those links actually existed.

The proposals covered a wide range of approaches: 8 students proposed a platform or web service that would allow them to access their collections of tools, and most of them pointed out that some kind of one-time, safe access should be provided as part of the service. One student called the diagram his "personal page of everything and included not only the tools he used for academic purposes, but also the ones he used for leisure, or communication with friends and family. His diagram matched one of our approaches, the browser-based PLE.

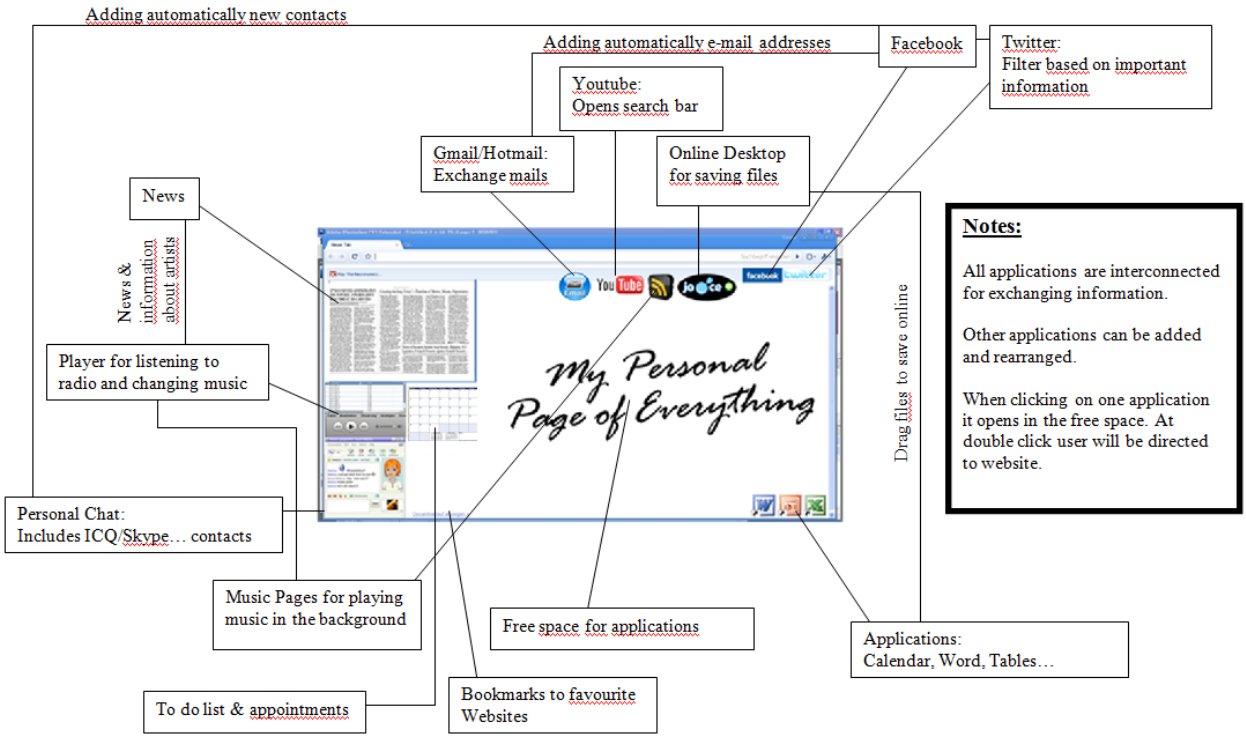


Figure 10. A start-page "Web diagram"

The Start-page/aggregator-based PLE approach was proposed by another student. In her words, it would be "a centralized platform allowing the access of user-selected Web 2.0 applications through a single password from one site". The student even searched for such a tool, and found and set-up a Pageflakes account.

The aggregator page approach was also mentioned by another student also, in this case using iGoogle, a Google application. This approach matches to some degree one of our approaches (the Wiki-based one), in the sense that it relies mostly on Google applications. However, the idea of using a Wiki for a single user was not even considered by the students, probably because they already had two Wikis being used for collaborative projects in this class.

The diagrams proposed by the students, along with some of the comments provided, may be found in Appendix A.

Contrary to what we expected, given the increasing popularity of Facebook, the Social-network approach proposed in the framework was not considered by the class, and that not a single student thought of using Facebook (or any other social network) as a hub for their diagrams. Those were still early days for Facebook, which since then has seen their membership grow up to 1.4 billion users as of March 2015 (Facebook, 2015), and several of the students participating in the study did not have accounts on the social network, and there were a few that have not even heard of it. Some of them joined Facebook after it was mentioned by their classmates during the discussions, or because other tools provided access to it: “one thing I started using through Flock is Facebook [...] I started to have conversations with classmates, friends and even teachers".

To put this in perspective, all of my new students during the Fall 2015 semester (75 in total) have an account on Facebook, except two (less than 2%). Still, it is not used for communication or socialisation between students and faculty members, and around 60% of them regard it as not important in their learning process (Appendix B shows the results of a survey conducted on the use of technology for learning). So, even though Facebook has become one of the most popular social networks, there is still no clear evidence that it plays an important role in learning.

A fifth approach was proposed by one of the students, one that had not been considered in the framework. This involved the use of a virtual desktop utility (Jooce) that allowed users to manage multiple desktops from one account, allows them to share desktops and files if they wish to do so, and provides access to multiple working spaces. Interestingly enough, Jooce was presented by one of our students, but she did not use it in her “Web 2.0 diagram”; it was researched and adopted by another student, following her classmate’s presentation of the tool. This is another example of peer learning and the power of communities and networks, both part of the PLN (Personal Learning Network) concept which in turn is closely related to PLEs, as proposed by some authors (Buchem et al., 2012; Ivanova, 2009).

This part of the study was completed before introducing the concept of PLEs to the class; the purpose behind this was that they "designed" their PLEs before discussing the concept, and were not forced to follow the framework. In fact, one of the most interesting moments during the pilot study experience was when the students were explained the PLE concept and realised they had already built one. This also confirmed our decision to follow a bottom-up approach and not discuss the PLE concept prior to the students testing of Web 2.0 applications, and supports the view of PLEs as a framework rather than as objects. Here, the main outcome was not the PLE as such, but the learning process which led to the students' discovery, testing, integration and adoption of a variety of Web 2.0 services which organically created their PLEs.

Development of PLEs

During the last part of the study, the PLE concept was introduced and explained, as well as the proposed framework and the four approaches. Students were able to compare the "Web 2.0 diagrams" they had drawn with the framework approaches; at this point, they were asked to develop their PLEs, either based on the diagrams they had proposed, or following a particular approach, or combinations of them. This process was later discussed and reflected on in the form of essays.

At the end of this phase, 17 students had built or developed a PLE, while 4 students reported that they did not see the usefulness and chose to drop out of the study. Overall, the active participation rate was 50%.

Reflecting - essays and interviews

The final phase of the study, at the end of the academic year, involved writing essays based on their learning experience of developing PLEs. Interviews and surveys were also conducted after the initial coding process, both face-to-face and through e-mails, in order to go deeper into certain aspects that were mentioned in the essays.

The results of the coding are shown in Appendix C. The analysis of this qualitative data was done through coding, a technique based on classifying the data items according to categories and topics. As this is an iterative process, it was done in consecutive steps; it is usually recommended to start it as soon as data is available (Bryman, 2012).
In this study, the coding showed several common themes that emerged from the data collected. At the end of the process, four main categories were identified:

- **PLEs as organisation and management tools.** This category groups items which were initially assigned to more general categories, such as "organisation", "classification", "complexity", "information" and "sources".

- **PLEs' role in strengthening of social interactions.** Includes items that were coded as "networking", "group", "relationships", "teachers", "discussions" and "social".

- **PLEs in the learning process and development of skills.** Items that were coded as "abilities", "skills", "learning", "knowledge" and "learning" were included in this category.

- **Problems, obstacles and suggestions.** A final category that groups items coded as "pros", "cons", "advantage", "disadvantage" and "recommendations".

An extract of the results from the coding process is shown in Table 1, Appendix C, focusing on the three main categories identified: evidence of PLEs as organization and management tools, evidence of PLEs helping strengthen social interactions, and evidence of PLEs as helping in the learning process and the development of skills; a fourth category includes evidences of the obstacles, criticisms and suggestions the students mentioned in their essays also included.

A second round of coding showed evidence of the students' awareness of the personal dimension of PLEs and their perception of PLEs as dynamic environments; these categories are shown on Table 2.

To preserve the anonymity of the students, initials were used. All students granted permission for using their essays, questionnaires and interviews in this research project.

Following the collection of these data and the preliminary analysis, the students were then contacted for a follow-up interview, either face-to-face or by email. The questions were formulated in such a way that the evidence for the categories that emerged from the coding process could be confirmed, we could go deeper into points that were not clear in the essays, and also to elicit new data from them.

The interviews were based on 4 questions, which were modified or complemented according to the interviewee responses:

1. How/What was your learning process using 2.0? We want to know exactly how do you think PLEs and building them helped or changed your learning process/experience.
2. How did the PLE concept help working with so many different tools?
3. How did the PLE + web 2.0 helped in the learning of the subject´s contents? (as opposed to learning in general)
4. Do you still use: - Web 2.0 tools? - Your PLE?

The interviews transcripts may be found in Table 3, Appendix C.

First and second iterations: 2009-2010 and 2010-2011

During the first iteration of the PELICANS project, the IS09 class (the group that participated in the pilot study) was in their third (and final) year of the degree. Two more groups were included: the students that enrolled for their 1st year (IS11) and the students that were beginning their 2nd year (IS10).

The IS09 group has been discussed earlier, as it is the one that participated in the pilot. In order to do a follow-up, a survey was sent to these students; 13 of the original participants answered. According to them, all but 3 say they still used their PLE, and rated it highly (4 out of 5) as a useful tool for organising and managing content, learning new information and skills, supporting their interactions with other members of their network, and overall, as an important tool both in their learning process and their jobs and internships. The results are shown in Table 4, Appendix C.

The IS10 group was introduced to the Web 2.0 concept during their first year, and explored some tools such as Flickr, del.icio.us and Blip.fm. At the start of their second year, a Wetpaint was created and used as a central resource point for the whole class. Most of the online subject-related discussions were held through the website; Twitter was also used, but less frequently than in the case of IS09. This seems to indicate that, regardless the choice of application, the communication need is there, and that as long as it is channelled through at least one medium, it does not matter which one is being used.

Regarding the last group, IS11, they were the only group to propose the use of a social network as a main "centre of operations" for the class, through Ning. It seems that the more evident social aspect of this tool helped most of the students develop and strengthen the interactions with their classmates, with the whole class working in a collaborative fashion. It also helped that the group was much smaller (only 15 students) compared to the other groups that had participated in the study, such as IS09 and IS10 (both with 31 students each).

The first iteration of PELICANS ran in parallel with the Hort Digital pilot (discussed in the next chapter), and both projects benefited from one another. The experience from the PELICANS pilot helped in identifying the ways students used Web 2.0 tools, and how they applied it in their learning process; this provided a starting point for the design of the Hort Digital teachers training modules. Conversely, the online community approach that provided the virtual platform for Hort Digital was also used during the second iteration of PELICANS, with the IS11 group.

The second iteration of PELICANS was built on the lessons learned during the pilot and first iteration, and also on the experience from the Hort Digital pilot, as the projects ran in parallel for a while.

The IS10 group explored more social online spaces, such as Wetpaint, which at the time had a Wiki-like structure and served as the main virtual space for the class. With the IS11 group, one of the tools tested in Hort Digital, Ning, was explored and the students decided to adopt it as the main online space for the class, running e-tivities and creating forum discussions through it.

After the pilot stage of PELICANS, and in parallel with its first iteration, a proposal for another project was developed, based on the lessons from PELICANS, and inspired by the MediaZoo at the University of Leicester. This allowed the research to move onto a different scenario, secondary education, and focus on practitioners as the main subject of the research. This way, information could be gathered about the teacher's point of view on the use of Web 2.0 tools and the PLE concept in their practice, thus complementing the students' perspective.

The experience from the PELICANS project showed that the creation and use of a Web 2.0-based PLE was perceived by most of the students as positive and that it added value to the learning process. The Hort Digital followed a similar approach, but at high school level and working directly with the teachers instead of with the students. The idea behind this was to help disseminate and spread the approach in a faster way, using a network effect, with the teachers implementing the ideas in their institutions and helping their colleagues in implementing theirs.

The Hort Digital project

Hort Digital was a project developed at Citilab-Cornellà (http://en.citilab.eu) with the support of the i2CAT foundation (http://www.i2cat.cat), and its objective was to help high school teachers use technology in innovative ways in the classroom. It was conceived as a Living Lab for secondary education, with plans to expand it to other levels and areas. It was offered in a course format during the 2009 -2010, 2010 – 2011 and 2011-2012 academic years, an initiative supported by the Department of Education of the regional government in Catalonia, Spain. In the course, teachers and facilitators worked together to propose, discuss and test innovative approaches to using technology in the classroom, with a focus on Web 2.0 tools and the personalisation of learning. One of the main goals was that the collaborative and social approach that was followed, supported by the creation of a community of practice, would have a positive impact in closing the digital gap between teachers and students, help teachers realise the potential of new technologies, and support the new policies that at the time were being issued by both the regional and national governments in Spain.

Hort Digital was designed as an open space, in which both new and traditional technologies were showcased, so users could test them, find new applications in the classroom, develop innovative projects in a collaborative environment, and follow up the implementation of those projects in the classroom. The project was inspired by the MediaZoo at the University of Leicester (MediaZoo, n.d.). The metaphor we chose, an orchard, aimed to illustrate the different types of tools and users, and the way the former can be incorporated into the users' toolkits – their orchards, which were by definition Personal Learning Environments.

Although the project focused on teachers and educators, its ultimate purpose was to reach students, and help them realise the potential of using technology and Web 2.0 tools in their learning process, both formal and informal, and to carry on these skills to their professional lives and lifelong learning.

The project followed a Living Lab approach, in such a way that users were involved in all stages of the process, and innovation was user-driven. In this context, tools and support were

provided to the users, and the learning was based on projects, proposed and developed by the users. To achieve this, and prior to the initial design of the project, a series of interviews were conducted with representatives of the high schools in Cornellà, the city where Citilab is located, with three main goals: explore in which ways, if any, was technology being used in the classroom; determine the needs of teachers and students; and listen to their ideas and suggestions.

The interviews were loosely based around the following questions:

- Is the school's technological infrastructure adequate for the students and teachers needs?
- Is there access to the Internet, both from the telecommunications and hardware point of view?
- Are teachers using ICTs in their teaching? How?
- Do teachers receive training in the use of ICTs?
- Do teachers ask for training in the use of ICTs?
- Are there time slots assigned for teachers to take courses or receive training?
- Are there any specific requirements for the school, in terms of infrastructure and training?

The interview process revealed a common theme: the need for training in ICT use in the classroom, as opposed to just training in ICT skills. Once the interviews round was finished, the project proposal was presented and explained to the high schools principals, who provided comments and suggestions as to which areas were the ones that needed most work and how could this be implemented in the high schools. The transcripts from these interviews and meeting are shown (in the original Spanish) in Appendix D.

The local representatives of the Department of Education in the city of Cornellà agreed to support the project, and coordinated the contact with the five high schools of Cornellà that would participate in the project. It was agreed that the Hort Digital would be an official course, and part of the Department of Education training offer for the 2009-2010 academic year. This was a very important point, since the recognition by the Department of Education counts towards teachers' promotions and CV, and this was detected as a key motivation point during the interview process with potential participants.

The main objective of the Hort Digital project was to help high school teachers work and innovate on the use of computers in the classroom, using tools and applications freely available to everyone, and through which students and teachers (and in some cases the families and the community) could interact and share experiences and information. The project was designed under the assumption that by the end of 2011 all high schools in the area of direct impact (Cornellà de Llobregat) would have participated in the Educat 1x1 project (educat 1x1, 2010), a government-led initiative to provide technological equipment to primary and secondary education institutions across Catalonia, part of a wider initiative throughout Spain.

1:1 initiatives

During the pilot phase of the Hort Digital project, the Spanish and Catalonian governments were in the process of revising their educational policies; one of these policies was aimed at the "digitalisation of education": providing resources to schools, teachers and students, in order to take advantage of the new technologies available, such as digital whiteboards, digital textbooks and netbooks. This project was known as Escuela 2.0, and the specific Catalan initiative was called EDUCAT 1x1. This was later renamed EDUCAT 2.0. (Vilaweb.cat. 2011.)

Many countries are following the 1:1 trend (Weston, 2010), but in the specific case of Catalonia, it was not clear how many teachers were receiving the necessary training and guidance in implementing new technologies in their practice, or whether they knew how to turn these into "tools of the trade", seamlessly including these tools and devices in their teaching (and learning) process.

Pilot study: 2009-2010

The Hort Digital project involved three main elements:

- the course itself, which ran during the 2009-2010 academic year and took place in both physical and virtual spaces, through face-to-face sessions and online collaboration. The group

of participants was composed of 35 professors from 4 high schools in Cornellà: INS Maria Aurèlia Capmany, INS Esteve Terrades i Illa, INS Miquel Martí i Pol, and INS Francesc Macià.

- a virtual space, where teachers and facilitators worked in groups, synchronously or asynchronously, held discussions, and shared ideas and content, through a virtual space based on Ning, a free, Web 2.0, social-network tool. This approach had been previously used successfully in other Citilab projects, such as Seniorlab (http://seniorlab.citilab.eu/) and Learning Teams. A wiki (http://projectehortdigital.wikispaces.com/) was also created, in order to use it as a repository for the content related to all the tools that were being covered and other resources that could be useful. Two blogs were also published: one, public, about the project itself, to promote the Hort Digital project; the other one, as a log diary, for the team organizing and managing the course. Problems, observations, details on the running of the course or comments were collected there.

- a physical space, which served as an open laboratory for teachers and students; the Hort Digital was conceived as an open space, so it was not only used for face-to-face sessions, but also for one-to-one, individual meetings between the participants and the facilitators, in order to guide and help the participants in the design of their projects and activities, and clarify any doubts regarding the use of the tools and applications themselves.

The face-to-face sessions were structured as modules, so they were fairly independent in terms of content; activities and e-tivities (Salmon, 2002) were planned for each one. From the methodological and pedagogical point of view, the scaffolding approach was rooted in Vigotsky's theories. The sessions were led by three moderators, who took turns in leading the activities, demonstrating tools and taking field notes. They would also actively participate in the activities, helping the participants when they struggled with specific points, but at the same promoting peer learning and support.

As it is often the case in Living Labs, due to their nature, the users' suggestions and ideas made us rethink the original plan for the course, which was changed after the first session, and continued to change throughout the course.

The original planning for the contents to be covered in the project was based on several sources and our own experience with the PELICANS project. The modules were created during brainstorming sessions with the other team members, and focused on actions and needs related with information processing, such as organising, classifying, sharing, creating, and so on, resulting in a diagram similar to Couros' Networked Teacher:

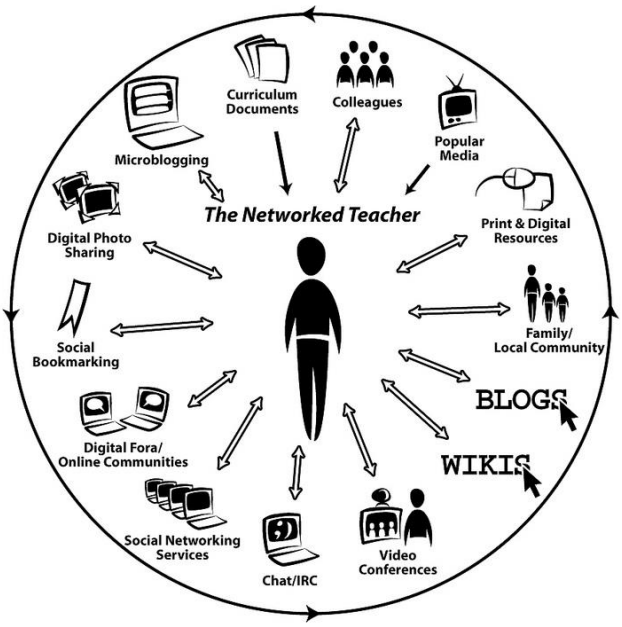


Figure 11. The Networked Teacher. Couros, 2008.
(https://www.flickr.com/photos/courosa/2922421696)

The modules were thus designed so collaboration and creation of information were covered at the beginning of the academic year (1st trimester); sharing and classification of sources during the 2nd trimester (microblogging and social bookmarking); and the 3rd trimester was mostly focused on multimedia: images, videos, audio, podcasts. This structure was also based on the evidence from the PELICANS project, regarding the ways students were using their PLEs, and the advantages they had identified. Thus, the modules were designed to highlight the potential

Web 2.0 services (and the PLEs based on them) provide for the organisation of information, learning new skills and creating and strengthening personal relations.

The final programme followed this sequence:

- Module 1 [October]: Social network – Ning
- Module 2 [November]: Wiki. Google Docs
- Module 3: [December]: Brainstorming. Review, planning of classroom activity
- Module 4 [January]: Presentation and discussion of activities.
- Module 5 [February]: *delicious* , YouTube
- Module 6 [March]: Video, video editing. Twitter.
- Module 7 [April]: Twitter. Images: Flickr, Picasa
- Module 8 [May]: Podcasting, Audacity. Audio feedback, user-created podcasts
- Module 9 [June] Netvibes, Pageflakes, Flock. Personal Learning Environments.

The physical space of the Hort Digital was where the face-to-face sessions took place. The course was designed so one session was held each month for each of the 4 groups of teachers. During the first 3 months the sessions were focused on what we considered the key elements for creating a learning community and fostering collaboration within the group: the social network platform and collaborative work tools.

In order to understand and try a closed social network, a Ning network was started, shared with all the teachers in the 4 groups. This way they could see and test the advantages of such an easy-to-start tool that allows easy and fluent communication among its users, and its possible implementations in their classrooms. Debates, pictures, videos, announcements and a blog were added to this virtual space and it was used as the main area of communication for the virtual area of the Hort Digital project.

Blogs, wikis and GoogleDocs were some of the collaborative work tools that were tested together with the teachers, so they could compare them, see the differences, and decide when and where to use them.

The scaffolding approach helped some of them overcome their fears of technology, and the work in small groups allowed the moderators to work closely with the participants, so they

could work at their own pace, focusing on their own subjects and interests, and at the same time being able to share their experience with their colleagues.

The best example of this is A.N. (female, age 57) who the very first day declared that she would go at a slower pace because she barely knew how to access her email, and apologized in advance for the problems she would cause. During the second session, we asked them to describe their "ideal" tool, the one that would fulfil a specific need they had, even if that service did not exist. She went on to describe essentially Google Docs, a tool she had never seen before. When she saw it, it was what we called the "magical moment" (which we would see again, several times during the life of the project, with different participants).
She started using it and soon was able to materialise her plans for activities in the classroom using this service; later, she also tried wikis, and by the second half of the course she was not only mastering these and other applications, but also became the class reference for questions and doubts about them. She was one of the participants that asked for additional editions of the course and one of the organizers of the creativity workshop that emerged from one of the brainstorming sessions in the second edition of the course.

The 3rd module included a brainstorming session with the participants, in which they discussed their points of view, needs and proposals. The reason this session was not done earlier is because it was decided to wait until the community was established and they were comfortable sharing their ideas and expectations with the group. Another purpose of the activity was to motivate the participants to start identifying their interests and the areas in which they wanted to develop the classroom activity. For the brainstorming session, each of the four groups created a poster listing the group's needs, and what kind of activities they would like to try or implement in their classrooms. The emphasis was on the ideas and proposals, rather than on the ICTs.
The results of the brainstorming activity, one for each of the groups that participate in the Hort Digital course, were added to the Hort Digital's wiki and summarized in a table, so all the groups could read the needs and proposals. A new column ("suggestions") was added to the table, so they could work as a team and help each other find the appropriate tools and approaches.

The main points that emerged from the brainstorming sessions were:

Needs:

- Share resources with other teachers;
- access to ICT tools in the classrooms;
- personalized feedback for the students;
- spaces for collaborative work;
- control and management of the classroom;
- involvement of parents and other members of the community in the teaching and learning process;
- increase motivation and participation;
- upload and share study materials with the students, and also user-generated content.

Proposals:

- Less students per class (16 being the suggested ratio per classroom);
- group activities; roleplaying;
- use of media (video, audio, etc);
- brainstorming sessions;
- shared resources;
- social network for the class;
- synergy between subjects.

Suggestions: (Made by the teachers on the wiki after the brainstorming session)

- Use video to motivate and promote discussions;
- training of teachers on digital skills and competencies;
- show solutions to exams and homework on a forum, and discuss with the students;
- work on writing and texts, to improve vocabulary and spelling;
- use online tools to help with attendance lists and classroom management, collaborative activities that involve the students and the teacher;
- take advantage of the interactivity provided by online, social applications and tools;
- promote co- and peer- assessment.

These suggestions were incorporated in the re-design of the content of upcoming modules and the overall structure of the sessions; some of the suggestions were not feasible, as they fell outside our possibilities, such as reducing the number of students per class. In that case, we explored options for allowing teachers to work with big groups and still maintain a personalised approach. For example, peer assessment, the social network, and elements of gamification were all tried with this goal. The use of forums and creation of FAQ helped answer doubts and questions, not only by the teacher but also by the students themselves.

Starting on the 4th module (January), teachers submitted a proposal for an activity in their classrooms, using some of the tools and applications that had been discussed, and that they felt could help them develop their ideas. After this session, the participants attended personalized sessions to work together with the facilitators on their proposals, identify potential problems or requirements, or learn new tools they needed to add to their "toolkits" in order to develop their projects. This exercise helped them visualize the goals and objectives they were trying to accomplish, and reflect on their skills and tools.

There was a wide range of proposals, which are shown on Appendix E. Most of them were based on one of the three main “hubs” that had been shown as options for centralising activities and online interaction of the participants: blogs, wikis and the social network platform (Ning during the first iteration, which later changed to gr.ou.ps, Posterous or Edmodo, depending on the choices made by the teachers, and the specific needs and characteristics of their groups of students).

The subjects also covered a wide range of fields, and it was interesting to see the same tools applied to different contexts. There were initiatives to use video for learning French, for demonstrating Chemistry experiments and for showing first-aid techniques in Physical Education. Blogs for creating virtual exhibitions of the pieces created in Arts, or to keep a log for a Science project. Wikis were used as the support for an e-book created by the students of Catalan Literature, or as the means to document a robotics project for Physics.

Starting on the 5th session, a number of other tools were introduced in the context of activities and e-tivities (online activities), so teachers could learn and practice with these applications

before adopting them and implementing them in the classroom. For example, an activity involving *delicious* was carried out both in the face to face session and online, and after that teachers started thinking about ways in which this tool could be used for creating a center of shared references and resources for the classroom, or as a means of keeping in touch and sharing information with their colleagues. The same approach was followed with other tools, some of which have been suggested by the teachers themselves, such as in the case of Twitter. The main goal was that, in this way, the teachers would create bit by bit a "toolkit", a set of personal learning and teaching support tools – their PLE. In this way, teachers create PLEs, so they can use the acquired knowledge and skills in their teaching, and furthermore, guide their students in building their own PLEs.

One of the core tools that was developed and used in both projects included in the study, and has since been adapted to other contexts, is a strategy based on the way learners interact with information. It was designed to help them identify their needs related to managing information, offer some solutions to classifying and organising information, and it also provides a structured approach to adding new services and tools to the teachers' practice, teaching, and learning.

A Personal information management strategy

The first step is to identify the main activities, channels and tools related to the flow and management of information in the personal, academic and professional lives of the learner. The actions and verbs used to describe these usually fall into one of the 6 categories described by Alter (2008): capturing, storing, retrieving, manipulating, sharing and transmitting information.

The proposed information management strategy focuses on five of these actions; transmission of information is usually not done directly by the users themselves, but is inherent to the actual flow of information. Storing and retrieving are usually seen as one, and associated with the idea of classifying and organising information. This makes sense, as Alter's definition focuses on the technological aspect of information systems, which take into account

infrastructure and telecommunications ("transmitting") and databases ("storing" and "retrieving"), which for the most part are not evident to the average user.

The device and service convergence phenomenon means that nowadays a single device (such as a smartphone or a tablet) is able to perform functions that in the past were carried out by several devices. The current generation of mobile devices are able to perform the equivalent functions of mp3 player, digital camera, web browser, email, video recording and viewing, calculator, watch and several more, depending on the model.

The strategy proposed here may be web-based or app-based, and thus not dependent on the type of device being used. It is easy to set up, even for beginners, and the benefits are readily seen.

The strategy is outlined as follows:

- The user chooses several online sources of information such as Websites, Blogs, Newspapers and identify their RSS feeds.
- The RSS feeds are collected and channelled through an RSS reader - Feedly, for example.
- The information collected through the feeds is read, reviewed and/or analysed, and the information that the user considers as relevant or important, and needs to be stored is saved on a social bookmarking service, such as *delicious*.
- Links and references are organised and classified using tags.
- Some of the information may also be manipulated, by associating it to other pieces of information, adding a personal opinion or point of view, or reflecting on it.
- The information can be shared as it is, or after having been manipulated, through blogging or microblogging.

This process can be simplified by automatising some of the steps. The free web service IFTTT (If This Then That) works using "recipes": easy to set (or in some cases pre-set) instructions that connect Web-based services. IFTTT can thus be used to connect the user's Twitter and delicious accounts, for example, or Facebook and delicious. Thus, when a user's Tweet (or Retweet, or Facebook post) contains a link, it is automatically stored in their

delicious account, under the assumption that if the user wanted to share that information, they might also want to save it and classify it for future reference.

The benefits of this strategy are numerous, as it helps new users with several tasks: building a PLE and a PLN; create and maintain an online reputation; establish new connections and thus have access to new resources and references; create an online library of resources that can be used for reference in the future. Several steps of the information management strategy are automated, thus making it easier for beginners and removing the need for keeping track of several tools simultaneously.

In the Hort Digital course, it provided structure, and allowed participants to gradually add elements to their "toolbox" (as they envisioned their PLEs). The strategy became richer and more complex as they discovered and use RSS feeds, wikis, and other resources recommended by their peers and the facilitators. This connected with social bookmarking in Module 5 and with microblogging in module 7, and resulted in an approach that by module 9 (and the end of the course) was identified by most of them as the foundation of their PLE.

First iteration: 2010-2011

The pilot for Hort Digital received very positive evaluations by the participants (Appendix F); with the continuing support of Citilab and the Department of Education, it was decided to offer the Hort Digital course (first level) again during the 2010-2011 academic year. A total of 18 teachers participated in this course, divided into two groups of 9 participants each. There were also two groups of teachers from a school in Barcelona, who asked for the sessions to take place at their workplace. In total, the first level was run for 36 teachers.

An interesting fact is that, although there had been no plans to organize a second level of the course, some of the participants in the pilot asked to continue with their training. Thus, a brainstorming session was organised, in which the participants themselves proposed topics and approaches for the second level course. This course was called Hort Digital II.

Hort Digital II

As explained above, Hort Digital II started as an initiative by some of the participants in the pilot, and so it was designed for the users and with the users, following a Living Lab approach. The second level consisted of the same number of sessions, 9, some of which would go deeper into some of the aspects that had been discussed in the first level, and some that would focus on new material. The total number of participants in this course was 13, as not all the teachers that participated in the pilot decided to continue their training.

Both levels were certified by the Department of Education, with 60 hours each.

Second iteration: 2011-2012

During the third, and last, year of the project, there was no first level course, for several reasons: budget cuts, changes in the education policies at regional level, and an increase in the cost that was to be covered by the participants. All this also led to the decision to end the project. Nevertheless, participants from the 2010-2011 iteration asked to continue their training in Hort Digital II, and some of the participants from Hort Digital II proposed the creation of yet a third level, Hort Digital III. So the second and third levels were run for one last time, and the first level was effectively cancelled.

Hort Digital III

Hort Digital III was, again, an example of initiative, motivation and interest; this time, the participants (a total of 5, plus the three facilitators, which also took on the role of participants for this level) were asked to take a more independent role, with each one facilitating a session on the topic of their choice. Thus, the participant-facilitator roles were blurred, and the sessions became an open forum for the sharing of ideas, experiences and knowledge, while providing a space for the teachers to continue trying new applications and devising ways to embed those in their practices. Some of the topics covered were basic skills and competences, augmented reality, mind maps, evaluation and assessment, project-based curricula, publishing tools, with a final session for reflection and wrap-up.

Chapter 4 - **Results and Discussion**

The results are discussed by first presenting an analysis based on the PELICANS data, which focuses on the students' point of view, and then focusing on both the teachers' and students' perspective, obtained from the Hort Digital project. Both are based on the coding categories elicited from the analysis of the data, which was discussed in Chapter 3.

PELICANS

What follows are extracts from the surveys and interviews carried out in the context of the PELICANS project, grouped according to the coding categories.

Evidence of PLEs as organisation and management tools

Most of the students reported a sense of chaos and confusion regarding the wide range of Web 2.0 tools and the need for some way of organising them: "there is such an overload of tools today that we need some kind of organiser for them". The PLE approaches gave them suggestions and ideas, and most of them came up with some way of managing the applications and tools. In this sense, building a PLE gave them a way of structuring their digital identity and tools. As two of the students noted, "I really support the use of PLEs, because it can help me to share information and exchange many things through the web 2.0 tools", and "[a PLE] is an easy way to manage and organise all the information I get from online sources, and also offline ones". Flock was repeatedly mentioned as a useful tool for centralizing the applications and offering a one-stop access to them, and at the same time a way of dealing with logins and passwords, as the following comment shows: "Flock has taken it to another level for me, by centralising all my different [web] stops that I do in one page".

Most of the students took into account non-digital components as part of their PLEs, and also noted that the tools included were not only academic. As one of the students noted, "this is not only my PLE but also my PEE (Personal Entertainment Environment and PSE (Personal Socialisation Environment)" which points to the fact that he did not see a clear division

between academic and social activities, and was also evidence that his learning process went beyond the walls of the institution.

Some of the advantages mentioned by the participants were:

- PLEs give them the ability to organize and manage data and contents, as well as the access to new sources of information, and the tools and applications they use to access them: "PLEs increase my level of learning opportunities, as I don't miss anything in [the] news' perspective".
- Using a PLE gave them the chance to integrate the tools they were more comfortable with and the new tools they were being introduced to, and that seemed to be potentially good resources.
- A PLE helps in filtering information, allowing them to pick out only the most valuable information.

Evidence of strengthening social interactions

The social element was one of the most important aspects of Web 2.0 tools, according to the students' opinions. According to them, the collaborative approach followed in this class through the use of the wiki and blog, together with microblogging and social bookmarking increased the learning opportunities and the availability of useful resources. By sharing information with their peers, they could help them in their learning process, and in return get additional resources and information on applications they did not know about, thus creating a network that would extend beyond the university and onto the professional world: "*I am developing a network that most probably will become extremely valuable in the near future*" reflects this fact. Other comments regarding the creation of a network and developing social interactions with their classmates and the teacher were: "*what I like the most about all these Web 2.0 tools is the ability to get inspiration, knowledge and to be able to interact with other people*", and "*the social element has had a large impact in my learning process, helped me to create stronger links with classmates, friends and teacher because you interact more and put your opinions forward*".

Two of the highlighted advantages of PLEs regarding social interactions were:

- PLEs gave them the ability to share and discuss different points of view, following the fact that Web 2.0 tools seem to be ideal tools to collaborate, and share and create knowledge.
- There was an ongoing exchange of ideas with fellow students and teachers taking place in class, but also outside of the learning institution, through the discussion of concepts that was taking place online.

Evidence of learning and developing skills

Although some of these students were familiar with Web 2.0 applications, for the most part they did not realize they could use them in their learning process. A high percentage of them (about 65%) were Facebook users prior to the beginning of the study, but none of them had used Twitter or *delicious* before, or any other microblogging or social bookmarking tools, as noted by one of the students: "I have been introduced to tools I do not think I would have been using already now, if it was not for this project". They did use blogs as a source of news (mostly on entertainment, news or specific interests), but very few of them knew what RSS were or how to use them.

There were many comments regarding the effect PLEs had on their learning process, and the skills developed as a consequence of building a PLE: "a proper working PLE decreases the level of stress and increases the opportunities to learn"; "a well-developed PLE can lead to enhanced (autodidactic) learning", and "[PLE] has changed my personal learning process".

Some of the benefits they reported were:

- Web 2.0 tools made the learning process more dynamic and interesting
- it helped them in transforming information provided in class and course textbooks into knowledge, as discussions forced them to reflect on the concepts covered in class
- the fact that they could use their PLE not only in a formal context, but also outside the school, where –in their own words- "a lot of the learning takes place".

Disadvantages and recommendations

The users were also asked about any particular problems and obstacles they might have found during the pilot study, in order to collect information that could later be used to change the methodology used in the study, and could inform future iterations of the study. Following is a

summary of the main points they mentioned, and some of their suggestions to improve the methodology.

- The activities can sometimes be confusing – a "big picture" is required from the start.
  This is still a difficult issue to tackle; the discussion of PLEs as a concept at the beginning of the study was avoided on purpose, to avoid leading the students in choosing one of the framework approaches, thus limiting their creativity and options. It seems that more guidance and support might be needed during the initial phase of creating accounts and trying the tools.

- "Creating a PLE can be too time-consuming."
  This of course depends on the approach and the applications chosen, and the student's experience, but it might indeed be a complex task. It is important to explain the advantages of an organised environment, and that the benefits outweigh the disadvantages. Self-reflection exercises may help students realise the potential of their PLEs.

- "Some tools cannot be tailored to the users' needs."
  This comment was made with reference to Flock´s limitation for adding tools other than the ones already provided with the browser, as well as the limited tools found in Google sites. There is no easy solution to this, and although efforts are being made to develop widgets and applications that are more flexible and can "communicate" with each other, there is no "perfect" tool. The convergence phenomenon and smartphones could provide an answer to this issue.

- Interoperability.
  Some tools do not "speak" to each other, which makes it hard to integrate them into one environment. As with the previous comment, this is a technological issue that we hope will be solved in the near future. As of today, though, it is up to the students to find those tools they feel more comfortable with and that can be adapted to their needs.

- Adoption problems.

  These were mostly related to student's experience with technology and Web 2.0 tools. Context helps and, whenever possible, the use of the tools and applications that make up the PLE should be related to their experience and environment.

- PLE might lead to distraction and procrastination.

  This is, according to some of the students, a consequence of mixing academic and "fun" tools. Students still see a marked difference between these two environments, as reflected by one of the comments: "the Facebook approach [to PLEs] is 'too social'"
- Technology issues.

  This was mainly mentioned in reference to system failure (down time) of some of the tools, like Twitter. They also mentioned the lack of support and the differences between the tools – while some of them are easy to learn and adopt, other tools require more time and practice. This, again, reflects their different backgrounds and experience with this kind of applications in the context of learning.

Personalisation.

The students seemed to like the range of options available to them and the fact that they could choose the applications that better suited their needs, and adapt them to some degree: *"I took the tools that I liked the most and the ones I thought would help me more while studying, and in that way now I think I know and I feel better when researching and learning from different topics."*. They also saw value in being able to take services that they were already using and integrating them with some of the new tools they had discovered: *"By combining my already customised iGoogle with Flock, my PLE provided me with nearly everything I needed for private and study purposes."*

They also acknowledged the fact that the approach helped them learn in a more independent fashion: *"What is nice with PLEs is that you can organize the tools after how you want them, and by that you can learn in your own way, the way you are structuring them."*

Dynamic nature of PLEs

The participants realised that PLEs are constantly changing, in the form of updates, new functions, new tools that become part of it or tools that stop working or are shut down: *"This conception of what I believe to be useful to me changes though, which means that every now and then I will remove an element from my PLE, or add one to it. This could be because I had a tool 'on trial' which turned out not to be to my liking, or because I learned about something new that would add real value to my PLE. Another possibility is that my view about a tool has changed since having heard about it."*

During the study they discovered new tools, and sometimes adopt one just to stop using it later in favour of another service that better adapted to their needs. They showed, for the most part, a remarkable ability to learn new tools without having to be guided through the learning curve, thus matching Prensky's view of Digital Natives. But it was the wider view of the PLE concept, the integration with other tools, the peer learning and collaboration and the teacher's guidance what really helped them move through a range of applications without major obstacles: *"The huge part that has changed in the way we have done things during this course is how we communicate what we are learning, and how we discuss this among us. I believe this will become the future of how learning and most of all how teaching will be implemented. A larger wave of integration in the learning will come out of this PLE and web 2.0, and I think the teacher will evolve into a facilitator more than an autocratic teacher telling us what to do."*

A phrase that sums up their view of technology in today's society and reflects our view of the role of technology in the classroom is the following:

"How can you not use Web 2.0 tools in the current Internet environment? That is really the question."

An interesting case was A.L., male, age 20. In his response to the questions (via email), he did not seem to think he had actually created or developed a PLE:

"*I have not built PLEs and I have never used it – none of the four approaches."*

"PLEs have not changed my learning process, obviously because I don't use them."

His answer to question 2 (How did the PLE concept help working with so many different tools?) was "*Don't use it, therefore didn't help*."

To question 3, How did the PLE + web 2.0 helped in the learning of the subject's contents? (as opposed to learning in general), he answered "*PLE didn't help in any way. However web2.0 tools did*." This pointed to some confusion as to what a PLE actually was; interestingly enough, this was one of the most active students in class, both during the sessions and online, and he was also an advanced user of Firefox, using add-ons and plug-ins to tailor it to his needs: "*I am still using web 2.0 the way I used it before. My browser, Mozilla, is, as if, specifically made to adjust to my needs*."

He did appreciate the fact that he could learn from other users in applications such as Twitter: "*i even kind of "left" school in order to read my online stuff....just amazing articles....and i prefer them than studying for exams and projects..and it is all THANKS TO TWWWWIIITTTTEEEERRRRRRRRRRRRRRRRRRRRRR....The POWER of sharing Yeah, so happy, really, impressed*"

This reinforced the initial approach: introduce them gradually to different services and applications, guiding them in the creation of their PLEs while not discussing the concept until later in the year. This way, students do not feel the pressure to choose one of the framework approaches and are free to come up with their own solutions and combinations.

HORT DIGITAL

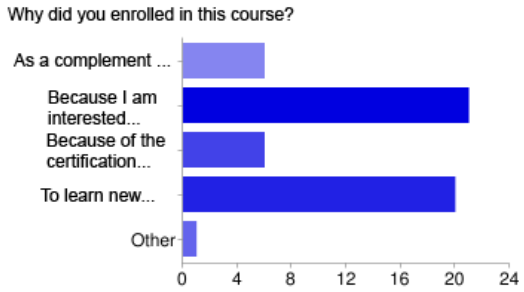
Teachers' point of view

As part of the work done during the Hort Digital project, surveys were conducted, both on participants and their students - actors and end users of this training - to learn their level of satisfaction and learning acquired, and to assess the effectiveness of the course and its contents. Below is a summary of the responses obtained from these surveys. The questionnaire applied was designed so that it covered the following points: motivation of participants, level satisfaction regarding the training received, the methodology used and the contents, evaluation of teachers, applicability of the contents during this school year and interest in continuing the training, among others. The total number of answers was 25.

The results are presented and discussed below:

Teachers survey

Question 1.



As a complement to previous training	6	24%
Because I am interested in the application of ICTs in the classroom	21	84%
Because of the certification	6	24%
To learn new skills and knowledge	20	80%
Other	1	4%

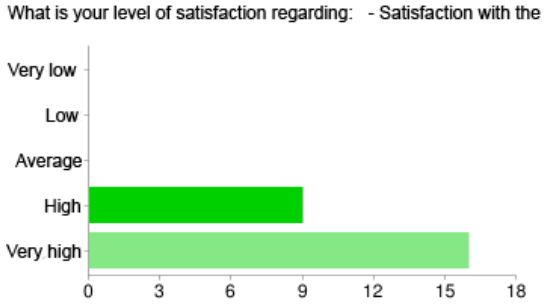
People may select more than one checkbox, so percentages may add up to more than 100%.

Question 2.

What kind of possibilities did you see for applying ICTs in the classroom BEFORE **taking** this course?

- *I only used the Internet to search for information and proposed exercises to the students that they could carry out in class with the help of computers*
- *Access to information*

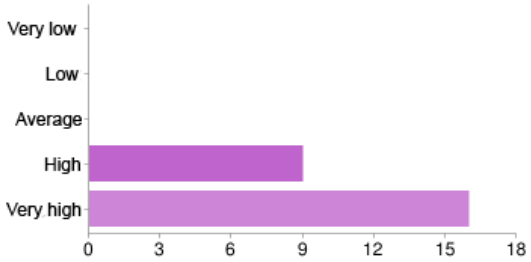
Question 3.



Very low	0	0%
Low	0	0%
Average	0	0%
High	9	36%
Very high	16	64%

Question 4.

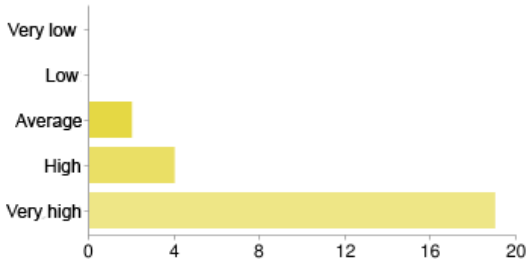
What is your level of satisfaction regarding: - Satisfaction with the contents



Very low	**0**	0%
Low	**0**	0%
Average	**0**	0%
High	**9**	36%
Very high	**16**	64%

Question 5.

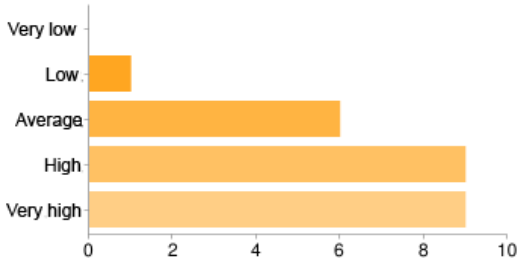
What is your level of satisfaction regarding: - Satisfaction with the contents



Very low	**0**	0%
Low	**0**	0%
Average	**2**	8%
High	**4**	16%
Very high	**19**	76%

Question 6.

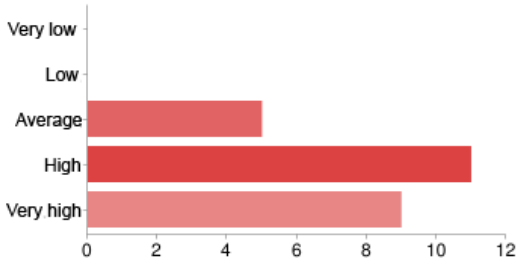
How would you rate the contribution of the following activities to your learning process? - Development of a practical application or project



Very low	**0**	0%
Low	**1**	4%
Average	**6**	24%
High	**9**	36%
Very high	**9**	36%

Question 7.

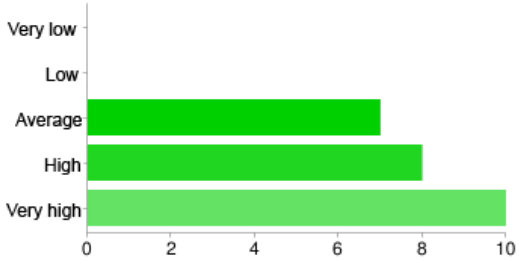
How would you rate the contribution of the following activities to your learning process? - Personalised sessions and tutorials



Very low	**0**	0%
Low	**0**	0%
Average	**5**	20%
High	**11**	44%
Very high	**9**	36%

Question 8.

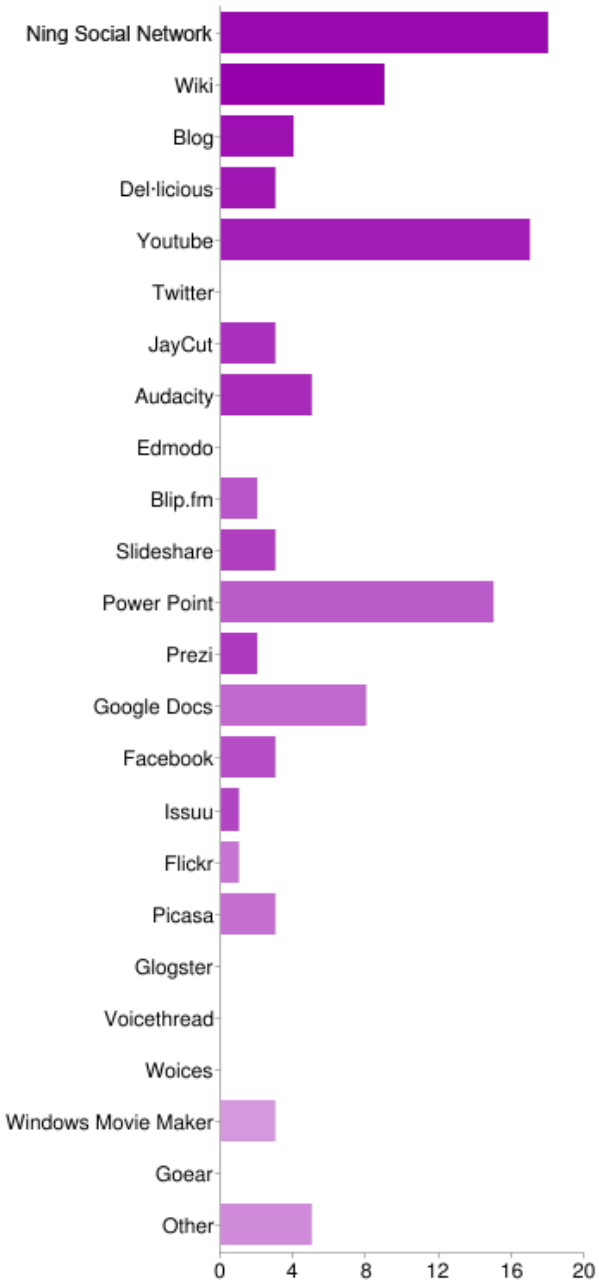
How would you rate the contribution of the following activities to your learning process? - Use of a virtual space, Ning



Very low	**0**	0%
Low	**0**	0%
Average	**7**	28%
High	**8**	32%
Very high	**10**	40%

Question 9.

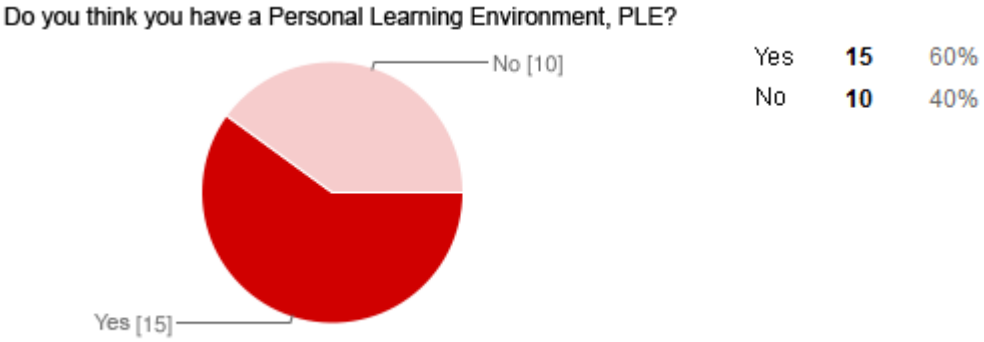
Select the tools and applications that you used with your students during this academic year



Ning Social Network	18	72%
Wiki	9	36%
Blog	4	16%
Del·licious	3	12%
Youtube	17	68%
Twitter	0	0%
JayCut	3	12%
Audacity	5	20%
Edmodo	0	0%
Blip.fm	2	8%
Slideshare	3	12%
Power Point	15	60%
Prezi	2	8%
Google Docs	8	32%
Facebook	3	12%
Issuu	1	4%
Flickr	1	4%
Picasa	3	12%
Glogster	0	0%
Voicethread	0	0%
Woices	0	0%
Windows Movie Maker	3	12%
Goear	0	0%
Other	5	20%

People may select more than one checkbox, so percentages may add up to more than 100%.

Question 10.



Question 11

If your answer is "yes", how does the PLE help you organise cointents and resources, create new connections or strenghten the ones you already have, and learn new skills and abilities?

- *Until recently, my PLE was books and videos, luckily I have now begun to enrich it with digital tools. But I need to make better use of these ones, I still need to learn how to organise and manage them.*
- *It has helped me innovate day after day, and learn. It is a lot of work, but it is worth it in the long run. Lectures are less and less the main component of the learning process, and thanks to the PLE concept, I can see that learning to learn is becoming more important*

Question 12:

Do you have plans to, or have you already helped your students creating their own PLEs?

- *After learning about PLEs, I think they should be considered as a tool for next year's students.*
- *I would like to help them create their own PLEs*

Question 13

Which potential do you see for the use of technology in the classroom after taking the Hort Digital course?

- *For now, it is another tool that I can use to work and communicate with my students. Since it is closer to them, it can facilitate communication and work, among them and with myself. It also allows for the joint creation of content, changes the way communication and information flows in the group.*

- *A lot of potential, because I think it motivates students to participate, increases creativity and empowers students in their learning process.*

- *It is the future. But we should improve many things in schools to carry out this kind of activities in class, because otherwise all the work will have to be done at home and perhaps we will lose the interest and attention of the students. "*

- *We work closely together with the students, there is more communication,we learn to apply easier and more engaging techniques"*

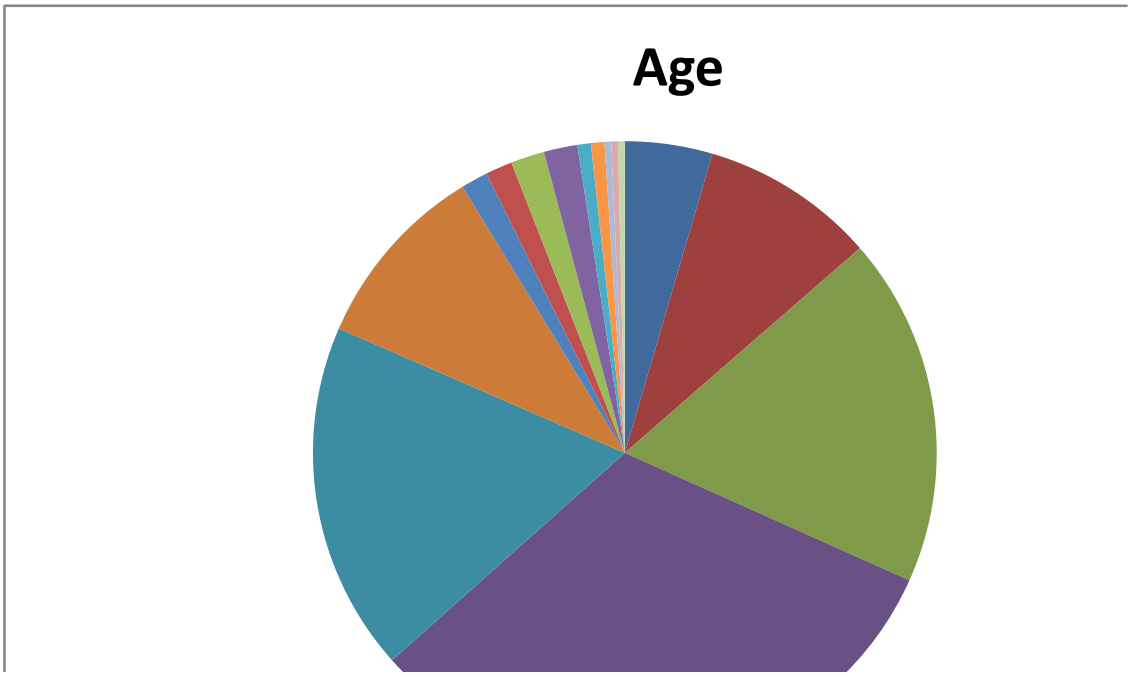
- *I have been using these tools for years, but only now I feel more capable, I have more resources and I have more interest in researching and planning new activities. I also feel more creative.*

These results show a high level of satisfaction with the course and with the creation of learning environments, whether they are shared or personal, physical or virtual. The teachers value the methodology and the knowledge and skills acquired. It also reflects the strong motivation and involvement by the participants. This is shown through the relatively high number of activities designed and developed using multiple ICT and web tools CAT, and the express desire of 100% of the respondents in continuing their training with a second level of the Hort Digital course.

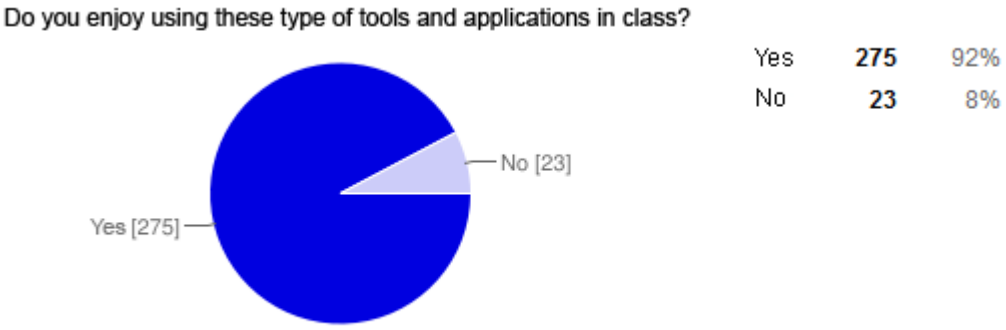
Students' point of view

The following survey was conducted among the students who had been involved in activities designed by their teachers and that made use of ICT and web tools. The total sample was 296 surveys, from a variety of levels, both at high school and vocational training. Below are the most significant results and a brief analysis of some of the issues surveyed.

<u>Question 1.</u> Age

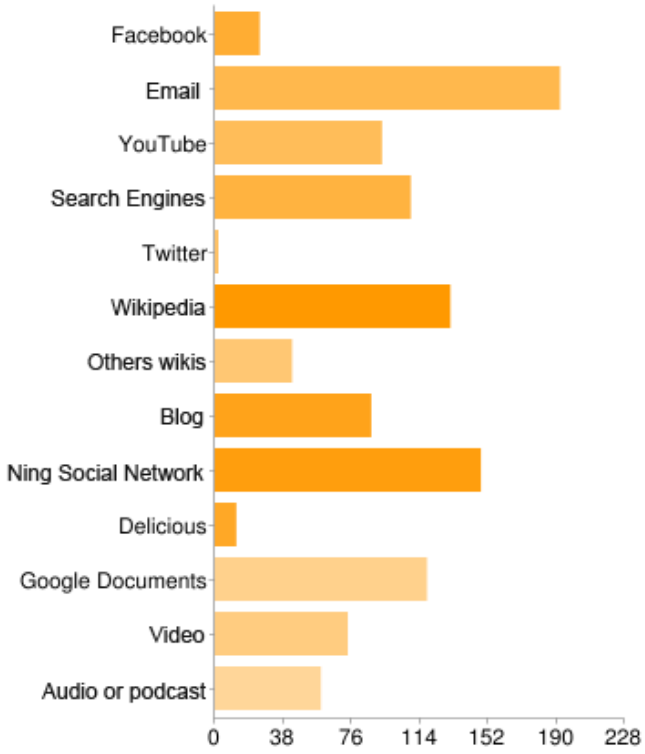


Question 2.



Question 3.

Which of the following tools and applications have you used in the context of this class?

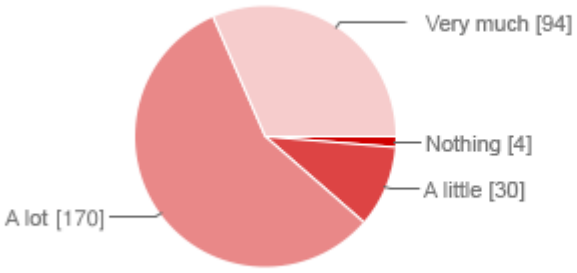


Facebook	**25**	8%
Email	**192**	64%
YouTube	**93**	31%
Search Engines	**109**	37%
Twitter	**2**	1%
Wikipedia	**131**	44%
Others wikis	**43**	14%
Blog	**87**	29%
Ning Social Network	**148**	50%
Delicious	**12**	4%
Google Documents	**118**	40%
Video	**74**	25%
Audio or podcast	**59**	20%

People may select more than one checkbox, so percentages may add up to more than 100%.

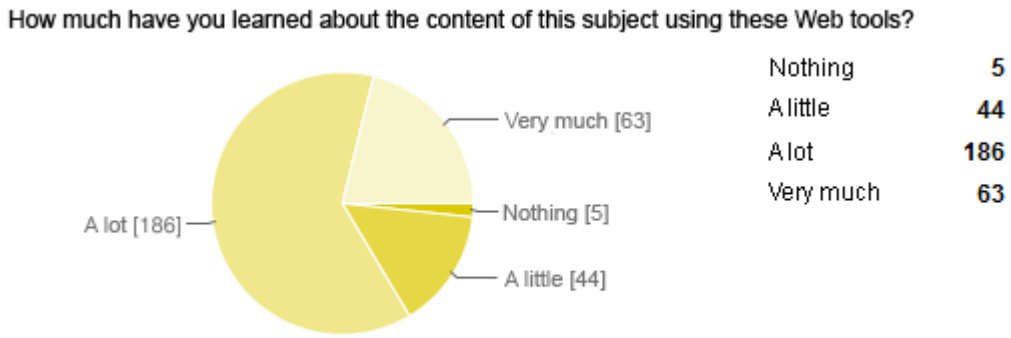
Question 4.

Have you enjoyed working with these Web applications in this subject?

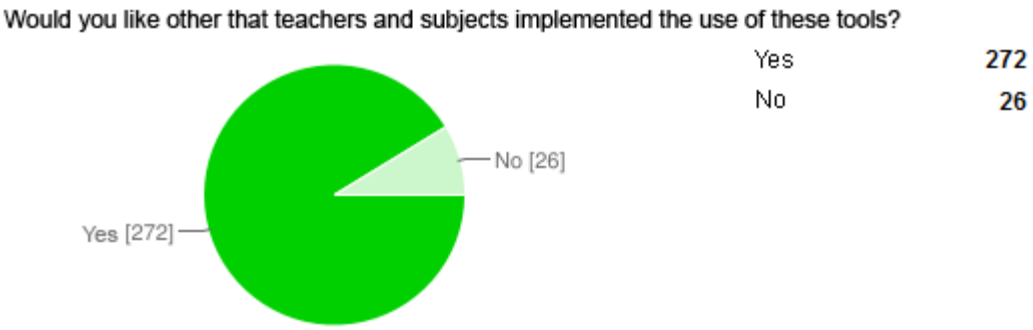


Nothing	**4**
A little	**30**
A lot	**170**
Very much	**94**

Question 5.



Question 6.



Question 7.

What is your opinion about the use of these web tools and applications in this subject, and what comments and suggestions would you propose?

I think it is a good tool for using and working in class, because it makes the subject more dynamic, and we are not only working with books.

I have enjoyed using these tools because it is a different way of studying, and breaks the monotony. I would like to keep using this approach.

I think it is important, since these tools are more and more common in our lives, and it is necessary to keep up with changes.

These results show that a large number of students, based on their experience during the life of this project, believes in using technology as tools for learning and would like to incorporate

this way of working in other subjects; more than 75% of them have experienced learning using technological support and note that this promotes new dynamics in the classroom, and increased motivation.
The full results of both surveys are shown in Appendix D.

The Hort Digital project from a Living Lab perspective

As discussed in Chapter 3, Living Labs are structures in which researchers work collaboratively and closely with end users in real environments, so the proposed solutions can be validated by them, and shed light on the significance that these new technologies have for both individuals and groups of people.

The Hort Digital project followed closely the usual protocol for developing Living Labs:

1. Analysis of the project. The Hort Digital project fit both with the objectives of the country-wide project that was being deployed at the time, Escuela 2.0, and the goals of Citilab, a foundation created for open innovation and citizen participation. The institutions provided the infrastructure and human resources, while the regional government supported the project with an official certification. In this sense, the project was an answer to the requirements and needs of the end users.

2. Propose changes to encourage innovation by users (user-driven innovation).

The users were included in all the phases of the project, including the initial stages of planning and design; this helped define objectives and allocation of resources, as well as elements such as frequency of sessions, duration, number of participants per course, technological elements and expected outcomes. The final version of the course was the result of interviews with representatives from the 5 high schools that would end participating during the project's lifetime, and incorporated their suggestions and requirements.

As user involvement was continuous, since they were actively participating in the sessions, during a whole academic year, there was a constant stream of ideas and suggestions, most of which were tested and incorporated in the design of the course. The users' involvement led to the design and execution of two additional levels that had not been included in the initial proposal.

3. Assessing the impact of changes in project results.

The results of the project were being assessed after each major milestone (end of pilot study, meetings for preparation of successive iterations, co-creation and organization of workshops, proposal and development of two additional levels for the course), where benefits to users were identified, changes were proposed and implemented, and dissemination of the project and its results were planned. The team participated in several conferences at Spanish, European and international level, where the results were presented and discussed with the wider research community (EDEN 2009, EDEN 2010, The PLE Conference 2010). The project was chosen as one of the key innovation projects in Catalonia in 2011 (Citilab, 2010).

As mentioned before, a Living Lab typically has five main features – all of these were present in the project:

- The users are co-creators: as discussed in the previous section, user involvement was continuous and led to several points of improvement for the project. One of the most important ones was the co-creation of additional levels for the course, something that was not in the original proposal for Hort Digital.

- Specific methodologies are used for integrating the user across the entire process of innovation: the sessions were run in the form of workshops, with active participation by the users. Several techniques were used, such as brainstorming sessions, work in smaller groups, projects, show-and-tell sessions, peer learning, and round tables. From the point of view of research, this involved a mixed approach that included ethnography and action research, and used several techniques for the collection of data, such as observation, field notes, surveys and interviews.

- The technological infrastructure necessary to allow user participation is available: Citilab was supported by the i2Cat foundation, which provided access to fast Internet

connection and wide broadband. Digital whiteboards, laptops and WiFi connection were available, and the room in which the sessions took place was designed in such a way that furniture could easily be rearranged to configure the space according to the nature of the sessions taking place. The schools that participated were part of the Educat 1x1 project, which include laptops, Internet access and in some cases digital whiteboards. Nevertheless, even where conditions were not ideal, the methodologies and approaches developed in the context of the project were successfully applied in the educational settings.

- It has a local approach: it takes into account specific regional and social characteristics. This was one of the main characteristics of the project, and something that was incorporated from the very beginning. The impact was local by design, but the dissemination plan helped taking the project results and benefits to other communities. The methodologies and techniques were adapted to the individual conditions and equipment of the schools that participated.

- It is sustainable. The pilot study was supported in its entirety by the institutions that collaborated, which provided infrastructure, connectivity, human resources and the resources for the dissemination plan. During the first iteration, and with the intention of moving towards a sustainable mode, the institutional support was cut down by 50%, and the remaining 50% was covered by the participants, directly or through their own educational institutions. In the final iteration, two of the five groups were able to cover 100% of the expenses of participating in the course.

Living Labs are usually based on qualitative research techniques, and that was also the case of Hort Digital. It can thus be considered one of the first Living Labs focused on education.

PLEs and lifelong learning

The duration of the research allowed sufficient time to conduct follow-up interviews with some of the participants in the PELICANS study, now young professionals in diverse areas related to business, such as finances, marketing and management. While the number of answers is not enough to draw conclusions (just 15% of the number of participants), it does

provide some empirical evidence to support the idea that PLEs could be used to support lifelong learning activities.

The semi-structured interviews were focused on three main aspects (the full interviews may be found in Appendix H):

- Whether the introduction and use of the PLE concept and the activities around the creation of it had proven successful when carried on to their professional lives
- If yes, could they provide specific examples related to skills, management of information, social interactions, any other? If no, why?
- Any other comments about the applicability of their experience in their professional field and/or further learning

The respondents were unanimous about the positive aspects of their learning experience around and using PLEs during their degree. One of them noted that "an advantage of having been an early adopter of these technologies helped me understand network dynamics and the motivations behind people's use and sharing of information". For another participant, the use of Web 2.0 tools and services in the context of the study allowed her to more easily transition "from using widely available applications to the corporate proprietary tools" and "was and still is a great help in building my knowledge and capability base".

Professional environments seem to have somewhat limited the use of some of the components of their PLEs. As one of the interviewees explains, "I have not been able to apply the tools at work, due to the internal IT structure and system, [but] I have been able to apply those tools in my private life, mainly to save time and stay more organised. The awareness [about] and ability to create/use a PLE helped me immensely during my MBA studies." He goes on to say that his PLE "[...] not only allowed me to stay connected with my study colleagues and enhanced the work with my team members across the globe, through collaborative work, but also eased research activities and simplified all administrative tasks."

These results point to the potential of PLEs for both lifelong learning and application on a professional level, and opens up avenues for future research.

Chapter 5 - **Conclusions, recommendations and future research**

The purpose of this chapter is to summarise the results of the research by proposing a methodology to help teachers and learners in the understanding, development and application of PLEs. The analysis of the results and the conclusions extracted from them aim to answer the research questions:

- How can PLEs help the learning process in a formal education environment?
- How can PLEs help practitioners in a formal education environment, both in their teaching activities as well as in their professional development?
- How can PLEs be used by learners to support lifelong learning?

Through the course of the research, and by means of the two projects designed and implemented in order to provide the necessary contexts for the study, a set of guidelines were developed with the intention of helping both learners and practitioners in the use of PLE to support their learning, and in the specific case of teachers, their practice. These guidelines are explained below:

Guidelines for helping learners develop a Web 2.0-based PLE

1. Focus on the What and Why, not the How. Suggest that students explore and propose different options for Web 2.0 services that have a focus on communicating, collaborating and sharing with other members of the group; what is important here is the communication capabilities, rather than the tools themselves. Learners need to be encouraged to consider their individual needs and interests, to list these, and then attempt to find (and share) solutions for them. Design online activities (e-tivities) to help participants practice with the tools and applications that are being explored; try to create e-tivities in which they could make use two or more of the tools, and are focused around relevant subject topics.

2. Start with a safe space.

Start by creating a small community in which students feel safe and are not afraid to try applications and make mistakes. Once the space is established, use it to explore connections

between the different applications and functions, between the tools themselves, and with other networks. A small community is easier to manage, so consider tools that allow the group to create a closed, "safe" environment, such as *Ning* or *Google+ Communities*.

3. Put an emphasis on sharing.

Once the networks are established, encourage the students to share information and interesting resources and links within their networks. New channels of communication and ways of applying what they are learning might thus be discovered. Take advantage of applications that allow users to share resources, such as *delicious* and Diigo. Common interests help create bonds within the group and help in developing a Personal Learning Network (PLN).

4. Encourage and reward participation.

Do not limit information to what students find, but encourage them to share original contributions, either individual or in groups. These contributions can be focused on content, but can also include comments and suggestions about the tools and applications currently being used. Emphasize the importance of sharing personal experiences and knowledge that could be of interest to the whole community.

5. Let the students explore their own path.

Be flexible with students as they build their own PLEs. The steps described here should not be considered sequential in nature, and will probably change based on each student's background and experience. It is useful to provide advice about "container" tools (such as the PLE hubs proposed in the framework), so participants can explore different options or develop their own ideas about connecting and managing the applications that make up their PLE. Flexibility and freedom are important. PLEs are, after all, personal.

6. A "learn to learn" approach works better than learning specific tools or services.

Learners should be guided as they test new tools, assisted in identifying common features, trained in how to obtain help when needed and to solve basic problems, and encouraged to find new ways of achieving their goals and objectives. If learners learn only how to use a specific tool, they will likely be lost when that tool is no longer available.

During the "Hort Digital" project some of the participants created online communities using Ning (www.ning.com). Ning phased out free networks in 2010, so the participants were forced to look for alternatives. Some chose Grou.ps (http://grou.ps/), which in turn switched to a paid-only option in 2011, others migrated to Posterous, which was closed in 2013. In almost all cases the transition between services was not a problem; the participants had been encouraged to explore the services on their own, choose which capabilities and functions were useful for them and which were not, and compare different approaches as they explored the options available. Being able to identify the potential of each service, and how they fulfilled their needs, made it easier to identify options and adopt them as a replacement.

7. Expose learners to families of services and tools, not just a single one.

For example, discuss the advantages of social bookmarking by comparing *delicious*, MrWong, StumbleUpon and Diigo, so learners can make educated choices on the tools that are best suited to fit their needs, and not the other way around. In the previous example, the participants had been shown different options since the beginning of the project, and some of the options had been discovered or proposed by them, so the focus was never on a specific tool, but rather on the requirements they had and how they were achieving their objectives by means of the different applications. Some of the participants were looking specifically for a platform that allowed them to create a community, so they switched to Google+ Communities, while others decided to explore Facebook as an alternative.

8. Propose alternative solutions and uses for tools that they are currently using.

Even though some services have been developed with a specific purpose, most of these services share basic features. For example, Twitter could be used to save resources for later use via the Favorites option, even though its primary function is to support microblogging. The Save option on Facebook would achieve the same purpose. Facebook may also be used to

create photo albums and share them with a community, but Flickr, Instagram and Pinterest serve similar purposes. Again, the idea is to focus on needs and how they are fulfilled by the applications, and not on the applications themselves. In the Hort Digital project, for example, blogs were used in a variety of contexts. A group used Blogger to keep track of project development and management so, when it was time to transfer the coordination of the project to another group, they would have a log of all previous tasks and milestones. Another teacher created a blog so students could share personal stories around specific topics, similar to what one of the participants was also doing with their class, but through Twitter.

9. Accept that change is something inherent to the nature of PLEs.

PLEs are dynamic, and change according to the needs of the learner, and also due to changes in technology. Change can be disruptive for users who are accustomed to a specific tool or application, but can also open a new world of possibilities. Most services allow users to download the information and the content users have created and stored in them; earners should be aware of Export/Import options for the services they use, in case there is the need to switch between PLE tools at various points in time. Compatibility may also be an issue, and learning curves and available support varies among the different tools that can be part of a PLE. The nature of PLEs means that users need to be learning continuously, and be flexible enough to switch to a new tool without experimenting major difficulties.

10. Stress the importance of support networks.

We are not alone in the learning process, and as access to the Web and the Internet increases, it is easier than ever to connect with other users and become part of a network. Changes in technology affect not only individuals, but also whole groups, so we can help each other by sharing experiences, advice and tips. The role of the Personal Learning Network (PLN) becomes crucial in the context of PLEs, and in many cases PLEs and PLNs are inextricably connected. Learners share objects and support each other, and their learning experience becomes richer. The experience working with secondary education teachers in the Hort Digital project demonstrated the value of support networks, which continue to this day, even after the project ended.

The results of a semi-structured interview carried out with some of the participants in the PELICANS study hints at the potential of PLEs for both lifelong learning and professional activity, and although limited by the size of the sample, it provides empirical evidence and support for future research in this area.

Conclusions

This study has shown that PLEs have the potential to contribute to learning in general. The diversity of tools that make up a PLE allows for flexibility across a broad range of contexts and learners. Web 2.0-based PLEs have several specific advantages in the context of learning. In a PLE, reflection could take part in several ways, including blog posts, microblogging, collaborating on a wiki, and more. Motivation may also be increased, because the student is actively involved in the learning process. Instead of being a receiver of information, the student becomes the protagonist of the learning experience: the Web 2.0 approach puts an emphasis on user-created content. The multiple channels of communication allow students to start and participate in dialogues, and to ask and answer questions. The result is an increase in participation and control over the learning process.

In such an environment, the systems being used provide access to a large pool of additional information that can be used to support and complement the material being covered. Although students may start at the same point using a common source of content, the learning process may then become divergent between learners, the PLEs being personalised according to the interests and learning styles of each learner.

Learners in a group seldom have a homogeneous profile. It is not unusual to find within the same course different age groups, motivations, academic level and personal circumstances. It makes sense to try and personalise the learning experience as much as possible. PLEs provide an excellent tool to meet this requirement. Although learners have access to the same content (hence ensuring that the quality of the material is constant and homogeneous for every participant), the actual processing of the information can be managed by each learner using a unique own set of tools, allowing each learner to tailor the learning process to their own needs and circumstances. As noted by Attwell (2007), PLEs recognize that "*learning is discontinuous ... will take place in different contexts and situations and will not be provided by a single learning provider. ... Personal learning environments can bring together learning*

from multiple contexts, including from home, from school, and from work, and can support formal learning activities provided by different educational institutions."

In opposition to the seemingly widespread notion that Millennial learners are familiar with the Internet and Web 2.0 tools in particular, this was not what was found in this study. Few of them had heard the term "Web 2.0" before, or knew what it meant. This is reflected in the following comment: "*I was quite surprised that I actually already used some web 2.0 tools without even knowing what they were*". The fact that these tools could be used for learning was even less obvious to them: "*In the course of the classes, I realised the possibility of using web 2.0 applications for actual learning. […] blogs, wikis and online communities, provided my with much information, which made studying easier*".

Regarding the approach used to introduce the services and applications to the learners, there were divided opinions on whether the PLE concept should have been presented earlier in the process. While some of them think they should be given a "big picture" and a clear purpose of how can Web 2.0 tools be incorporated and integrated, some of them thought that the hands-on, do-it-yourself approach actually made them become more familiar and knowledgeable with the applications, and that the "chaotic" situation forced them to come up with solutions on their own.

The social element was observed not only in the collaboration online and the increased communication, but also on a "network effect" with some of the tools: adoption of these was in some cases motivated by some of their peers; since they saw their classmates trying some of the applications, some of the students decided to join and try them too. Word of mouth and comments were also effective in bringing some of the students on board.

One of the main conclusions of the study was the fact that, in the end, the choice of hub for the PLE and the specific tools that the student adopts are not the end result nor the most important point in the experience: it is the journey itself, the way they discover and try new tools and applications, how they use them to share and collaborate, and how they take on a "prosumer" approach, learning together, even teaching each other. Teachers become guides in the learning experience.

Learners also reclaim ownership of the learning process, and take on a more active role in the management of their learning, thus fostering independent and lifelong learning. One of the participants in the PELICANS project, when interviewed five years after participating in the project, stated that when choosing amongst different options to create a discussion space for an ongoing project, "*my experience from what we had done in Uni and in class, working with different tools, helped in the evaluation phase and my analysis on how the users would or would not take advantage of the discussion space given*".

Methodology

The methodology used provided an appropriate framework for the research, since the main purpose of the study was to carry out interventions in actual educational settings, and transfer the results from research to practice as soon as possible. The use of Design-Based Research allowed for changes and modifications to be introduced along the way, which made the process more dynamic and flexible. Changes were made not only in the contents to be covered, but also in the structure of the courses, the order in which the contents were introduced and the assessment. Innovation took the form of new projects and techniques in the classroom, and also in the creation of new spaces and communities for the sharing and dissemination of the skills and knowledge being acquired in the context of the two projects created as part of the study.

The Living Labs approach used in the Hort Digital project provided the stage for a participatory culture approach, helping in the creation of a community of practice, which extended its influence to individuals and institutions that were not directly involved in the research study. Design was led by the users, which participated actively in all stages of the research projects. The project followed the Living Labs protocol during its design and execution, and it also exhibited all the main characteristics of Living Labs, turning out to be one of the first examples of a Living Lab in the education field.

Impact on practice

One of the main goals of the research was to provide guidelines and help introduce changes in teaching practice. The use of DBR allowed for the interventions to be carried out in an educational setting, making it easier to introduce changes to the current practice of the teachers participating in the project. Although the original projects were carried out in very specific settings, the methodology has since been adapted successfully to other scenarios and profiles, including researchers from the health sector, administration personnel, and primary education teachers.

Motivation and willingness to learn were more important than technological savvy or being "Digital immigrants". One of the participants in the Hort Digital project did so just three years shy of retiring, with a basic knowledge of web browsers and email. She introduced changes in her practice, not only in the use of technology in the classroom, but also in her methodology and pedagogy.

PLEs and innovation

Innovation is considered to be a central construct for effective practice, policy and research in the field of learning technology (Campbell, 2013). As technology evolves, one of the main challenges for learning technologists is to devise successful strategies for the deployment of innovative technological solutions that meet learning needs. According to the "innovator's DNA" framework (Dyer et al., 2011), there are five unique discovery skills that indicate innovative leadership: questioning, observing, experimenting, networking and associating. All these have been identified in the context of the PELICANS and Hort Digital project.

The questioning element is present in the paradigm shift that PLEs represent: redefining roles for both teachers and learners, integration of formal and informal learning, and learning processes based on or supported by portable, flexible, mobile technologies. According to our experience, innovation works by example: teachers in general will not adopt new technologies and approaches until they see the benefits, and are sure that the effort and time invested will be worth it; this is closely related to Use/Benefits analysis, as illustrated by the Delone and MacLean model. For example, once they "own" a technological toolbox, they realize they can

choose among several different options when it comes to presenting material or developing their own.

Observation involves gathering data and analising it, in order to gain insights about new approaches. In the two projects mentioned above, observation was mostly qualitative, a trend that is common in educational settings. Observation allowed us to gradually change the focus from teaching new technologies to helping the learners embed them into their learning and practice. A "learning to learn" approach, which allows learners to transfer their skills from one medium to the next, makes the learning process easier and more efficient.

Experimenting relates to learners actively sharing and participating within a community. In both projects, participants dedicated significant time to sharing insights and resources, know-how, tips about what worked and what did not, identifying points that could be improved and so on. The creation of communities of practice was most evident in the Hort Digital project, where learners not only shared their knowledge with others, but also took an active role in the development and implementation of new levels for the existing course (which had originally been planned to be taught in one academic year, and ended up being extended to three). The empirical data gathered from both projects helped in turn in the shaping of subsequent iterations.

Networking and Associating are interrelated. In the case of PLEs, the creation of the PLE Conference and its 5-year run helped strengthen an already existing community of researchers in this field. The Conference itself is characterized by a spirit of collaboration and innovation, involving multidisciplinary perspectives, taking advantage of social media, and finding new ways of keeping it fresh and dynamic. Personal Learning Networks (PLNs) work as an extension of the PLE, fostering the development of personal relationships, collaboration and cooperation, both online and face-to-face.

Future research

The field of Personal Learning Environments is in development, and even though during the last 5 years there has been a marked increase in the number of papers and research that is being published, there are several areas still to be explored. During the course of this research, and through collaboration with other researchers, some potential areas for future research were identified.

Frameworks for developing Web 2.0-based PLEs

The framework was first presented in an EDEN Research Workshop in 2008, and later published as *Putting the Pieces Together: Conceptual Frameworks for Building PLEs with Web 2.0 Tools*, co-authored with Edirisingha, P. and Mobbs, R. as a chapter in *Distance Learning in Transition* (2009).

The work on the framework inspired this research topic, and was the foundation of the PELICANS Project (in collaboration with the BDRA, University of Leicester). The framework was published in 2008 and since then Web 2.0 services have become increasingly more popular amongst users; a revision of the framework could be of interest. In the original paper where the framework was published, we also proposed that mobility would be the future of PLEs, which could also be of interest given the ubiquity of smartphones in today's society.

Digital Identity and PLEs

This topic was explored in *To be or not to be, the importance of Digital Identity in the networked society* co-authored with Costa, C. (2011). This paper explored some of the aspects regarding approaches and practices of educators, using web technologies to foster their digital identity within their networks and, at the same time, developing a social presence to complement their professional and academic profiles. The issues posed by the web were presented through dichotomies: open or closed, genuine or fake, single or multiple, drawing from learners' experiences in building their digital identities, during the process of creating PLEs.

Activity Theory and PLEs

(co-authored with Buchem, I. and Attwell, G.)

The work that was later published as *Understanding Personal Learning Environments: Literature review and synthesis through the Activity Theory lens* (co-authored with Buchem and Attwell (2011), started as a systematic review of publications on the topic of PLEs up until 2011. While analysing and coding over 150 sources, we decided to use activity theory as a research framework to guide the classification and qualitative analysis of the literature under review. Activity theory could thus be used as a framework for conceptualising and designing Personal Learning Environments.

PLEs in the context of Information Systems models and theories

(co-authored with Monguet and Brigos)

Proposed as an open session during the PLE Conference 2014, this short paper looked at models and theories from the information systems field, and its potential application to the analysis of PLEs in education. As discussed in Chapter 2, Personal Learning Environments are closely related to Information Systems; thus, Information Systems models and theories could be applied to the analysis and understanding of PLEs and their adoption by learners. In particular, the following theories and models are relevant in the context of PLEs:

- The Delone and Maclean model of User satisfaction
- The theories of human needs
- The TAM and UTAUT models of technology adoption

The application and analysis of these theories and models in the context of PLEs could help users and learners understand them better and in turn gain more benefits from building and using PLEs.

Technology Transience and PLEs

Along with Monguet and Brigos, we explored the topic of technology transience in the context of PLEs. This was published in 2015 as *Constant Change: the Ever-Evolving Personal Learning Environment*. As discussed in Chapter 3, technology transience is an

important factor in the development and use of PLEs, and it would be interesting to explore this effect in a more systematic way.

PLEs as information management tools

Based on Alter's (2008) view of work systems as information systems, and its characterization through 6 information-related operations, an information strategy is proposed as a way of introducing users to the PLE concept. This strategy emerged from the experiences in both the PELICANS and Hort Digital projects, and has been tested with success in the form of 3-hour workshops, which have been attended by hundreds of participants not only from the education field, but also from the health sector, research institutes and library services. More research in this area would help in developing courses and training workshops for a wide range of fields.

PLEs and lifelong learning

As mentioned before, a more in-depth follow-up with the participants in the PELICANS study could shed some light on how are these young professional using and taking advantage of the PLEs that they created during their participation in the study, and provide data that may be used for further refining and improving of the guidelines suggested in this work.

Final remarks

I started this Thesis by stating a Personal Rationale in addition to the research and scholarly motivation. I would like to close it in a similar fashion.

One of the issues with which I struggled when writing this document was actually the use of the first person, something that was frowned upon by several of my colleagues and some of the friends that helped me revising the successive drafts. Some saw it as going against the academic writing style, while others thought it took away some of the "seriousness" of the

Thesis. But this is obviously a topic with a very personal element, not just because it is (after all) about Personal Learning Environments, but also because in more than one way has changed my personal and professional lives.

The journey to finishing my PhD has indeed shaped me as a researcher, but also as a practitioner. Although an engineer by training, I am a teacher at heart. For almost 20 years I have been teaching in HE institutions, and my teaching style has been shaped by mentors, my own teachers, my parents and of course my students. It has also gone through a dramatic change in the last 8 years, ever since I started questioning my first choice of research topic (learning styles) and started looking for other ways to personalise learning. When I first heard about PLEs, and made the conscious decision to start my research again from scratch, I never suspected it would have such an impact in my life.

At the end of this journey, and reflecting back, I am grateful for the opportunities and learning moments, and hope that this knowledge can help others through their own learning paths.

BIBLIOGRAPHY

Adell, J. & Castañeda, L. (2010) Los Entornos Personales de Aprendizaje (PLEs): una nueva manera de entender el aprendizaje. In Roig Vila, R. & Fiorucci, M. (Eds.) Claves para la investigación en innovación y calidad educativas. La integración de las Tecnologías de la Información y la Comunicación y la Interculturalidad en las aulas. Stumenti di ricerca per l'innovaziones e la qualità in ámbito educativo. La Tecnologie dell'informazione e della Comunicaziones e l'interculturalità nella scuola. Alcoy: Marfil – Roma TRE Universita degli studi. pp 19-30.

Anderson T. (2006). PLE's versus LMS: Are PLEs ready for Prime time? Blog entry. Available http://terrya.edublogs.org/2006/01/09/ples-versus-lms-are-ples-ready-forprime-time/ [Accessed 11 February 2009].

Attwell, G. (2006). Personal Learning Environments – a position paper. http://www.knownet.com/writing/weblogs/Graham_Attwell/entries/6521819364 [Accessed 11 February 2009].

Attwell, G. (2007). Personal learning environments: The future of eLearning? eLearning Papers, 2(1).

Attwell, G. (2009). Barriers to personal learning environments. Retrieved from http://www.pontydysgu.org/2009/01/barriers-to-personal-learning-environments

Barrett, 2007. **ePortfolios with GoogleApps.**
Retrieved from https://sites.google.com/site/eportfolioapps/components/mashup on July 15th 2008.

Barrett, H. Online Personal Learning Environments: Structuring Electronic Portfolios for Lifelong and Life Wide Learning. On the Horizon | Vol. 17 No. 2, 2009, pp. 142-152,
Emerald Group Publishing Limited

BECTA 2008. Learners' use of Web 2.0 technologies in and out of school in Key Stages 3 and 4

BECTA. Implementing Web 2.0 in Secondary Schools: Impacts, Barriers and Issues. BECTA, 2008.

Blees I., Rittberger M. Web 2.0 Learning Environment: Concept, Implementation, Evaluation. eLearning Papers (http://www.elearningpapers.eu) 1 Nº 15, June 2009, ISSN 1887-1542
Bradwell P. The edgeless university: why higher education must embrace technology. Demos, 2009.

Bryman, A. Social research methods. 2012. Oxford University Press; 4th edition.

Castañeda, L. & Soto, J., 2010. Building Personal Learning Environments by using and mixing ICT tools in a professional way. Digital Education Review, 0(18), pp.9–25.

Castañeda, L. y Adell, J. (2011): El desarrollo profesional de los docentes en entornos personales de aprendizaje (PLE). En Roig Vila, R. y Laneve, C. (Eds.) La práctica educativa en la Sociedad de la Información: Innovación a través de la investigación / La pratica educativa nella Società dell'informazione: L'innovazione attraverso la ricerca. Alcoy: Marfil. 83-95

CETIS. http://wiki.cetis.ac.uk/Ple/Report [Accessed 8 February 2008]. (2007).

Cigognini, M.E., Pettenati, M.C., Paoletti, G. and Edirisingha, P. (2008). Guiding Learners to become knowledgeable learners 2.0, Proceedings of the EDEN 2008 Annual Conference: 11 – 14 June, 2008, Lisbon, Portugal.

Citilab. 2010. Tres projectes de Citilab, seleccionats com a cassos d'èxit en innovació social per la Generalitat. Retrieved on April 20th 2011 from http://www.citilab.eu/que-esta-passant/noticies/arxiu/tres-projectes-de-citilab-seleccionats-com-a-cassos-dexit-en-innovac

Costa, C. & Torres, R. To be or not to be, the importance of Digital Identity in the networked society. Educação, Formação & Tecnologias, 4-10, 2011

Couros, A., 2010. Developing Personal Learning Networks for Open and Social Learning. Emerging Technologies in Distance Education, pp.109–128.

David S. White and Alison Le Cornu Visitors and Residents: A new typology for online engagement by. First Monday, Volume 16, Number 9 - 5 September 2011 http://firstmonday.org/ojs/index.php/fm/rt/printerFriendly/3171/3049

Design-Based Research Collective - Design-Based Research: An Emerging Paradigm for Educational InquiryEducational Researcher January 2003 32: 5-8

DFES (2005). Harnessing technology: Transforming learning and children's services. Department for Education and Skills, UK. Retrieved August 2008, from http://www.dcsf.gov.uk/publications/e-strategy/docs/estrategy.pdf

Downes, S. Learning Networks and Connective Knowledge (2006).Retrieved from - http://it.coe.uga.edu/itforum/paper92/paper92.html on April 17th 2009.

Downes, S (2010). Pedagogical Foundations for Personal Learning, Keynote address at the 'Learning Futures Festival', the Annual E-Learning Conference at the University of Leicester, UK, January 10, 2010.

Downs, S. (2010). Pedagogical foundations for personal learning, Keynote address at the "Learning Futures Festival," the Annual E-Learning Conference at the University of Leicester, UK, January 10, 2010.

Driscoll, M. P. (2005). Psychology of learning for instruction. Boston: Pearson Education, Inc.

ECAR (2007). The ECAR study of undergraduate students and information technology.

educat 1x1, 2010. Línies bàsiques del projecte. Retrieved from http://www.edubcn.cat/rcs_gene/extra/00_educat_1x1/03_documents/Linies_basiques_del_Projecte_eduCAT1x1_publica.pdf on June 23rd 2011.

EDUCAUSE (2006). EDUCASE Learning Initiative. Learner-Centered Concepts, available online at http://www.educause.edu/content.asp?page_id=940&bhcp=1 (accessed on 11.08.2008).

EDUCAUSE Learning Initiative. (2006). Learner-Centered Concepts. EDUCAUSE. Retrieved March 2009, from http://www.educause.edu/content.asp?page_id=940&bhcp=1 .

Emerging Technologies for Learning, Vol. 2. BECTA, 2007.

Facebook. "Facebook Reports First Quarter 2015 Results". April 22, 2015. Retrieved April 26, 2015.

Fiedler, S. (2010). Personal Learning Environments_ concept or technology? The PLE Conference Barcelona 6-8 July 2010. Retrieved from: http://pleconference.citilab.eu/wp-content/uploads/2010/07/ple2010_submission_45.pdf

From Digital Natives to Digital Wisdom: Hopeful Essays for 21st Century Education (Corwin 2012)

Fraser, J. Personalisation.
Retrieved from http://fraser.typepad.com/edtechuk/2006/10/personalisation.html April 21st 2010.

Freire, P. Pedagogy of the oppressed. 1970. Continuum.

García Aretio, L. (2001). La educación a distancia. De la teoría a la práctica. Barcelona, Spain: Ariel, p. 328.

Gibbons, M et al., 1994. The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies. SAGE Publications ltd.

Hedtek (2010). The Manchester Personal Learning Environment. Retrieved from http://hedtek.com/current-projects

History of Personal Learning Environments. (n.d.). Wikipedia. Retrieved November 6, 2010, from http://en.wikipedia.org/wiki/History_of_personal_learning_environments

Kuechel, T. http://theok.typepad.com/digital_signposts/2009/07/content.html
Retrieved August 20th 2009

Illich, I. Deschooling society. 1970. Harper & Row.

Ivanova, M. (2009). From personal learning environment building to professional learning network forming. Paper presented at the 5th International Scientific Conference E-learning and Software for Educatio. Retrieved from: http://www.scribd.com/doc/22583785/From-Personal-Learning-Environment-Building-To-Professional-Learning-Network-Forming

Jaroszyńska, A.; Torres Kompen, R. and Edirisingha, P. (2010). Using Virtual Desktops for developing Personal Learning Environments: a learner's perspective. The PLE Conference, ISSN 2077-9119. Retrieved from http://pleconference.citilab.eu on July 25, 2010

JISC (2007) A report on the JISC CETIS PLE project. available online at http://wiki.cetis.ac.uk/Ple/Report (retrieved on August 8th 2008).

Katz, I. R., And Macklin, S. (2007). Information and communication technology (ICT) literacy: Integration and assessment in higher education. Systemics, Cybernetics and Informatics 5 (4): 50-55.

Kerr, W. A challenge to connectivism http://learningevolves.wikispaces.com/kerr (retrieved on Jan 23rd, 2014)

King, A. From Sage on the Stage to Guide on the Side. *College Teaching.* Vol. 41, No. 1 (Winter, 1993), pp. 30-35 Published by: Taylor & Francis, Ltd. Stable URL: http://www.jstor.org/stable/27558571

Kop, R and Hill, A. Connectivism: Learning theory of the future or vestige of the past? The International Review of Research in Open and Distance Learning, Vol 9, No 3 (2008)

KS3 and KS4 learners' use of Web 2.0 technologies in and out of school - Summary. BECTA, 2008.

Liber, O., Perry S., Beauvoir, P., Swannie, J., Franklin, T., Davies, S., …Krann, W. (2204). Report out from personal learning and research environments. JISC. Retrieved from http://www.jisc.ac.uk/uploaded_documents/Personal%20Learning%20ppt.ppt

Lorenzo, G. and Dziuban, C. (2006). Ensuring the net generation is net savvy. Washington, DC: EDUCAUSE. available online at http://www.educause.edu/ir/library/pdf/ELI3006.pdf (accessed on 11.08.2008).

MacLeod, I. H. (2007). Facebook as PLE: I have seen the future! MachIanations. Retrieved from http://machianations.blogspot.com/2007/05/facebook-as-ple-i-have-seen-future.html

Mason, R., & Rennie, F. (2008). E-learning and social networking handbook: Resources for higher education. London, UK: Routledge.

McFedries, P. (2007) Social-isms. IEE Spectrum Online. available online at http://spectrum.ieee.org/apr07/5014 (accessed 11.08.2008).

Mcloughlin C., Lee M. (2008). Future learning landscapes: Transforming pedagogy through social software. Innovate 4 (5).

MediaZoo. http://www.le.ac.uk/beyonddistance/mediazoo/ Retrieved July 18th 2008

Muldoon,N. (2008) Self-direction and lifelong learning in the information age: Can PLEs help? Lifelong Learning Conference: 5th, 2008, Yeppoon, Queensland.

Oblinger, D; Oblinger, J. (2005). Educating the Net-Generation (EDUCAUSE e-Book), available online at http://www.educause.edu/content.asp?PAGE_ID=5989&bhcp=1 (accessed on 11.08.2008).

Olivier, B. and Liber, O. (2001) "Lifelong Learning: The Need for Portable Personal Learning Environments and Supporting Interoperability Standards." The JISC Centre for Educational Technology Interoperability Standards, Bolton Institute, December 2001

Prendes, M.P., Castañeda, L., Ovelar, R. & Carrera, X. Componentes básicos para el análisis de los PLE de los futuros profesionales españoles: en los albores del Proyecto CAPPLE. *EDUTEC, Revista Electrónica de Tecnología Educativa,* 47. 2014.

Prensky, M. (2001). Digital Natives, Digital Immigrants, On The Horizon, Mcb University Press, Vol. 9 No. 5.

Prensky , M. (2005) TEACHING DIGITAL NATIVES: PARTNERING FOR REAL LEARNING

Prensky, M. 2011. From Digital Natives to Digital Wisdom. Corwin.

Salmon, G. (2004). E-tivities: The key to active online learning. London, UK: Routledge.

Santos, C.; Pedro, L., Pais, F. (2014): Innovation, Knowledge and Sustainability with PLEs: an Empirical Analysis from SAPO Campus Schools Pilots. Journal of Literacy and Technology, Special Edition: Personal Learning Environments: Current Research and Emerging Practice Volume 15, Number 2: June 2014.

Sangrà, A.; Wheeler, S. (2013). «Nuevas Formas De Aprendizaje Informales: ¿O estamos formalizando lo informal?». En: «La informalización de la educación» [monográfico en línea]. Revista de Universidad y Sociedad del Conocimiento (RUSC). Vol. 10, n.º 1, págs. 107-115. UOC.

Sclater, N. (2010) eLearning in the Cloud. In International Journal of Virtual and Personal Learning Environments (IJVPLE). Thomas, M., editor. Volume: 1-Issue: 1

Severance, C.; Hardin, J.; Whyte, A. (2008). The Coming Functionality Mash-Up In Personal Learning Environments, Interactive Learning Environments, 16:1, (p. 47-62)

Szücs A., Tait A., Vidal M., Bernath U., (2009) Distance Learning in Transition, Chapter 55: Putting the Pieces Together: Conceptual Frameworks for Building PLEs with Web 2.0 Tools. Wiley-ISTE

The Economist. (2008, May 3). Innovation: Home invention. The Economist, 98.

The Telegraph. 2015. Mobile phones and iPads could be banned from classrooms. Retrieved October 15th 2015 from
http://www.telegraph.co.uk/education/educationnews/11861301/Mobile-phones-and-iPads-could-be-banned-from-classrooms.html

Theil, S. (2008) The boom in online education, Newsweek, Aug. 18-25.

Thomas, M. (2013). Technologies, Innovation, and Change in Personal and Virtual Learning Environments (pp. 1-338). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-2467-2

Thompson, J. (2007). Is Education 1.0 Ready For Web 2.0 Students? Innovate 3 (4), available online at http://www.innovateonline.info (accessed 10.08.2008).

Toffler, A. (1984) The Third Wave. London: Pan Books Ltd, 1981

Torres Kompen R., Edirisingha P., Monguet J. (2009) Using Web 2.0 applications as supporting tools for personal learning environments. Best Practices for the Knowledge Society. Knowledge, Learning, Development and Technology for All, 33-40.

Torres Kompen, R., Edirisingha, P. & Mobbs, R. (2009). Putting the pieces together: Conceptual frameworks for building PLEs with Web 2.0 Tools. In Distance and e-learning in transition. Wiley-ISTE.

Torres Kompen, R., Edirisingha, P. Flight of the PELICANS, 2010. Proceedings of The PLE Conference 2010.

Torres Kompen, R.; Edirisingha, P.; Mobbs, R., "Putting the Pieces Together: Conceptual Frameworks for Building PLEs with Web 2.0 Tools", in Distance and E-Learning in Transition, Wiley-ISTE 2009

Trinder K., Guiller J., Margaryan, A. (2008). Learning From Digital natives:bridging formal and informal learning. YORK: The Higher Education Academy.

Universities UK (2008). The future size and shape of the higher education sector in the UK: threats and opportunities, available online at www.bookshop.universitiesuk.ac.uk/downloads/size_and_shape.pdf (accessed 10.08.2008).

University of Aveiro. (2010). Retrieved from http://labs.sapo.pt/ua/ , July 2010.

Venkatesh, V., Morris, M.G., Davis, F.D., and Davis, G.B. "User Acceptance of Information Technology: Toward a Unified View," MIS Quarterly, 27, 2003, 425-478.

Vilaweb.cat. 2011. L'Educat 1x1, radiografia d'un projecte. Retrieved from http://www.vilaweb.cat/noticia/3849329/20110217/leducat-1x1-radiografia-projecte.html on June 4th 2011.

Von Hippel, E. (2005) Democratizing Innovation. MIT Press.

Weller, M. The Centralisation Dilemma, in Educational IT International Journal of Virtual and Personal Learning Environments, 1(1), 1-9, January-March 2010

Weston et al. The End of Techno-Critique: The Naked Truth about 1:1 Laptop Initiatives and Educational Change. The Journal of Technology, Learning, and Assessment. Volume 9, Number 6; January 2010

Wild, F., Mödritscher, F., & Sigurdarson, S. (2008, July 9). eLearning papers. Retrieved from www.elearningpapers.eu

APPENDICES

Appendix A.

Web 2.0 diagrams

What follows is a sample of the diagrams created by the students, along with a short comment on each one:

Figure A.1: a start-up screen with multiple login options.

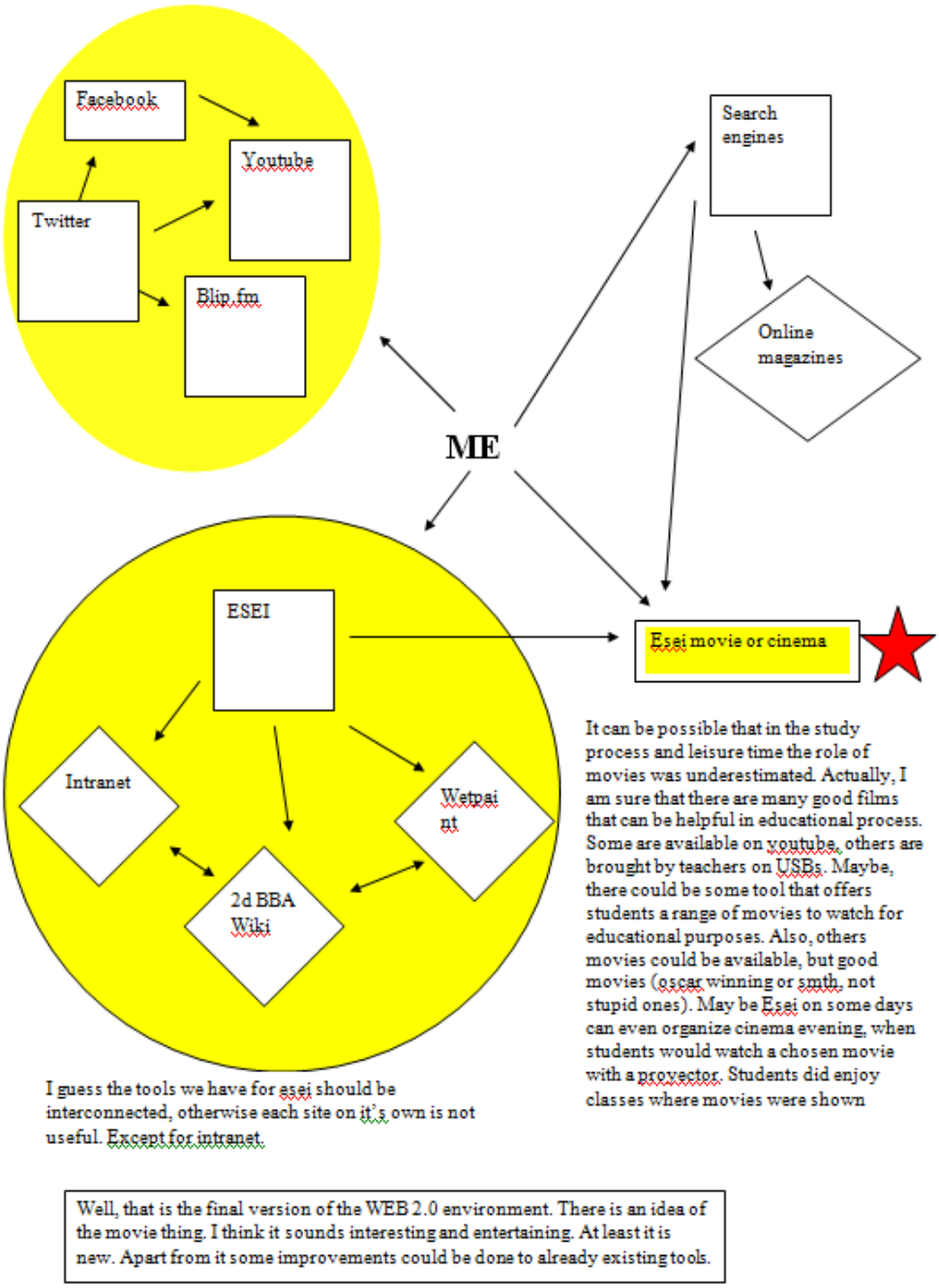


Figure A.2. A diagram showing how different environments are related (social media elements vs Intranet/VLE). The student puts herself at the center of her PLE.

For me, an ideal environment for web 2.0 would be a website where you sign in once and you will be able to go directly to any other web 2.0 tool, depending on which one you decide to have. At this site, you are also able to get updates from the tools of you choice, so you don't have to go to each site if you haven't received any updated of what is going on within that special tool. It should also be possible through the different tools, for instance to go from Flickr over to Twitter without signing in again. It takes time, as well as it is annoying remembering the different usernames and passwords. But how can this be possible in a secure way, so that no one else that is using the computer will be able to use your account in the different tools.

This picture illustrates different web 2.0 tools that I would use if it would be possible to have them all at the same website with their different updates. It should also be possible to go between them, from their own website over to the other. Today, it is possible, but the problem is how to make the main website secure and liable for me, without anyone else using my accounts. So that would be the ideal environment for me, having one website where I can sign in for all my accounts once.

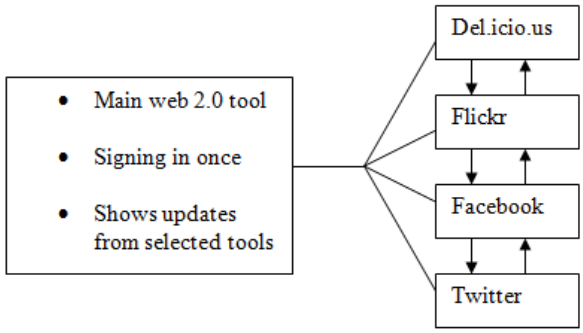


Figure A.3. A diagram proposing what essentially is an aggregator page with a multiple login option.

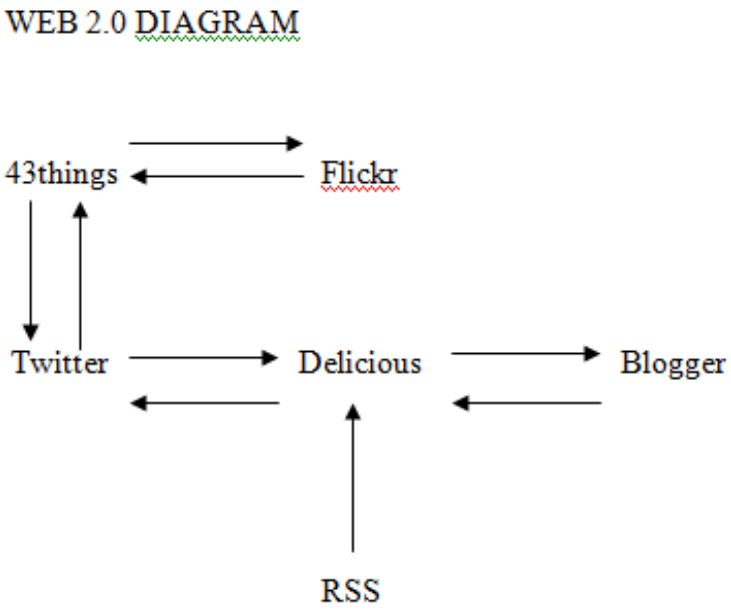
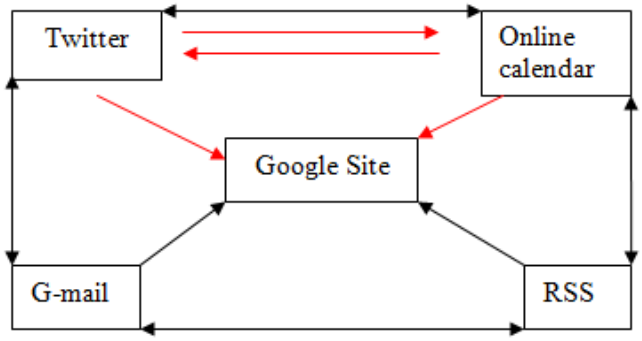


Figure A.4. A diagram showing how applications are interconnected. The information flow is very similar to our proposed information-management strategy.

The Web 2.0 tools that I chosen are twitter, Google site, RSS, and G-Mail.

Here is the ideal Web 2.0 environment of mine.



Red lines- Combinations I preferred.
Black lines- Existing combinations
Double direction arrows- My ideal connection between Web 2.0 tools

Figure A.5.

The student's comments:

"The RSS tool would allow users to assess updated news that you might be interested in, and because of the RSS tool is already operated within Google Site. Therefore, if you have already got the Google account, you do not need to log it every time you use RSS tool, it saves you time and eliminating the risks of remembering wrong password. Back to the point, the internet world is saturated with information and it may waste you bunch of time to look for the specific information that you need, RSS allows you to check out information or news that you preferred. By using G-mail allowing families or friends to share the information and connect with each other which making the world smaller to some extent. Again, by operating the Web2.0 tool by the same intermediaries (Google Site in this case), it saves time and allows you to surf through internet more efficiently.

The twitter allows users to leave instant messages between a certain groups of people, you could get to know what is other being doing, it is especially useful when you adopt it to school, like what we did, and people could keep on track what others are doing for homework and remind each other.

The online calendar is a Web 2.0 tool that you set up your personal calendar and other users would randomly log on to the website to see whether you have achieved the scheduled goals. Visitors of the Website could have suggested some useful comments which they have similar experiences to assist you working more smoothly to finish the scheduled tasks. I think this tool could be combined with twitter so that create a sort of relationship among the group and may allow members in the group work effectively. Adopting twitter and online calendar to Google would hopefully provide a better Web 2.0 environment to mass users and by showing the two ways arrows, it may allow tools to actually talk to each other on the foundation of Google Site."

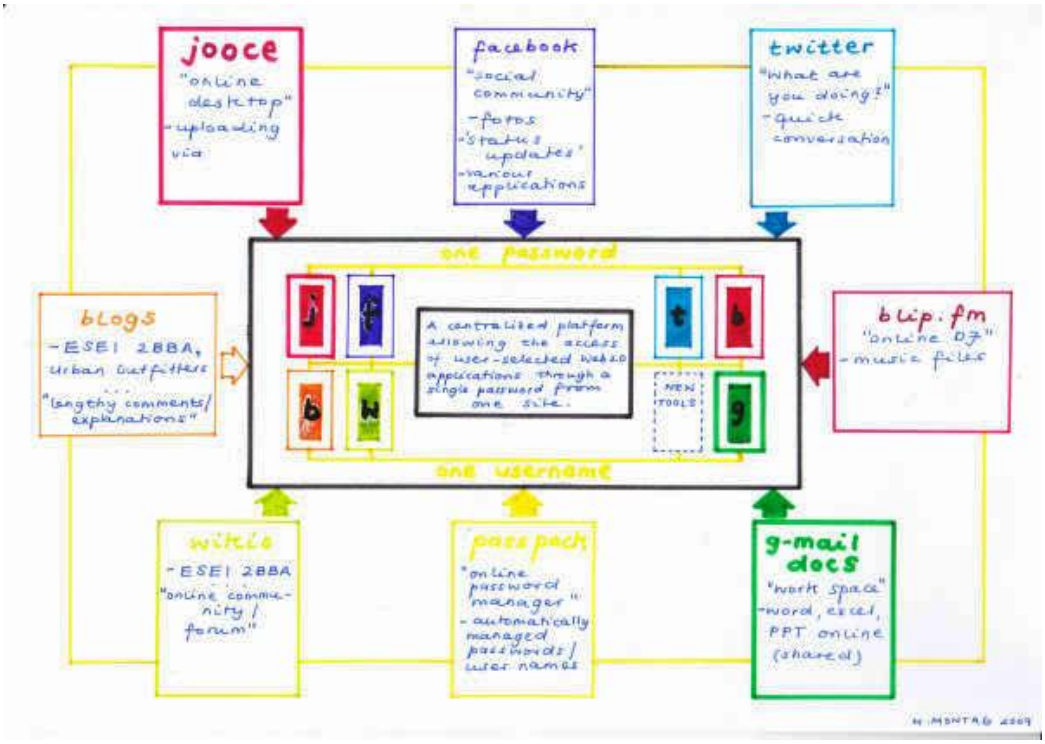
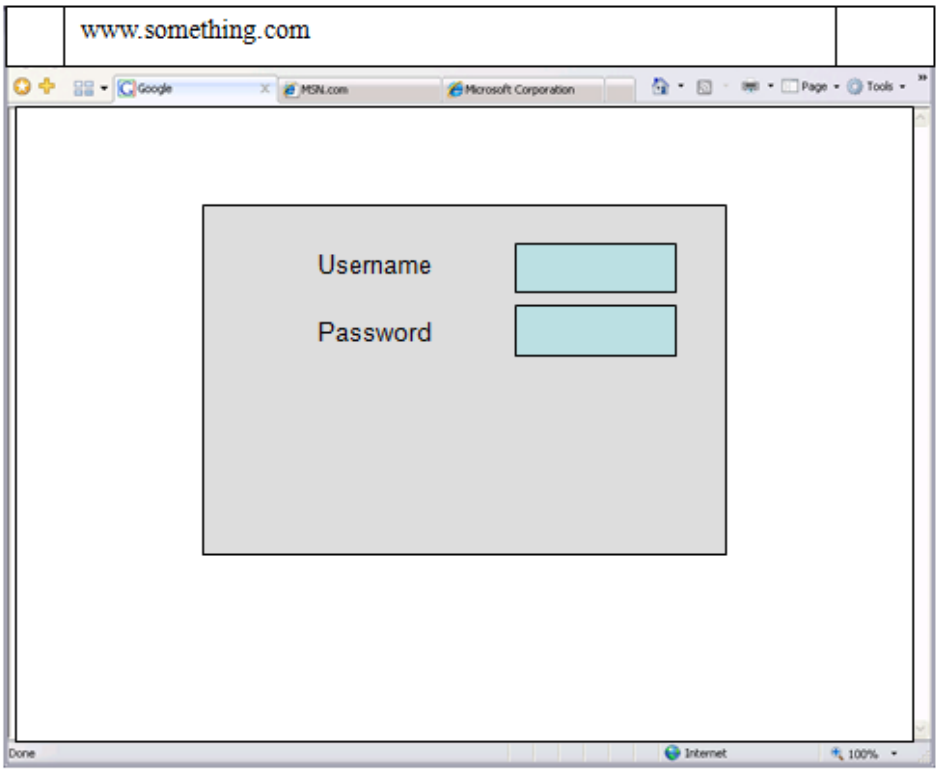


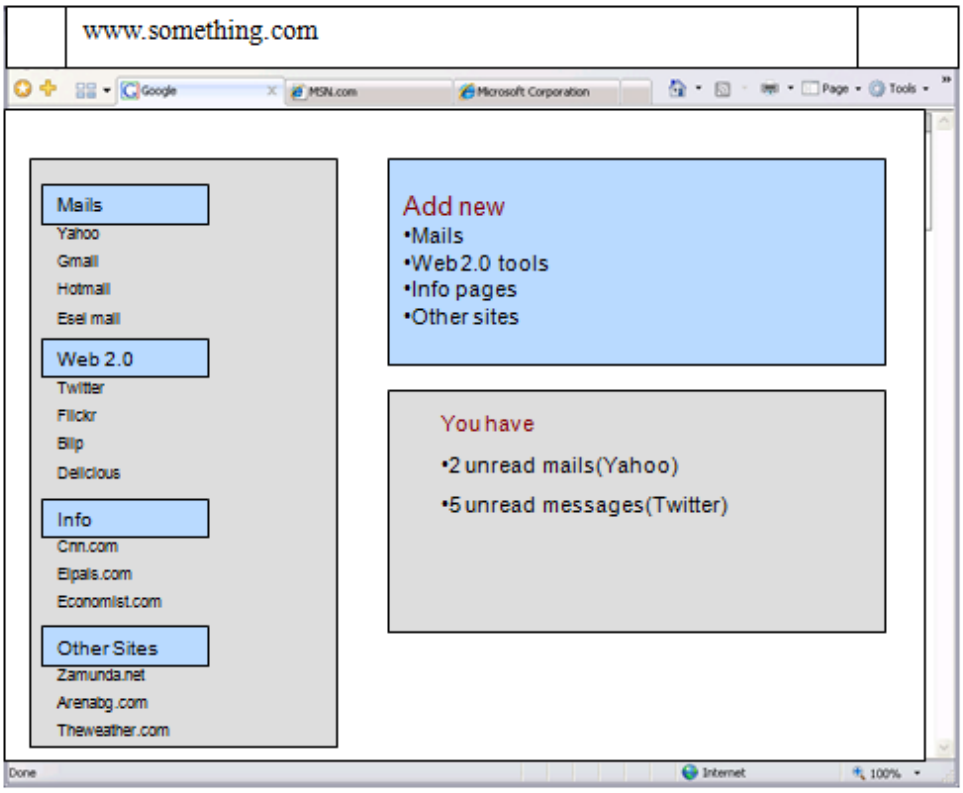
Figure A.6.

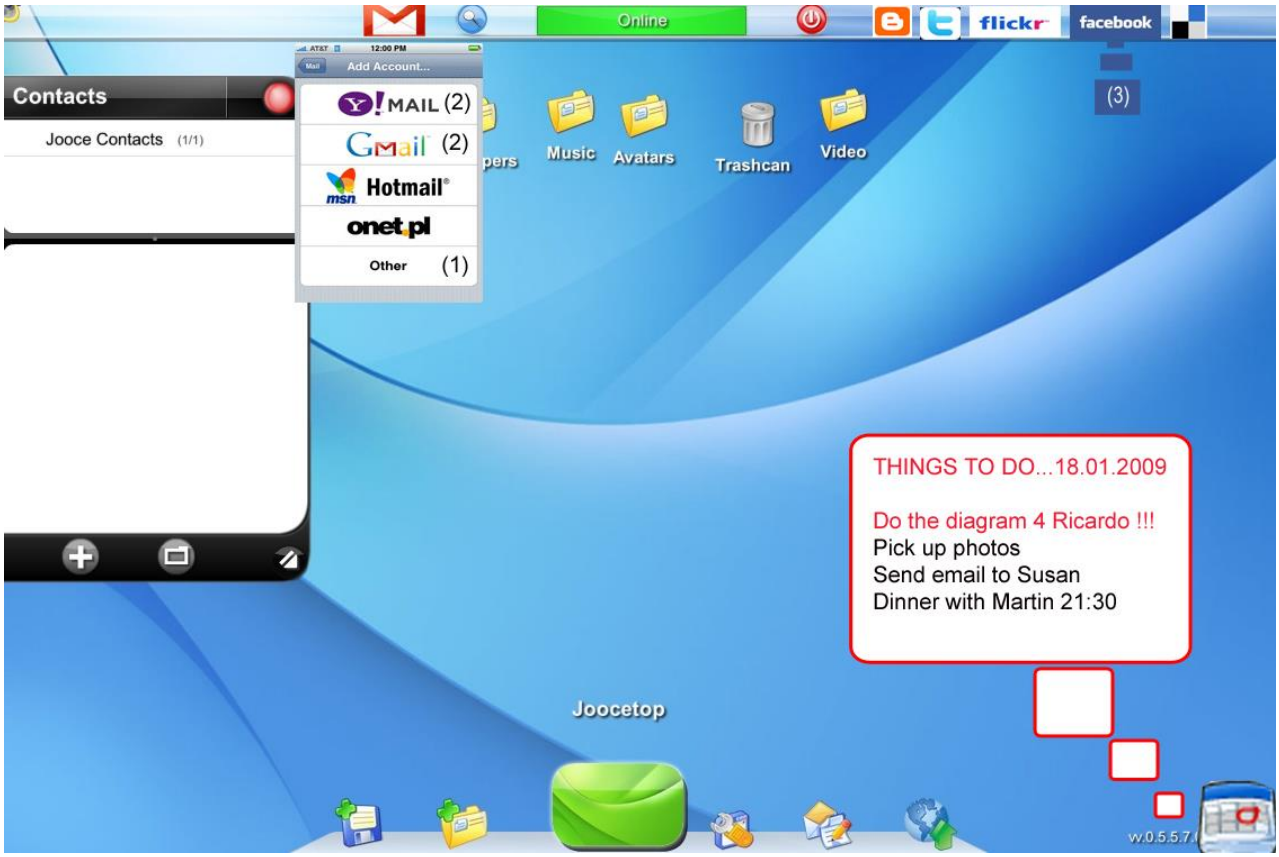
"You go to your Home Page as usual. Enter the address of the platform that I believe still does not exist."

"Here you are asked you Username and password which you have chosen when you were creating your profile. With these usename and password you get direct access to the following *(See next slide)"*



"On the left side you have links to all the places you want to have a direct acces to. You just have to click on Yahoo for example and this leads you straight to your email without having to enter the password and username for this account. On the top right side you have the option to add new accounts and sites you want to visit directly. And below there is something like an *Alert* showing mails and messages you have received but still not seen."


www.something.com
Google
MSN.com
Microsoft Corporation
Page
Tools
Mails
Yahoo
Gmail
Hotmail
Esel mail
Web 2.0
Twitter
Flickr
Blip
Delicious
Info
Cnn.com
Elpais.com
Economist.com
Other Sites
Zamunda.net
Arenabg.com
Theweather.com
Add new
•Mails
•Web 2.0 tools
•Info pages
•Other sites
You have
•2 unread mails(Yahoo)
•5 unread messages(Twitter)
Done
Internet
100%



"Jooce desktop would be a starting point in my perfect 2.0 environment as you can access it from every computer and have all your settings (one of my problems now is that I have shortcuts to all web 2.0 tools on my computer (from delicious bookmarks) but I don't have them when I'm working on different computer.

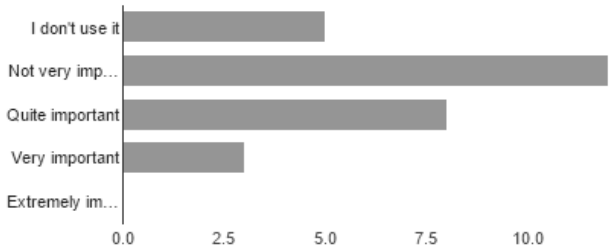
In the upper part of the screen I placed links to blogger, twitter, flickr, facebook, and delicious. On the right there is an icon that develops into all mailboxes that I have (new ones can be easily added). As I don't want to loose time checking if there are any updates in my mailboxes or networks, there are also notifications to be displayed whether there are any new messages/comments/photos etc.

As I also have problems with my agenda, while entering my jooce desktop the Google calendar should display me the things I had planned for the day."

Appendix B

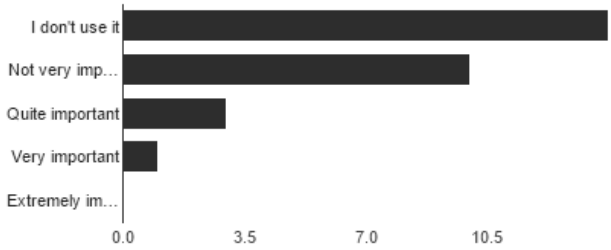
Extract from responses received on a survey conducted about the students' use of technology (October 2015). Total sample: 28 students.

Facebook [How important are the following services in your learning?]



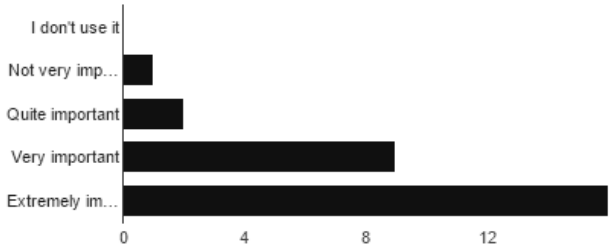
I don't use it	5	17.9%
Not very important	12	42.9%
Quite important	8	28.6%
Very important	3	10.7%
Extremely important	0	0%

Twitter [How important are the following services in your learning?]



I don't use it	14	50%
Not very important	10	35.7%
Quite important	3	10.7%
Very important	1	3.6%
Extremely important	0	0%

Google (search engine) [How important are the following services in your learning?]



I don't use it	0	0%
Not very important	1	3.6%
Quite important	2	7.1%
Very important	9	32.1%
Extremely important	16	57.1%

Appendix C

Table 1. Main coding categories and evidences.

Student/ Evidence of...	Improved skills & Learning	Organisation and management	Strenghtening social interaction	Criticism, negative points
C.H., male, age 24.	"I know Flock has a news feed, but I do not use it (yet) since my iGoogle is already modified to list all the main topics I need to know" "My decision fell on combining Flock with iGoogle, so Flock is my standard browser and iGoogle is my start page" "very often I choose, or have to choose, the 'getting smarter' path [...] I start by filtering the Twitter comments based on their usefulness for my studies [...] the next stop for me is the class's blog and wiki" A well-developed PLE can lead to enhanced (autodidactic) learning, and to a better and more widely informed workforce from a business point of view. Interesting is also that the concept of trying, creating and using PLEs is fully applicable to our own lives,	"my iGoogle [is] a big information center"	"I prefer to learn alone -since I am more effective then- I do not use the 'social' element often" "one thing I started using through Flock is Facebook [...] I started to have conversations with classmates, friends and sometimes even teachers"	"this browser [Flock] does not completely satisfy my needs [since] it is installed on the computer and saves all the setting on the computer it is installed on, it lacks flexibility"

	and can actually be used to inform ourselves better about practically any topic we would want to be informed about.			
M.A., female, age 22.	"I have been introduced t tools I do not think I would have been using already now, if it was not for this project"	"Likes the idea where I have all those sites I am using, collected together in one place. I don't have to remember which sites I like to go and read on. I constantly get new updates from all different sites I am usually checking, so I do not have to remember all different sites, passwords, etc""	"what I like the most about all these web 2.0 tools is the ability to get inspiration, knowledge and to be able to interact with other people" "[Twitter] definitely created a stronger link between us classmates and the teacher" "If I see a trend that most people are switching to, then I do the same"	in the beginning it was nice seeing new tools. But as I said earlier, in the end it was just too many If I just got to know Netvibes a little bit earlier, it would have been easier to keep being updated; instead I forgot tools that we had been using. So just a bit earlier introduce, Flock, Netvibes etc, to let the student choose how they want to handle the tools
M.V., female, age 24.		"I really support the use of PLEs, because it can help me to share information and exchange many things through the web 2.0 tools" The usage of the PLEs (Personal learning environment) can help us organize, manage and control our digital ID and contents.	"with tools like this, I create many close relationships with my classmates and teachers"	
A.N., female, age 20.		"using a PLE will help me more to have a better organised online		

		learning environment" "[a PLE] is an easy way to manage and organise all the information I get from online sources, and also offline ones"		
L.I., male, age 22	"PLEs increase my level of learning opportunities, as I don"t miss anything in a news perspective" "a proper working PLE decreases the level of stress and increases the opportunities to learn" "it has quite obviously opened my eyes for new possibilities to make my learning more effective, in the way that my selection of tools has become wider and therefore of better quality" "Web 2.0 tools have opened a totally new side of my head, and I have started to get really interested in technology for the first time"	"there is such an overload of tools today that we need some kind of organiser for them" "Flock has taken it to another level for me, by centralising all my different [web] stops that I do in one page" helps me to stay updated about both my personal and professional network". I find it extremely useful with these tools because they help me to organize my daily life. A word like organize is central for me and describes how I want my "professional" life to look like, I am therefore open to any tool that can help me to get even more organized.	"it has widened my connection network that is extremely important for me when learning and taking on new approaches [...] I learn the most during discussions withg others" "I am developing a network that most probably will become extremely valuable in the near future" "it has helped me create new links with people I normally would not talk to" "I have discovered many people's skills and knowledge thorugh online tools, because it keeps down my perceptions about that the other factor is that it helps me to stay updated about both my personal and professional network. I do use PLE's and I really feel that it has and is helping me in	

			organizing my daily life. It is not only my work, which has been more centralized, but as well my social life that I believe has helped me a lot.person"	
K.E., male, age 20.	"the concept of trying, creating and using PLEs is fully applicable to our own lives and can actually be used to informa ourselves better about practically any topic we would want to be informed about" "a well-developed PLE can lead to enhanced (autodidactic) learning"	"there is no way to deny that the Web 2.0 environment offers its users easier access to more information than ever before" "PLEs may be the answer to reduce complexity or at least a major step in doing so"		"Web 2.0 [tools] can raise much complexity [...] regarding passwords and usernames, interconnectivity or even complexity caused by the amount of tools available right now"
J.N., male, age 21.	"PLEs help people become more familiar with the capabilities of Web 2.0, which is very important"	"[Flock] allows me to become more organised while surfing the Internet. It saves me time, space and is much easier to navigate. I can organise my most viewed sites so they are just a click away and they consistently update"		"they could also create problems [users could become distracted and procrastinate more"]
C.A., male, age 21.	"the main advantage of [building a PLE] was to understand in some sense what the use of the Internet is heading towards		"the social element has had a fairly large impact in my learning process, it has helped me to create stronger links	

			with classmates, friends and teacher because you interact more and put your opinions forward"	
N.A., female, age 21	"I have created a Wiki [and] it really helps." "[PLE] has changed my personal learning process"	she goes on to propose the use of e-portfolios (without actually using the term), and proposes to develop one as part of the subject's activities.	"it is easier for me to ask for help if I need it and to learn more new things" "the only thing that helped me know more about others was Blip.fm, bacause I consider music as a very good representation of people"	The only thing that bothers me, however, is the question of privacy. But after all, this problem remains no matter whether I am on the Internet or not.
A.L., male, age 20.	The use of Web 2.0 tools will allow him to "continue learning stuff […] even after finishing studies". "I […] am addicted to Twitter [and] I'm becoming addicted to delicious as well". having the environment and the network will definitely going to help me in working, studying and learning a lot more different stuff	I would use PLEs to help organize and manage my content and digital IDs because it will save me time, it would be easier to manage and operate with such an environment	Socialising process like strengthening relationships with some people is a great advantage as well. it also helped me create new links with new people all over the world which I am communicating and sharing information with every single day.	
M.I., female, age 21.		Having participated in all these activities has undoubtedly changed the way I connect with different groups from my environment in the sense that now I can contact in a more efficient way. After I started using Flock, I was able to	Thanks to Twitter and Flickr, for example, I was able to communicate with classmates on a whole new level. I am not saying that I have become closer with them, but I got the chance to learn new things about them based on the way they express themselves, the jokes and comments they make, etc.	One thing I would change is the "element of surprise" and lack of clear purpose that came with the introduction of the PLEs at the beginning of last semester. What I mean by this is that, as we did not know what was the actual purpose of having all those accounts, at some point I

		organize better my accounts and web 2.0 applications. I find it really time saving having all in one place and being able to see with one glance the latest activities on Twitter or Facebook, or the latest news, for example. That way you see only the thing that interest you.		felt overwhelmed by all this and started loosing interest.
A.K., female, age 21	I think that knowing these tools opened many different possibilities to use them, and for me personally, they appeared to be really useful	[the wiki] is designed as a place where I can store all the documents, videos, and links that I have, organized into subjects, personal folders, etc PLE's might also serve as a great storage of information gathered over a years and organized in easily accessible way	Sometimes, if there are things I would like to discuss or ask to other students I am also using twitter As for the relationship with my classmates and friends, using social networking gives a feeling of cooperation and allows easier contact even with people you don't necessarily want to keep the constant contact with	Currently, I need to check separately the links on delicious and then go and look for more information using search engines. The problem is that many links overlap and double searching is time consuming (and occasionally irritating).
B.R., male, age 20.		?. I think the PLE wont help me only to be able just to have all the tools in one page and saving time but also killing the lazy	I think 'social networks " is a good way to keep in touch with relatives and also to communicate and follow the news, but if I'm interested in this approach it will be more	

		personality on me I mean sometimes I am just so lazy to check one of my tool or just to open an new window so that's why usually I forgot my password for a tool or even my "user name" because I didn't check this tool often, so with the PLE it will heal me from " laziness and bad memorie" at least	for my professional life , i am using it today like a student but I think in the future I will be more addicted to the "social networks " why? In my personal opinion i believe to be an "professional individual" who has a web presence control and valued , there's no more effective than the "social networking" because you must be visible to be found, and hunting by recruiters, you need to be noticed and be promoted	
H.A., female, age 22.		As I am a regular user of various Web 2.0 tools, I do appreciate the idea of having a centralized platform that allows for the integration of these tools.	I highly appreciate the possibility of being able to work on e.g. university projects in an interactive manner with other team members outside of the educational institution.	I have started to use fake usernames, because I am somewhat deterred by the opaqueness of legal issues concerning privacy in the Web 2.0 environment

Table 2.

Additional categories (second round of coding)

Student/ Evidence of...	Perception of PLEs as changing entities	Personal dimension
C.H., male, age 24.		He also mentions that this is "not only my PLE but also my PEE (Personal Entertainment Environment" and PSE (personal Socialisation Environment)"
M.A., female, age 22.	. I am sure that in 5 years time, a lot of websites have been replaced/renamed, but I still think that the main functions will remain, but with new design, more features, everything working more together, linked together to easier go from one tool to another.	
K.E., male, age 20.	My use and choice of tools will depend of course upon the work I will be doing in five years time, but I hope and think that by that time I will have improved my network of tools and applications so as to be informed daily on what is happening in the world concerning various, sometimes very different, topics.	
N.A., female, age 21	With the way technology evolves my answer would be that PLEs will most certainly have changed to be something else or they would become obsolete by something much more innovative	I will definitely create my own PLE in the most suitable way for me
M.I., female, age 21.	I do believe that even in 5 years time, some of today´s PLE (or their variations) will continue being widely used and applied. I, personally, see myself using some of my connections built and maintained with Twitter and Facebook. However, many things will have changed for 5 years´ time and may be I will be using better versions and variations of those PLEs.	
A.K., female, age 21		my private wiki site, which might be seen as my basic personal learning environment.

Table 3.

Follow-up Interviews.

A.K., female, age 21

How/What was your learning process using 2.0? We want to know exactly how do you think PLEs and building them helped or changed your learning process/experience.

My learning process with the use of Web 2.0 tools started as simple as getting to know and exploring new applications starting from twitter, through de.li.cio.us, wikis and flickr, up to blog, blip.fm and jooce. Getting familiarized with these tools opened to me some more opportunities and ideas about organizing and structuring the data I already had as well as the creating new sources of new information. While I was using twitter more for the dynamic discussions and instant messaging (saving all data was annoying as I had to copy to the word document), de.li.cio.us and wiki appeared to be very valuable platforms for saving and sharing information right after I found them. Also the blogger is still giving me the possibility to review previous topics and search for more of relative comments. The biggest benefit however from using the Web 2.0 tools for me was the fact that all the things I was learning were shown to me not only from a single perspective of a teacher or an author of an article or book, but also from the points of view of many other people. Comments and discussions helped to spot out the mistakes or controversial aspects as well as develop the topic over its presented frames. Having the sources for the PLEs I started the research in order to create the environment that would join all of the tools and applications together with each other as well as with the documents, pictures etc that I had saved in my files. As I approached the PLEs in a different way than already established paths, the searching for my optimal PLE platform was another opportunity to increase my knowledge about web 2.0 and learning options. Furthermore, it gave me possibility to establish new platforms for creating groups of friends and ‘partners’ in learning.

2. How did the PLE concept help working with so many different tools?

As I managed to develop my final personal learning environment not a long time ago I haven't had much opportunity to check how it is helping me to manage the different tools. However, from what I already noticed it facilitates it quite a lot as I no longer need to browse all different addresses and it's much easier to remember all the tools to check. It also helps to manage some of the passwords and join groups of friends from different sources. Finally, it allows you to share files, music, etc from one place what makes it easy and fast.

3. How did the PLE + web 2.0 helped in the learning of the subject´s contents? (as opposed to learning in general)

As by now I was using the Web 2.0 tools and PLEs mainly for learning business and business technology, I already answered this question in the first point. The additional tool that helped me a lot with developing knowledge for this subject was the RSS reader as the most difficult thing for me to manage was to keep up with the news from different sectors and different sources. Getting more up-to-date information and being able to save the interesting sources that provide this information is also extremely valuable for following and benefiting the character of business information systems' class. Apart of these, using the web based tools means using technology so developing knowledge in the field of the class.

4. Do you still use: - Web 2.0 tools? - Your PLE?

From web 2.0 tools that we got to know in class the ones that I'm still on the more or less regular basis using are the wiki, blogger, and de.li.cio.us. The reason I stopped using twitter as frequently as before is lack of time to do the follow up of the topics discussed. Besides of these, of course I keep my profile on Facebook and some other Web 2.0 platforms that we did not discuss in the class (mainly because they are available only in Polish and useful only for people from Poland).

Concerning the PLE, I cannot say that I still use it – it's more that I'm starting to use it. I'm currently trying to develop the platforms of g.ho.st and AjaxWindows virtual desktops as

they match the best my needs. Unfortunately working on them means trying to persuade their creators to improve them so that they can function in a way I need them to. However, although they still lack a lot in relation to the Web 2.0 tools, I'm using them on regular basis to make notes if I don't have access to my computer, to save and 'transport' files and to organize myself (stickies is a wonderful tool). The interesting fact is that although since I have a PLE I use some of my Web 2.0 tools more often, PLE to big extend limited my use of de.li.cio.us as I can save all my bookmarks in the applications provided by the system.

A.L., male, age 20.

How/What was your learning process using 2.0? We want to know exactly how do you think PLEs and building them helped or changed your learning process/experience.

I will refer to my previous papers on PLEs where I said that I have not built PLEs and I have never used it – none of the four approaches. I am still using web 2.0 the way I used it before. My browser, Mozilla, is, as if, specifically made to adjust to my needs. For now, I am pretty satisfied with it and I do not see any sense in implementing any of the approaches, which I believe, at this current stage of my e-environment, will be only a burden. To sum up, PLEs have not changed my learning process, obviously because I don't use them.

NOTE: If you want me to develop this question more, or another question, please, let me now!

How did the PLE concept help working with so many different tools?

Don't use it, therefore didn't help.

How did the PLE + web 2.0 helped in the learning of the subject's contents? (as opposed to learning in general)

PLE didn't help in any way. However web2.0 tools did. I will consider that the question regards to Business Information Systems by "of the subject's contents", so web2.0 helped a lot. The Wikis and Twitter helped me to learn the BIS content a lot more than what I was going to learn on my own. Discussing different topics with the professor and a few more competent students was pretty useful with very appropriate question being raised, which I believe nobody could have come up with during the lectures at the university because nobody had the time to scrutinize the content like what students did at home. Web2.0 helped me because, using Twitter for example, the subject's content was provided in its most simple form, maybe because of the limited number of characters you could use.

Overall, web2.0 helped with simplified form of the subject's content, more ideas being shared, more valuable questions being raised, and more sensible answers being given due to the seriousness of the students who were using the tools, which in class, with half of the students being simple-minded is quite impossible.

Do you still use: - Web 2.0 tools? - Your PLE?

Of course I still use them. PLE – not. As I mentioned in my previous paper – Twitter, YouTube, Wikis, Delicious, Flickr, RSS, Intranet, Ideablob, Flixya and Zebo and now I started using Facebook – not only for social purpose.

There is an increased rate in using Delicious, YouTube and RSS. My "active" Twitter participation rate fell, on purpose, due to lack of other members' participation but my "passive" rate went even up because, I follow more and more people which post more and more stuff, so I am just "consuming" at the moment. Simply put, now, I am an information leech in Twitter.

A.N., female, age 20.

The fact of using Web 2.0 tools for my learning process helped me improve it, and actually for my way of learning it was really useful. As I said in previous papers, I do not like all of the tools, but some of them help me organize myself while learning. Before I just looked in different encyclopedias, and websites for the information I considered useful for any project or report I had to do, and that was it; now with the 2.0 tools I see it more dynamic and more interesting. I took the tools that I liked the most and the ones I thought would help me more while studying, and in that way now I think I know and I feel better when researching and learning from different topics.

Organizing one "big" environment with different tools was not quite easy, I had different tools and different options I could use, but I managed to do it and in a way that made it easier for me. I didn't have tools I didn't consider useful for me and my way of learning, and I actually only took the ones I thought I will use the most and that will help me more. The concept of PLEs actually facilitated the way I was using the different tools, it helped me organize them and use them in an easier way and more useful way.

The combination of the 2.0 tools and the PLE in the subject of Business Information Systems was even more helpful than learning in general. In such a subject we are learning about new technologies and new advancements in the world of business and information systems. When I got to class I didn't know anything about the Web 2.0, 3.0, etc and even less about PLEs. When I began using those tools and those concepts I realized that it was not only a big part of the subject, but that it actually made it easier to learn about the different advancements we are having in business. All these tools and concepts that we are using are part of what is going on in the real business world, and learning them and actually using them to discuss topics not only offline is something that I consider more interesting and more actual in today's world.

What is true is that I'm not actually my PLE as such, but I still use and more than at the beginning the web 2.0 tools. Sometimes I think that for certain works the PLE will not help as compared to others especially group works and that is why I don't use it, but basically is because I change a lot in my way of learning, as in many aspects in my life. I don't like routines and sometimes I close accounts and reactivate them without any good reason. Other reason I think that affects my use of PLE is that I don't update it too often or if I didn't use it for some period of time I forget about it, but in any way I, when using it, consider PLE really useful for my learning process.

B.R., male, age 20.

Honestly I wasn't using so often web 2.0 , it was just for fun more than anything else but after this year I am seeing the 2.0 in a total different view for me today the web 2.0 seems to be ideal tools to collaborate and share and create knowledge. What strange on my process of learning was that I was getting ideas day after day I mean I began more innovative than I was before maybe because I think by promoting exchanges and co-creation ", Web 2.0 applications had optimized my innovation process. The 2.0 had allowed me to navigate and to create new forms of expressions and new rules of social behaviours. Web 2.0 has changed my browsing habits and treatment of information by offering new ways to locate information. the fact that Web 2.0 places the learner at the center of the environment as known today as the PLE in my personal experience to reassemble all my resources of learning (digital or others) so in short this allows me to be in a professional continuous development.why?? One of the most interesting tools that I have tried can be the social bookmark; this process of sharing and research can be much more fruitful than even advanced search into a search engine such as Google.the fact that two users interested in the same subject can meet more easily on the network as they share stories or information they deem relevant to the community in example of delicious; Since it is a collaborative indexing system that marks the evolution of classification systems as it is me who created my own meta-data according to my own vocabulary, and my way of seeking information.an other example Social networks as they enable people to create

social interaction sp these applications promote ergonomics and use of the user interface through a simple browser I can say here tht social networks are part of the structural aspects of a personal learning environment. Wiki one of the most interesting one the particularity of it is that the content of pages is not frozen. The fact that everyone can add, delete information helps to develop knowledge, build information collectively , the interest of the wiki is also linked to the fact that each individual contribution created a collaborative to everyone that wants to be every day better. So all this tools are helping me like I already say just to reassemble all my resources of learning like my PLE and the concept of putting all the tools in one application will allow me or already allowed to react and interact in a quick way and also not the envy but the need to explore more tools to extand my learning environment.

like i have said before if i continious with the web 2.0 and specially with the social networks it will be more for my professional life , i am using it today like a student and honestly not so often but i am using it and i can say it is already a first step because in the past i was not at all interested about it maybe because of my culture where we dont get in touch with people easily but for sure i will be more connected to the "social networks just for a simple reason i believe or i think that the ability oto communicate is a key factor to a sucess of a person and the social networks are the best way to do it so at the end i will defenitly stay using web 2.0 and more oftem than i do my purposes will be on the social networking are to be visible and noticeable and also able to communicate. I am quiet interested about the PLE and its concept and I don't think its possible to use the web 2.0 without developing a personal learning environment and putting all the tools together it is just perfect I am now using google chrone who can be an exemple of it it is just good and I think some little modification of it can make it perfect but it still interesting and saving me a lot of time , as I am in a continous professional development why to stop it? I will continue using it…maybe students of today have not grown up with Web 2.0, but the young people to whom they will teach , they will lead them in this universe …the question that I am asking myself about ; Future teachers are they the Web 2.0 or 3.0???

C.H., male, age 24.

1. What was your learning process using 2.0?

   As we started this course, I had heard already about web 2.0 but did not know what this term was about. After being explained the concept, I was quite surprised that I actually already used some web 2.0 tools without even knowing what they were. Nonetheless, the basic application of web 2.0 for me was for social communication such as Facebook or StudiVZ and entertainment such as Kongregate. In the course of the classes, I realised the possibility of using web 2.0 applications for actual learning. Eventhough, tools as Twitter, while being interesting, are no option for to study, since I prefer to learn on my own, blogs, wikis and online communities, provided my with much information, which made studying easier.

2. How did the PLE concept help?

   As we were going on in the class, and I heard of more and more tool, I came to the point that I had so many accounts in so many different applications, I could not even remember where I had created an account. As Ricardo, then (finally) informed us that there is a possibility to put some of these applications together, I again was surprised that I already used one of these PLE, iGoogle. Despite that, changing my browser to Flock, made it possible for me to save a lot of time in logging in and out on several different pages. By combining my already customised iGoogle with Flock, my PLE provided me with nearly everything I needed for private and study purposes.

3. How did the PLE + web 2.0 helped in the learning of the subject´s contents?

   These “technologies” helped immensely my learning process, especially since in Business Information System most of the topics were presented by the students, who often did not really know what they were talking about.

4. Do you still use Web 2.o, PLE

I am still using my iGoogle Flock hybrid with all the features those systems provide, but I had to cut down on the web 2.0 application, since as i mentioned before, i cannot remember them anymore.

H.A., female, age 22.

1. How/What was your learning process using 2.0? We want to know exactly how you think PLEs and building them helped or changed your learning process/experience.

Web 2.0 tools have extended my learning experience from the classroom to my home. My management professor during the first year of my university studies once told us that rather than remembering specific formulas or theories, we would probably leave university remembering comments of and discussions with fellow class mates. This is exactly where Web 2.0 tools come in for me. I am now sharing links, files, and thoughts with fellow classmates from home and I feel that this enriches my learning process. It helps me to look at a video explaining the concept I have read about in a text book, or discussing pros and cons with a fellow student to reflect on the topic I am studying. I am increasingly 'building bridges' and seeing connections between the different subjects and concepts I study. This type of learning has a very social aspect to it that I enjoy, because academic and private conversations are mingled.

I am still attending classes, reading hard copy text books, and prefer to print documents in order to highlight them manually while reading. When preparing presentations for class I still think it is necessary to meet in person, to discuss, prepare and practice the work to the fullest extent possible. Nonetheless, I am absolutely thrilled about the concept underlying Web 2.0 and the benefits Web 2.0 tools render to my private and academic life (and I am not just saying this because I think you want to hear this, Kompen). The technology used is surely interesting, but what is really great to see, is how it all comes to life through people networking. This is the future.

2. How did the PLE concept help working with so many different tools?

I enjoy the ease of using Google Docs in that it only requires me to access with my username-password combination to one program, which allows me to upload and share files, e-mail, chat, talk over VOIP, etc. I had difficulties getting myself to regularly use a program such as Flock or Netvibes, because it meant getting used to yet another interface. Although from a rational point of view, using a PLE to manage and access various programs should render more convenience, I preferred to access Facebook, Twitter and other Web 2.0 tools directly. However, this has changed since the E-Mail server I have been using for many years, that I access daily, and to the interface of which I am very familiar with, allows me to build a PLE. For more information on this please refer to the answer of question four in this document.

What I am looking for most in a PLE, besides a convenient interface, is the integration of passwords and usernames.

3. How did the PLE + Web 2.0 helped in the learning of the subject's contents?

Web 2.0 tools have advanced the way I study and learn. Exchange with fellow students and one of my teachers now takes place much more outside of the learning institution and I enjoy the discussion of concepts that takes place online. It has helped me immensely in transforming information provided in class and course textbooks into knowledge, as discussions force me to reflect on the studied concepts. However, this is more true for 'soft' subjects than for instance the Corporate Finance class that I take. While one can easily talk about theory online, it gets more difficult if financial formulas have to be discussed online. In that respect, I still feel that for some learning experiences, it is easier to meet in person, even if Google Docs provides the opportunity to chat, upload files, and talk over VOIP.

A tool I could picture for the future, would be an extension of the Google Docs program, which would allow you to upload a file and have several users work on this file at the same time. But instead of having only one cursor, as Google Docs has now, the program would asign users a color-coded cursor when opening the document, so that changes could be

made simultaneously and tracked by the other users. This would also allow users to point out something in the document for others while working on it.
It is the lacking ease of discussing certain subjects, in comparison to talking subjects through person -to-person, which leads me on to the answering the next question.

4. Do you still use: - Web 2.0 tools? - Your PLE?

I am still using many of the Web 2.0 tools I have been using for a while, and continue to use some of the ones introduced in class. In relation to the way I learn, Web 2.0 tools now form a more regular form of communication with my fellow students.
In trying to answer this question I remember Metcalfe's law that we discussed last year. While I did find Twitter, for instance, very useful for conversation style communication with various peers, I am using this tool less now, because less of my fellow class mates are using it. The less people I know are tweeting, the less value the tool offers for me.

As for the PLE - I am neither using the social-networking, start-page, or browser-based approach, although I downloaded programs such as Flock, to try each approach. I am, however, still using Google Docs frequently, to upload and share projects I work on with class mates. The start-page and browser-based approach I cannot seem to get used to, mainly because it involves dealing with yet another program, even if that functions to integrate all the Web 2.0 tools. I do use Facebook to communicate with fellow students about university matters, but am still somewhat reluctant to do so, because I feel my 'social' network should be kept apart from my studies. There is evidence, some of my friends feel the same about this, as I had recently post someone on my Facebook wall '*Please don't post school shit on my wall ;P*'. It speaks for itself.

I was surprised to discover a couple of days ago that the German E-Mail server (web.de) I use, the function and design of which has largely remained the same over the past six years, now lets its users build what effectively classifies as a PLE, in that has introduced tabs which allow you to access, for example, Facebook out of your E-Mail inbox. You can set the server to remember your user names and passwords and I am very happy about this, because it means I get to use the interface I am familiar with to access all Web 2.0 tools I

use without the hassle of having to remember and type various username-password combinations.

J.N., male, age 21.

I was very pleased overall with my experience with 2.0 and PLEs. They really benefitted me because their extremely useful for internet organization. Keeping the web 2.0 tools we used frequently on my favorite sites, helped me keep up with the pace of the class. I really like the concept of creating more space while browsing. Before having a PLE I found myself having constant windows open while working and it became annoying. The PLE concept helped me with the different tools we used because it allowed me to easily follow them while being on the internet. Providing me with frequent updates was very beneficial because I knew what was happening at all times that I was online. I especially was a fan of having the facebook chat open while looking at other websites. I felt that using PLE and Web 2.0 was great because it was a hands on experience. I have accounts with all the 2.0 tools and its nice because I have become a follower of most of them and like using them on a regular basis. They are a great approach to teaching and showing students the benefits they provide by creating accounts and staying active, instead of just showing them in class. After I leave Barcelona I fully plan on keeping my accounts active and using my PLE everytime I log on to the use the internet.

K.E., male, age 20.

Having participated in this project up until this point shows already that I, to a very considerable extent, believe in the usefulness of PLEs and the offerings of the Web 2.0, so I will not comment too much on its utility again.

What I did realise though, is that studying the meaning, the possibilities and the formation of PLEs helps a lot in understanding the Web 2.0 environment, and the opportunities it offers to the internet users of today. The 2.0 concept on itself can be quite overwhelming,

even confusing at times, and the idea of a PLE can help create some order in this environment, upon correct usage of course.

This is because a PLE in the first place is personal, and based on personal preferences and tastes. This means that the ideal PLE will vary from person to person, as each individual will add different elements to his or her Personal Learning Environment. Subsequently I believe that the ideal PLE for an individual should not be created by someone else than this person. Creating a useful general basis (for example with relevance to a certain topic or subject of study) is of course possible, but there should always be left room for the user to make adjustments to his or her PLE.

To illustrate I will explain how I use my PLE, and what currently are its main purposes when it comes to my usage. This will show immediately what I mentioned in the paragraph above, as without a doubt my ways of using the PLE will differ greatly from how many other people use their PLE.

Most importantly, I do not use my PLE so much for the purpose of studies or university. Instead my PLE is aimed more, so I discovered, at managing my contacts (FaceBook, E-Mail accounts), and more importantly, staying up-to-date with the news worldwide (ranging from newspapers to gadgets and travel) through Digg and my recently renewed RSS-readers, Bloglines and Omea Reader. I might deactivate my Digg account though, and I will remove Omea soon too I think, because its very similar to Bloglines, and I find Bloglines simply more usable.

I know the size of my PLE is relatively small still, but this is because I am only mentioning those tools that I am using frequently, those tools that I really consider to be useful to me at this moment. This conception of what I believe to be useful to me changes though, which means that every now and then I will remove an element from my PLE, or add one to it. This could be because I had a tool "on trial" which turned out not to be to my liking, or because I learned about something new that would add real value to my PLE.

Another possibility is that my view about a tool has changed since having heard about it. For example, I am considering opening a new account on Twitter, with the aim to create a (small) network of people and causes that post something every now and then, with relevance to my fields of interest. Twitter has become a source for a lot of primary resource information, and in some cases the system was quicker to report global events than any

newspaper in the world (think about images of the aviation disaster outside Amsterdam a few months ago). Besides Twitter I will also be trying out other tools, such as Snipi, ASmallWorld (via invitation) and WeAreHunted.com, to name a few.

Personally I think that because of the way I am using my PLE, i.e. not so much for study- and/or university-related causes but more for gaining general knowledge and managing networks, I am able to use it more frequently during my free time (for example, during the coming summer holidays), and most probably I will keep using and improving it after having finished my studies.

L.I., male, age 22

How/What was your learning process using 2.0?

Building and developing my PLE has in the large picture helped me to organize my time on the Internet much better, and the result from this is that I have developed a much more effective and better learning process. However, I can't really say that I in detail use my PLE to just increase my learning process or experience. It has more been about organizing my time on the Internet.

Let's say Twitter for example, I basically only use this tool during the time that I study for an exam, and at that moment the PLE has helped me to keep track on all the updates on Twitter.

We can then of course talk about how we define learning in this context as the following question. I can honestly say that I personally define my learning time or learning experience as something that is constantly going on.

What I really want to say is that on one hand it has changed my way of learning as it has helped me to integrate a tool like Twitter in a much more effective way. But, I do not think that the largest impact the PLE has had is in the way that it has changed something. It has more helped me to bring "all" the tools that I have been using before, in one place.

How did the PLE concept help working with so many different tools?

I almost answered this in the first question; that it is mainly this that the PLE approach has helped me with. I do not think it has had a huge impact on my learning process, instead I believe it has become the best organizer that I can possibly have in my daily Internet life. Without the PLE I would have kept spending time on going to every single page to see if something new has come up, however, with my PLE I do not have to do this.

How did the PLE + web 2.0 helped in the learning of the subject's contents?
(As opposed to learning in general)

The way that we have approached Business Information Systems this year has increased my level of interest in both the subject itself, but also in the area of Business Information Systems in large. It has decreased the level of "heavy" theoretical classes, which I am not a very big fan of; and instead increased the level of integration into the teaching and learning process.

It has been like discovering a new world if talking in a very philosophical manner, I think this journey of discovering and testing new ways of learning approaches has made my interest in this subjects much large. Instead of having the teacher telling us what we have to do after what he has read in the textbook, we have together discovered what we should learn during this course.

The huge part that has changed in the way we have done things during this course is how we communicate what we are learning, and how we discuss this among us. I believe this will become the future of how learning and most of all how teaching will be implemented. A larger wave of integration in the learning will come out of this PLE and web 2.0, and I think the teacher will evolve into a facilitator more than an autocratic teacher telling us what to do.

Do you still use: - Web 2.0 tools? - Your PLE?
How can you not use Web 2.0 tools in the current Internet environment? That is really the question. After having this course I have as described above discovered a whole new world of tools that is helping me constantly in my daily life. I have in some strange way developed a "passion" for computers (meaning what we can do with web 2.0), which I never thought I would.
I am today still using a PLE, but I can honestly say that I have not found the completely right one for me yet. There is still issues about the usability and design that is missing for me to really stop testing. However, when thinking about it, I believe that this testing can help me to learn even more about the market of PLE's. I have used Google chrome, igoogle, Flock, Netvibes, and today I am currently using pageflakes, which I think is the best one I have used so far.
Another point that I would like to mention (which I have discussed with you Ricardo), is that I as a Mac user is constantly using my invisible desktop that is full with widgets. I can honestly say that I am using this page as much as I am using my PLE, and in some issues I think this page is much more user friendly.

That was all from me, and I would like to add that this has been a very interesting journey that I have been honoured to take part of.

M.A., female, age 22.

How/What was your learning process using 2.0? We want to know exactly how do you think PLEs and building them helped or changed your learning process/experience.
My learning using 2.0 tools has been to easier discover more tools that are available and interact with people in another way than I knew from before, which was Facebook and e-mails. I didn't know about any of the tools we have been using in class from before, which has been good to experience and understand, because there are so many things I have been missing and still don't know about, because I am not updated enough. But maybe that is a question about interest and need of tools. What is nice with PLEs is that you can organize

the tools after how you want them, and by that you can learn in your own way, the way you are structuring them.

How did the PLE concept help working with so many different tools?
I would say that it helped a lot, as I mentioned before, depending on how you structure it yourself, you will easier manage and find them according to how many tools you are using, also easier following updates, and remembering usernames and passwords etc.

How did the PLE + web 2.0 helped in the learning of the subject's contents? (as opposed to learning in general).
In the beginning I couldn't really see the point, but after a while I did. I can now see how those all are somehow linked together and they are useful separate as together depending of the use of them.

Do you still use: -Web 2.0 tools? –Your PLE?
The only things I really use is Facebook, YouTube, read blogs (I am not blogging myself) and e-mail, for me, I got everything there I need to interact with people I want. The rest of the tools are cool to know, maybe I will need them or use them in the future so it is nice to be aware about that they exists.

I am not using my PLE anymore, a big reason for it that I felt that it took long time for it to load. Another reason is that I am not using so many websites, or I know them by heart so I think it feels easier to go directly to the websites that I want to, instead of using my PLE. I also like the feeling that I go directly to the website and I can have a look at everything that is going on there, with the PLE it is only showing a small part of the updates. I think it was good to have tried the PLE, and I think it is a nice concept, but I have now gone back to the way I did before using PLE. But I would definitely consider it in the future; maybe I will see it differently depending on how many web 2.0 tools I will be using

M.I., female, age 21.

To begin with, I would say that learning about 2.0 tools in general was a fun experience. When we started introducing new tools every week, I felt I was being explained things that could one day become very useful. I remember that we started with Twitter, and I like it so much that as soon as I got home, I made a registration, and was in fact one of the first people to register to Twitter.

Probably I would be concentrating more on Twitter because it is the tool I most oftenly use and which I think has converted in the most useful one in terms of helping with my learning.

I particularly liked the idea of starting discussions on Twitter just before the first exam we had, as this was an extremely useful way of sharing your doubts with other classmates and obtaining a better understanding of the concepts through the different explanation everyone had on the questions and subjects.

Although I was finding it very interesting learning about and applying new Web 2.0 tools as part of our course throughout the year, I began to feel overwhelmed by the numerous tools we were supposed to use on a daily basis, as well as all the different registrations, usernames and passwords. I think it was at that point when I got lost and started loosing interest. Then, of course, Ricardo Kompen made his presentation about the research he is doing on PLEs and finally things started to clear out again. Later the same night, I downloaded Flock and registered. Once I started to see the big picture, I began to see the actual benefits of using the PLEs.

I particularly like Flock, as it helps me keep track of applications that are really important to me without having to loose time in signing in ad out all the time.

I would say that the exercises we did, involving the use of almost all web 2.0 tools we have mentions this year, were very interesting, but I, personally do not see myself using Flickr, Delicious, or Blip, at least in the near future(3-4 years).

M.V., female, age 24.

First of all I think that there isn't one single definition of PLE. However, now I would define it as "a map through which I can organize my learning process, both formal and informal". I've tried to build it in such a way, as you can see- tools, places, people, technology, that are somehow involved in my life. But as I always say "a PLE is mine, there's no right or wrong, it's just the way I see it".

So the main roots are really straightforward in my diagram (information, language, etc.). In the last two years of my life, I had such a narrow vision of my "learning process", which more or less it coincided with the university. But there was a radical change in my personal life before a couple of months and I've said to myself, that I have to keep my language knowledge "alive". It was not so easy, because I'd lost the communication with the others (both formal and informal). But I can say now, that I have woken up from a bad nightmare. So I have discovered the potential of Web 2.0 Tools. I am really amazed by the use of technologies to learn everything. The virtual world offers me the chance to communicate with other people, and gave me the opportunity to exchange knowledge and ideas, so in this way I can test my languages and cultural competence. I speak too much, that I forgot to explain the main core roots of my PLE.

I will start with the Information section. I have mentioned "Retrieving". By this I mean"How I can gather information from different materials (books, classmates, social networks). Under"Storing", I have included all the devices, that help arrange this information (folders, tags, blogs).

By Culture I mean the way through which I can increase my knowledge, like for example to see the culture of different nations, customs, food, etc.

The third important part of my PLE is the Places and People section. This part contains the places where I can find "my useful" information to increase again my competence in this so complicated world. I think that the usage of a Web 2.0 are becoming more and more popular and especially because as a business student you have to communicate with your colleagues everyday (even though I didn't make it). So at the beginning of next month I will travel and this is one of the best chances for me to expand my PLE.

The last and maybe the most complex and difficult section, mainly because for me these four skills (listening, speaking, writing and reading) are really important and complicated. Because you have to know what to say to someone in every single situation .Here again I have mentioned formal and informal, but I don't mean only formal education, but every time when I want to learn something new.
I don't know if I have answered to the questions that I have, but the important thing is that I have presented my own vision for my own PLE. In the last months I have really improved my learning process, especially referring to the social networks. And I'll continue to use them, maybe not every day, like many people use Twitter, but with the time everyone, including me will see the importance of the social sites.

N.A., female, age 21

One more time I have to write about my PLE, but this time the questions to answer are much more different and for me, personally, more difficult.
I have no explanation why, may be because the learning process of every person is such that it takes a lot of time to be analyzed and assessed. I believe that it wouldn't be hard to evaluate it, if someone else is doing it, but now that I have to come up with the best words to explain it – I find it a bit difficult.

However, I don't believe it is impossible and I will do my best to be as precise as possible. Again I have to start with my introduction to the web 2.0 tools. I have already said a couple of times that in the beginning it was a bit annoying and without any kind of order, as we were supposed to log in, in all these different sites without having the slightest idea why. Nevertheless, now I can see what the purpose of these tools is. At the moment everything that I am using is ordered in my flock browser, which is something incredible, at least for me.
I have incorporated every web 2.0 tool in the browser and the other sites that I am using are also remembered there. I want to say that I have the sites which are not supported by flock, by remembering their passwords, which allows me a faster access. So, I think that every morning when I am opening my browser I am actually opening my personal online world,

where I can see what is going on around the world, I can see what my classmates, friends and family are doing – pretty much everything I am interested in.

May be I am not explaining it very good, but saying all these things, one can see that my learning process and all my internet experiences are totally changed. Six months ago I had no idea that such sites or tools even existed and now I can not imagine not using them.

If I have to say exactly what new things I learned by using my PLE – I would have to say "a lot". I learned that there is a faster way to check what is going on, in the sites where I have a registration (twitter, flickr, facebook, youtube, gmail, yahoomail). Just by logging I can see if there are any updates from my friends as well as check my mails in less than one minute. Another aspect is probably that I can check the news around the world again very fast. I have these four links incorporated in my flock browser, which allows me to go there and read everything I am interested in. Moreover, there is the option to save the articles that are of most interest to you. I think that's great, since I can go back and read them again or at least share the links with my friends.

The PLE concept really helped me organize all these different tools, because as I said before it was pretty messy going to every site and logging in. I really like that it is personal and every person can make it in accordance with his/her needs. In that way you are given the opportunity to learn something more about your friends or the people you are sharing a network with. I think this could be considered as another learning aspect. It is easier asking for help if don't understand something as you are in constant connection with a lot of people.

I probably forgot to mention before that I have one more tool that I recently added to my flock browser and that is facebook. I was really against having an account there but now that I have tried it I see it is really useful for socializing and being in touch with people you want. I know that facebook can be used as a PLE but (as I am a new user there) I still don't know how this works. However, it is more than interesting to find out and what is more important find out by myself.

I will definitely continue to use these tools and most importantly continue to use my flock browser. I believe that there is no person who tried it and decided it is not useful. I am not going to mention again all the advantages it has, because I already did. I can imagine even now talking or communicating with people from my class but in 5 years time. Of course, I know it is not going to be the same as seeing them, but at least we are not going to forget each other.

In a conclusion I should probably say that my learning process is changed, as everything I do, I do it by using either web 2.0 tools or my PLE. (I know they are not separate but I mean my PLE for sites not incorporated in flock). My experience is also not the same, as before I was using the internet mainly for watching movies and from time to time, for home works (in my high school), and now there all these other activities and emotions one can get - even complaining to one another.
Well, I don't know what else to say. I am not sure I answered in the best way, but I hope what I have written is not useless, because I really like this project, especially being part of it.

O.G. (female, age 20)
Basically, the Web 2.0 tools that I use, are mostly concentrating in entertaining me, but not actually learn smth. By it I mean, facebook and alike applications. However, there are still other tools that help me learn. Though, in fact, these tools do not quite teach me, but they help to access necessary information. For example, esei 2bba website is a platform to upload information for subjects, homework and learning. This gives direct access to presentations, so that I don't have to wait for ages for presentations or gather them from all the students.

Information flow through WEB 2.0 is much faster and gives me the latest up-to-date information. However, the problem arises, when you somehow spend some time without checking and then loose the track.

Another concept is about filtering information, my PLE helps me pick out only the most valuable information, in my consideration. I know what I have to focus on, therefore PLE (for instance using FLOCK), can be programmed for that news updates that are crucial for me. As a result I can save time looking for things in search engines.

In general, there can be many examples of which applications exactly help and how. As for me, WEB 2.0 and PLE ease my learning life in the following way:

1) Save information (I can save the pages I find interesting and get constant updates from them)
2) Track the interested topics
3) Get full and easy access to the necessary data
4) Organization of these flows
5) Constant news update.

To make a long story short, I can formulate everything mentioned in the above in a couple of lines.

We always speak that there is too much of information right now. PLE and WEB 2.0 help me filter only the valuable one, the one I learn from, organize it and finally use for learning. PLE is a handful tool that helps arrange my web learning, making it less complicated and serve as a kind of a guidance through internet, so that I can focus on those things that I am interested in and not waste my time on numerous waste that the net is full of.

ST (male, age 21)
My learning process concerning Web2.0 tools starts from, first of all, grab materials from intranet or wiki, and do the work by checking information from Google Research or ask professors through emails regarding questions about the work. I think PLE could assist me for life-time learning on both formal and informal sides. I used to have different accounts

for connecting friends in different stages of my life, PLE assists me to integrate all the contacts I need in one programme and avoid the risk of loosing password or biased (in some accounts you have fewer contact, you choose to log in programme with most contacts and minority of friends may feel ignored or apart as time goes by) on logging one Web 2.0 tool rather than the other one, it helps me to keep in touch with my friends easier. PLE has changed my experience in learning; it provides a user-friendly platform which allows me to interact with it easily, not only to socialize with friends but also to do my studies. The RSS function in Flock allows me to find information for efficiently, I used to spend bunch of time looking for abundant information on the internet. Also, I am using online calendar that helps me to organize my works better and avoid missing deadline.

Importantly, face book, which is one of the functions in Flock, helps me to find friends that I have not seen for long-time while I was studying in England and we start communicating and exchanging information about our life, by doing that, I learned more from cultures in different countries and different ways of communicating and different ways of thinking.

The idea of interlink variety of Web2.0 tools with a platform where users could manipulate easily, because normally, like me, I only use certain number of Web 2,0 tools because we are now overcrowded by Web2,0 tools and tired of looking up or adopting new tools. PLE (Flock) is a good practice which saves my time and allows me to use Web2, 0 tools that "fits my needs" and I do not need to spend time looking for tools because they are already there. To work in an "integrated environment" make me feel like using one tool as a whole rather than thousands of tools that I have no ideas about.

Most of the Web 2, 0 tools I use are integrated in the PLE, flock. Also I used some additional Web 2.0 tools in order to make my PLE more customized, online timetable management and intranet and Flickr and Webinaria. First of all, Flickr allows the whole class to upload Photoshop exercises and share your work with other people in order to evaluate your own performance and seek for improvement next time and if friends or classmates who saw the picture you posted on Flickr, you may start talking or discuss

about it. It assists to learn faster because you are talking to someone you familiar. Webinaria allows people to create a podcast about a specific topic, I could check podcasts that I am interested in from other people's Face book account which is very convenient for me. RSS which integrated in Flock is very important and useful. I have used it several time assisting me to search for materials that I require for the projects. It saves me lots of time in examining irrelevant materials.

Yes, I still use Web 2,0 tools + PLE not only for studies but socialization. Most parts of my lives now are based on my own PLE; the PLE consisted of flock and some other tools that Flock does not have which are Messengers, Hotmail, Wiki, Facebook (just created because it is included in Flock), intranet, blog and online timetable management. It did help me to schedule my work better. I would be appreciated if there could be more functions for Flock which could easily adopt to individual needs so I only need to log in once and that's all.

Table 4. Summary of the IS09 follow-up survey (2010)

ID	Do you have a PLE? If yes, can you describe it briefly? If not, can you explain why?	Which of these tools are part of your PLE?	Does having a PLE help in your studies?	Does having a PLE help in finding and managing information?	Does having a PLE help you establish/ maintain relationships with your classmates, peers and teachers?	If you have a PLE, how does it help, or might help, in your job/internship?	Which of the tools and activities carried out during the study was the most useful for you? Why?
K.E.	For the moment, my PLE is the internet, as I access all tools, instruments and websites that I use via internet. I have no real single platform yet that combines the access to all these elements in one place.	Twitter, Gmail, Google, Netvibes, YouTube	4	4	4	- It might help you to develop and maintain your professional network more efficiently - When still looking for a job or internship, a well-functioning PLE could help you find a job that reflects the contents of your PLE, and subsequently, your interests.	Studying the concept and early developments of the PLE itself was very interesting, and showed a lot of potential. For the rest, it was useful to see, in a nutshell, what the internet has to offer when it comes to 2.0 tools. Ranging from FaceBook to FlickR to Twitter, each tool can be put to a use in specific situations. So even though we might not find them useful at the moment, it is important that we know about them, and that we can possibly use them

							later on in our social and/professional lives.
A.L.	I do not have a PLE. I do not have a PLE because I do not need it at this stage of my life. Moreover, I barely have time to use computers and I use a few tools and applications. In my opinion, a PLE would be helpful for people who use a lot their computers, and who deal with many web 2.0 tools plus many other applications. Since I am not falling into this category, I have not created my own PLE. To sum up, the main reason is time. No time for spending hours and hours in front of PC. In addition, Mozilla Firefox	Gmail, Google, YouTube, del.icio.us, Facebook, Google Reader	2	4	2	I do not think it is going to help me in my job. Most of the companies forbid any kind of Internet usage at the workplace, thus people cannot use their PLEs even if they want. If I had the chance to have a PLE at my workplace, I would not use it because my I am there to work. In theory, it might help me, but only for certain jobs which require constant access to Internet.	Only Delicious - because it helps me store all the internet websites which are useful for me and not wandering in Google every time I need to look for something. In addition, it allows me explore the best and most popular websites due to the "explore tag" option. RSS feed - because it "scans" the web pages and brings to me all the latest updates and news I need. It also saves me a lot of time, since I do not go to check every day whether there are new publications

	completely satisfies my e-necessities for now.						
M.V.	The usage of the PLEs (Personal learning environment) can help us organize, manage and control our digital ID and contents. It was going to be a solution to the chaos of the social web, it was going to give all those slack education managers something to spend money on so they could say they were on to it, and help with assessment, validation, and auditing and mind control. PLE movement side stepped it again and described it more as a process rather	Twitter, Gmail, Google, Flickr, Clipperz, Jooce, Slideshare, YouTube, Blip.fm, del.icio.us	5	5	5	I can say that I really support the usage of the PLEs, because it can help me to share information and exchange many things through the Web 2.0 tools, which are connected in one tool, as Flock for example. For me this is really important, because with tools like this, I create many close relationships with my classmates and my teachers. I am very thankful, that I study this kind of things, even though I didn't use every of them. And that's why the world of information technology is so wonderful and useful.	During my study, probably the most useful tool was Twitter. It gave me the oppurtunity to be in connection with all my classmates and of course our teacher. It gave me the oppurtunity to share opinions and to recieve an information from my collegues.

	than a product. PLE is another win for freedom, flexibility, personal choice and financial savings. Web 2.0 websites allow users to do more than just retrieve information. So, I can say that Web 2.0 tools are really important in today's life of the business people, because it allows you to communicate with your colleagues and business partners all over the world. There are many types of Web 2.0 tools, but I want to focus on one of them, because I think that it best answers to my interests. Flock is browser-based tool, based on the Mozilla Firefox, and I prefer to use this one,						

	because it connects many tools in one, like Twitter, Gmail, etc. I choose this one, because I really hate every time to log on in every separate tool.						
A.N.	My PLE right now consist of different tools that help organize the webpages i use the most, the search engines im using to find the information i need and that i consider useful, organizing my "profesional emails" from personal ones, it helps me communicate with others and to see others opinions, and easily organize what i consider my solutions	Twitter, Google, del.icio.us	4	4	5	I think it can help organizing the information i will be dealing with, providing updates of the company, receiving updates from similar companies, receiving comments and feedbacks from actual customers, and now im actually using many of these tools in my current internship to develop an online strategy for the company.	Wiki, and Twitter wiki because we could keep every persons opinion and/or questions and answers, as well as a group solution for differents assignments, but i prefered the most twitter becuase it was a fast and easy to communicate with others who were actually using it.
A.K.	I don't have any specific PLE. The reason is that I'm storing all the materials I need on my computer together with	Gmail, Google, YouTube, Blip.fm	5	4	4		

	all the links and programmes that I need. As I don't use many social network tools, I don´t need to have quick access to them and it does not cost me much time to check them all. Concerning the websites I use often, I know the addresses of most of them or I have them saved in the 'favorites' on my computer. The only tool I'm using often to store the most important or used files in the internet is dropbox. Alternatively, usually I send anythig I need to my email. I actually consider my netbook a PLE because I can carry it everywhere with me and therefore save everything there.						
H.A.	I mainly use Google Apps to	Gmail, Google,	4	3	4	- time efficiency - keeping an overview of tasks	Google Apps. - usability / ease

	function as my PLE. However, I still visit sites such as facebook.com individually, as Google Apps does not allow me to integrate that site's content directly. I found getting used to other PLEs difficult.	YouTube				and documents	of navigation - study-focus (While it would mean easier access to facebook.com for example if that site's content was integrated in Google Apps I am not sure I would like that. I use Google Apps for more study-related purposes and like to keep it separate from the informal communication on facebook.)
M.I.	I only use the basic Gmail, Google, and Youtube. I have tried others (Twitter, Flickr, Blip, Flock, del.icio.us) But they gradually dropped out of my PLE as they did not result useful and efficient for me.	Gmail, Google, YouTube	4	4	4	Maintain me informed and communicated on important subject matter (google, gmail)	For a short period of time, Flock was quite useful as it helped put some order in the many and different PLEs(Flick, FB, Twitter, etc). But with the reduction of PLEs used, Flock is no longer required.
C.H.	Yes, I use Flock, with iGoogle as starting page. Further I have jooce as a special tab to "transport" files from one	Twitter, Gmail, Google, Flickr, Jooce, Flock, Netvibes, YouTube, Blip.fm,	4	4	5	It is a good tool to manage and maintain business relationships. It makes information gathering easier and faster	Flock, since it provided a platform to combine all others. The class wiki, since it supported studying for the

	computer to another one.	del.icio.us, Facebook, Studivz, Yahoo-Mail					exam.
O.G.	I believe I have a PLE, which, unfortunately is has not expanded much recently. That environment consists of basically WEB 2.0 tools and applications that help bring them together and easy to follow. The most used are listed below. Each tool helps me learn, search, share information, follow interesting people, subjects and discussions. Basically, it, kind of, represents my online ID, where I can either express myself through pictures, music, links i use, communication with friends. The PLE also	Twitter, Gmail, Google, Flickr, Picasa, Jooce, Flock, Netvibes, YouTube, Blogs, Linkedin, Skype	3	4	4	The PLE is quite helpful in maintaining the contacts with people far away and even the close surrounding. However, I have not seen it extremely useful in my job/internship. I do have contacts with colleagues via WEB 2.0 tools, but they do not hold any professional meaning. Another reason is that the working environment consists of people of different generations. Thus, their knowledge of PLE is very limited or does not exist at all. Consequently, my PLE has not yet helped me in professional life, though further integration of both environments might change the situation.	The most useful tools for me turned out to be Twitter, Picasa, Google applications, YOUtube, gmail. Clearly, most of them belong to Google, so I can admit that I am its devoted user. But on the other hand it saves my time and allows to use the same passwords everywhere, which is comfortable. NOt long ago, I really became very in to blogs, which was surprising for myself. Blogs gave me an opportunity to get more wide range of information on various topics that I am concerned about. It might not be objective and allows to compare various opinions. Sometimes I read news not from online papers but blogs. Another

	serves as a storage place for me. I believe that cloud computing is growing bigger and I often save documents there, so that I have a back up of my files in the cloud. Shortly, this is my PLE.						tool I appreciate is Picasa. I am used to aploading pictures there and share them with friends. As it is a google application, I use it most often.
B.R.	yes i am using google chrome..easy to manage ... i dont need to have many pages open and i can organize the tools as i want.	Twitter, Gmail, Google, YouTube, del.icio.us, facebook	4	3	5	i have one and its help me to be organized and earning a lot of time!!!	i think twitter was the most important one since we could be in touch with other claasmates and the teacher.
L.I.	Well, I do not use a PLE as I did earlier, currently I am using the very new version of Safari that show me all the websites I visit the most as my starting page. But I do still think it is kind of a PLE, since it always have a "blue star" on	Gmail, Google, YouTube, Dropbox	3	2	2	Well if you consider my approach a PLE I can not really see how it helps at the moment. What it does for me is basically updating me within the online newspapers that I follow, the blogs I follow, and that is basically it...	First of all I have started to explore the range of services that gmail/google offer, for exampel I am using google groups rather heavily in my studies at the moment. Jooce is another tool that unfortunatly never became that useful since it never really

	the top of every page whenever there is an update, which is very useful when any of the blogs that I follow have been updated. However it does not realy work good with facebook. But for that I have my mac mail box that always update me if something has happened on facebook. I use Google chrome in the very same way, both Safari and Chrome are kind of built on the same principle. I do not know who copied who though... The reason for me not using the "old" way of a PLE is basically personal adaption, I have tested many different ones and I really think they all are a bit						worked properly, however it made me aware of the concept of cloud computing and it developed a desire to find a similar service that actually worked good. Therefore I am today using a service called Dropbox, it does not have the design as Jooce had, however it works perfectly and it synchronises all my folders that I have on my computer whenever I have a internet connection. The core activity of developing and testing different PLE tools and platforms has made me much more aware of different services available, and in addition it has made me realize what I actually want in my "personal" PLE and that is why I use safari for example.

	complicated and does not fulfill my needs. Both Safari and Chrome are very simple, look very nice, and are therefore very approachable!						

Appendix D.

Summary of interviews and meetings with high school principals and teachers from Cornellà de Llobregat (2009).

The interviews were loosely based around the following questions:

- Is the school's technological infrastructure adequate for the students and teachers needs?
- Is there access to the Internet, both from the telecommunications and hardware point of view?
- Are teachers using ICTs in their teaching? How?
- Do teachers receive training in the use of ICTs?
- Do teachers ask for training in the use of ICTs?
- Are there time slots assigned for teachers to take courses or receive training?
- Are there any specific requirements for the school, in terms of infrastructure and training?

Summary is shown in original Spanish. Names have been removed to preserve anonymity.

En general, todos los IES comparten las mismas necesidades, problemas e inquietudes. Las áreas principales son:

Proyectos de investigación

4 ESO

2n Bachillerato

En ambos casos existe la posibilidad de llevar a cabo los proyectos en el Citilab. Se propone que el Citilab participe ofreciendo temas de investigación, tutores y recursos. El formato intensivo a finales de año, como ya se hizo con el IES Martí i Pol, es una opción, pero también se podrían ofrecer otros formatos, para evitar que coincidan todos los estudiantes al mismo tiempo.

Coordinadores de Informática:

En general, el puesto de coordinador de Informática lo hace el profesor de informática, si existe, o cualquier otro profesor que tenga conocimientos más o menos avanzados en comparación al resto. El soporte de parte del Departamento es mínimo, una hora de mantenimiento a la semana, casi todos consideran que es insuficiente y recurren a servicios

externos para compensar las fallas. La conexión a Internet es de mala calidad, con cortes frecuentes. Todos coinciden en que la idea de una coordinación de coordinadores TIC es necesaria, y que podría ser liderada por Citilab.

TIC

A excepción de uno o dos IES, la dotación de recursos es pobre y la mayoría no tienen proyector/pantalla/ordenador en cada aula, aunque cuentan con al menos un aula TIC. Citilab comentó la posibilidad de colaborar en la dotación de material audiovisual para el aula TIC (en construcción) del IES Joan Miró. Hay alguna posibilidad de colaborar o canalizar la colaboración de alguna entidad u organización para la dotación de más aulas TIC o de equipamiento básico a los IES que no lo tienen?

Formación de profesores en TIC básicas

Existen cursos de formación a través del Departamento de Educación, normalmente se hacen en Julio y a voluntad de cada profesor. El incentivo es doble: la formación y los puntos que se otorgan. Señalan que una forma de incentivar a los profesores a participar en las actividades de formación que se hacen en Citilab es que se consiga la homologación de estos cursos con los del Departamento, y que se puedan dar los puntos equivalentes.

Formación de profesores en estrategias y metodologías usando TICs (Huerto Digital)

El interés es alto, y probablemente tengamos una participación mayor a la esperada (es urgente definir un espacio en Citilab para la creación del Huerto Digital). Un estimado conservador sería de unos 25 profesores durante el primer año (prueba piloto), pero esta cifra puede ascender fácilmente al doble. Un gran problema es que el único día disponible que tienen es el miércoles, por la tarde, de manera que habría que coordinar las actividades de manera que se distribuyan los profesores y los institutos. Las actividades comenzarían en Octubre , en versión presencial y con componente virtual.

Puntos de atención

Preparar una oferta de curso informática básica (tipo cursos 1,2,3) para la primera quincena de julio.

Homologación de estos cursos por parte del Departamento

Información más detallada sobre el Huerto Digital y las actividades de formación que ofrece

Puntos de interés

Algunos institutos ya han llevado a cabo actividades en el Citilab (EduLab, Proyectos de investigación, robótica, LEGO)

Ciertos institutos pueden ser líderes en algunas áreas, como tecnología o bachillerato artístico

Detalles de cada Visita

IES 1 (19 Mayo)

Director:

Cap d'Estudis:

Projectes de Recerca de 4º ESO y 2º Bachillerato:

3 grupos de 25 alumnos, una tarde a la semana

4º ESO en horario lectivo

2º Batx fuera horario lectivo, por las tardes

Proyecto de comprensión lectora, 50 alumnos 4º ESO (2 horas, 1 tarde a la semana). Tres proyectos:

Música (Jazz contemporáneo)

2 obras de teatro

Preparan en el instituto 1er trimestre

Ayuda de monitor 2do trimestre

Uso de audiovisuales, Citilab, 3er trimestre

Proyecto, Inglés (5 a 8 alumnos). Pasar libros de texto a una plataforma digital (Moodle), para prácticas de lectura, compartir recursos

Se propuso la idea de usar Podcasting (esto es una de las tecnologías de L'Hort Digital).

Infraestructura actual es escasa, conexión a Internet con caídas frecuentes (ADSL 4 MB Telefónica), conexión por cable e inalámbrica (WiFi)

50 ordenadores, más de 400 estudiantes. Se espera llegar a 100 ordenadores.

Hay un coordinador de informática y un informático

No hay responsable de formación al profesorado.

2 aulas de informática, un aula TIC, un Laboratorio de informática. Citilab podría aportar equipamiento Audiovisual al aula Tic que está en construcción.

Aprox. 43 profesores. Propuestas de formación:

Curso TIC a finales de año académico (primera quincena de Julio)

Centralizar en Citilab o aportar desde Citilab el soporte a todos los coordinadores de informática. Reuniones 1 vez cada quince días, en Citilab, dos horas, últimas horas de la mañana.

Hort Digital, sesiones de formación metodologías/estrategias/pedagogía

Agrupar profesores por asignatura, todos los IES

Sesión inicial presencial en Citilab

Sesiones virtuales se pueden manejar virtualmente, por cada asignatura (problemas de tiempo, trabajar propuesta)
6 a 8 miércoles (tarde) al año, primeros dos trimestres.
Propuesta adicional nuestra, sesión de feedback al final del año?
Ayuntamiento de Cornellà, acuerdo para proveer de conexión vía fibra óptica a los IES?

IES 2 (19 Mayo)
Ya han participado en actividades en Citilab (Edulab, robótica).
Falta soporte en el uso de las TIC en el aula (Hort Digital). Ya usan Moodle y pizarras digitales, y reciben formación en el uso de la herramienta, pero no en cómo adaptarla a sus necesidades particulares en cada asignatura. Organizan su propia formación, reciben apoyo del Centro de Recursos del Departamento de Educación.
El Departamento tiene un proyecto para dotar a los alumnos de libros digitales (no de lectores de libros digitales?).
Projecte de Recerca 2009 – 2010: los temas ya están adjudicados en el caso de 2º de Batx, la investigación se hace en Julio. Se podría preparar el curso 2010 – 2011 (la oferta de proyectos se debe presentar en Junio 2009).
Nos enviarán el calendario y una lista de los trabajos que se han hecho, informarán a los departamentos, y nos invitarán a las presentaciones. El 2 de Junio se presentan los trabajos en el Citilab, lo organiza el Depto. de Educación del Ayuntamiento.
En el caso de 4º ESO, el trabajo es similar a un crédito de síntesis, se analiza un proyecto de empresa, incluyendo todos los elementos de la ciudad (servicios, educación, policía, bomberos, etc.). Es más sociológico que económico (debido a que se adaptó del proyecto de síntesis y no es propiamente un projecte de recerca. La próxima promoción se hará más énfasis en la parte de investigación como tal). Se desea introducir elementos TIC en el trabajo de investigación. Por ejemplo, formato audiovisual, para grabación de entrevistas y trabajo de campo. Hacer énfasis en el uso de PowerPoint para presentaciones (considerar otras herramientas del Hort Digital – Voicethread, por ejemplo?).
Invitar a para que muestre el proyecto "Visualizar la ciudad" a profesores y coordinadora de 4º ESO.
Posibilidad de continuar con Edulab/Relatos digitales, incluyendo la formación al profesorado y nuevos grupos de estudiantes. En este IES se ha trabajado con 1 ESO, aula de

acollida y aula oberta. Aunque no tienen claro cómo darle continuidad a este proyecto, comentan que ha mejorado mucho la integración de los estudiantes con el resto de los alumnos. Queda por confirmar la realización de una segunda edición de EduLab 1 (aparte de EduLab 2). Se habló también de la posibilidad de hacer algún taller de Scratch.
Este IES podría hacer el papel de líder en la implementación de herramientas tecnológicas en el aula, por su experiencia en el área y participación en proyectos de este tipo. Es importante destacar que tienen más formación en el uso de TICs como herramientas, y no en la parte de estrategias y pedagogía.

Todas las aulas de ESO tienen un proyector, pantalla y ordenador, y portátiles suficientes para todos los estudiantes, en principio. Comenzarán a trabajar con libros en versión digital. Destacan el período del 1 al 15 de Julio como el momento idóneo para hacer la formación básica en TICs para el profesorado. Es algo completamente voluntario por parte de los profesores. La formación se debería hacer con grupos de profesores de áreas específicas, para compartir recursos y experiencia. En principio, cuatro áreas: tecnología, lenguas, ciencias e historia.
En el caso de formación en metodologías y estrategias pedagógicas usando TICs (huerto Digital), la formación tendría que hacerse algunos miércoles de cada mes, de 3 a 5 pm, por ejemplo, y debería existir un componente virtual (esto está considerado ya dentro del Huerto, usando formación a distancia a través de redes sociales).

Preguntan si Citilab puede otorgar certificados, comentan que Barcelona Activa lo hace en situaciones similares a las del Citilab.

En este IES hay aproximadamente 134 profesores, 65 de los cuales en ESO y Bachillerato. Comentan que, en su experiencia, al introducir una herramienta tecnológica en el IES, la adopción por parte de los profesores es bastante rápida (efecto red). En ocasiones anteriores, el uso de email o de proyectores en las aulas.

Cuentan con dos aulas informáticas, además de las aulas de ESO que están acondicionadas para el uso de ordenadores, proyector y pantalla. Preparan un aula TIC, se sugirió la posibilidad de que Citilab aporte el equipo necesario (cámara de video, etc.) para convertirla en aula TIC/Audiovisual. Entregarán un calendario de actividades, Citilab propondrá un esquema de formación básica en TICs para llevar a cabo en Julio (similar a cursos 1,2,3). Comenzarían a trabajar en El Huerto Digital en Octubre, organizarán reuniones informativas por cada área en el IES.

IES 3 (20 Mayo)

Cap d'estudis:

Han hecho proyectos de investigación en el Citilab anteriormente, en 1 semana, intensivo, sobre el Mundo de las ONGs, usando un tema único para todos los estudiantes. Se llevó a cabo una jornada de presentación y se hizo streaming, pero no se ha recogido el material en una web. Comentarlo con Paco.

Han solicitado un curso de Scratch para profesores de informática, que luego difundirán la información a los estudiantes. La solicitud se hizo al Centro de Recursos. Para 2009-2010 propondrán el uso de soporte mixto papel/digital para el material escolar, libros, etc. El próximo año, cada espacio del IES contará con ordenador+pantalla+proyector.

El mantenimiento a los ordenadores es muy importante, el IES ha contratado a alguien para hacer mantenimiento tres veces por semana, esto lo resuelve cada centro por su cuenta, pues el apoyo con que cuentan de parte del Centro de Recursos es insuficiente.

El coordinador de Informática es el profesor de Sanitat. Las funciones de este coordinador no están bien definidas, y todos los profesores deberían conocerlas. Es difícil encontrar a alguien que ocupe este puesto. Se comenta la posibilidad de crear una Xarxa de coordinadores de informática, coordinada por/desde el Citilab. En este IES no hay una asignatura específica de tecnología.

En cuanto al Projecte de Recerca de 4 ESO, comentan que es más productivo hacerlo en una semana, intensivo (36 horas). La experiencia en el Citilab ha funcionado muy bien. Proponen que en la próxima edición, los estudiantes presenten un borrador al final de esta semana, para poder pulirlo y trabajar sobre el antes de la presentación final.

En cuanto al Projecte de Recerca de 2n Bachillerato, se comienza en el primer año de bachillerato.

Se propone en este caso usar el Huerto Digital también con los estudiantes que hacen Projecte de Recerca, de 20 a 25 estudiantes.

Coinciden en las necesidades de formación del profesorado, proponen también del 1 al 15 de Julio. En cuanto al Huerto Digital, sugieren de uno a dos miércoles (por la tarde) al mes, comenzando en octubre.

IES 4 (20 Mayo)

Director:

Coordinadoras de 4 ESO y 1,2,3, Bachillerato.

Projecte de Recerca de 4 ESO es equivalente a un Projecte de Síntesis

90 a 110 estudiantes, lo ideal es dividirlos en grupos de 5 a 10 estudiantes, trabajando 1 hora semanal, o 3 horas trimestrales, o 2 horas cuatrimestrales. Posibilidad de concentrar estas horas en una semana, en Abril, Mayo o Junio. Se podrían trabajar tres proyectos en simultáneo, con 3 temas distintos: Scratch, Wikipedia, otro tema por definir.

Formación de profesores: están interesados, también proponen 1 quincena de Julio , pero comentan que estas horas de formación tendrían que estar avaladas por el departamento de Educación de alguna forma. Contactar con el centro de Recursos.

Les interesaría tener más información sobre el Huerto Digital para difundir al profesorado (preparar folleto informativo – Ricardo Torres).

Punto interesante, este es el único IES que cuenta con bachillerato artístico.

IES 5 (25 Mayo)

Projecte de Recerca de 4 ESO se podría concentrar en 2 o 3 días en el Citilab, en Abril o a finales del primer trimestre (35 horas). Habría que comentarlo con la coordinadora.

Projecte Recerca 2n Bachillerato, necesitan temas de investigación, puede proponer algunos el Citilab? Los estudiantes comienzan a trabajar en los proyectos en 1 de Bachillerato, unos 75 estudiantes, durante el primer trimestre. La presentación se hace después de las vacaciones de Navidad, en Enero o Febrero. En el departamento de tecnología, los temas que trabajan son de actualidad tecnológica, 8 a 10 estudiantes, de forma individual. Los Projectes se hacen por Departamento, estos que se comentan aquí son los de tecnología. Sugerimos la posibilidad de dar soporte no sólo a tecnología sino a otros departamentos, destacando que el Citilab no es un centro puramente tecnológico, sino de innovación social, les interesa mucho esta posibilidad. Normalmente hay dos estudiantes asignados a cada profesor, pero les vendría muy bien contar con tutores externos en el Citilab.

Hay un coordinador de informática, pero les parece muy interesante la idea de que el Citilab coordine o de soporte de alguna forma los distintos coordinadores de cada IES.

Cuentan con dos aulas de informática, entre los profesores hay tanto expertos como principiantes. Informática es una asignatura obligatoria en 4 ESO desde hace poco.

Hacen énfasis en que los cursos que se hacen a través del departamento otorgan puntos, posibilidad de que el Citilab haga lo mismo?

Hay dos aulas TIC, con aproximadamente 40 ordenadores (para 725 estudiantes), no hay proyectores en todas las aulas. Conexión 6 MB con Telefónica, hay WiFi y cable. El departamento da una hora semanal de mantenimiento a través de T-Systems.

Están muy interesados en la formación a través del Huerto Digital pero insisten en que estas horas deberían corresponder a puntos otorgados por el departamento de Educación.

Tareas:

-Pr. Recerca 2 Bachillerato:

- Nos enviarán una lista de temas que se han utilizado en anteriores proyectos
- Posibilidad de que Citilab proporciones ideas y tutores para futuros proyectos
- Ver si los estudiantes están interesados en hacer los proyectos en Citilab

-Projecte 4 ESO:

- Hablarán con la coordinadora
- Enviarán documento con requerimientos y especificaciones

-Formación profesores en el Huerto Digital

- 1 miércoles al mes o más

Appendix E

Examples of projects based on Web 2.0 services and technologies.

1 .- The Industrial Technology wiki

The teacher who developed this activity worked with a small group of 11 students, at 1st year, high-school level, in the Industrial Technology subject. She wanted to create a wiki with a very simple structure: each student would be responsible for developing the content for describing a type of energy source (nuclear, wind, solar, etc.); these topics were randomly assigned, and the participants were in charge of doing the research and took responsibility for developing that section in the wiki. The teacher established a content structure, and each student would work on the contents for that source of energy: information, transportation, distribution, environmental impact and economics. There was a basic rule they had to observe throughout the activity: cut-and-paste was strictly forbidden. The work was carried out individually, but at the same students were collaborating in the generation of content, through the creation of a shared website, a wiki. It was a different way of focusing the content of the subject, a depart from the traditional classroom work where the teacher explains and the students take notes. The part of the activity that was done using the digital environment was much more active and engaging, according to the students themselves.

In order to motivate the students and create a dynamic based on peer assessment, the teacher suggested that the students proposed exercises and questions as a way of guiding their peers through the contents they were in charge of. They would answer the questions and exercises, send them to the student responsible for that topic and then mail them to the teacher, who would be responsible for evaluating the process and outcome. Based on the creation and publication of the wiki, two more activities were proposed. The first one was the creation of a digital book, *El llibre de les energies* (The book of energies), compiling all the contributions.

The second one was a debate, which would start as a discussion in the classroom but would be developed in depth in a forum, which was in turn a section of the closed social network that had been created for this subject. The teacher provided a scenario: "there had been a catastrophe in the world, there were just a few survivors, everything was destroyed. The

students were part of a committee of experts that had to propose solutions to start a new society and the most appropriate energy resource to be used, according to the natural resources at their disposal: tides, water, wind, forests, uranium...". The eleven students participated and supported the reasons why they would propose the energy source for which they had been responsible, and the debate continued with high-quality and participative contributions.

The assessment of the exercise by the teacher was very positive; the collaboration between students, evaluation of the published texts and the final result were all aspects that enhanced learning and the development of valuable skills: learning to learn, to seek information, collaborate and develop their own content.

The students discovered that there were other sources besides Wikipedia. They realized that searching the Internet requires some knowledge, strategies and dedication. They practiced their reading and writing skills, something not always easy in the context of a technology-oriented class.

2 .- Tecnomac 1. Technology Tales

The teacher responsible for this activity wanted to include all the students from the same level: four groups of 1º ESO (12 and 13 years), about 80 students in total. She wanted to work on some concepts studied in the technology course, and reinforce them through written expression. In previous years it had been proposed that the students created texts, tales and fables about specific themes covered in other subjects. This time, she used the same approach, but introducing some collaborative aspects, oriented mainly to sharing the texts they produced with their peers, and promote participation and opinion.

She chose a closed social network that they called Tecnomac 1 and that allowed the participants to create participation forums to answer questions and doubts, and also integrated a blogging platform. During class, the teacher explained the exercise and the steps to be followed by the participants, and established the rules to be followed for the activity, in a specific section of the social network. She started a series of threads in the forum to discuss topics related to the activity, and it was established that any

communication concerning the activity would be carried out through the Tecnomac 1 website. The aim of this exercise was to help students realise the differences in use and objectives in each of the new virtual spaces within the network: notes to inform and comment, the forum to discuss, ask and have a communication among all the participants, and the blog to publish the final text.

It is importantly to note a very relevant aspect related to the activity: they set the last day of the exercise to be the day of Sant Jordi, 23rd April, which is an important date in Catalonia, as this is the patron saint of the region, and it is also the Day of the Book. The Catalans celebrate this day with a tradition: giving loved ones a rose and a book. After each student published their story, they had to select the five stories they liked the most, by going to the personal blogs and "giving" them a virtual gift, a bow; the equivalent of the "like" button in many popular social networks.

Participants could vote up to five days before Sant Jordi and that day, an award would be given to the most voted story: a rose. They also organized a public reading of the stories.

The use of a virtual environment facilitated the participants the reading of all the contributed texts: they were practicing reading, listening, learning, and even evaluation and reflection skills, as the second part of the exercise was to vote for their favorite texts. This approach would have not been feasible without the use of digital media and tools. The closest they had gotten to implementing this activity with "traditional" media was to have the teacher read a few of the contributions, or display them on panels or on the classroom. This option is probably the best one when it comes to the exhibiton of drawings, as all participants can see the drawings made by their peers and these can be exhibited for some time, decorating the classroom; however, when it comes to text the effect is not the same. It is not easy to read the contributions when they are posted on the walls. Publishing and reading in the blogs was a very positive experience, the students understood and got engaged in the dynamic, and the overall results were good. We believe that one of the key factors that led to this activity success was the fact that it was carried out through blogs and a virtual space. It was an important step for these students in the introduction of using and understanding more complex learning environments, such as the closed social network. We expect that in time they will become more familiar with these kind of tools, learn how to use all their potential and adapt them to

their needs, thereby promoting the personalization of this type of virtual spaces.

3 .- Projectes Mediambientals

This teacher carried out an interesting project for the subject *Projectes Mediambientals* (Environmental Projects). This is an optional subject, offered as an alternative to Religion at 3rd ESO level (ages 14 and 15). The main objective of this course is for students to acquire skills and knowledge from practical experience, by managing projects that impact their environment and the school, in order to improve the quality of life of the members of the community.

One of the objectives of integrating ICTs in the subject was the publication of the actions that students took place at the institute, during the projects and activities. In a blog, the students are responsible for the publication of numerous entries on topics related to monitoring the development of certain tasks, such as waste management and the paper recycling center, writing articles about issues related to renewable energies, the maintenance of an aquarium at the school, and the observation of flowers, plants and trees in the surroundings. This activity generates knowledge, as students publish and share their experiences, read those of their peers and even make contact with students from other institutions through comments on the blog.

The teacher also created a closed social, with the aim of organizing work teams, have a space for discussion, create a section for solving doubts and asking for help when needed, be aware of what the other students are doing, raise questions, post pictures. In addition, another outstanding objective of this network was to be a focal point and meeting place for people's awareness on environmental issues, so that students, regardless of who was participating in the project at any given semester, could still remain "connected" to each other by sharing these concerns, and could also integrate other individuals, inside and outside the school.

The social network and blog were the main spaces for publishing and sharing photos, but the group also opened an account at Flickr to collect and provide access to all the photos taken throughout the course, so the graphic documentation of the activity was accessible to all participants, the school and anyone else that could be interested.

The teacher was very aware of the work done by students when doing the assessment and establishing the evaluation criteria for specific actions in the virtual environment such as the correct use of the blog, the proper use of e-mail -replying, attaching documents and files, being respectful and observing good practices- , to be responsible for the tasks that has been assigned to them (deadlines, use feedback to correct and improve tasks, homework...), appropriate use of the blog and the social network, and be respectful of their peers and their work. In this way, the teacher managed to fully integrate the knowledge of digital tools and their correct application to the subject they studied:

"It is as important that the fish are well cared for as that this fact is documented and shared on the internet. It is as important to learn a method of chemical analysis of water from the tank as it is to learn to photograph the process, to select and capture images from a virtual album and post them to the blog following a minimum of guidelines".

This is an innovative, and extremely interesting, view of how the new curricula should integrate both content and skills.

4 .- A network in French

In this French class, with 19 students at 3rd ESO level (15 years), the teacher proposed to use a closed social network. The proposal implied a need for communication and negotiation in the new virtual space. The teacher introduced this tool as an extension of the class and as a publishing platform for exercises of different types and with a variety of learning objectives.

At a technological level, the new platform supposed no problems for students, as they are accustomed to using social networks and interact within them; examples are Facebook and Tuenti.

As a first step, the teacher started by negotiating the rules of behavior in this virtual space for academic purposes. Text documents, audio and video to be published should always be related to the class, the academic goals and following the communication dynamics that were established; and would never be unrelated to the subject or of a private nature. Respect should be shown for all participants and their opinions. All communication would

take place in the language they were studying, French. This negotiation was conducted in this language and using the forum space on the network.

Moreover, the teacher made it clear that each of the activities to be carried out by the students would be fully explained in the network, as well as the points they would get for each action. From 1 point for posting a profile picture to 6 for a text comparing *before* and *after* pictures, all activities had an assessment scale that was public and available to everyone. In this way the teacher established the academic nature of the activity and motivated the students to participate. This was not a ludic virtual network in which the language happened to be the foreign language they were studying, but it was a workspace in which all activities had an evaluation and a grade associated to them.

The next proposed activity was to ask each student to post on their personal page on the website links to three songs in French, and to add the lyrics to one of them. Furthermore, they were asked to write a comment about the song, artist, composer and a personal opinion on it. After a few days, each student should discuss and comment the contribution of at least one of their classmates.

To work the past tense verb form, the teacher suggested that students posted two pictures of themselves on the network, one from a few years ago and a recent one. These photos would be used as the basis for a text in which each one of them would describe and analyze the changes that had undergone through the years.

To complete this exercise, it was necessary to carry out some work throughout several sessions prior to it, with the aim of preparing the grammatical base of the text.
In a third exercise, each student would post a photo of a painting by Toulouse-Lautrec and write a description, thus practicing vocabulary and adjectives; this, of course, was also in French. The photos posted became a virtual mini-exhibition of 10 paintings by the artist, with reviews by all 19 students.
The teacher corrected the comments and the students were able to improve the texts using these corrections.

After these activities the teacher realised the wealth of information the class had collected through their personal pages, and that was accessible to all the students and the teacher.

Two points stood out: first, the fact that students had taken the time and effort to personalise their personal pages using graphic elements; this suggested an idea: another activity, in which student would vote the personal page they liked the most. Second, that participation was so high, that even those students that in class usually kept quiet and were shy, would participate and publish content, and openly express their opinion in the forum,through texts, drawings and photos.

The activities proposed in this closed social network are known to all those who have studied a second language: exercises with songs and lyrics, photos of before and after, describing pictures, etc. However, the environment of communication and exchange of documents (photos, videos, songs, reviews) established a new framework for the process of learning in which students brought and shared knowledge, and thus enriched their learning process.

From a pedagogical point of view the social network meant the perfect excuse to communicate in the language they were studying. It helped strengthen the content that was being studied in the classroom, and increased communicative competences by the mere act of participating in this virtual space.

Students were able to customize the exercises: publishing your favorite music and work, and their views on their peers'; describing the pictures they liked, the changes that they had gone through over the years, and so on. This customization increased motivation and helped strengthen relationships in the group, opened the way for expressing personal opinion, for debating, and for getting involved in the content of the course.
The publication of the texts, so they were available to everyone, and so the corrections were also public knowledge, benefits all students, who can improve their own work thanks to the collective knowledge.

The exercises on Toulouse Lautrec's paintings and on songs helped them become more proficient in the culture of the language they study.
Finally, as already noted, it is important to consider the network as a tool that promotes the integration of students who for various reasons are withdrawn when participating in class.

5 .- French advertising videos

This French teacher continued to use the closed social network that had been created for her subject as a channel of publication for other works to be carried out during the course and as a meeting place for communication and exchange of ideas.
The activity here described consisted in creating an advertisement in video format. The teacher had issued guidelines for its students to design a story with both a written and a spoken script, in the foreign language they were studying, French.

This activity was carried out through four class sessions plus the extra work at home and then an evaluation session.
For the co-evaluation of the videos that were created, they took into account three criteria: creativity, language and level of technical difficulty.
The students regarded very highly this experience. The completed works were posted in the social network to be shared with parents and peers, which greatly promoted the motivation and confidence associated with competence in the target language.

This activity is a perfect example of an exercise with a communication approach to tasks, and integrates the 4 language skills: speaking and writing, listening and reading. It is based on the traditional classroom dramatizations, in the format of short videos that are made in class and represent real situations in the target language, a scene in a restaurant, market or hospital. The preparation that requires the completion of a five-minute video, is integrated into the program objectives of the course and so students have to prepare, develop, rehearse and represent a script. The creation of the video becomes a perfect excuse to carry out a project in a foreign language.

6 .- A learning environment for poetry

This Catalan literature teacher was responsible for a group of 16 students at high school level (ages 15 and 16). Part of the program was devoted to poetry, and as a teacher and a lover of literature, she believes that the students best learn to understand and feel the poetry by reading aloud. It was also one of the parts of the programme that students found more difficult.

The *Poems of Marius Torres* activity used video as format. For this activity, the teacher created a very simple, closed social network whose primary goal was to serve as a communication channel for this exercise, by using the forum and by posting videos to share with the other students.

First, the teacher made a selection of videos of Marius Torres, which showed the poet reading his own poems, which were part of the content that should be explored in the course. The listening of these texts provided valuable references for students. Then each student would select a poem, read it, understand it, work on it and record their reading on video, and finally post it to the network.

Previously, in class, they would rehearse the interpretation of the poem and then comment the text.

The last step was a joint reading of tanka (Japanese poetry) during the graduation ceremony on the day of Sant Jordi, accompanied on piano by a student who played a piece by Ryuichi Sakamoto.

At first the students were reluctant to interpret the poems in class and make the video public. After the teacher encouraged the possibility to choose "their" poem, they started to get involved in the activity and overcame their fears.

It was difficult to make an expressive and interpretative reading. The activity during class focused on the rehearsals: they did relaxation exercises, voice and body, imagery, diction, intonation. Students improved their understanding of the poems, which was one of the main objectives set by the teacher for this exercise.

The video recording was a challenge that students faced with a nice disposition and limited resources. Some of them made do with just a mobile phone camera, webcams on their computers, without using lots of effects, but they all completed the task and participated in the activity. Each student had the choice to read and interpret a poem published in their personal environment.

Technically, the recordings have room for improvement. But the exercise proved to be a rewarding experience for the students. They watched their videos repeatedly on the social network and sent many positive and encouraging comments to each other.

The assessment of the teacher of the experience and the evaluation of the exercise (carried out by having conversations with her students) was very positive. She emphasises the engagement of the students in the activity, the increased motivation, the degree of

understanding and identification achieved by reading and recording, and the interaction established among them through the dynamics of the activity.

b. *Ramona, adiós,* by Montserrat Roig

This exercise was based on a book by Montserrat Roig, entitled *Ramona, adiós* and which tells the story of three generations of women - grandmother, mother and daughter- in Catalonia, in the late nineteenth and early twentieth century.
The teacher felt it was very important that students knew the social and economic context of those years in which the novel is set. To this end, she proposed that they searched photos of that period and made a video with them. The task would be done in groups of three persons, who would chose one of the themes developed in the novel.

The teams would select representative samples of these themes, from the point of view of the three female protagonists and find pictures to illustrate these, and record the reading of related fragments of the text.
Video editing was somewhat hampered by the lack of resources and expertise. But some students were very involved, learned how to use the programs and helped others to use them. The videos and photos were published in the closed social network of the class. Although the selection of images was not always the most accurate, and the mixture of styles and the excess of effects could impair the aesthetic coherence, students were very satisfied. The experience was very rewarding for them and they felt very proud with the results.
The teacher praised the exercise as a very positive experience, especially the involvement of students and the deeper understanding of key aspects of the novel. In this sense, the activity successfully met the proposed learning objectives.

7 .- *Fem literatura* (We create literature)

Once again, this teacher of Catalan literatureproposed an innovative initiative to her class of 4th ESO level (ages 14 and 15). The objective of the activity was that his 20 students knew the relevant information sources relating to Catalan Literature that they should follow during this course and from those, research the contents related to the programme, using a wiki. The teacher was in charge of designing a table of contents with the aim of identifying and grouping the topics to be covered. The students formed groups and the

topics were distributed among them, so they were responsible for selecting and writing the contents and publishing it on the wiki.

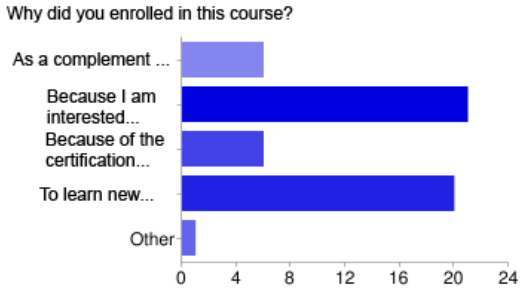
In an activity of this nature it is essential that there is a clear understanding of the tasks of each participant, individually and in teams, what are the protocols to be followed in a shared virtual environment and how to access and publish information. The teacher listed in one of the sections of the wiki all the resources that were considered as relevant, in order to create quality information.

A quality wiki is one that has many links to sources, from which it gathers the information that is made available to the users. Students were to apply the same philosophy, indicating the information sources that supported the information in the texts they published; to complete this task, they had to read and compare these sources, select the parts they considered most appropriate use hyperlinks to these references in order to support their contributions. The literature and the websites suggested by the teacher were intended to be sources of quality information, and would be used to construct shared knowledge. This is an efficient way of generating shared content, access quality data, select, compare the information to be published, disseminate it, and make it accessible. We know that the Internet can provide us with access quality information; the teacher guides the students in finding and filtering it.

Appendix F

Teachers survey

Question 1.



As a complement to previous training	6	24%
Because I am interested in the application of ICTs in the classroom	21	84%
Because of the certification	6	24%
To learn new skills and knowledge	20	80%
Other	1	4%

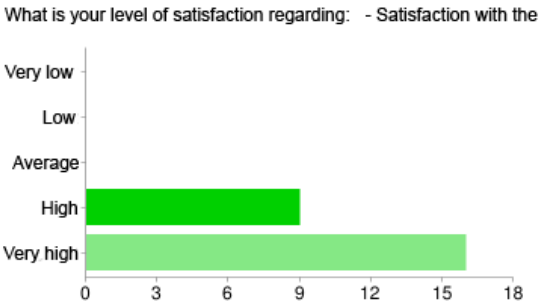
People may select more than one checkbox, so percentages may add up to more than 100%.

Question 2.

What kind of possibilities did you see for applying ICTs in the classroom BEFORE taking this course?

- *I only used the Internet to search for information and proposed exercises to the students that they could carry out in class with the help of computers*
- *Access to information*

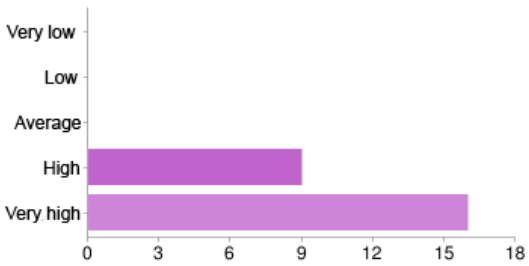
Question 3.



Very low	0	0%
Low	0	0%
Average	0	0%
High	9	36%
Very high	16	64%

Question 4.

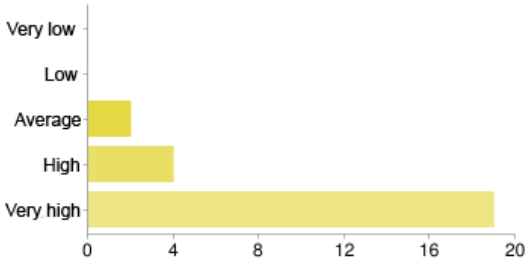
What is your level of satisfaction regarding: - Satisfaction with the contents



Very low	**0**	0%
Low	**0**	0%
Average	**0**	0%
High	**9**	36%
Very high	**16**	64%

Question 5.

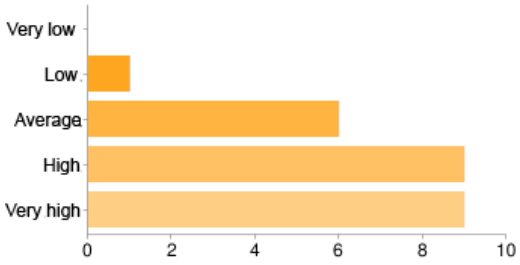
What is your level of satisfaction regarding: - Satisfaction with the contents



Very low	**0**	0%
Low	**0**	0%
Average	**2**	8%
High	**4**	16%
Very high	**19**	76%

Question 6.

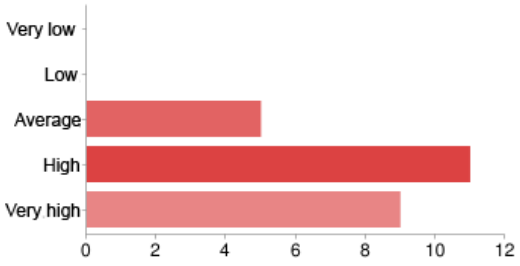
How would you rate the contribution of the following activities to your learning process? - Development of a practical application or project



Very low	**0**	0%
Low	**1**	4%
Average	**6**	24%
High	**9**	36%
Very high	**9**	36%

Question 7.

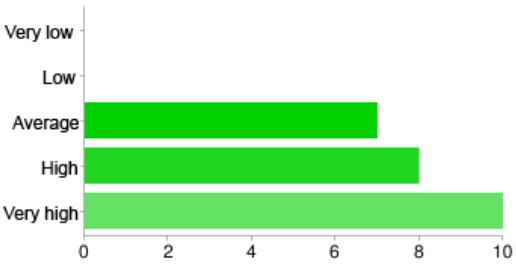
How would you rate the contribution of the following activities to your learning process? - Personalised sessions and tutorials



Very low	**0**	0%
Low	**0**	0%
Average	**5**	20%
High	**11**	44%
Very high	**9**	36%

Question 8.

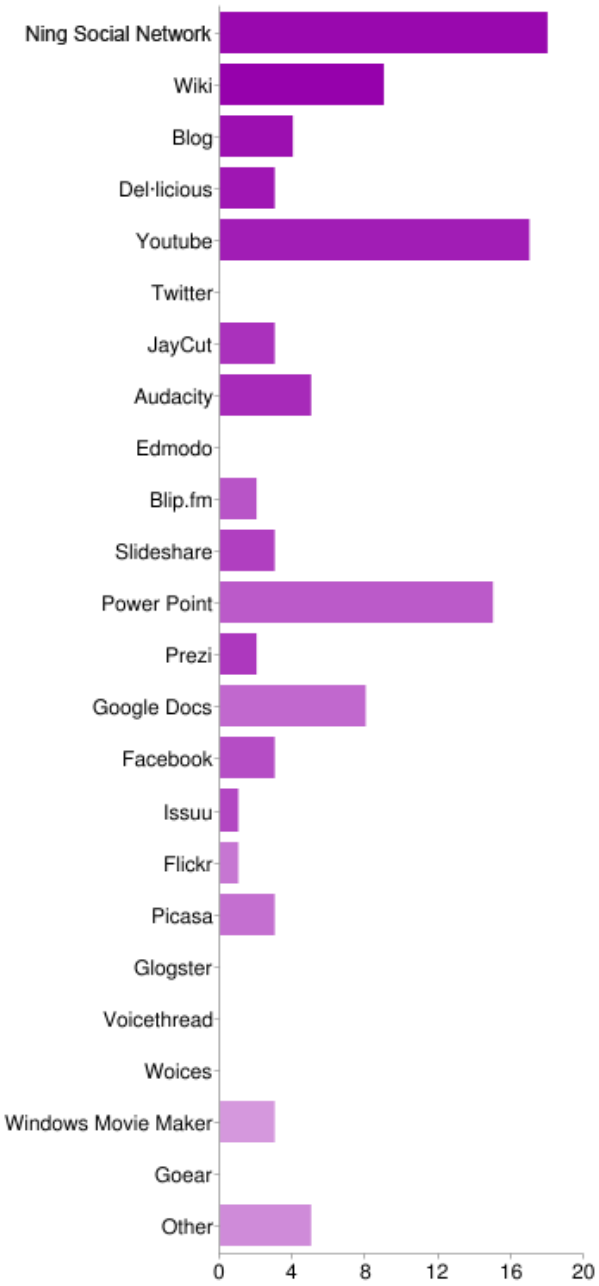
How would you rate the contribution of the following activities to your learning process? - Use of a virtual space, Ning



Very low	**0**	0%
Low	**0**	0%
Average	**7**	28%
High	**8**	32%
Very high	**10**	40%

Question 9.

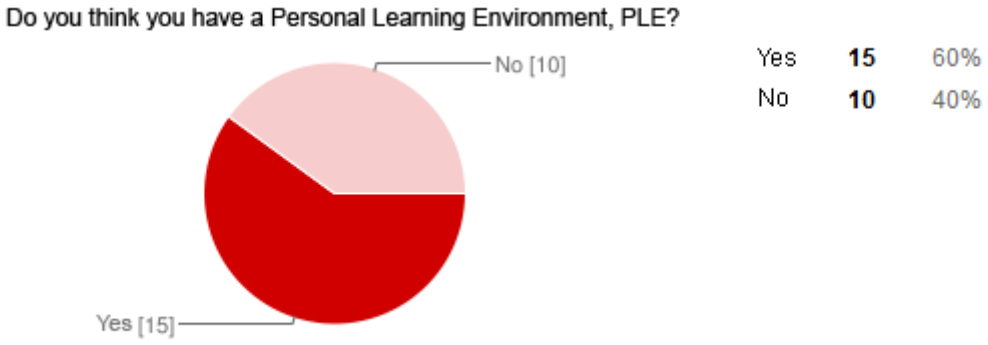
Select the tools and applications that you used with your students during this academic year



Ning Social Network	18	72%
Wiki	9	36%
Blog	4	16%
Del·licious	3	12%
Youtube	17	68%
Twitter	0	0%
JayCut	3	12%
Audacity	5	20%
Edmodo	0	0%
Blip.fm	2	8%
Slideshare	3	12%
Power Point	15	60%
Prezi	2	8%
Google Docs	8	32%
Facebook	3	12%
Issuu	1	4%
Flickr	1	4%
Picasa	3	12%
Glogster	0	0%
Voicethread	0	0%
Woices	0	0%
Windows Movie Maker	3	12%
Goear	0	0%
Other	5	20%

People may select more than one checkbox, so percentages may add up to more than 100%.

Question 10.



Question 11

If your answer is "yes", how does the PLE help you organise cointents and resources, create new connections or strenghten the ones you already have, and learn new skills and abilities?

- *Until recently, my PLE was books and videos, luckily I have now begun to enrich it with digital tools. But I need to make better use of these ones, I still need to learn how to organise and manage them.*
- *It has helped me innovate day after day, and learn. It is a lot of work, but it is worth it in the long run. Lectures are less and less the main component of the learning process, and thanks to the PLE concept, I can see that learning to learn is becoming more important*

Question 12:

Do you have plans to, or have you already helped your students creating their own PLEs?

- *After learning about PLEs, I think they should be considered as a tool for next year's students.*
- *I would like to help them create their own PLEs*

Question 13

Which potential do you see for the use of technology in the classroom after taking the Hort Digital course?

- *For now, it is another tool that I can use to work and communicate with my students. Since it is closer to them, it can facilitate communication and work, among them and with myself. It also allows for the joint creation of content, changes the way communication and information flows in the group.*

- *A lot of potential, because I think it motivates students to participate, increases creativity and empowers students in their learning process.*

- *It is the future. But we should improve many things in schools to carry out this kind of activities in class, because otherwise all the work will have to be done at home and perhaps we will lose the interest and attention of the students. "*

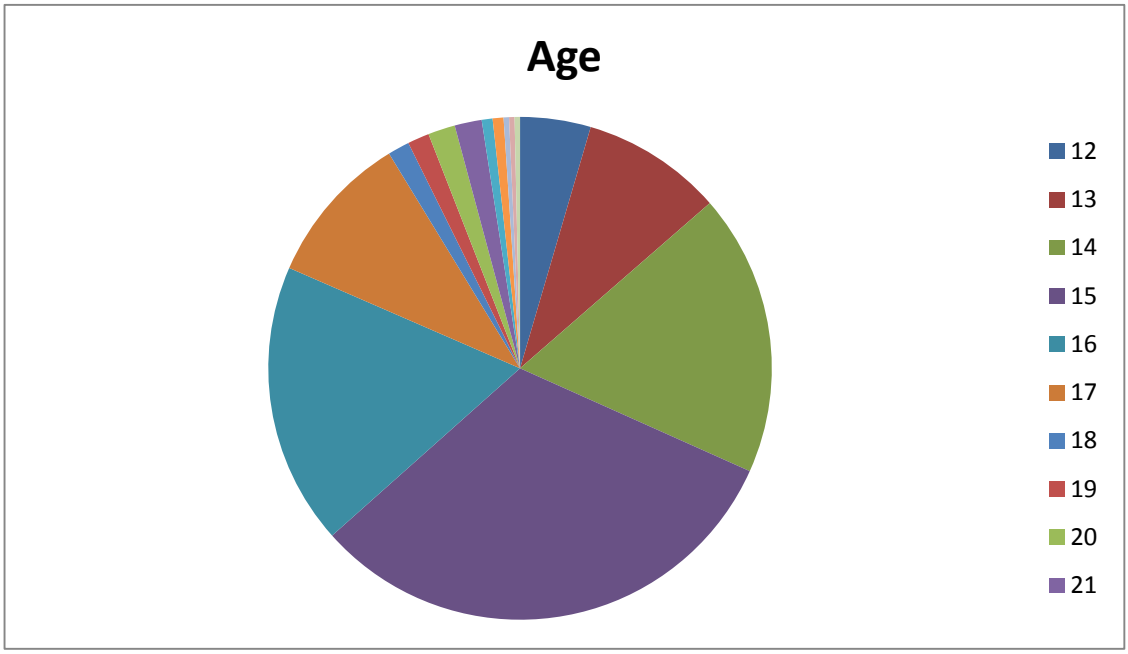
- *We work closely together with the students, there is more communication,we learn to apply easier and more engaging techniques"*

- *I have been using these tools for years, but only now I feel more capable, I have more resources and I have more interest in researching and planning new activities. I also feel more creative.*

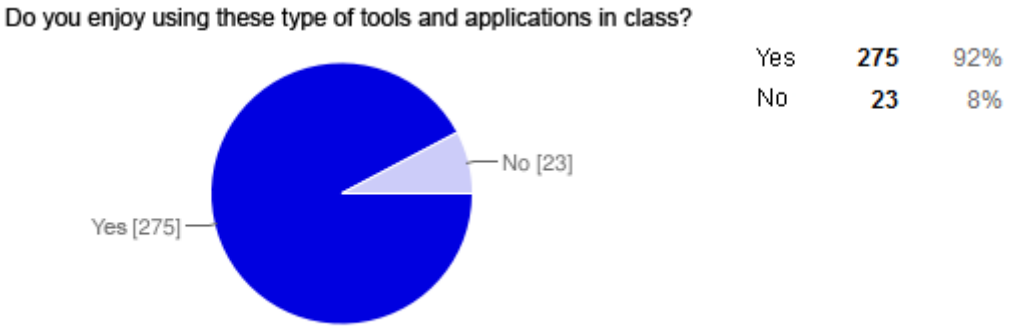
Appendix G

Students survey

<u>Question 1.</u> Age

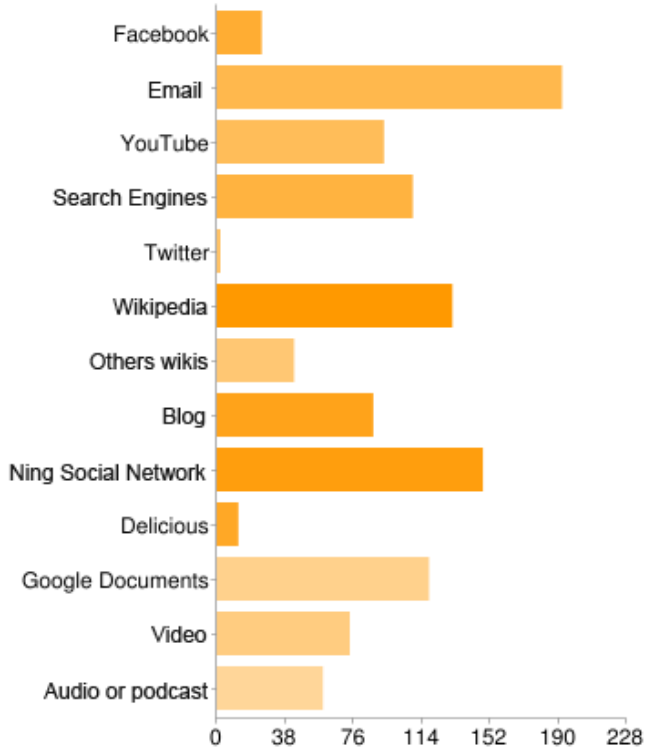


Question 2.



Question 3.

Which of the following tools and applications have you used in the context of this class?

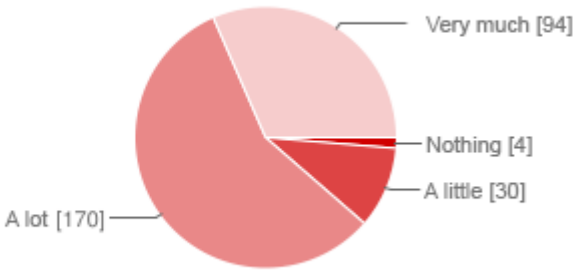


Facebook	25	8%
Email	192	64%
YouTube	93	31%
Search Engines	109	37%
Twitter	2	1%
Wikipedia	131	44%
Others wikis	43	14%
Blog	87	29%
Ning Social Network	148	50%
Delicious	12	4%
Google Documents	118	40%
Video	74	25%
Audio or podcast	59	20%

People may select more than one checkbox, so percentages may add up to more than 100%.

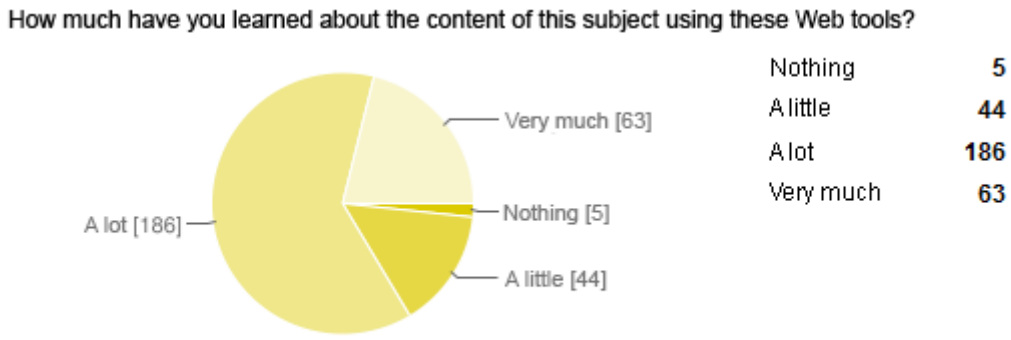
Question 4.

Have you enjoyed working with these Web applications in this subject?

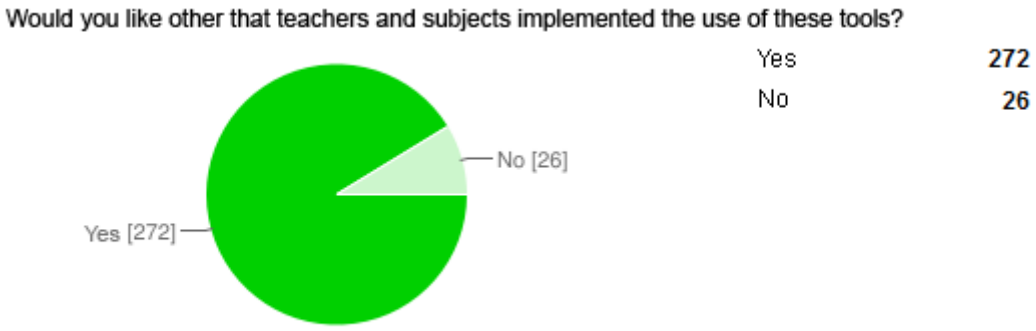


Nothing	4
A little	30
A lot	170
Very much	94

Question 5.



Question 6.



Question 7.

What is your opinion about the use of these web tools and applications in this subject, and what comments and suggestions would you propose?

I think it is a good tool for using and working in class, because it makes the subject more dynamic, and we are not only working with books.

I have enjoyed using these tools because it is a different way of studying, and breaks the monotony. I would like to keep using this approach.

I think it is important, since these tools are more and more common in our lives, and it is necessary to keep up with changes.

Appendix H.

Interviews to participants in the PELICANS pilot study (October 2015)

A.K., female, age 27

While the answer to the question whether learning about Web 2.0 tools turned out to be beneficial to me is a definite "yes", it should be viewed through a prism of a specific perspective. Back during my university studies, some 6-8 years ago, the topic of Web 2.0 applications was still a relatively new and unexplored one and constituted what could be considered a revolutionary approach to creating, sharing, capturing and storing content. The PLEs I built at that time were covering a broad range of applications that I was often experimenting with. In my personal life (outside of university), I found most useful the virtual community tools such as Facebook, Twitter or Flickr (and later on, Instagram). Facebook gave me the possibility not only to create instant and lasting connections with newly met people, but also to recapture the network of contacts going years back and spread out across the globe. In addition, it facilitated to an enormous degree the organization of meetings, events and other initiatives within the "friends" groups. Twitter was irreplaceable for quick updates or instant information exchange, while Flickr allowed me sharing photos with my friends and relatives miles away, with little concern for volumes or file sizes. In addition to the virtual community tools, there was a wide range of file sharing, presentation and self-organization applications that I found especially useful in the university environment. Amongst those most worthy of notice were the Google Docs, for real time online collaboration, Slide Share, for presentation content, and Prezi, for innovative and engaging slide creation. I was also using some organization tools like Google Calendar or bookmarking sites like del.icio.us.

Within the past years however, as the Web 2.0 environment evolved and I moved into professional environment of big corporations, my use of Web 2.0 tools has somehow changed in nature. First of all, I have limited considerably the personal use of the tools. I still own a Facebook account, but it's now for me mostly the tool for keeping up to date with people that I have little personal contact with. Twitter's functionality of instant messaging for me has been completely replaced with WhatsApp messenger. One could argue of course, and rightly so, that smart phone message applications limit the exposure

to the specific group of people, but I have found it more useful for the casual exchanges as the limitation makes them easier to follow. I still consider Twitter a valuable tool for following news threads, life commentaries or posts of users that are of interest to me (business leaders, book authors, etc.), but my use of it is now much more focused on the specific content on which I appreciate real-time updates. After becoming more engaged in business world, I also discovered the tremendous impact of LinkedIn – social network for professionals. In the recent years, I have observed it to turn not only to the equivalent of Facebook for presenting the professional profile of a person (what converted it for many firms to a principal recruiting tool), but also providing unbeatable opportunity for building professional network and giving a platform for creating and sourcing business related knowledge. Moving towards business environment, I have also found more interest in applications like Flipboard that allows me to source, filter, group and access from any mobile device all the news, magazine content and other information published online. Last, but probably most impactful trend in my approach to the Web 2.0 tools and PLEs, would be the fact that I have shifted almost completely from using widely available applications to the corporate proprietary tools. Google Docs has been replaced by internal Sharepoints, Project spaces, and countless other tools offered by companies I've worked for. Organization of meetings and events (both professional and personal) moved to Outlook Calendar, sharing and sourcing of content, to internal Knowledge Exchange portals, and creating presentations, to in-house applications that ensure compliance with company's formats while providing bottomless data base of slide designs, presentation dynamics, graphics, etc.

Summing up, although I am still using some of the Web 2.0 tools that I've learned about back at the university, most of them have been replaced by new applications or, in the largest proportion, by company tools. Nevertheless, I can still say with certainty that what I had learned about the Web 2.0 tools and PLEs during my university years has been and still is a great help in building my knowledge and capability base. Looking at my experience however, I have noticed an interesting phenomenon – while during the past years, I have developed the preference for Web 2.0 tools to be more personalized and focused on my needs, significantly narrowing down their selection for my PLE, at the same time, I came to depend on PLE platforms that have been built with fixed structure and given to me with a standard customization. Based on that, I believe that to truly continue to benefit from a PLE concept, as I got to know it back at school, the PLE

platforms would have to evolve from focusing on World Wide Web 2.0 tools towards solutions for enclosed corporate environments with their own “Web 2.0” applications.

M.V., female, age 31.

The Web 2.0 has become a consolidated virtual “reality”. Due to their ease of use, social media have become pervasive and extremely popular among web users. This social phenomenon is mainly fueled by personal needs and motivations, but Web 2.0 tools are now also beginning to devolve their communicative power in people’s professional lives. Web 2.0 is changing the way society communicates. The next generation of social networking has created endless opportunities for people to share content. Web 2.0 technologies allow for two-way interaction.From a business standpoint, major companies see Web 2.0 as an opportunity to expand into new markets, and reach out to people who use social networking sites. The challenge now will be for companies to find a way to integrate these technologies into a way that can promote the business. Sites such as Facebook and Twitter can be used as marketing tools, but only if the company knows how to make use of them. While many people understand how to use these popular sites, not many are aware of how to utilize them in a way that attracts customers and grows a business. As the internet has become the most convenient and popular medium of communication, Web 2.0, an enhancement of the existing internet, has developed a system in which online users have become participants rather than mere viewers. Web 2.0 is constantly changing the way people see information. For example, a Wiki user has the option of deleting, adding, and modifying information. There is no one that really controls the content on these types of applications. Because there is no one monitoring the content, there is no way of knowing whether or not the information from these sites is correct. However, these mash-up sites create opportunities for people to share content in ways that were not possible before Web 2.0 . Companies must also beware that social networking sites such as Facebook and Twitter could be used against them. Social networking sites make it easy for customers to post their view of a company on a website. Someone who had a bad experience with a product could tweet about the experience, leaving the company vulnerable to these attacks. A company must pay even more close attention to the customer service aspect of the business in order to ensure that customers are not tempted to say harmful opinions about the company. As an example, a frustrated United Airlines customer wrote a song and posted it to YouTube about how the airline was

careless with his luggage and broke his guitar. This is obviously not the kind of publicity that any company wants to have. Web 2.0 requires companies to be more up to date with services and customer feedback. As the internet has become the most convenient and popular medium of communication, Web 2.0, an enhancement of the existing internet, has developed a system in which online users have become participants rather than mere viewers. Based upon the interaction with online users, Web 2.0 is becoming more and more popular. Web 2.0 created an advanced communication platform both for public and private use. For public use, it enhances the way people collect information by giving more access to information around the world. It allows the mass population to communicate with each other and spread ideas rather than receiving their information from a specific authority or a single resource. In the Web 2.0 environment, the information can flow freely and people can express their opinions without fear of repercussions. For example, Google Documents facilitates group work on projects by allowing members to create, share and update documents to the same page and combine all the thoughts from different members at the same time. For private use, Web 2.0 helps to meet the personal needs of users for creating and sharing private information from limited users. Web 2.0 actually makes the internet more personalized by allowing each individual to have information that is tailored to their needs and interests. For instance, the Gmail phone offers users the ability to enjoy free and fast online communications dedicated to traditional physical devices such as telephones and cell-phones. Facebook and Twitter have become so popular right now; they enable users to create their own online personal space in which they can make or search friends, and update their personal information. Web 2.0 also takes accessibility to the next step by letting users have the power to determine how much of their content they wish to share and in what ways. Web 2.0 lets users choose if they wish to upload content using audio, video, or text files. People can even use Facebook to arrange a date, a social party such as Halloween or any group activities happening in their social network. Users are enjoying sharing their stories and daily feelings on Facebook and Twitter instead of staying alone at home to watch television. Web 2.0 increases the effectiveness of marketing. Online retailers earn the benefit of marketing by communicating immediately with a prospective buyer and provide all the information and clarifications that he or she needs. For example, many of online retailing websites have applied the Web 2.0 applications such as video catalogues, instant calling options and instant message services. Although Web 2.0 has several advantages to society, there are some disadvantages. These disadvantages include several concerns amongst users. First, companies are unsure how to

use the data. Secondly, there are privacy concerns with personal information out on the web. Third, Web 2.0 content is not always reliable information because anyone can update it. Fourth, Web 2.0 is seen as a security threat to many company managers. Another concern with Web 2.0 is personal privacy, especially with children. As a parent, Facebook, MySpace, and Twitter can be worrisome. When a child goes online, it is easy for them to go to these social networking sites and give out personal information about themselves and their families. Many children do not realize how dangerous the web can be, and how many people can access the information that they put online. There are several cases in which adopted children have been stalked by their birth parents that used Facebook to find them. Most adoptive parents want communication to be through a social worker or other intermediary, and worry about the child's birth parents having unwanted communication with their child. Web 2.0 is vastly changing the way information is spread throughout the world. Like any technology, there are both advantages and disadvantages of using it. Web 2.0 can be used to help promote a company's business, but it can also be a means for customers to complain about the company's service. Web 2.0 allows for a faster way of spreading information in the form of Twitter and Facebook, but these sites also raise privacy concerns. Web 2.0 allows for more opportunities for people to share information on the internet. More people's opinions will be online, and there is no way of guaranteeing what others will do with this information. As we mentioned, there have been some problems with adoptive parents finding out that their children are talking to their birth parents without their consent. These types of problems will continue to rise in the future. Web 2.0 will ultimately grow and continue to impact our lives.

C.H., male, age 31.

I really believe that the web 2.0 tools with regards to PLE provided me very useful hub to combine various web activities. While I was not able to apply the tools at work, due to the internal IT structure and system, I was able to apply those tools in my private life, mainly to save time and stay more organised. However, the awareness and ability to create/use a PLE helped me immense during my MBA studies. It not only allowed me to stay connected with my study colleagues and enhanced the work with my team members across

the globe, through collaborative work, but also eased research activities and simplified all administrative tasks connected to and around my studies.

L.I., male, age 30

I must say it has helped in certain areas: Personal: It is clear that I had a further understanding compared to my friends back in Sweden, I clearly knew more about this world and could offer advice on cases like this. A small example would be helping out my two younger brothers when they started Uni, concerning surveys and how to collaborate and share information with fellow students online. Professional: It is clear to me that I take less advantage of it in my professional life for some unknonwn reason. In my previous employment, just after finishing Uni I did a project where the aim was to build up an interactive online forum for distributors, where discussions and sharing of information could take place. We decided to use a project manager tool called Basecamp in this case, due to many different reasons. But I must say that my experience from what we had done in Uni and in class, working with different tools, helped in the evaluation phase and my analysis on how the users would or would not take advantage of the discussion space given. I have also quite recently built a CRM system using excel, pivot tables and several formulas for our office in Spain. This is also something I can remember from our class in Uni. In the headquarter of my current employer we use Microsoft Dynamics CRM, but our Spanish office has not been implemented in the system yet. This is the reason to why I decided to build this small "CRM" to help us keep track of our open inquiries etc. There are for example one formula that turns a cell red after 2 months of inactivity, giving a heads up to the sales guys to make an action. I also use Linkedin when I am looking for new people and when evaluating new employees.

H.A., female, age 22.

Gave me a head start in adopting Web 2.0 tools. Personal advantage of being an early adopter is being able to

recommend tools to friends, making it easier to connect / share / communicate with them. Professional advantage includes better understanding of network dynamics, i.e. when / how / why people are likely to share information.