Use of PLE-Portfolio to Assess the Competency-Based Learning through Web 2.0 in Technical Engineering Education*

MARÍA GRACIELA BADILLA QUINTANA
Educational Computing Unit and Knowledge Managment, Universidad Católica de la Santísima Concepción, Alonso de Ribera Avenue 2850, Concepción, Chile. E-mail: mgbadilla@ucsc.cl

JOSÉ LUIS CARRASCO SÁEZ
ICT Area, Lota Arauco Technical Training Center, Universidad de Concepción. E-mail: jlcarrasc@cftlotarauco.cl

MIQUEL ÀNGEL PRATS FERNÁNDEZ
FPCEE Blanquerna, Universitat Ramon Llull. E-mail: miquelpf@blanquerna.url.edu

This article describes an experience of the use of Personal Learning Environment (PLE)-Portfolio to compile various digital artifacts in virtual spaces, which represent a theoretical content learning process associated with knowledge, in a competency-based context, using a variety of Web 2.0 tools. Based on the Learning Spiral as a framework for curriculum design in connectivisim and in the co-association, it created lessons, activities, and projects in order to create dynamic learning situations that contribute to the development of thinking skills and mental habits of first-year college students of technical engineering education at the Higher Technical Network Administration and Computational Support of the Lota Arauco Technical Training Center at the University of Concepción. To analyze the experience, it proposed an evaluation model that was built using ICT, evaluative principles, a defined competencies standard, evidence and types of ICT assessment. As data instrument collection, rubrics were used that allowed to determine what students did with and without ICT. Main results of this experience are the generation of a methodological and evaluative model that facilitates theoretical learning, from the paradigm of learning using ICT, for example to promote higher competencies development in students, incorporating ICT seamlessly into a learning activity, increasing motivation and collaborative work in the physical and virtual classrooms.

Keywords: Web 2.0; ple-portfolio; e-learning evaluation; competencies; evaluation models with ICT

1. Introduction

The impact of the Information and Communication Technologies (ICT) has become the core of a change that involves most of the society fields. Education is not an exception, and consequently technology incorporation in professional technical education is essential.

In an ambience of learning based on the development of competencies, it is easy to observe two of three dimensions associated with the competencies, the *knowledge to make* and the *knowledge to be*.

Then, the theory associated with knowledge must not be evaluated appealing to the memorizing of contents, which will be easily forgotten by the students.

It is important that the proper pupils create relevant contents that then they can re-use in the moment that they consider suitable, since as Siemens [1] indicates, to *Know how* and to *Know what* they are being complemented by to *know where*, that is to say the understanding of where to find the required knowledge.

In this context ICT arise like an extremely useful tool to value the interaction of the students, and to be employed under the education concept at line, or education in network, like a continuous one of didactic emphasizes and levels of use of technologies that go from the individual access to inalterable information, up to the entire immersion at an ambience of practice led by a teacher and supported by a community of learning [2].

In this proposal, the role of the teacher will be of facilitator and mediator, using the concept of the co-association. In the pedagogy of the co-association, Prensky [3] points out that to use the technology is a task of the students, while the work of the teacher consists of acting like an orientator and a guide of the use of the technology for effective learning. To do this, the teachers need to center and to become even more expert in things that already are part of its work, including asking good questions, to provide context, to guarantee the rigor and to evaluate the quality of the work of the students.

To compile the evidences of the learning process, the Ple-Portfolio concept will be used, in order to make use of the big variety of hardware of the Web 2.0 that allow work and generate collaborative

content, and a space where the products prepared by the pupils will remain reflected. Analysis of current research reveals that social networking sites are a useful tool in teaching and learning as well as in employability and career management of students [4].

The methodological proposal will promote the skills of top thought in the students, going on from tied activities to remember, up to the creation of digital artifacts, together with the use of Web 2.0 tool such as Delicious, Scoopit, Googlegroups, Cmaptools, NetVibes, Googledocs, Youtube, Wikispaces, Twitter, Skype, Facebook Scribd and Prezi.

This paper describes an experience with students of technical engineering education at the Higher Technical Network Administration and Computational Support of the Lota Arauco Technical Training Center at the University of Concepción. Main objective is to propose an evaluation model that was built using ICT, evaluative principles, a defined competencies standard, evidence and types of ICT assessment using a variety of Web 2.0 tools.

The model promotes that the evaluation with ICT should not treat itself about a mere copy of the evaluation that is realized in the classrooms. It include between other aspects, a process of authentic evaluation, since it tries to find out what the student does or what is capable of doing, using diverse strategies or evaluative procedures [5]. The evaluation with ICT, will be tackled from the encyclopedic point of view and collaborated based on the definition proposed by Bàrbera [6], and from the point of view self evaluative, co-evaluative and hetero-evaluative, according to the types of evaluation with ICT to assess virtual learnings proposed by Abarca [7] and Stén, Pawlowski and Pirkkalainen [8].

2. Background

The model of Personal Learning Environments (PLE), is a concept that proposes a new paradigm. The PLE is not an application, it is not a platform, it is not a program that it can download or upload; rather, it has to do with a philosophy, a way of understanding as people learn. Here, the student fixes his own contents like beginner. It is a model centers on the student who is learning, providing tools to meet the needs of the knowledge society [9].

The term PLE describes [10, 11] a gateway to knowledge, and he defines them as a self-defined collection of services, tools, and devices that help learners construct their own Personal Knowledge Networks, sharing tacit knowledge nodes (e.g. people) and explicit knowledge nodes (e.g. information). Similarly, Lubensky [12] and Schaffert and

Hilzensauer [13] see personal learning environments as being a facility or facilities for an individual to access, aggregate, configure and manipulate digital artefacts of their ongoing learning experiences.

PLEs help people to control and organize the individual learning process, offering support so that they can set their own learning goals; manage their learning, managing both content and process; and communicate with others in the learning process [14].

The portfolio practice has proved to be effective in supporting students' learning, as it allows them to document evidence of their learning and to reflect on personal growth [15].

The e-portfolio is an electronic collection of evidences that shows one's learning journey over time and which can relate to specific academic fields or one's lifelong learning. Learning journey can be seen as one's formal and informal learning over period of time, it includes the developed or gathered resources, social networks and evidences of one's competencies. These evidences may include written documents, photos, videos, reports on research projects, observations by mentors and peers, and self-reflections on one's own professional activities. Barrett emphasizes the key aspect of an e-portfolio: reflection on the collected evidences, such as why it was chosen and what one learned from the process of developing e-portfolio [16]. Ple-Portfolio mixes the potentialities of the free Personal Learning Environment and e-portfolios.

The theoretical modality that support this investigation centers on the socio Constructivism, of Lev Vigotsky [17]; in the Theory of Learning for Discovery, of Jerome Bruner [18]; in the Significant Learning, of David Ausubel [19]; in the conectivism, of George Siemens [1]; and in the pedagogics of the co-association, of Marc Prensky [3].

We focus on the Learning Spiral like the frame of the curricular design that helps us to construct lessons, activities or projects directed to the development of the skills of thought and mental habits of the students. According to Pincheira, Carrasco y Sierra [20] the states of the spiral are:

- To experience: Corresponds to the stage in which the mediator (teacher) must generate the context for the development of the activity, delivers the instructions, the execution of the activity is realized and the results are obtained.
- To share: It is a slightly unknown stage of the process and therefore not very well developed in a traditional educational ambience and that corresponds to the instance in which the beginners unload its emotion and/or emotiveness generated by the success or defeat opposite to the realized activity, in order to open its minds for learning.

- To process: In this stage the process looks critically observing: what was done? and, why was it done?
- To generalize: In this stage the idea is to relate the theory and the general knowledge to the real experience, generating significant learning.
- To apply: In the closing of the activity it seeks how to be demonstrated as new learning is incorporated in a personal way and collaborative for every beginner. This learning serves also like input for the next experience.

3. Methodology

This investigation is exploratory and descriptive with a not experimental design, using a qualitative methodology.

This initiative was specified in the unit of *Foundation of Networks*, which it is part of the Networks Module, of the first year of the Technician's career of Top Level in Administration of Networks and Support Computational. This career is develops under a curriculum based on the development of competencies, on the Center of Technical Formation Lota Arauco, that belongs to the University of Concepcion Corporation (Higher level education). According to the plans and programs of the career, Foundation of Networks is a unit of formation where it expected at the end of this, students should be to configure a computer network, from the physical and logical point of view.

The average of age of the students is 20 years, who comes from municipal schools of the communities of Lota and Coronel (the most part), of the Region of Bío Bío, Chile.

The previous knowledge of the students is related mainly to the experience that they have using the computer at user's level, for those what happens behind the computer does not have major relevancy. Principally they use the social networks and consider that they are consumers of information, more than producers.

Regarding to its conception of the process of teaching-learning, it has largely established the traditional conductive model which was formed during primary and secondary education. Even if the curriculum corresponds to a modular system based on the development of work competencies, their attitude to the beginning of the unit does not go in the line of developing competencies of proactivity and self-regulation of learning, not either in the development of the three-dimensional components of the competencies: *knowledge*, *to be able to do* and *to be able to be*.

The instruments of data collected were eight rubrics related to: the group work, the collaborative work of the course group, self-assessment, making

of a conceptual map, of a video tutorial, of a Wiki, of a written document and glossary of terms, and of an oral presentation.

Data analysis was made in a scale from 1 to 7, where 1 is the lowest score, and 7 is the highest score. The average approval of a student is a score of 4, or higher, in all rubrics.

4. The study

For explicating the activities of teaching -learning that are proposed to the students, it was developed a synoptic staff that sums up in the Table 1 the combination of the learning spiral, with the strategies, the competencies and the pupils activities.

4.1 Plan for the development of the proposal

The relationship between the verbs associated with the skills of top thought, with the use of ICT tools and the construction of the final products is outlined in the Table 2.

4.2 Description of the evaluative proposal

Considering the characteristics of this investigation, which looks that students compile theoretical material to generate new products, it has been chosen the encyclopedic and collaborative evaluation approaches (see Fig. 1). The first one refers to the large number of contents that manage a more complex source or of different sources, while the second one refers to the assistance that the technologies give as regards the visualization of the collaborative processes implied in an evaluation of these characteristics [6].

The evidence of the students' work in the construction of new knowledge, from its theoretical compilation using the ICT as a tool, it was reflected in a Ple-Portfolio, which contains the final products that the students present. To evaluate the expectations of learning reflected in the standard of competencies, were elaborate rubrics, because these are instruments that can be used with many different methods, such as it is demonstrated in Table 3 with the Wiki. For example, rubrics can also be used to promote cooperation, metacognition, self assessment, co-evaluation, progress monitoring, and to verify the students' comprehension.

5. Results

This experience allowed experiencing a methodological and evaluative model with ICT that facilitates theoretical learning in the teaching of learning with use of the Ple-Portfolio, using as strategy the integration curricular of the ICT in the classroom, from the paradigm to learn using ICT.

The proposed model allowed evaluation of the

Table 1. Proposal development

Activity	Objective	Description	Strategy	Technique
Experience	Comprehend the importance of looking for information from reliable sources.	The teacher mentions to the pupils that he needs to look for information in Internet, information related to the configuration of networks of computers. It is requested that they work in teams searching in google for information about the following concepts: Importance of the networks of information in the current society, types of networks of information, model OSI, model TCP IP, devices of communication of information, means of data transmission, Addressing IP, construction and physical and logical configuration of a network of information. Basic tests of the network. Then they will have to: to write on a card the entire quantity of results thrown in the searcher google, to select 15 places at random, to analyze them and to propose 5. They must justify the selections, and exhibit them briefly.	Strategy of problematicalness and approach to reality.	Conference in small groups.
Share	To recognize the emotion and the corporal state	The pupils mention how they feel after having lived through the experience to dive for so much information.		
Process	To determine what they did and as they did it. Across questions the pupils are guided so that they reconstruct what they did before.	The results are analyzed as a whole with the pupils as they went so far as to recommend to the teacher 5 places. Analyze the entire number of places that were in the Web: how do we know if the information is reliable? how might they filter the information: how can they update the information quickly?: Is it necessary to manage all the places? What might be done to quickly gain access to the information that is considered to be valuable?: am I considered to be a consumer or a producer of the contents: do we have any strategy to filter the contents?		
Generalization	Contextualize the experience with the theory	Explain the importance of organizing the contents, of filtering and having reliable information sources, of producing own content, of a collaborative way of having it at our disposal. Examples of tools to order the contents, and contextualize with some allusive concepts to the connectivism.	Strategy of search, organization and selection of the information. Strategies of extrapolation and transference Work strategies colloaboratively.	Project method. Individual learning place. Education network.
Application	Apply what was learned to a real situation	It is explained to the pupils who during the semester have checked several theoretical concepts, which must be reorganized like course, not to lose them. One invites to the group course to produce its own content for the unit, which will allow them to gain access to these when they estimate necessarily. The quality of the created content will depend on them.		

learning expectations stated in the standard of competencies, from the point of view of the self-assessment, co-evaluation and hetero-evaluation.

The evidences of the work of the students are the digital artifacts that were elaborated with use of the Web 2.0: a platform scoopit of every group, a conceptual map of the on-line unit, a Wiki of the on-line unit (see Fig. 2), a video tutor of the unit lodged in youtube, a final document and glossary of terms, published in scribd.

In a scale of scores from 1 to 7, the digital product that obtained the best note was the Conceptual Map ($M = 7.0$), then the Document, Glossary and the Wiki ($M = 5.5$ each), and the Video ($M = 5.0$). The group evaluation score of the course was referring to the collaborative work of the studied group, that score affected all the students of the same way. The group course evaluation ($M = 5.0$) was done as a whole with all the students according to the indicators of the rubric, to agree on the note that was reflecting the collaborative work of the course. In synthesis most of the activities were approved with regular qualifications, except the conceptual map, which reflect an excellent domain by students.

Individual self-assessment ($M = 6.4$) and the self-assessment group ($M = 6.4$) were reflected the performance of individual students and groups working in building products in a very real way. There were students who would use the instance to assign grades that reflect their individual contribu-

Table 2. Relationship between the use of Web 2.0 tools and the higher order thinking competencies

Key Verb	Digital Activity	ICT Tool	Final Product
To remember	To look for information across basic search engines.	Search engine: Google. Students platform: Alumnos.cftlotarauco.cl Institutional e-mail: alumnos.cftlotarauco.cl	(1) Scoopit each group. (2) Conceptual map of the on-line unit. (3) Wiki of the on-line unit (4) Video tutor of the unit lodged in youtube. (5) Final document and glossary of terms, published in scribd. (6) Presentation in Prezi of the process lived by each of the groups to construct the final product.
Comprehend	To categorize and to label information.	Platform to filter contents: scoop.it	
Apply	To edit and to recommend information. To prepare preliminary version of the products: conceptual map, wiki, video tutor, final document, glossary of terms.	Platform to construct the preliminary mental map compilation of the unit: Cmaptools. Platform to construct the document and the preliminary compilation glossary terms of the unit Googledocs. Platform to construct the wiki: wikipedia. Software to construct the video tutor: camtasia.	
Analyze and evaluate	The preliminary products are analyzed collaboratively	Group work platform: googlegroups. Scoop.it platform Social networks: facebook, twitter, Communication hardware: skype, e-mail, google docs, google groups.	
Create	To publish the final products of the unit	Platform to construct the mental map compilation of the unit: Cmaptools. Platform to construct the document and the compilation of the terms glossary unit Googledocs. Platform to construct the wiki: wikipedia. Software to construct the video tutor: camtasia	
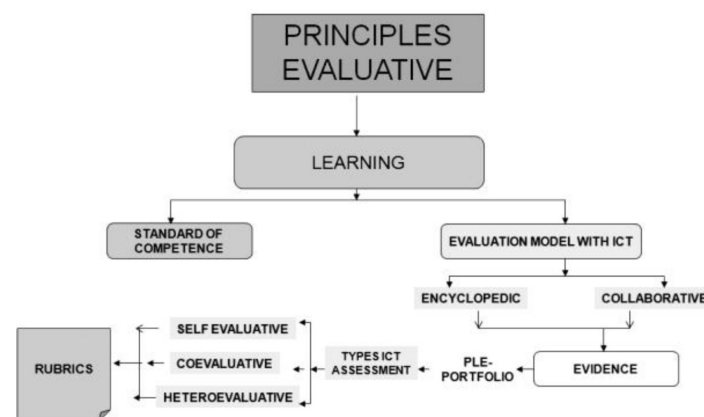
Fig. 1. Proposed of a model of evaluation with ICT.

tion to the group and the course. The perception of their own work in the course was excellent, which is evidenced in their high qualifications.

Ple-portfolio with the digital products and rubrics, is available in the platform Scoopit in *Products created and filtered by first year pupils of the Technician's career Superior level in Administration of Networks and Support computational* [21] in the URL http://www.scoop.it/t/recopilacion-ccna1

Main positive aspects in students were reflected during the activities. There were high motivation and participation during classes, the development of multiple evidences in their own ple-portfolios about requirements with 2.0 tools, and also, the opportunity to reflect, individually and in big group, about their teaching and learning processes.

Results shows that students working in virtual environments with the use of tools of the Web 2.0 like Delicious, Scoopit, Googlegroups, Cmaptools, NetVibes, Googledocs, Youtube, Wikispaces, Twitter, Skype, Facebook Scribd and Prezi, are capable to: to obtain information from a variety of credit

Table 3. Example of a rubric of assessment of the Wiki

4	3	2	1
Intention			
Our wiki has a clear intention. Every part of the place heightens the intention.	Our wiki has a clear intention. Every part of the place heightens the intention.	We try to print an intention on our wiki, but our wiki treats for the most part on only one topic.	Our wiki does not intend to sum the information up.
Information			
Our wiki covers content that is important for the intention. Our information is complete, balanced and impartial. The wiki tackles 5 topics of requested contents and that are described in the standard.	Our wiki has suitable information. We present the content of an impartial way. The wiki tackles 4 of 5 topics of requested contents and that are described in the standard.	Our wiki presents some cracks in the information. Sometimes, our wiki is partial in its presentation. The wiki tackles 3 of the topics of requested contents that are described in the standard.	Our wiki has very little information. The wiki has between 1 and 2 of 5 topics of requested contents and that are described in the standard.
Interpretation			
We use our investigation to do significant inferences and to extract original conclusions about the topic. We relate the content of our wiki to experiences or wider topics and of actuality.	We use our investigation to extract conclusions about the topic. We established relations between the information in our wiki and other topics.	We try to extract conclusions about the topic but some of our conclusions are not based on facts.	We do not extract any conclusion about the topic. Simply, we repeat or paraphrase our sources.
Sources			
We obtain information for our wiki from a variety of credit worthy sources. The readership can easily quarrel about from where we obtained our information.	We get information from credible sources. Readers can know where we got our information.	We get our information from a few sources and some of them are not very credible. Not always readers can know where we obtained our information.	We get our information from some sources that do not have credit. Rarely mentioned of where we got our information.
Organization of the Site			
The information in our wiki is divided in a logical way on separated pages. Our linkage allows to the persons to move easily between the different pages and it helps them to locate the beginning page.	The information in our wiki is divided in a logical way on separated pages. Our linkage allows to the persons to move without confusion through the page.	We try to divide the information logically in our wiki, but sometimes the organization does not make sense. Some pages have no links to help our readers navigate through the site.	Our wiki is disorganized. Readers can easily get lost between pages or cannot use links to navigate to other pages.
Links			
All links in our wiki works, they are adapted for the audience and they are related to the intention of our site.	All links in our wiki works and they are related to the theme of our site. All linked sites are appropriate for our audience.	All links on our wiki works and they are related to the theme of our site, but a few links do not work.	We do not have links to our wiki and our links are inappropriate or not related to the topic.
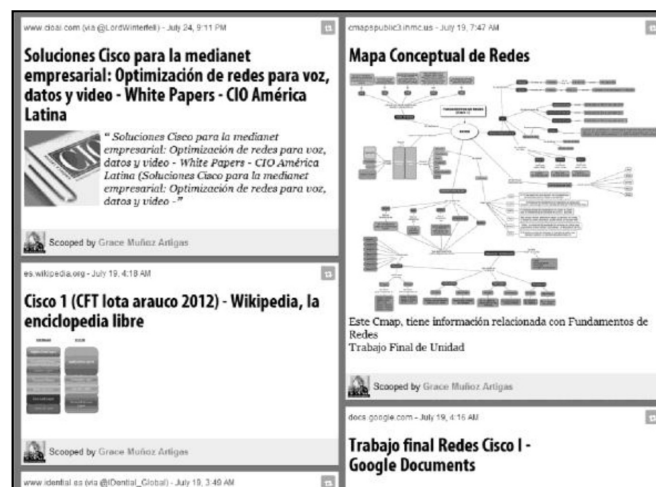
Fig. 2. Example of the Ple-portfolio online unit basis of a student Networks.

worthy sources, publishing information cited the original font, to use their investigation to do significant inferences and to extract original conclusions about studied topics, to analyze and evaluate products, and finally to create new originals products. It happening from activities tied to reminding, up to the creation of digital appliances.

Main problems detected in the implementation of an innovative formative model in according to the perception of the teacher of the subject, are related to the disorientation with the technological way and with the use of the web 2.0 tools, both of the proper students, and of the rest of the educational community.

Results show that peer collaboration and interaction via PLEs is not always easy to establish. The previous thing is because the first year students of the career are accustomed to traditional models of formation where they assume a more passive role. Deal with a model that demands proactivity and self-regulation of learning, at first disorients them, but little by little they go adapting themselves in a process that will bring them over to the reality of the labour world.

6. Discussions

In this work a model of evaluation with ICT was proposed, to go deeply into one of the most complex aspects into a curriculum based on the development of competencies *to know*, that is evaluated across memory evaluations, and of repetition of contents. Therefore it considered as a challenge to incorporate the technologies and to evaluate with them, avoiding as Bàrbera [6] says, that the evaluation with ICT should not treat itself about a mere copy of the evaluation that is realized in the classrooms.

For such a motive, it was chosen to use models of evaluation using ICT from the encyclopedic and collaborative point of view, since the students had to generate products validated by them from the summary of the theoretical material of the unit *Foundations of Networks*. This reinforces what Adell [22] said, on having referred that the students learn creating cultural appliances in diverse languages, as the writing, the visual, or the web, among others.

Our results correspond to some extent with the characteristic of PLEs described by Downes [23] and Attwell [24]. Ple-portfolios developed by students using Scoop it included tools for producing and publishing materials, to share new information, and to comment. According to Valtonen, Hackling, Dillon, Vesisenaho, Kukkonen, and Hietanen [25] students in this study made minimum use of tools for aggregating material, resources and recommend information related with Computer Networks.

This study provides evidence that our students are able to increase their higher competencies to support learning processes. Contrary to Hakkairen et al [26] our students take the control of their educational responsibilities, this kind of metacognitive skills are not responsibility only of teachers in this kind of environments [27–30].

7. Conclusions

This experience provides an insight into the experiences of employing personal learning environments portfolios in a Technical Training Center at the University of Concepción in Chile.

It is possible to state that, results from students, suggest positive effects on the generation of a methodological and evaluative model that facilitates theoretical learning, from the paradigm of learning using ICT, for example to promote higher competencies development in students, incorporating ICT seamlessly into a learning activity, increasing motivation and collaborative work in the physical and virtual classrooms.

On the other hand methodological proposal promoted the higher order thinking competencies in the students with the use of tools of the Web 2.0 which affected positively the increase of the motivation of the pupils and their comprehension of the importance of the collaborative work the physical classroom and the virtual classroom.

The present work has addressed the need to balance knowledge about web 2.0 tools before working on the development of Ple- Portfolios to solve disorientation with the use and integration in an academic way. Despite the fact that the target population of this study is on average less than 20 years, i.e. they are digital natives.

In order to support this evidences, it is suggested to carry out studies which involve integration of all courses of the career curriculum, especially considering the supporting role they can offer in the process.

References

1. G. Siemens, *Conectivismo, una teoría de aprendizaje para la era digital,* 2004, http://edublogki.wikispaces.com/file/view/Conectivismo.pdf, Accessed 15 July 2013.
2. A. Filatro, Filatro, S. Conceição and A. Bertholo, Educación en red y modelos de diseño instruccional, *Apertura*, **5**(1), 2005.
3. M. *Prensky, Enseñar a nativos digitales*, Biblioteca innovación educativa y Editorial SM, United States, 2005.
4. V. Benson, S. Morgan and H. Tennakoon, A Framework for Knowledge Management in Higher Education Using Social Networking, *International Journal of Knowledge Society Research*, **3**(2), pp. 44–54, 2012
5. P. Ahumada, (2005). *Hacia una evaluación auténtica del aprendizaje.* Editorial Paidós, México.
6. E. Barberà, Aportaciones de la tecnología a la e-Evaluación. RED. *Revista de Educación a Distancia*, **5**(6), 2006.

7. R. R. Abarca, *Propuesta para evaluar aprendizajes virtuales, Universidad Católica de Santa María,* 2009, http://www.ucsm.edu.pe/rabarcaf/PropEvalAprVirt.pdf, Accessed 15 July 2013.

8. T. Stén, J. M. Pawlowski and H. Pirkkalainen, The Globalization Competence Assessment Framework: Assessing Globalization Competences in the Information Systems Domain, *International Journal of Knowledge Society Research,* **3**(4), 2012, pp. 33–46.

9. J. Mott, Envisioning the post-LMS era: the open learning. *Educause Quarterly,* **33**(1), 2010.

10. M. A. Chatti, M. R. Agustiawan, M. Jarke and M. Specht, Toward a Personal Learning Environment Framework, *Virtual and personal learning environments,* **1**(4), DOI: 10.4018/jvple.2010100105

11. M. Conde, M. García, M. Rodríguez-Conde, M. Alier y A. García-Holgado, Perceived openness of Learning Management Systems by students and teachers in education and technology courses, *Computers in Human Behaviour,* 2013. doi http://dx.doi.org/10.1016/j.chb.2013.05.023

12. R. Lubensky, *The present and future of Personal Learning Environments (PLE),* Blog Entry, 2006, http://www.deliberations.com.au/2006/12/present-and-future-of-personal-learning.html, Accessed 15 July 2013.

13. S. Schaffert and W. Hilzensauer, On the way towards personal learning environments: seven crucial aspects. *Elearning papers,* **9**, 2008.

14. M. Van Harmelen, Personal Learning Environments. *Proceedings of the 6th International Conference on Advanced Learning Technologies (ICALT'06),* IEEE, Kerkrade, The Netherlands, 5–7 July 2006.

15. H. P. Yueh, Engineering Students' Perceptions of and Reflections on Portfolio Practice in Leadership Development, *The International Journal of Engineering Education,* **29**(1), 2013, pp. 99–106.

16. H. C. Barrett and N. Garrett, Online personal learning environments: structuring electronic portfolios for lifelong and life-wide learning, *On the Horizon,* **17**(2), 2009, pp. 142–152.

17. L. Vygotsky, *El desarrollo de los procesos psicológicos superiores.* Grijalbo, Barcelona, 1979.

18. J. Bruner, *Toward a theory of instruction: Cambridge Mass,* University Press, Harvard, 1966.

19. D. Ausbel, J. Novak and H. Hanesian, *Educational psychology: A cognitive view.* 2nd edition, Holt, Rinehart, and Winston, New York, 1978.

20. R. Pincheira, J. Carrasco and P. Sierra, Formación para el Emprendimiento: Un cambio metodológico apoyado por el uso de tecnología, *XVI Congreso Internacional de Informática Educativa,* Santiago de Chile, 2011.

21. J. L. Carrasco, *Productos creados y curados por alumnos de primer año de la carrera de Técnico Nivel Superior en Administración de Redes y Soporte Computacional,* 2012, http://www.scoop.it/t/recopilacion-ccna1, Accessed 15 July 2013.

22. J. Adell, *Diez cosas que funcionan con las TIC en el aula,* 2008, http://palotic.es/wordpress/?p=398, Accessed 18 August 2012.

23. T. Downes, Elements of a personal learning environment. ITK—Conference 2010. Hameenlinna, Finland, 2010, http://yadda.icm.edu.pl/yadda/element/bwmeta1.element.elsevier-a283ff50-367e-303e-90de-187068c7da58, Accessed 5 September 2013.

24. G. Attwell, The personal learning environment—the future of learning? *eLearning Papers,* **2**(1), 2007, pp. 1–8.

25. T. Valtonen, S. Hackling, P. Dillon, M. Vesisenaho, J. Kukkonen and A. Hietanen, Perspectives on learning personal environments held by vocational students, *Computers & Education,* **58**(2), 2012, pp. 732–739.

26. K. Hakkarainen, M. Bollstrom-Huttunen, R. Pyysalo and K. Lonka, Inquiry learning: Guide for teachers. WSOY, Hersinsky, 2004.

27. M. D. Lytras and P. Ordóñez de Pablos, The role of a "make" or internal human resource management system in spanish manufacturing companies: empirical evidence, *Human Factors and Ergonomics in Manufacturing,* **18**(4), 2008, pp. 464–479.

28. P. Ordóñez de Pablos, The nurture of knowledge-based resources through the design of an architecture of human resource management systems: implications for strategic management, *International Journal of Technology Management,* Special Issue, **27**(6/7), 2004, pp. 533–543

29. J. Zhao and P. Ordóñez de Pablos, Analysis of cooperative mechanism of industry-academy R&D alliance lab and case study, *Human Factors and Ergonomics in Manufacturing,* March-April, **20**(2), 2010, pp. 123–134.

30. J.-Y. Zhao and P. Ordóñez de Pablos, School Innovative Management Model and Strategies: The Perspective of Organizational Learning, *Information Systems Management,* **26**(3), 2009, pp. 241–251.

María Graciela Badilla Quintana is Teacher in primary education, Journalist and Licentiate in Social Communication, Master in education, and Doctor in pedagogical investigation. She won grants from the Government of Chile for postgraduate studies and from the Agency for Management of University and Research Grants, Generalitat of Catalonia for a predoctoral Stage in England. She works as a Head of Educational Computing Unit and Knowledge Management at the Universidad Católica de la Santísima Concepción, Chile. She teaches courses related to integration information and communication technologies in pre and postgraduate studies in education. Dr Badilla's research focuses on investigation surrounding the educative applications of ICTs, strategies and resources for the leadership, formation and advising of the educative innovation with ICT support and Impact of ICT in the educative organizations.

José Luis Carrasco Saez is a Civil Engineer in Computer Science graduated with a bachelor's degree in computer engineering. Nowadays, he is studying a Master's in Computer Education and Knowledge Management. He works as Head of the Information and Communication Technologies Academic Area at Lota-Arauco, a Community College of the University of Concepcion, Chile. His research line focuses on curriculum integration of ICT and its impact on education, knowledge management in physical and virtual learning environments, and the relationship between learning theories, learning styles and ICT.

Miquel Àngel Prats Fernández is Teacher, Psychopedagogist, Doctor in Education at the Faculty of Psychology, Educational Science and Sport Blanquerna, Ramon Llull University in Barcelona. He is currently the Director of Undergraduate Studies in Early Childhood Education FPCEE Blanquerna (URL). He is also professor of educational technology, researcher and head of the line EduTIC of the consolidated Research Group PSiTIC (Education, Society, Innovation and ICT) at the same university. He was director of the Center for Technology ITUARTE (CETEI) of the John XXIII Foundation and the first five editions of ITworldEdu. Prats is a member of the College of Communication Educators of Catalonia, and he is also a collaborator of the projects Edu21 and Infonomia.com.