Web 2.0 tools in pre-Service Teacher Education Programs: An Example From Portugal

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Abstract: The main goal of this project was to verify the importance of providing technological-rich experiences with Web 2.0 tools in pre-service teacher education programs as a way for teacher´s to integrate technologies in the classroom as transformative learning strategies. As educators in a public university we assume that the failure of ICT integration in Portuguese schools is due to a lack of professional development of teachers in technology-supported pedagogy. Different Web 2.0 tools – blogs, wiki, Google Page Creator, Google Docs – were explored by pre-service teacher´s with different pedagogical goals: to build individual/group e-portfolios, to enhance cooperation and collaboration, to facilitate interaction and communication competencies. Results are presented and discussed in order to infer a set of guidelines to help teacher educators and professional development providers to incorporate in teacher education programs regarding the use of Web 2.0 technologies for teaching and learning.

Keywords: Web 2.0; teacher education; internet; pre-service teacher

1. Introduction

The conclusions from the Spring 2006 European Council underline that education and training are critical factors in developing the EU's long-term potential for competitiveness as well as social cohesion and reiterate that "investments in education and training produce high returns which substantially outweigh the costs and reach far beyond 2010" (EU, 2007, p. 7). Further on the spring 2007 European Council describe education and training as prerequisites for a well-functioning knowledge triangle (education - research - innovation) which play a key role in boosting European economic growth and the creation of new jobs (Barna & Lenghel, 2008).

To accomplish such goals the Portuguese government presented in 2007 the *Technological Plan for Education* (http://www.escola.gov.pt/inicio.asp) that established ICT competencies to be attained by all Portuguese K12 students by 2010. An enormous volume of public funds was invested in the equipment of all public schools with computers and internet access. Special policies like 2007 *e-school* (http://eescola.pt/indexA.aspx) facilitated the acquisition of computers with internet access at low prices to hundreds of students and teachers from basic and secondary schools aiming to attain by 2010 the ratio of 2/1. Recent research, however, shows that although these initiatives have significantly increased the number of "wired" schools across the country, educational practices have remained unchanged: teachers continue to teach in traditional ways and when they use computers and the internet it is not for enriching technology-supported learning opportunities for their students. The greatest futile public assumption was that making computers available to educators would automatically result in their implementation in the classrooms (Piano, 2008). It is critical issue to prepare technological proficient teachers that provide the learning opportunities that facilitate students´ use of technology to construct knowledge, to communicate and to be aware of the importance of the lifelong education. The key question that guided our research was to verify whether a technological learning experience using the Web 2.0 tools in teacher education programs helped future teachers to develop positive attitudes towards the use technologies for teaching and learning thru the creation of innovative learning opportunities that facilitate the use of technology to learn and communicate.

2. Teachers and technologies

To live, learn and work successfully in an increasingly complex, information-rich and knowledge-based society, students and teachers must utilize technology effectively (Guerra, 2000; King, 2002). The informed and responsible citizens of the 21st century must be technological prepared to be: a) capable information technology users, b) Information seekers, analyzers, and evaluators, c) Problem solvers and decision makers, c) creative and effective users of productivity tools and d) Communicators, collaborators, publishers, and producers (Unesco, 2008). At varied different levels, both professional development programs for teachers currently in the classroom and programs for preparing future teachers should provide technology-rich experiences throughout all aspects of the training (Schwab, 2000; Woodbridge, 2004).

Recent research shows Portuguese teachers lack adequate training in using computers and the internet in their classroom practices (Silva, 2004; Silva & Miranda, 2005) and that most pre-service teachers have limited technology training in their education preparation programs and were rarely given the opportunity to create lessons using technology or opportunities to practice teaching with these technological tools (Ponte & Serrazina, 1998; Gil, 2001; Piano, 2007). In fact, most education programs often view technology as a subject to be added to the program rather than a tool to be integrated into current curriculum, but for changes to occur teachers need to be introduced to new pedagogical activities with technologies, then given time to practice and reflect about them (Coutinho, 2005; Ponte & Serrazina, 1998). Teachers do not adopt new pedagogy simply because they think they possess the skills and knowledge to do so; to integrate ICT in the classroom requires new roles, new pedagogies and new approaches to teacher training. If we want future teachers to utilize technology effectively in the classroom education programs must take into account that more important than getting familiarized with technologies teachers need time to reflect on learning strategies with ICT and "to share problems and issues with instructors and peers" (Baylor & Ritchie, 2002, p. 410).

It is the quality of teacher education programs that is the key issue to a successful integration of ICT into the classroom and depends on the ability of teachers to structure the learning environment in non-traditional ways, to merge new technology with new pedagogy, to develop socially active classrooms, encouraging cooperative interaction, collaborative learning, and group work (Unesco, 2008).

3. A new web paradigm: Web 2.0

According to Rosen (2006), every ten years new technological trends emerge: in the 70´s we had the mainframes, in the 80´s the client server technology, in the 90´s the Internet and in the 2000 decade …the Web 2.0! The first generation of the Internet, also known as Web 1.0, had, as main attribute, the enormous amount of information available and that everyone could access. However, at that time, the users were just spectators of the action that was happening on the webpage that they visited, and, in most cases, they did not have permission to make changes in the page contents. The Web 1.0 was also very expensive for the users; the big majority of the services were paid and controlled through licenses, the systems were restricted to who had power and money to support the transactions online and to buy the software for design and maintenance of the websites.

With the change of paradigm, new communication scenarios in the internet were set up and different roles were offered to the web users. In the new generation of the Web terms as Blog, Podcast, Hi5 or Del.icio.us, are just some examples of tools that are part of the variety of systems available on the global network (Richardson, 2006). But more important that the quantity and versability of the tools is the new attitude that is now available for each user: they can produce their own documents and publish them on the web automatically, without need of large knowledge of programming environments and sophisticated computer systems (Anderson, 2007).

Each day increases the usage of tools, such as blogs, wikis, podcasts and RSS feeds, among others that are generally called social software (Hayman, 2007), that represent the new paradigm of this social and collaborative Internet. Although many of us haven't realized that something has changed in Web, the fact is that the "Read Only" Internet changed to a "Read Write" model. The advantages to the users are many and some still have to be discovered: a) the content that used to be static, can now be divided and reunited in different ways to fulfill the interests and needs of each individual; b) the contents are created online in a collaborative way and according to the most dominant interests of a huge number of users; c) a new a social community emerges, a space where "the web surfer negotiates the connections within a social or idea network, exchanges bits of content, creates something new, and then the cycle begins again" (D´Sousa, 2007, p. 6).

Web 2.0 applications hold profound potentials in education because of their open nature, ease of use and support for effective collaboration and communication; they change the traditional view of human knowledge and open up more opportunities in teaching and learning (Ferreira, 2007; Moura, 2007). Teachers must use Web 2.0 tools not only to attract students' attention but to enhance their learning experiences. Today, over several hundreds of the Web 2.0 applications are available and have potentials in teaching and learning. Some of these tools include: podcasts (i.e., audacity, iTunes), Weblogs (i.e., Blogger), wikis (i.e., Mediawiki, PBWiki), social bookmarking tools (i.e., del.icio.us), social networking tools (i.e., EduSpace, Facebook, MySpace), social media sharing tools (i.e., Flickr,

SlideShare, YouTube), virtual 3D community (i.e., Second Life), social library tools (i.e, LibraryThing), customized sites (i.e, Googlepages) and collaborative writing tools (i.e., Google docs).

4. The project

At the Institute of Education and Psychology of the University of Minho, Braga, Portugal we prepare pre-service teachers to use technologies in the classroom for more than 15 years and constantly had to adapt our teaching practices to the technological changing world we live in: we began with the audiovisual pedagogy, then introduced beginning teachers to the computer and the multimedia applications and now the Internet is central in our 3th grade educational technology programs. We assume that the failure of ICT integration in Portuguese schools is due to a lack of professional development of teachers in technology-supported pedagogy; we need to prepare educators who are proficient creating technological learning environments that engage students in learner centred environments where interaction and cooperation are essential for success in the knowledge society we live in (Coutinho, 2005; Coutinho, 2006; Coutinho, 2007a; Coutinho, 2007b). In the beginning of school year 2007-2008 we engaged in a research project named *Learning, training and research on the Web* financed by the Center of Research in Education of Minho University whose main goal was to enhance the use of Web 2.0 tools in teacher education programs as a way for teachers to use efficiently technologies for teaching and learning.In order to have a holistic view of the awareness of the emergence of the new Web paradigm and its potentialities for enhancing new forms of learning an initial large scale survey was conducted. An electronic questionnaire named "Web 2.0: Personal Use versus Classroom Use" was sent to all academy institutional e-mails. The main goal of this study was to verify if our academic community (students and teachers) used (or not) Web 2.0 tools, which tools were used and with which purposes (personal or professional) and in which contexts (formal or informal). Although considering the high rates of non responses, the results of the valid questionnaires (1811) confirm a reality already foreseen: i) the concept of Web 2.0 was only known by a minority of students; ii) some Web 2.0 tools are well known (blogs) and others (such as social bookmarking tools) that are (almost) unknown; iii) most tools are used for personal purposes (e.g. search tools and blogs); iv) relative to formal classroom uses, results show that an important part of the higher education community is still very distant from this new web paradigm; v) despite not using web 2.0 tools in pedagogical contexts, the academic community that participated in the survey believes in its educational value (Bottentuit Junior & Coutinho, 2008a).

Taking into account previous studies that analys the efficacy of different models as well as the best practices related to pre-service teacher education programs (Downes et al, 2001; Brito et al, 2004; Mayo et al, 2005; Eça, 2007) a new program was designed to test the use of Web 2.0 resources in the UM pre-service teacher education programs as tools to increase communication and enhance learning. According to this new program student teachers: a) get acknowledged with a variety of Web 2.0 tools as well as with pedagogic approaches to use these Web technologies in the classroom; b) had to analyse and comment a selection of relevant experiences related to the use of this new web paradigm and to reflect in the implications for the future of lifelong learning; c) had to design a classroom learning activity using one (or several) Web 2.0 tools for their future pupils. At the end of the semester all students presented to the class the e-portfolios they had developed as well as the pedagogical plan for a real classroom learning activity. Formative evaluation was implemented all over the semester and all students had to participate in final assessment (auto and hetero evaluation). 109 pre-service teachers who attended Educational Technology education programs in the school years 2006-2007 and 2007-2008 used Web 2.0 tools in different contexts and goals. As Brown (2006) states we believed that an effective pedagogical use of these tools could determine the promotion of innovative and collaborative learning strategies in educational contexts either formal or informal: "Rather than treat pedagogy as the transfer of knowledge from teachers who are experts to students who are receptacles, educators should consider more hands-on and informal types of learning. These methods are closer to an apprenticeship, a farther reaching, more multilayered approach than traditional formal education" (Brown, 2006, online).

4.1 Web 2.0 tools to develop e-portfolios

4.1.1 Blogs

Electronic Portfolios (e-Portfolio) are usually defined as "a tightly integrated collection of Web-based multimedia documents that includes curricular standards, course assignments, student artefacts in response to assignments, and reviewer feedback to the student's work." (Gathercoal *et al*, 2002, p.

30). In teacher education programs e-Portfolios have been widely suggested as an effective tool to assess pre-service teachers' technology integration skills in classrooms. The process of creating e-Portfolios is valuable not only because it helps teachers acquire technology design, production, and integration skills but also because it encourages reflection thinking for entire developing and implementing process. Loughran & Corrigan (1995) also showed positive results of using e-Portfolios in the teacher education programs: pre-service teachers can link digitized artefacts they created in a variety of media format through the reflection process they explored. Four studies were developed using blogs as e-portfolios with different classes of beginning teachers (Coutinho 2006; Coutinho 2007a; Coutinho 2007b; Coutinho & Bottentuit Junior, 2007a). 105 student teachers of Portuguese language, Foreign Language and Science participated in the project. The learning experience took place at the 2nd semester, 3th grade course of Educational Technology at the school of education at Minho University whose main goal is to motivate future teachers to use ICT in the classroom. Students used blogs as a pedagogical strategy in two of the models proposed by Davis (2004): as individual portfolio and as a support for collaborative work (group e-portfolio). The evaluation of the experiences used several techniques for data collection as usual in exploratory case studies (Yin, 2004): interviews, direct observation, online questionnaires and content analysis. As to results the most relevant aspect to register was the enormous motivation of student teachers in the learning experiences. Most participants were not aware of the emergence of a new web paradigm; some had already used blogs for personal purposes but never for class work in academic settings during their education program. None of the students (except for two) reported difficulties in using the tool; in all studies we could verify an evolution in the way students used the tool both in terms of the quality of the interface or the handling of technological functionalities like aggregation of contents (RSS).

We could verify blogs are a very good solution when used as e-notebook for individual work and assessment (Coutinho, 2008). However, we have to register for future research that when we work with a large group (more than 12 students) it is very difficult for the instructor to give prompt feedback (through comments to posts) in individual e-portfolio. However if the instructor does not visit the blogs regularly (once a week) to leave feedback, an important part of the potentialities of this Web 2.0 tool to learn and communicate could be lost. We also verified that, when used for individual work, colleagues leave less comments´ in other students´ blogs than when used for group work. For group work (3-4 members) blogs enhance more interactivity and communication in the classroom: students leave more comments in other blogs, engage more in class discussions but continue to value more the instructors´ feedback. Cooperation was verified successfully in one of the studies that focalized in this specific matter (Coutinho 2007b): students recognized they had developed team skills and that they felt more responsible for their own and other´s learning. Assessment was another aspect to consider regarding the potential of blogs as learning tools for group work: in all different studies we could verify evaluation become a more easier and transparent process for the whole class (auto and hetero evaluation agreeing with instructors´ proposals in most cases was reported).All future teachers recognized they had developed ICT skills and most had a firm intention to use blogs for teaching and learning activities in the classroom in the year to come - induction period: (6 said it would depend on school conditions and 2 said it would depend on whether students had/had not internet access at home). All agreed that the process of building and publishing online on blogs enhanced students´ responsability for the learning process. The empowerment of pupil and teacher to post and to comment, the sense of real worldwide audience and the ability to collaborate beyond the barrier of the classroom (and therefore the school) that makes writing and reading through weblogs a more educationally interesting proposal than others. Students will not experience ownership and responsibility for their work in the same way as when it is published and criticized constructively by those in the classroom and, more importantly, those outside the classroom in the wider world. The teacher also loses out on a great opportunity to improve writing and reading skills. Above all, the whole education community loses out on the chance to motivate large numbers by using technology that is available and which increasingly forms part of teenagers' lives.

4.1.2 Google page creator

GooglePage Creator was used to build e-Portfolios in two case studies developed in the second semester of school year 2007/2008 (Coutinho, 2008). The first study enrolled 20 pre-service teachers of Portuguese Language and the second 10 student teachers of History who attended the curricular subject Multimedia Education (3h/week class). During the first session each student created a gmail account. Apart from the individual account on Google, students organized into groups (3-4) and created a group account to access to GooglePageCreator and create a website that worked as the e-portfolio of the group all over the semester. In this webpage, in addition to elements of the personal

identification of the members of the group (picture, contacts, mini-curriculum) should be collected all documents (text, images, references, sites) that the group considered relevant for class work and assessment. Each group took advantage of the features that the web 2.0 tool provides, which led to e-portfolios in very diverse formats (available at educacaomultimedia.googlepages.com). The instructor also had a personal website (ccoutinho.googlepages.com) and a site of the subject (mieuminho.googlepages.com), where all participants could access links to the sites of the other groups, as well as to all information considered useful to scaffold learning in the early stages of development of the group work. In order to promote class interactions each group also created a blog using Blogger.com that was linked to the homepage of the group. The blog´s purpose was to be a space for debate and reflection on the class activities as well as for publishing essays related to the class assignment.The sites were visited every week by the instructor who sent feedback and comments using the e-mail or the blog of the group, in order to improve the quality of the portfolio both in terms of usability and layout as well as in the trustworthiness of the contents available. Students also used GoogleDocs for collaborative writing and so a mixture of Web 2.0 tools was used to enhance learning, interaction and collaboration. The idea was to familiarize teachers´ with different Web 2.0 tools in order that they could have a critical insight into the potentials and limitations of each depending on the age and style of the learners, the curricular subjects and the learning goals. For final assessment groups planned and presented a classroom activity to develop with their own students in the year to come (induction period) justifying the reasons that lead to the choice of a specific Web 2.0 tool as well as its´ adequacy according to learners´ age and cognitive development. At the end of the semester focus group sessions were conducted to obtain student teachers´ reactions to the pedagogical experience. All students valued the learning experience, considered classes to be very "interesting" and "catching"; they also considered the curricular subject essential to "prepare future teachers of the XXI century" who want "the school to be part of students´ everyday life". The pedagogical proposals students developed were amazing and revealed a high sense of awareness of ICT potential to teach and learn (educacaomultimedia.googlepages.com).

4.2 Wiki

A wiki is a website produced by several authors through a collective work. It is similar to a blog in its logic structure, but it also allows to add, edit or remove content created by other authors. Wiki allows the challenge of online communication and the creation of new web pages only by clicking on certain buttons and by writing a text, as if it was a word processor. Wikis allow to publish and share content on the web in a very easy way (Santamaria & Abraira, 2006; Qian, 2007).The wiki project was developed in the first semester of 2006/07 (October thru February) and enrolled 16 Science pre-service teachers who attended 3th grade Educational Technology program.We believed that learning would occur through the exchange and sharing of information and opinions among a peer group in an online community of practice and we used a wiki in order to: a) introduce blended learning solutions in our regular classes; b) to develop collaborative skills that enhanced students autonomy and habits of search of information on the web. The instructor presented the project, defined timing and forms of assessment but all other tasks were managed by students. The idea was that students should organize into groups and study in depth a topic of the 8th grade Biology program. A class wiki site was designed (claracoutinho.wikispaces.com). All groups had different tasks and so, at final, the whole group build an enormous collaborative repository that has a kind of manual for future 8th grade students! The instructor visited the wiki to scaffold students learning through comments and suggestions. Groups` contributions to the wiki database were assessed for final approval in the course. The quality of the essays exceeded all expectations: each topic was organized as an interactive index format that facilitated the search for relevant information; posts were written in an academic format including relevant citations; a final extended bibliography was suggested for further research on each topic.The wiki learning experience was assessed thru the administration of an online questionnaire at the end of the semester. The feedback received from participants sustain the idea that wiki can be effective for collaborative work and for teaching the Biology curricular subject. Future teachers´ recognized the importance of peer interaction to create a common identity, to promote the knowledge construction and sharing; a relational involvement was also valued as a key element for a mutual support and essential for the success of the collaborative wiki activity (Coutinho & Bottentuit Júnior, 2007a).

5. Conclusions

In this article we presented the results of a research project developed with Web 2.0 tools in pre-service teacher education programs whose main goal was to provide technological-rich experiences

to student in order to promote the integration of technologies in the real classrooms. Different Web 2.0 tools were used in different contexts and with different research goals: to build individual/group e-portfolios, to enhance cooperation and collaboration among peers, to develop skills in searching, organizing and sharing web resources, to facilitate interaction and communication competencies. Results show that Web 2.0 are versatile tools that serve for varied pedagogical purposes. Blogs showed to be effective: a) to build individual/group e-portfolios, b) as a space for the discussion (forum) of polemic topics for a whole class, and c) to facilitate interaction and communication competencies in b-learning environments. GooglePages is an excellent tool for students to build individual sites or for group assignments and also for the instructor to use as a course learning platform. Wikis are very effective for cooperative/collaborative learning activities that demand skills in searching, organizing and sharing web resources as well as collaborative writing.

For most participants it was a surprise to verify that Web 2.0 technologies had so much to offer to educators, enhancing learning environments and encouraging knowledge deepening and knowledge creation. The involvement and the enthusiasm in the different pedagogical activities, the quality of the artifacts produced and published on the web, the opinions obtained from online questionnaires, interviews and written open reports show that most future teachers had a firm intention to use internet resources for pedagogical purposes in the year to come (induction period). It was also clear for future teachers that the successful integration of ICT into the classroom depends on teachers´ ability to structure the learning environment in non-traditional ways, developing socially active classrooms, encouraging cooperative interaction, collaborative learning and group work. There are different goals for integrating ICT into the school curriculum and teacher education programs: ICT as a subject of study, ICT as a tool for learning and ICT as integral to both matter and pedagogy (Downes *et al*, 2001). Our project highlights the deficiencies of separate ICT subjects as the dominant strategy for teacher education programs: on the other hand, as suggested in the Unesco 2008 report, we believe that the adoption of integrated or interdisciplinary approaches in ICT-based teachers´ education develops positive attitudes towards technologies and enhances the adoption of constructivist learning settings in the classroom routines: "Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills" (Unesco, 2008, p. 1). If we don´t show teachers how technologies can be used to learn then we will have a generation of highly competent monolingual technicians with nothing much to say.

References

Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning? *Educause Review*, vol. 41, nº. 2, 32–44.

Anderson, P. (2007). What is Web 2.0? Ideas, technologies and implications for Education. *Technology & Standards Watch* Retrieved http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf consulted 30/08/2007.

Barna, C. and Lenghel, E. (2008). E-Learning: the core of lifelong European Education. In L. Gómez Chova et al (Eds.). INTED 2008, *Proceedings of International Technology, Education and Development Conference, Valencia: IATED (International Association for Technology, Education and Development)*. (s/p).

Baylor, A. L. and Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms? *Computers and Education*, Vol 39 (4), p. 395-414.

Brito, C.; Duarte, J. and Baía, M. (2004). *As tecnologias de informação na formação contínua de professores. Uma nova leitura da realidade*. Lisboa: Editorial do Ministério da Educação.

Brown, J.S. (2006). *Growing up Digital: How the Web changes work, education. and the ways people learn.* Available http://journalism.berkeley.edu/conf/conference2003/present/brown-paper.pdf, consulted 20th November 2007.

Coutinho, C. (2005). *Percursos da Investigação em Tecnologia Educativa em Portugal: uma abordagem temática e metodológica a publicações científicas (1985-2000).* Série "Monografias em Educação". Braga: CIED, Universidade do Minho.

Coutinho, C. (2006). Utilização de blogues na formação inicial de professores: um estudo exploratório. In Panizo *et al* (Eds.) *Proceedings of the 8th International Symposium on Computers in Education*, (Vol 2), pp. 157-164.

Coutinho, C. (2007a). Infusing technology in pre service teacher education programs in Portugal: a study with weblogs. In R. Craslen et al (Eds.).*Proceedings of the 18th International Conference of the Society for Information Technology and Teacher Education*, SITE 2007. pp. 2027-2034. Chesapeake, VA: AACE.

Coutinho, C. (2007b). Cooperative Learning in Higher Education using Weblogs: a study with undergraduate students of Education in Portugal. In A. Tremante et al (eds).*Proceedings of International Conference on Education and Information Systems, Technologies and Applicattions, EISTA, 2007*, Vol I, Orlando, EUA.

Coutinho, C. (2008). Tecnologias Web 2.0 na formação inicial de professores: um estudo com alunos da Licenciatura em Estudos Portugueses.

Coutinho, C. and Bottentuit Junior, J. B. (2007a). Blog e Wiki: os futuros professores e as ferramentas da Web 2.0. In M. J. Marcelino and M. J. Silva (org.), *Actas do IX Simpósio Internacional de Informática Educativa (SIIE 2007),* pp. 199-204. Porto: ESE-IPP.

D´Sousa, Q. (2007). *RSS Ideas for Educators. Version 1.1.* Retrieved the 27th July 2''7 from http://www.TeachingHacks.com.

Downes, T.; Fluck, A.; Gibbons, P.; Leonard, R.; Matthews, C.; Oliver, R.; Vickers, M. and Williams, M. (2001). *Making Better Connections: Models of Teacher development for the integration of information and communication technology into classroom practice*. Report of the Australia Commonwealth Department of Education, Science and Training.

Eça, T. (2007). Blogs e ferramentas Web 2.0 na aprendizagem de línguas. *Centro CRIE-ESE de Setúbal*, pp. 11-36.

European Union – EU (2007). *Delivering lifelong learning for knowledge, creativity and innovation.* Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Region, Brussels, 12.11.2007.

Ferreira, L. (2007). O que aprendemos com a Web 2.0: novos rumos para a aprendizagem. In A. B. Alves (org.) *Actas do Encontro Internacional "Discurso, Metodologia e Tecnologia".* Miranda do Douro: CEAMM, pp. 237-247.

Gathercoal, P., Love, D., Bryde, B. and McKean, G. (2002). On Implementing Web-Based Electronic Portfolios. *Educause Quarterly* (2), 29-37.

Guerra, M. (2000). *A Escola que Aprende*. Porto: Asa.

Hayman, S. (2007). *Folksonomies and Tagging: new developments in social bookmarking*. Retrieved the 20th June from http://www.educationau.edu.au/jahia/webdav/site/myjahiasite/shared/papers/arkhayman.pdf.

King, K. (2002). Educational Technology professional development as transformative learning opportunities. *Computers and Education,* 39, 283-297.

Loughran, J. and Corrigan, D. (1995). Teaching portfolios: a strategy for developing quality learning in pre-service science teachers. *Teaching and Teacher Education,* 11(6), 565-577.

Mayo, N; Kajs, L and Tanguma, J. (2005). Longitudinal Study of Technology Training to Prepare Future Teachers. *Educational Research Quartely*, 29 (1), 3-15.

Moura, A. (2007). A Web 2.0 na aula de língua materna: relato de uma experiência. In António B. Alves (org.) *Actas do Encontro Internacional "Discurso, Metodologia e Tecnologia*. Miranda do Douro: CEAMM, pp. 9-24.

O'Reilly, T. (2005). *What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software* Retrieved March, 17th, 2007 from http://oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html.

Piano, A. R. (2007). *Vinte anos de investigação sobre Tecnologias Educativas em Portugal: uma sistematização da investigação desenvolvida entre 1985 e 2005.* Master Dissertation (unpublished). FPCE-UL, Portugal.

Ponte, J. P. and Serrazina, L. (1998). As NT na Formação Inicial de Professores. Lisboa: DAPP-ME.

Qian, Y. (2007). Meaninful Learning with Wikis: making a connection. In R. Craslen et al (Eds.).*Proceedings of the 18th International Conference of the Society for Information Technology & Teacher Education, SITE 2007*. Chesapeake, VA: AACE, 2093-2997.

Richardson, W. (2006). *Blogs, Wikis, Podcast and other powerful Web tools for classrooms.* Thousand Oaks, CA: Corwin Press.

Rosen, A. (2006). Technology Trends: e-learning 2.0. *The e-learning Guild´s Learning Solutions E-Magazine*. Retrieved the 20th April 2008 from http://www.readygo.com/e-learning-2.0.pdf

Santamaria, F. G. and Abraira, C. F. (2006). Wikis: posibilidades para el aprendizaje colaborativo em Educacion Superior. In L. Panizo *et al* (Eds.) *Proceedings of the 8th International Symposium on Computers in Education*, (Vol 2), pp. 371-378.

Schwab, R. (2000). Technology and the changing roles and responsibilities of teacher educators. *Log On or Lose Out Technology in 21st Century Teacher Education*. Washington, DC: American

Silva, F. and Miranda, G. (2005). Formação Inicial de Professores e Tecnologias. In P. Dias and Freitas V. *Actas da IV Conferência Internacional Challenges, 2005*. Braga: CC Nónio Sec-XXI, UM, pp. 593-606.

UNESCO (2008). *ICT competency standards for teachers.* Paris: United Nations Educational, Scientific and Cultural Organization. Retrieved the 7th March 2008 from http://cst.unesco-ci.org/sites/projects/cst/The%20Standards/ICT-CST Policy%20Framework.pdf.

Woodbridge, J. (2004). Technology Integration as a Transforming Teaching Strategy. *TechLearning.* Retrieved 25 July, 2006 from http://www.techlearning.com/story/showArticle.jhtml?articleID=17701367.

Yin, R. (1994). *Case Study Research: Design and Methods* (2ª Ed). Thousand Oaks, CA: Sage Pub.