Chapter 23

Challenges for Teacher Education in the Learning Society: Case Studies of Promising Practice

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ABSTRACT

In this chapter the author presents the results of a project developed in pre-service and in-service teacher education programs at the Minho University, Braga, Portugal. The main goal of the research was to test the importance of providing technological-rich experiences in teacher education programs as a strategy to promote the integration of technologies in the classroom. As educators in a public university we assume that the failure of ICT integration in Portuguese schools is due to a lack of teacher training in technology-supported pedagogy. We present and discuss a set of principles that we consider essential to understand and sustain the importance of the learning experiences we develop in teacher education programs both for pre-service and in-service teacher education. Different Web 2.0 tools were explored in different contexts and with different pedagogical goals: to build e-portfolios, to enhance cooperation and collaboration among peers, to develop skills in searching, organizing and sharing web resources and to facilitate interaction and communication competencies. Results are presented and discussed in order to infer a set of guidelines for the design of teacher education and training programs regarding the use of ICT in teaching and learning.

INTRODUCTION

Thinking about the future of training in the knowledge-based society needs to be holistic as learning will become a lifelong activity that cuts across different learning generations and life spheres such as

private, public and work. The focus should therefore be not only on traditional formal learning institutions such as schools and universities but it should also embrace other forms of adult education and many forms of informal learning. Learners need to be prepared not only to operate the technology but also for higher-order skills such as knowing and understanding what it means to live in a digitalized

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and networked society and specially what it means to work in online collaborative teams where information is shared and knowledge collaboratively constructed (Punie & Cabrera, 2006).

The first generation of the Internet had as main characteristic the amount of available information. However, the user's role in this scenario was only of viewer of what was happening in that particular web page, as he didn't have authorization to change or edit the content. This stage, that is also called Web 1.0, was very expensive to users, because most services were paid and controlled through licences; the systems were only available to those who could afford online transactions and buy software to create and maintain sites (Anderson, 2007). Along with the changes of paradigm in the internet, a huge and varied online service are now available for several aims and the use of these resources grows as the users produce information, sharing their knowledge through the Internet, in an easy, fast way (Fryer, 2005; Richardson, 2006). Hayman (2007, p.1) defines Web 2.0 tools as "a cluster of web-based technologies services with a social collaboration and sharing component, where the community as a whole contributes, takes control, votes and ranks contents and contributions".

According to Yuen & Yuen (2008), Web 2.0 applications hold a profound potential in education due to 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. Teachers can use Web 2.0 tools not only to attract students' attention but to enhance new and varied learning experiences (Ferreira, 2007; Moura, 2007). Today, over several hundreds of the Web 2.0 applications are available and have potentials in education. Some of these tools include: podcasts (i.e., audacity, iTunes), Blogs or 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., Google Pages) and collaborative writing tools (i.e., Google Docs).

Teachers can use internet resources for many pedagogical purposes and learning goals (Alexander, 2006). However recent research shows that, for technologies to be integrated in the classroom, teachers' need specific training and time to reflect on the importance of using ICT as cognitive tools (Jonassen, 2007), that enhance student's learning and communication skills (King, 2002). In this article we assume that, without changing teacher education programs in Portugal, there is no chance for technologies to be integrated in the classrooms routines: teachers will continue to teach in traditional ways and students will (rarely) use computers other than for drill and practice exercises and word processing. The key question that motivated the development of the research project started by the authors' team in 2006, was to verify whether the introduction of a new ICT program with the Web 2.0 tools in pre-service teacher education as well as continuing professional development programs: a) helped students/teachers to embody best practices to create enriched and collaborative learning environments, and b) motivated students/teachers to integrate and use technologies to create, in the classroom, learning opportunities to facilitate the students' use of technology to learn and communicate.

CONCEPTUAL FRAMEWORK

ICT and Teacher Education

The impact of ICT in our global societies held the development of different policies regarding the introduction of information and communication technologies in schools and educational systems. To live, learn, and work successfully in an increasingly complex, information-rich and knowledge-

based society, students and teachers must use technology effectively (Guerra, 2000; Punie & Cabrera, 2006). Very recently, the UNESCO (2008) published a policy framework untitled *ICT Competency Standards for Teachers* that states that 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.

At different levels, both professional development programs for teachers currently working and programs for preparing future teachers should provide technology-rich experiences throughout all aspects of the training (Mayo *et al.*, 2005; Qi & Vandersall, 2007; Schwab, 2000; Woodbridge, 2004). According to the quoted 2008 UNESCO report, “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).

To accomplish these 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 supply of all public schools with computers and internet access. However, recent research indicates that Portuguese teachers lack adequate training in the use of computers and the internet, in their teaching and learning practices (Alves, 2008; Silva, 2004); they also show that most pre-service teacher 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 (Gil, 2001; Piano, 2007).

In fact, teacher education programs both at pre-service and continuing ICT professional development often view technology as a subject to be added to the program rather than a transversal tool to be integrated into the current curriculum. Research shows that for changes to occur, teachers need to be introduced to new pedagogical activities with technologies, given time to practice and reflect upon the experiences learned during the ICT professional development program:

Teachers needs more than a few courses focused on hardware or surveys on educational software; rather they require training that incorporates technology into the curriculum – and allows time for teachers to experiment with new technologies and to participate in relevant professional development activities (Léon, 2001, p. 6).

New technologies require new roles for teachers, new pedagogies, and new approaches to teachers’ training. If we want teachers to use technology effectively in the classroom, within training programs one must consider that, as important as getting familiarized with technologies, teachers need time to experience learning ICT strategies which can facilitate the students’ use of technology both to learn and communicate, and time “to share problems and issues with instructors and peers” (Baylor & Ritchie, 2002, p. 410).

More than quantity it is the quality of teacher development programs that is the key to a successful integration of ICT into the classroom. As educators in teachers’ training and initial education programs in a public university for more than fifteen years we assume that the failure of ICT integration is due to a lack of professional development of teachers in technology-supported pedagogy. A review of the literature sustained a set of principles and inspired, at a conceptual level, the development of the ICT professional development programs with Web 2.0 tools:

- There is no chance of changing educational systems if teachers are not involved in the reform process (Downes *et al.*, 2001);
- Teacher education programs are crucial for technology to be integrated into the classrooms (Coutinho, 2005; Piano, 2007);
- The successful integration of ICT into the classroom will depend 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 (Woodbridge, 2004);
- 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 (UNESCO, 2008);
- Using ICT it is possible to extend the teachers' professional development so as to advance their skills in pedagogy, collaboration, leadership and innovative school development (Schwab, 2000);
- Effective ICT professional development is experiential, engaging teachers in concrete tasks in teaching, assessment, observation and reflection that illuminate the process of learning and development (Carlson & Gadio, 2002; CERI, 1998; Ulmer & Timothy, 2002);
- Effective ICT professional development is collaborative and interactional involving knowledge share among educators and the focus on teachers' practice communities (CERI, 1998; Hargreaves, 1998; King, 2002);
- Through there are different perspectives for integrating ICT into teachers' education programs, the literature supports that

integrated or interdisciplinary approaches are most effective to enhance the adoption of constructivist learning settings in real classrooms (Downes *et al.*, 2001).

THE PROJECT

At the Department of Curriculum and Educational Technology of the University of Minho (Portugal), we prepare teachers to use technologies in the classroom: from the audiovisual in the 80's, the computer in the 90's and more recently the Internet, we constantly had to adapt our teaching methods to the technological changes. Our responsibility is to prepare teachers who are proficient in creating technological learning environments that engage students in learner-centred environments where interaction and cooperation are essential for the success in the knowledge society we live in.

Aware of the potential that the new internet generation can bring to the development of innovative learning environments, we started in the year of 2006, a research project entitled *Learning, Training and Research on the Web* financed by the Center of Research in Education-CIED of the University of Minho whose main goal was to discuss the potential of Web 2.0 in teacher education programs both for graduation and professional development of teachers. The main idea which was in the basis of the project regarded the development of teachers' competencies for the integration of technologies in the classroom, as well as a philosophy which values pedagogical strategies in which ICTs are cognitive tools used by the teacher to help the student in knowledge searching, constructing and sharing.

Since then, ten case studies were conducted enrolling different groups of teachers who attended pre-service education programs as well as continuing professional development. In total, 105 pre-service and 77 postgraduate teachers enrolled in education programs used Web 2.0 tools in different contexts and research goals. Like Brown (2006), we believed that an effective pedagogical

use of these tools could determine the promotion of innovative and collaborative learning strategies in the classroom.

Taking into account the literature review stated above as well as our own experience of teaching Educational Technology assignments at the University of Minho, we designed an education program using Web 2.0 tools (Coutinho, 2008). According to this pre-service teacher education program students should: (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) analysed and discuss relevant experiences related to the pedagogical use of this new web paradigm with implications for the future of lifelong learning; (c) design/implement a classroom learning strategy using one (or several) Web 2.0 tools. The new program was developed throughout 15 weekly face-to-face sessions of 3-4 hours each, followed by at-distance activities. The at-distance activities were aimed at finalizing the didactic-pedagogic activities carried out during the weekly meetings, since the access and exploration of the virtual environments requires many hours of dedication. Each student, according to its own knowledge of the informatics tools, moved forward in the process according to its own rhythm. The non-presential period was destined to the accomplishment of the collaborative writing assignments as well as to the reflexion, discussion and evaluation of the subjects proposed during the meeting. At the end of the semester all students presented to the class the assignments they had developed as well as the learning artefacts designed for a real classroom activity. Formative evaluation was implemented all over the semester and all students had to participate in the final evaluation process (self assessment and hetero assessment by other class members) (Coutinho, 2008).

The pedagogical activities with Web 2.0 tools had different purposes in ICT professional development programs. In fact, we worked with in-service K-12 teachers who attended a postgrad-

uate Master Program in Educational Technology. According to Glatthorn (1995, p. 41), "Teacher development is the professional growth a teacher achieves as a result of gaining increased experience and examining his or her teaching systematically". In fact, for most teachers who attended our Master Program the main objective is to develop ICT skills and competencies to improve teaching, not a mere career development. The curricular subject was Research Methods in Education (RME), a 3 hours/week lecturer class that aims to provide teachers with competences in a broad range of social and scientific methods necessary for the development of an original dissertation that is compulsory for obtaining the Master degree in Education. Our previous experience of teaching RME in professional development programs of K-12 teachers who work and have difficulties to attend regular classes, suggest that much more could be done in order to prepare wiser teachers and researchers for the fast-changing knowledge-based societies we live in. We believed that learning would occur through the exchange and sharing of information and opinions among a group of teachers who aimed to develop ICT competencies as well as research skills. Web 2.0 tools – Blogs, Wiki, Del.icio.us, Google Page Creator and Google Docs – were used in different contexts and with specific goals: to build individual/group e-portfolios, for collaborative writing, to build a bibliography for a research project, to build a class repository of contents, to share and publish contents in the Web. Table 1 summarizes the ten studies carried out.

Web 2.0 Tools in Pre-Service Teacher Education Programs

The term blog or weblog refers to a personalised webpage, kept by the author in reverse chronological diary form (Downes, 2004). 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). A total of 105 graduate

Table 1. Summary of the ten studies conducted in teacher education programs

	N° studies	Web 2.0 tool	School Year	Curricular Subject	Participants
Pre-service teacher	4	Blog	2006/2007 2007/2008	Educ. Technology (3h/week)	75
	2	Google Page Creator+ Blog+ Google Docs	2006/2007 2007/2008	Multimedia Education (4h/week)	30
Post Graduation (in service teachers)	1	Wiki	2006/2007	Research Methods In Education	16
	1	Google Page Creator+ Google Docs	2007/2008		24
	2	Social Bookmarking (Del.ici.ous)	2007/2008		37

students from the 3rd year of the academic licensure in Portuguese Language, Foreign Language and Physics and Chemistry were involved. The activities took place in the classes of the Educational Technology/Multimedia Education subjects (3-4 hours/week) which incorporates the pedagogical component of the initial teachers' education at the University of Minho and aims the to prepare teachers' to use technologies in the classroom. The future teachers used blogs as a pedagogical strategy in two of the modalities predicted by Davis (2004): as an individual portfolio (each student used the blog as a place to publish his own assignments and reflections) and as a support to the collaborative work (group portfolio).

The assessment of the pedagogical activities with this Web 2.0 tool had resorted to different data collection techniques, which is common in exploratory case studies: interviews, observation, online enquiries and the content analysis of the artefacts.

Concerning the results, the first registered data was the enormous motivation originated by the proposals among the future teachers who, in great majority, ignored both the concept of Web 2.0 and its tools. Only few of them used blogs, but only for personal purposes; none of the participants had previously used this tool in classroom context in the education program. Only two students reported having technical difficulties in the use of this tool; in all the studies, the blogs' evolution

was noticeable regarding interface quality as well as the domain of specific functions such as the assemblage of contents (RSS).

We could verify that blogs run quite well when used as individual portfolios or e-notebook. However, we must warn to one fact that was inferred from our experiment with the future teachers and which should be considered in future studies: if there is a large group (more than 15 students) it becomes very difficult for the teacher to support and give feedback on a weekly basis (through comments on the posts) to each one of the students' portfolio individually. However, if the teacher does not pay regular visits to the blogs to comment, the students will lose interest in the activity and a large part of the potential of this Web 2.0 tool for enhancing learning will be lost.

On the other hand, when students use the blog as a group portfolio (3-4 students per group), the interactions in class are much more intense and dynamic, with the students visiting and leaving more comments in the colleagues' blogs. The teacher's role continues to be valued, but not as much as when the blog was used as an individual portfolio. The assessment issue was another aspect to highlight, since in the different studies where the blog was used for group work, the evaluation became a simpler and clearer process to the whole class. The blog's potentialities for the promotion of cooperative learning strategies was also demonstrated with success in the study where the analysis

was focused on this issue (Coutinho, 2007b); the students recognized having developed group work competencies, feeling more responsible both for their learning as well as for the others. In synthesis and focusing the pedagogical potential of blogs, our research showed they are a good option: a) to manage knowledge in a community; b) to create individual or group e-portfolios; c) to develop cooperative/collaborative learning strategies; d) to facilitate students perception on his own learning (individual portfolio), e) to enhance interaction between instructor/student and student/student outside the classroom.

In all the studies, the future teachers highly appraised the pedagogical experiments with blogs, concerning the ICT competencies' development (greater enjoyment in using the ICTs and the internet, development of skills in information research and online publication) and they all finished their course stating a clear intention to use the same tools in the classroom with their future students (6 students said that this use would depend on the school's conditions and 2 considered as vital the possibility of the students having access to the internet outside the classroom). They all agree that the blog motivates the students to become more responsible for their own learning process. They also agree that keeping the productions online and accessible to a global public motivates a more careful selection of the contents, both at the organizational level and the quality of the written texts.

It is 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 (Gomes, 2005b). To publish online is important for students to experience ownership and responsibility for their work and also to learn to criticize constructively in the global network. The teacher has also a great opportunity to improve writing and reading skills. Above all, the whole education

community loses out on the chance to motivate large number of learners by using technology that is available and which increasingly forms part of teenagers' lives (Coutinho, 2008).

Google Page Creator, is a free web-based application that allows the creation of customized Websites. The tool was used to build group websites in two studies developed in the second semester of school year 2007/2008. One study project enrolled 20 pre-service teachers of Portuguese Language and the other 10 student teachers of History who attended the curricular subject Multimedia Education (3h/week class) (Coutinho, in press). In small groups student teachers developed an electronic portfolio for class work and assessment. In order to promote class interactions each group also had a blog built in Blogger.com which 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. Students also used Google Docs for collaborative writing and so, in this experience, a mixture of Web 2.0 tools was used to enhance learning, interaction and collaboration.

The idea was to familiarize students with different Web 2.0 tools in order for them to have a critical insight into the potentials and limitations of each other, depending on the age and style of the learners, the curricular subjects and the learning goals. For the final assessment each group had to plan and present a classroom activity to develop with their own students in the next year (induction period) justifying the reasons that lead to the choice of a specific Web 2.0 tool as well as its' adequacy according to the 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 student teachers valued the learning experience, considering classes to be very "interesting" and "catching"; they also considered the curricular subject essential to "prepare the future teachers of the XXI century" who want "the school to be part

Table 2. Case studies with pre-service teachers

Tool	Part.	Pedagogical Strategy	Methods for Data Collection	Results (synthesis)
Blog	75	Students build blogs for classroom work and assessment; Blogs were used as individual portfolio (1 study) or cooperative group work (3)	Direct observation. Focus group interviews Questionnaires.	Blogs are excellent tools <ul style="list-style-type: none"> - To create individual and group portfolios - To create a class space for debate and idea sharing - To develop cooperative learning strategies - To complement face to face classes - To promote interactions outside the classroom - To help develop auto-perception on learning - With syndication technologies enable groups of learners and teachers to keep track of new posts. - To build up a corpus of interrelated knowledge via posts and comments.
Google Page Creator+ Blog+ Google Docs	30	In small groups, students used Google Page Creator to build a website; The site included a link to a blog that was used for classroom interactions; Google Docs was used for collaborative written assignments.	Questionnaire. Focus group interviews. Content analysis of artifacts.	GPC+B+GP are useful: <ul style="list-style-type: none"> - to create online class repositories - to publish and share contents - to manage knowledge in a community - to enhance interactions (blog) - to enhance collaborative writing competencies (Google Docs) - to develop ICT skills

of the students' lives". The pedagogical proposals developed by the student teachers were also amazing and revealed a high sense of responsibility and a firm will to establish a classroom environment that takes into account the learning opportunities that facilitate the students' use of technology to learn and communicate. Table 2 summarises the design and results of the case studies carried out with pre-service teachers.

Web 2.0 Tools in Post Graduate Education Programs

Wikis are one of the most promising technologies that allow implementing collaborative techniques on the work group in virtual environments. A wiki is a website produced by several authors through a collective work. It is similar to a blog in its logical structure, but it also allows adding, editing or removing content created by other authors. Wiki allow publishing and sharing content on the web in a very easy way (Schwartz *et al.*, 2004; Qian, 2007).

According to Leuf & Cunningham (2001) wikis can be used in two different writing modes

or styles of usage: the document mode and the thread mode. In document mode contributors create collaborative documents and in the thread mode contributors carry out discussions in the wiki environment by posting signed messages. Although there is still few research regarding educational uses of wikis, findings support the use of this tool for collaborative learning (Augar *et al.*, 2004; Santamaria & Abaira, 2006).

The project with wiki technology was developed in the first semester of 2006/07 (October thru February) and enrolled 16 in-service teachers who attended a Master Program on Research Methods in Education (RME) (Coutinho & Bontentuit Junior, 2007b). 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: a) to create a repository of contents for RME subject; b) to introduce blended learning solutions in our regular classes; c) to develop collaborative skills that enhanced students autonomy and habits of information search on the web.

The instructor presented the project, defined timing and forms of assessment but all other

tasks were managed by students. The activity was proposed to students when they were already familiarised with the syllabus of RME program. The idea was that students would organize into groups and study in depth one of the research methodologies proposed by the instructor upon a selected bibliography. Students freely organized into groups and a wiki site was designed (<http://claracoutinho.wikispaces.com>). All groups had different tasks and so, at final, the whole group built an enormous collaborative repository that has already been accessed by more than one thousand visitors! Students edited the wiki database whenever they wanted and the instructor visited the wiki to scaffold students learning through comments and suggestions. The teacher was a mediator who adjusted the level of information and support so as to maximize group ability to take responsibility for their own learning. 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 the topic.

The wiki learning experience was also assessed thru the administration of an online questionnaire at the end of the semester. The feedback received from participants sustained the idea that wiki technology can be effective for collaborative work and professional development in ICT. Teachers' recognized the importance of peer interaction to create a common identity, to promote the knowledge construction and sharing; they all agreed that a relational involvement was necessary to a mutual support and that this was a key factor in the success of the collaborative wiki activity. As stated by VanHarmelen (2007), we also verified Wikis are very useful to develop class projects, and are particularly suited to the incremental accretion of knowledge by a group, or production of collaboratively edited material; teachers can use

them to supply scaffolding for writing activities, providing supply for page structure, hints as to desirable content, and then provide feedback on student generated content.

The second project was developed in the first semester of 2007/08 (October thru February) and enrolled 24 in service teachers who attended a postgraduate education program in Educational Technology. The idea was that teachers should work in teams and develop a research project on a program topic upon a selected bibliography (Coutinho & Bottentuit Junior, 2008a). In the first class all participants had to create a gmail account. Apart from the individual account on Google, each group also acceded to the Google Page Creator - to create a web site 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 elements of the group (picture, contacts, mini curriculum) should be collected all documents (text, images, references, sites) that the group considered relevant for final evaluation. Each group took advantage of the features that the Web 2.0 tool provides, which led to e-portfolios in very diverse formats. At the end of the semester, each group digital portfolio became a repository of information on a specific research methodology and contents of the subject of RME, which all colleagues could consult and use for future research projects. The instructor also a site of the RME 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. The sites of each group were visited every week by the instructor who sent feedback and comments using the group e-mail, 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.

The main purpose of this project was to prove that in any teacher education program we can effectively teach a particular content – in our case the

compulsory curricular subject “Research Methods in Education” - while incorporating technology concepts and developing ICT skills and competences. The enthusiasm maintained by teachers all over the semester, the quality of the e-portfolios developed by the groups (the evaluation of the websites took into account pre-established criteria which focused on the quality and originality of the collection of artefacts available, as well as on the rigour of the academic writing, important in the context of a curricular subject which prepares novice researchers in educational contexts), as well as the feedback obtained on the final online survey, shows that teachers valued the learning experience of using this Web 2.0 tools and that they had a firm intention to incorporate the technologies they experienced in their own teaching practices. All participants agreed to have developed ICT skills and competencies. We also verified that the process of developing e-portfolios improved the teachers’ reflective thinking and fostered deep learning of RME core. Nevertheless, even though participants recognized that Google Page Creator was useful to build a class repository of the assignments for a whole class they, they also considered that it had limitations when used for group e-portfolio in the same classroom: the tool does not allow participants to share ideas and opinions and leave comments. Some teachers suggested that a blog was a better option when the learning activity demands and values communication among peers (Coutinho & Bottentuit Junior, 2008a).

The third and fourth studies with in-service teachers involved the use of a social bookmarking tool Del.icio.us that allows users to quickly (through the use of “bookmarklets”) save desired website addresses and categorize them with one or multiple “tags” that are user defined (Hayman, 2007). As a social bookmarking service, the del.icio.us website indicates how many other users have linked to a particular website address, and allows users to link to the social bookmarks of those other users. Social bookmarks can be an invaluable aid for the development of research

projects and for personal use in keeping track of and sharing valuable Internet resources (Fryer, 2005). Attending to the characteristics of the subject - Research Methods in Education – as well as the teaching methodology adopted for class work and assessment (group work), teachers created a del.icio.us account and developed an online bibliography for the final project on a chosen research methodology of the RME program. Central to this project was the idea that there is a great benefit in collaboration among a group of peers and that it could produce a final written essay that reflects the interests and understanding of the group as a whole. By studying the usage of this Web 2.0 tool as well as the attitudes toward this collaborative activity, it would be possible to determine the next steps in the effective use of the new generation of web services in teaching and learning. On the other hand, as instructors in an education program we believed that the use of this new web tool could help to prepare teachers who are equipped with technology resources and skills and who can effectively teach any curricular subject while incorporating technology concepts and skills. A total of 37 in-service teachers (from two different classes) participated in the study and fulfilled an initial questionnaire to verify previous knowledge on social bookmarking; we verified that for the majority of the participants terms like “social bookmarking”, “Tags” and particularly “RSS” and “folksonomy” were unfamiliar. For final assessment of the learning activities teachers participated in different focus group sessions (5 subjects per session of 1h 30m). We purposely created an informal scenario for group interviews in order for participants to feel at ease to answer and interact. Teachers were informed that the interview session would be audio taped for research purposes. As to results, most participants said they had no difficulties in using Del.icio.us. Most reported as positive aspects of the tool, its’ ease of use and its’ availability from any computer with internet access. All teachers agreed that the social bookmarking tool has great potentialities

Table 3. Case studies in postgraduate education programs

Web 2.0 Tool	Nº Partic.	Pedagogical Strategy	Methods for Data Collection	Synthesis of Results
Wiki	16	A class repository of contents for RME assignment in wikispaces.com; Each group of teachers was responsible for a specific methodology. The instructor and students added comments to group websites for assessment; at the end of the semester an online collaborative RME manual was available to the community.	Initial questionnaire; Direct observation; Written reports; Final online questionnaire.	Wikis are suitable: - to create class projects in b-learning environments - to increment accretion of knowledge in a group - to produce collaboratively edited material - teachers can supply scaffolding for writing activities (providing supply for page structure, hints to desirable content, feedback on student generated content) - Students can flag areas of the wiki that need attention, and provide feedback on each other's writing.
Google Page Creator/ Google Docs	24	In small groups, teachers used GPC to build a website; The site included a link to a blog that was used for outside classroom interactions; GD was used for collaborative written assignments.	Observation Interviews Questionnaire Content analysis	GPC+GD are suitable: - to create online class repositories - to publish and share contents - to manage knowledge in a community - to create group e-portfolios - to enhance collaborative writing skills - to develop ICT skills
Social Book-marking (Del.ici.ous)	37	In small groups. Teachers created an account in Del.ici.ous; For a semester, the group developed an online bibliography to share resources for the development of the final assignment on a selected research methodology.	Initial questionnaire Focus Group Interviews.	Easiness of use and availability from any computer with internet access were most valued; the downside are the difficulties in tagging in groups that have not pre-established a set of categories shared by all (collabury). The tool is suitable: - To create and organize (with tags) an online bibliography that is always available - to share preferred sites with colleagues - to develop skills in searching Web information - to find new and never thought resources that could be related to research areas of interest and let them available to the scientific community - to accede to lists of websites others searched before

for the development of a research project as it allowed to organize and share web resources consulted while searching the internet, to have a bibliography always available online, to find new and never thought resources that could be related to different research areas of interest (Coutinho & Bottentuit Junior, 2008b). The potential of the tool to enhance collaboration among peers was also highlighted by participants: to have a Del.ici.ous account was "an added value for the whole group", because it allowed "to share with the group the researched sites makes the research project more collaborative, enhancing diversity and creativity". Limitations were also reported: difficulties in tagging in groups that have not pre-established a set

of categories shared by all members (collabury) and low quality of the software interface (Coutinho & Bottentuit Junior, 2008b, 2008c).

CONCLUSION

In this chapter we presented the results of case studies developed with Web 2.0 tools in teacher education programs at the University of Minho, Portugal. In all the studies the main goal of the research was to provide technological-rich experiences with Web 2.0 tools in pre and in-service teacher education programs in order to promote the integration of technologies in the classroom.

Different Web 2.0 tools – blogs, wiki, social bookmarking, Google Page Creator, Google Docs – were integrated in teacher education programs in different contexts and with different research goals: to build individual/group e-portfolios, to enhance cooperation among peers, to develop collaborative writing and publishing competencies, to develop skills in searching, organizing and sharing web resources and to facilitate interaction and communication in and outside the classroom.

As an overall conclusion from the project we can state that almost all participants in the learning experiences were not aware of the emergence of the new social web paradigm that allows users to read, write and communicate in the global network. Most participants said they used the web for personal purposes or to prepare pedagogical activities; however, in the real classroom, pedagogical activities using the web resources were only reported by 5% of the teachers. As to pre-service teachers' the scenario is not very different: the computer and the internet were used by most students to develop faculty assignments but never as a pedagogical tool in the classroom activities. For most participants it was a surprise to verify that the new internet generation 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 participants enrolled in the project had a firm intention to use internet resources as transformative learning tools to integrate in classroom curricular activities. It was clear by the participants' feedback that the successful integration of ICT into the classroom depends - as stated by Woodbridge (2004) - on the ability to structure the learning environment in non-traditional ways, developing socially active classrooms, encouraging cooperative interaction, collaborative learning and group work.

Regarding the use of each of the Web 2.0 tools in the case studies we verified each one has its own positive and negative features depending on the curricular objectives the teacher wants to pursue in the classroom. Our research shows that blogs are effective: a) to manage knowledge in a community; b) to create individual or group e-portfolios; c) to develop cooperative/collaborative learning strategies; d) to facilitate students perception on his/her own learning (individual portfolio), e) to enhance interaction between instructor/student and student/student outside the classroom. On the other hand, tools like Google Page Creator and Google Docs complement each other when the curricular goal of the pedagogical activity is to create online repositories of contents for a group of peers to publish and share; students can be organized into small groups and work a specific topic using Google Docs for outside classroom meetings; the assignments are then published in the website for the instructor and colleagues to read and comment; the addition of a blog to the site is a good idea for the creation of a complementary space for debate and discussion of the different contributions. The use of wiki technology is an alternative for similar purposes – to create a group repository of contents; they are particularly suited to the incremental accretion of knowledge by a group, or production of collaboratively edited material with the additional functionality of allowing commentaries to be done on each page: teachers can use them to supply scaffolding for writing activities, providing supply for page structure, hints as to desirable content, and then provide feedback on student generated content; the downside is that they are difficult to manage when the number of collaborators is big, what means more interference of the instructor in organizing the contents of the database.

Social bookmarking tools are very useful when students have to develop a collaborative research project and need to search, share and organize Web resources; the downside is the difficulties in tagging in groups that have not pre-established a

set of categories accepted and shared by all collaborators (*collabury*). For younger students the teacher can also use the social bookmarking tool to help learners in a “guided tour” across internet resources, and also to use the functionalities of the tool to tutoring the students’ web searches for a specific assignment.

As stated in the theoretical framework, 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. Our research project highlights the deficiencies of separate ICT subjects as the dominant strategy for teacher education programs: on the other hand, as suggested by Downes *et al.* (2001), we believe that the adoption of integrated or interdisciplinary approaches in ICT-based teachers’ training develops positive attitudes towards technologies and enhances the adoption of constructivist learning settings in the classroom routines. 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. The key skills of the future will include the ability to develop innovative ways of using technology to enhance the learning environments, to encourage technology literacy, knowledge deepening and knowledge creation. In fact, as stated in the 2008 UNESCO report, “To live, learn and work successfully in an increasingly complex, information-rich and knowledge-based society, students and teachers must utilize technology effectively” (UNESCO, 2008, p. 1).

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KEY TERMS AND DEFINITIONS

Web 2.0: Hayman’s (2007, p.1) defines Web 2.0 tools as “a cluster of web-based technologies services with a social collaboration and sharing component, where the community as a whole contributes, takes control, votes and ranks contents and contributions”.

Pre-Service Teacher Education Program:

Education programs that prepare student teachers before they have undertaken any teaching for the multiple roles of classroom teacher, school team member, community leader, and education advocate.

ICT Professional Development: ICT skills and knowledge attained for both teacher professional development and career advancement. According to Glatthorn (1995, p. 41) “Teacher development is the professional growth a teacher achieves as a result of gaining increased experience and examining his or her teaching systematically”.

Wiki: A wiki is a website produced by several authors through a collective work. It allows authors to add, edit or remove contents.

Social Bookmarking: Social Bookmarking is the practice of saving bookmarks to a public Web site.

Blog: The term blog or weblog refers to a personalised webpage, kept by the author in reverse chronological diary form.

Google Page Creator: Free web-based application that allows the creation of customized Websites.

Google Docs: Free web-based word processor which allows authors to share and collaborate online.