

ISSN: 0212-5374

DOI: <http://dx.doi.org/10.14201/et20153315782>

## EXPLORING STUDENT STUDENTS' ATTITUDES AND BELIEFS TOWARDS E-PORTFOLIOS AND TECHNOLOGY IN EDUCATION

*Explorando las actitudes y creencias de los estudiantes  
de educación en relación a los e-portfolios  
y la tecnología en la educación*

*Explorant les attitudes et les croyances des étudiants  
concernant e-portfolios et de la technologie dans  
l'éducation*

Gemma TUR\* y Victoria I. MARÍN\*\*

\* *Dr. Phil., School of Education coordinator and associate lecturer in Early Childhood Education and Primary Education and the Master's Degree in Teacher Training. Educational Technology Group (GTE). Department of Applied Pedagogy and Educational Psychology. Universitat de les Illes Balears, Ibiza. Spain. Correo-e: gemma.tur@uib.es*

\*\* *Associate lecturer in Primary Education and Pedagogy. Educational Technology Group (GTE). Department of Applied Pedagogy and Educational Psychology. Universitat de les Illes Balears, Palma. Spain. Correo-e: victoria.marin@uib.es*

Recibido: 27-02-2014; Aceptado: 24-07-2014; Publicado: 31-04-2015

BIBLID [0212-5374 (2015) 33, 1; 57-82]

Ref. Bibl. GEMMA TUR y VICTORIA I. MARÍN. Explorando las actitudes y creencias de los estudiantes de educación en relación a los e-portfolios y la tecnología en la educación. *Enseñanza & Teaching*, 33, 1-2015, 57-82.

**SUMMARY:** This article reports on student teachers' attitude towards technology in education and e-portfolio processes. Attitude is closely related to teachers' beliefs and the later have been defined as second-order barriers. While an important effort has been made to overcome first-order barrier such as resources, training and support, it cannot be observed that technology has been successfully introduced in education. Therefore, second-order barriers such as attitudes and beliefs are being considered nowadays in order to address the lack of innovative use of technology by teachers. It has been argued that the introduction of technology has to be directed towards the empowerment of cognitive and high-level thinking skills and has to be used based on student-centred approaches. Building e-portfolios and helping students which grow and curate their own Personal Learning Environments (PLE) are two approaches to go beyond technology-centered models. E-Portfolios are viewed as part of students' PLE so social media are used to enhance both e-portfolio processes and students' PLES. The research is based on a survey in four groups of students at the local branch in Ibiza of the University of the Balearic Islands. The participants have previously built their e-portfolios with Web 2.0 tools during one semester. Students are asked to document their learning weekly and reflect on the change experienced in the way they think about educational issues. Students are also asked to use new tools and social media services to give evidence of their own learning. The survey is based on a Likert scale so as to be able to analyse the students' attitude and beliefs towards their e-portfolio and technology in education. The results show that a generally positive attitude is developed by students. Conclusions highlight the slight difference in student teachers' attitude between technology and specific e-portfolio processes.

*Key words:* ICT in education; teacher training; e-portfolio; web 2.0; personal learning environments (PLES); higher education; attitude and teachers' beliefs.

**RESUMEN:** Este artículo informa sobre la actitud de los estudiantes de educación respecto a la tecnología en la educación y los procesos del e-portfolio. La actitud está estrechamente relacionada con las creencias de los profesores, que se han definido como barreras de segundo orden. Así como sí ha habido un esfuerzo importante para superar las barreras de primer orden como son los recursos, la formación y el apoyo, no se observa que la tecnología se haya incorporado en la educación de forma satisfactoria. Por tanto, hoy día se están considerando las barreras de segundo orden como las actitudes y las creencias para solucionar la falta de un uso innovador de la tecnología por parte de los profesores. Se ha discutido que la incorporación de la tecnología tiene que dirigirse a potenciar las habilidades superiores cognitivas y de pensamiento, y se debe emplear desde enfoques centrados en el alumno. La construcción de e-portfolios y la ayuda a los estudiantes para que gestionen y hagan crecer sus Entornos Personales de Aprendizaje (PLE) son dos enfoques valorados para ir más allá de los modelos tecnocéntricos. Los e-portfolios se consideran como parte del PLE de los estudiantes, de forma que los medios sociales se utilizan para mejorar los procesos del e-portfolio y los PLE de los alumnos. La investigación utiliza como instrumento un cuestionario dirigido a cuatro grupos de estudiantes de la sede de Ibiza de la Universidad de las Islas Baleares. Los

participantes habían creado previamente sus e-portfolios con herramientas Web 2.0 durante el primer semestre. Se pidió a los alumnos que documentaran su aprendizaje semanalmente y reflexionaran sobre el cambio en sus formas de pensar sobre temas educativos. Además, también se les pidió que usaran nuevas herramientas y servicios de los medios sociales para aportar pruebas de su aprendizaje. El cuestionario está basado en una escala Likert para analizar las actitudes y creencias de los estudiantes respecto a su e-portfolio y la tecnología en la educación. Los resultados muestran que los estudiantes desarrollaron en general una actitud positiva. Las conclusiones señalan una pequeña diferencia en la actitud de los alumnos respecto la tecnología y los procesos específicos del e-portfolio.

*Palabras clave:* TIC en educación; formación de profesorado; e-portfolio; web 2.0; Entornos Personales de Aprendizaje (PLE); educación superior; actitud y creencias del profesorado.

**RÉSUMÉ:** Cet article donne des informations sur l'attitude des étudiants par rapport à l'enseignement de la technologie dans l'éducation, et les processus des e-portfolio. Cette attitude est étroitement liée à ce que pensent les enseignants, et ont été identifié comme des obstacles du second ordre. Tout comme il faut lui-même un gros effort pour surmonter les obstacles tel que les ressources de premier ordre, de formation et de soutien, on constate que la technologie n'a pas été introduite dans l'éducation avec succès. Ainsi, aujourd'hui sont considérés comme des obstacles du second ordre les attitudes et les croyances pour résoudre le manque d'utilisation de méthodes innovatrices par les enseignants. On a constaté que l'introduction de la technologie doit améliorer le savoir et la pensée, et devrait s'utiliser, grace a des repaires, pour aider les étudiants. La construction des e-portfolio et l'aide aux étudiants pour gérer et améliorer leur environnement d'apprentissage personnel (PLE) sont deux approches pour aller au-delà des modèles techno-centrée. Les e-portfolio font partie des PLE des étudiants: Pour que les milieux sociaux s'utilisent pour améliorer le processus e-portfolio et le PLE des étudiants. La recherche utilise comme moyen, un questionnaire avec quatre groupes d'étudiants au siège d'Ibiza de l'Université des Îles Baléares. Les participants avaient déjà créé leurs e-portfolios avec, comme outil, le Web 2.0, dans la première moitié du cours. Il a été demandé aux étudiants, de faire un compte rendu de leur apprentissage hebdomadaire, et de réfléchir sur le changement de leurs manieres de penser sur les questions éducatives. De plus, ils ont également été invité à utiliser de nouveaux outils et les services des milieux sociaux pour preuves de leur apprentissage. Le questionnaire est basé sur une échelle de Likert pour examiner les attitudes et les préjugés des étudiants par rapport a leur e-portfolio et dans la technologie de l'enseignement. Les résultats montrent que les étudiants ont développé en general une attitude positive. Les conclusions montrent une petite différence dans l'attitude des étudiants par rapport aux processus technologiques et spécifiques des e-portfolio.

*Mots clés:* TIC dans l'éducation; la formation des enseignants; e-portfolio; Web 2.0; environnements d'apprentissage personnels (EAP); enseignement supérieur; attitudes et les croyances des enseignants.

## 1. INTRODUCTION

Technology in education very much depends on teachers' attitude towards its usefulness, so any ICT project needs their support in order to be successful (Teo, 2008; Teo, Lee & Chai, 2008; Teo, 2009; Boza, Tirado, Ramón & Guzmán-Franco, 2010; Prestridge, 2010; Ruiz Palmero & Sánchez Rodríguez, 2012; Tirado-Moreta & Aguaded-Gómez, 2014). Attitude is strongly related to beliefs and teachers' beliefs are established by earlier experiences (Hermans, Tondeur, Braak & Valcke, 2008). Hermans *et al.* (2008) argue that, when entering educational programmes, student teachers have already defined their educational beliefs which can be very much influenced by the experiences lived as students. Therefore, it seems relevant to try to change those sets of beliefs which can impede the innovative and transformational processes lead by technology. Jonassen (1996) defines this innovative use as the role played by technology for cognitive processes, which later Ermert and Ottenbreit-Leftwich (2013: 176) call «technology-enabled learning».

There has been a wide interest in the barriers to successful technological integration. Two main branches of barriers have been defined (Ermert, 1999, 2005; Ermert & Ottenbreit-Lefwich, 2013: 177). On the one hand, first-order barriers have been observed: they are external to teachers and mainly consist of «resources, training and support». Ertmer, Ottenbreit-Lefwich, Sadik, Sendurur and Sendurur (2012: 424-425) have explained that resource barriers refer to hardware, internet access, software and tool access. Support includes diverse areas such as administrative, technological, professional and peer support.

On the other hand, second-order barriers have also been defined and they are internal to teachers: they are related to «attitudes and beliefs, knowledge and skills». Teacher beliefs are defined as «tacit, often unconsciously held assumptions about students, classrooms and the academic material to be taught» (Kagan, 1992: 65). Ottenbreit-Leftwich, Glazewski, Newby and Ertmer (2010) argue that teachers with student-centred beliefs may introduce technology using student-centred approaches.

In addition, Tsai and Chai (2012: 1058) have also argued the existence of a third-order barrier which would be related to the lack of «design thinking» and that could be addressed by approaching teacher education with models such as the Technological Pedagogical Content Knowledge (TPACK) model defined by Mishra and Koehler (2006).

Historically, first-order barriers have been considered paramount for technology integration in schools, but after vast investment worldwide it cannot be considered that technology is now successfully integrated for innovative uses related to the empowerment of authentic student learning. Therefore, based on Ermert and Ottenbreit-Lefwich (2013: 177) second-order barriers are now considered as the «true gatekeepers».

In Spain it has been reported that teachers' beliefs, among other factors, are barriers for the integration of technology in Primary and Secondary Education (Montero & Gerwerc, 2010; Tirado-Morueta & Aguaded, 2014).

The current study is based on a learning activity aimed at giving an early learning experience with ICT in order to work on student teachers' attitudes and beliefs towards ICT, and in particular, eportfolios and PLES.

## 2. TECHNOLOGY IN EDUCATION

One of the current and relevant educational concepts related to teacher training are personal learning environments (PLEs). Although it might be considered that we have always had a PLE (what we use to learn), it is only nowadays that its research has acquired special importance, with the multiplying action of technology (Castañeda & Adell, 2013). The PLE concept refers to the effort to construct an appropriate environment centred on the learner, connecting each tool, service, relationship, etc. in the learning process (Adell & Castañeda, 2010; Attwell, 2007). Therefore, its construction would be within what is considered open or flexible learning, as the student has control over how to learn, and has choices (Salinas, 2013).

As Castañeda and Adell (2013) describe, three components of the PLE are to be considered: reading/accessing information, creating/reflecting by doing, and sharing/interacting with others. In addition, according to Tur and Urbina (2012a), these components of PLES can improve e-portfolio processes, referring to tools to access information, tools to create and edit information and tools to collaborate with others.

Furthermore, e-portfolios are considered one of the three components of the PLE since they allow the students to create and reflect about what they are doing in their learning process, and also can be methodologically integrated with the institutional virtual learning environment (VLE) (Salinas, Marín & Escandell, 2011). In other cases, e-portfolios are considered the heart of the PLE, its DNA or what makes the PLE what it is –ever in transformation–, setting the institutional learning environment apart (Ravet & Attwell, 2007). However, the e-portfolio has also been considered a tool for students to build their PLES, integrating the educational institution environment with informal learning (de Benito, Escandell, Ordinas, Salinas & Sastre, 2012).

In any case, self-directed learning and reflection, which are enhanced by e-portfolios, are, nowadays, key skills for teachers. As Masters (2013: 8) states «if we can empower our (teacher education) students (teachers) to build a construct of their learning journey as they progress through their course, then it is likely that they will be able to extend these skills beyond our classes». The ultimate goal for student teachers at university is to become lifelong learners (self-directed learning) and reflective in their practice, «who can, in turn, empower their own students».

### 3. BACKGROUND

Shroff, Trent and Ng (2013) have observed the wide variety of conceptual interpretations of e-portfolios. Among this wide range of interpretations and purposes, our e-portfolio design is based on the learning portfolio (Zubizarreta, 2009). Zubizarreta (2009: 20) defines the learning portfolio as follows:

The learning portfolio is a flexible, evidence-based tool that engages students in a process of continuous reflection and collaborative analysis of learning. As written text, electronic display, or other creative project, the portfolio captures the scope, richness, and relevance of students' intellectual development, critical judgment, and academic skills. The portfolio focuses on purposefully and collaboratively selected reflections and evidence for both improvement and assessment of students' learning.

We also refer to electronic portfolios, in agreement with Lin, who argues that an e-portfolio is a technologically-based portfolio (Lin, 2008: 194). This would mean that the only difference between a standard paper-based portfolio and an electronic one is simply the digital support. In initial research, there was a wide debate about the idea that electronic portfolios were qualitatively different to portfolios. For example, Oner and Adadan (2011) claim that e-portfolio are not better than paper-based portfolios. Moreover, some authors argue that choosing the tool to construct an e-portfolio is not the fundamental decision but rather the planning of students' reflection (Batson, 2010) and activities (Shada, Kelly, Cox & Mali, 2011) on their e-portfolio. Zubizarreta (2009) has also advised about the difficulties students may encounter when using electronic tools through of lack of skills. However, other authors highlight the benefits of the electronic tools in the construction of portfolios. Thus, the possibilities for hypertext and complex organisation of pieces of evidence in e-portfolios are only possible thanks to the electronic support, as argued by Yancey (2004) and Tosun and Baris (2011). In relation to this, one of the advantages to build an e-portfolio in teacher education is to introduce technology as a learning tool as it has been argued (Kabilan & Khan, 2012; Karsenty, Dumouchell & Collin, 2014).

Also, Karsenty, Dumouchell and Collin (2014: 3488-3489) have set out the four main functions of e-portfolios in initial teacher education:

- The exposure function, that is to say, to show the development of professionals skills during their educational programme;
- The reflective function, which has been one of the most studied functions, closely related to deep learning (Moon, 1999) and the ability to reflect on one's own learning journey (Parkes & Hadger, 2010; Parkes, Dredger & Hicks, 2013), connecting past experiences with future learning (Cheng & Chau, 2012);

- The assessment function, about which e-portfolios have been considered to be a tool for authentic assessment offering the possibility to go beyond tests (for example, as in Raposo & Sarceda, 2010); and
- The social function, which has been one of the least attended functions (Garrett, Thoms, Alrushiedat & Ryan, 2009; Garrett, 2011).

There are three main references in this study:

- The three processes defined by Zubizarreta (2009). The learning portfolio (Zubizarreta, 2009) is the activity of documenting learning through collaboration and reflection. Thus the author describes three main processes: reflection, which is explained in a *deweynian* way, as an experiential cycle for the development of higher-level cognitive skills; documenting learning which means providing and selecting evidence of what is claimed; and, collaboration which is mainly understood as feedback among peers or as mentorship from teachers. It is a simple model which understands that learning occurs in any of them, but that the highest level takes place when these processes are tapped. He argues that «the student who pulls all three domains together stands a greater chance of transforming an incidental learning activity in a deeper, enduring learning process» (Zubizarreta, 2009: 26).
- The three processes in the construction of an e-portfolio defined by Barrett (2011). Barrett (2011) defines three steps in the construction of e-portfolios: artefact construction, evidence collection and final presentation. Students carry out their learning process by building their artefacts, which show the level achieved, and select them to be archived on a chronological basis, reflecting on every piece of evidence. The last step means showcasing learning: showing learning achieved over a period of time, reorganizing the chronological learning by connecting evidence.
- The development of the two selves defined by Cambridge (2009, 2010). Cambridge (2009, 2010) states that during the construction of a chronological e-portfolio a *networked self* is developed, whilst with the final presentation of an e-portfolio, having an overview of all the learning process, students develop their *symphonic self*. The former is quick, integrated in everyday life and is aimed at collaborating and networking with others. The latter needs to be done calmly, in order to be able to show the integrity and authenticity of the learning. Similar to Barrett's final step, Cambridge's notion of self means the reorganisation of learning documented in order to reflect on the whole process.

Web 2.0 has recently been introduced to e-portfolio literature and many authors refer to the affordances of Web 2.0 for the construction of e-portfolio (Tosh & Werdmuller, 2004a, 2004b; Crichton & Kopp, 2008; Ivanova, 2008; Chuang, 2010). This concept refers to the change in the users' attitude towards the Internet, in the sense that it is required from them their participation and

collaboration, and not only their passive consumption of information. Therefore, users become both information consumers and producers, in what it has been called «prosumer» (Hilzensauer & Schaffert, 2008). In this sense, Web 2.0 and also PLES, mainly supported by Web 2.0, are considered more a way of doing and thinking than mere technological applications (Davis, 2005; Adell, 2010). As Davis explains, «it's about enabling and encouraging participation through open applications and service with rights granted to use the content in new and exciting contexts». Hence, the importance we give to attitudes in the use of PLES, Web 2.0, and e-portfolios among them.

Networking is an important new line of research and discussion in e-portfolio literature brought by the introduction of Web 2.0 tools. Attwell (2012) suggests that the introduction of social media into the construction of an e-portfolio makes networking another important e-portfolio process. Moreover, Karsenti, Dumouchel and Collin (2014) have highlighted the key role played by Web 2.0 tools in the construction of e-portfolios. On the one hand, they argue that these tools «should not require users to have programming skills or to be highly tech-savvy» (Karsenti, Dumouchel & Collin, 2014: 3490). On the other hand, they argue that social media tools allow us to overcome isolation in education, which is supposed to first emerge in initial teacher education. Furthermore, they also argue that Web 2.0 enhances the collaboration process between peers and educators as it brings a networked structure to the construction of e-portfolios. Finally, Cabero, López Meneses and Jaén (2013) have argued that blogs, one of the most popular tools in Web 2.0, are useful and easy to use tools for the construction of eportfolios.

#### 4. RESEARCH

##### 4.1. *Context*

This research is based on the implementation of an e-portfolio project at the University of the Balearic Islands, in Ibiza local branch. An e-portfolio project has been implemented since the school year 2009-10 and, due to initial research during the pilot implementation, some changes have been introduced in the following courses, such as scaffolding for the use of technology in students' first steps and for the reflection process. The e-portfolio is based on Web 2.0 tools: blogs for an e-portfolio platform and a wide diversity of tools for the construction of artefacts. A net of e-portfolios –with the tool Netvibes– for each group<sup>1</sup> has been built in order to foster collaboration, following the idea of *netfolio* suggested by Barbera (2009) (see Figure 1).

1. <http://www.netvibes.com/eportafolis11-15#General>, <http://www.netvibes.com/gemmamaster#PIC-2011>, <http://www.netvibes.com/grau1216#General>.



Students are asked to write weekly on their e-portfolio reflecting on the topic discussed in presential lectures. Also, students construct an artefact with a different Web 2.0 tool that demonstrates their learning. Each evidence is weekly assessed with a rubric, so students obtain an important scaffolding process on their learning and reflection processes. Also, in face-to-face lessons, students comment each others' work in order to improve reflection and collaboration. At the very beginning of the academic year, each group has a lesson on technological aspects such as opening a blog and using Web 2.0 tools. Afterwards, with just this initial lesson, little help is provided for each tool so students have to investigate individually and in groups the way each tool works. No problems about technical issues were reported by students, so every year this approach has been repeated since the academic year 2011-12.

The assessment process is carried out through an institutional VLE. The fact that the e-portfolio is based on social media means that the e-portfolio is open to access. Considering students' opinion, obtained in previous research (Tur & Urbina, 2013), it was decided that assessment needed to be restricted to the group of students. So, rubric results and assessment comments are private on the institutional VLE.

#### 4.2. *Research objective*

The main objective of the research in which this study is framed is to understand the processes behind the implementation of the e-portfolio project described above.

In this specific study, our research objective is to discover and understand the tendencies in the students' attitudes towards ICT and e-portfolios. The main question of the study is: What is the attitude of students towards: technology in education, technology for their future teaching careers, the learning experience in itself and the e-portfolio construction process?

#### 4.3. *The Sample*

The survey is presented in four groups of students during the 2011-12 and 2012-13 academic years. Two groups of students are undergraduate students in the Early Childhood Teacher Training programme at the University of the Balearic Islands, and the two other groups are graduate students in the MA programme to become Secondary Education teachers. All groups are small so the total number of participants is 60. From the total, 46 of the students were female and 14 male. They have no previous academic experience in the use of e-portfolios or any other Web 2.0 tool for education, although they use social media for free-time and leisure. However, students have no experience of using Web 2.0 to carry out assignments for assessment. So these courses are their first contact with the social media tools in an educational sense.

#### 4.4. *Methodology*

Although the predominant methodology for the research project in which this study is framed is qualitative, this study is mainly based on a quantitative methodology due to the characteristics of the objective of the study. Previously in the research, case studies have been focused on the understanding of eportfolios and students' attitudes in pre-determined groups, such as the experimental implementation group (Tur, 2013) and the group which created eportfolios after the first changes in design (Tur & Urbina, 2012b). However, this study is aimed at knowing general attitude and perceptions of all students who have participated since its first implementation in the 2009-10 school year.

For Curtis, Murphy and Shields (2014) it is usual in education to address research from mixed paradigms, since in different stages of the study both qualitative and quantitative methodologies may be necessary. Quantitative research is «explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics)» (Aliaga & Gunderson, 2002). Although one of the advantages of this methodology is the possibility of generalization, in the case of small samples, like this one, it is an ambitious goal. Consequently, this study should be considered as an exploratory study and needs to be conducted in more contexts for its results to be generalizable.

Within the different types of quantitative methodologies, this study uses a descriptive methodology, since the measurement of students' attitude towards e-portfolios and technology in education has been carried out through a survey using a Likert scale already created by Lin (2008) with the purpose of measuring students' perspectives of the e-portfolio. Likert scales permit the observation of attitude tendency of the subjects surveyed (Pérez Juste, 1997), which fits in fairly well with what the main objective of this study is about. The main characteristic of the descriptive method is the narrative of facts and singularities of a sample or interest area in an objective and verifiable way. These methods enhance the collection of factual information related to a concrete situation, the identification of problems, conduct comparisons, the planning of future changes and the taking of decisions (Van Dalen & Meyer, 1981).

#### 4.5. *Phases of the study*

This study considers different phases according to the type of methodology used (Cohen, Manion & Morrison, 2011: 259):

- Phase 1: Defining the objectives and formulating research questions. As mentioned previously, the objective of the research of which this study forms a part is to obtain evaluation information from the students on the implementation of the e-portfolio project. And the research questions of this study are based on students' attitude towards different aspects of the development of the project.

- Phase 2: Deciding the issues on which to focus and the information needed. In this study, the issues in which we are interested are the attitude of students towards technology in education, technology for their future teaching careers, the learning experience in itself and the e-portfolio construction process
- Phase 3: Deciding the sampling required. Since the groups of students are small, all the students are the sample for the survey.
- Phase 4: Deciding the instrumentation and the metrics required, generating the data collection instruments, deciding how the data will be collected, piloting the instruments and refining them.  
The survey used to evaluate the students' attitude is the Likert scale –Annex 1– created by Lin (2008: 200) translated into Catalan. It consists of 17 questions, although the original questionnaire had one more question that has been eliminated because it is about the presentation of the e-portfolio, which students have not yet carried out. It is based on five possible answers ranging from totally disagree (1) to totally agree (5), number 3 being neither agree or disagree. The instrument covers all the study main interests regarding the research questions. The survey was paper-based so as to ensure that all the students answered it at the end of their courses. Data collected through the instrument was completed with qualitative data collected from written texts provided by the student teachers participating.
- Phase 5: Data collection. First of all, this phase consisted of the completion of the paper-based questionnaires by the students. Secondly, students were asked to write a final entry in their blogs to reflect on their learning process. Students were invited to observe the affordances of creating digital artefacts, documenting learning and collaborating with others. Also, they were asked to reflect on the empowerment of their PLES and the use they are willing to make in their future professional careers.
- Phase 6: Data analysis. All the data were gathered in order to elaborate tables and graphics to help their analysis. Written paragraphs were selected to illustrate the quantitative data.
- Phase 7: Report the results, through publications and other means.

## 5. RESULTS AND DISCUSSION

All the students from the sample ( $n = 60$ ) answered the paper-based survey. In the following table, the results of each question are presented in percentages (see Table 1). After the graphics that complete the overview of results shown in Table 1, some extracts of written texts by student teachers are also offered (translated from Catalan). Following each section of quantitative data, four short opinions have been selected to illustrate percentages: one for each group of students, thus the

two first are chosen from among undergraduate students, and the last two, among the postgraduate students.

TABLE 1  
 Results of the survey about students' attitudes towards e-portfolios and technology in education

	TOTALLY DISAGREE (1)	DISAGREE (2)	NEITHER AGREE OR DISAGREE (3)	AGREE (4)	TOTALLY AGREE (5)
Item 1	0	0	0	61.7%	38.3%
Item 2	0	1.67%	11.67%	35%	51.67%
Item 3	43.3%	28.3%	21.67%	6.67%	0
Item 4	1.67%	5%	33.3%	50%	10%
Item 5	71.6%	21.7%	6.7%	0	0
Item 6	1.67%	6.67%	20%	53.3%	18.3%
Item 7	0	0	8.3%	45%	46.67%
Item 8	0	1.67%	3.3%	53.3%	41.67%
Item 9	90%	8.3%	1.67%	0	0
Item 10	1.67%	6.67%	33.3%	50%	8.3%
Item 11	0	0	13.3%	35%	51.67%
Item 12	78.3%	16.67%	3.3%	1.67%	0
Item 13	0	0	15%	53.3%	31.67%
Item 14	60%	21.67%	18.33%	0	0
Item 15	1.67%	3.3%	15%	38.3%	41.67%
Item 16	83.3%	16.67%	0	0	0
Item 17	3.3%	23.3%	18.3%	35%	20%

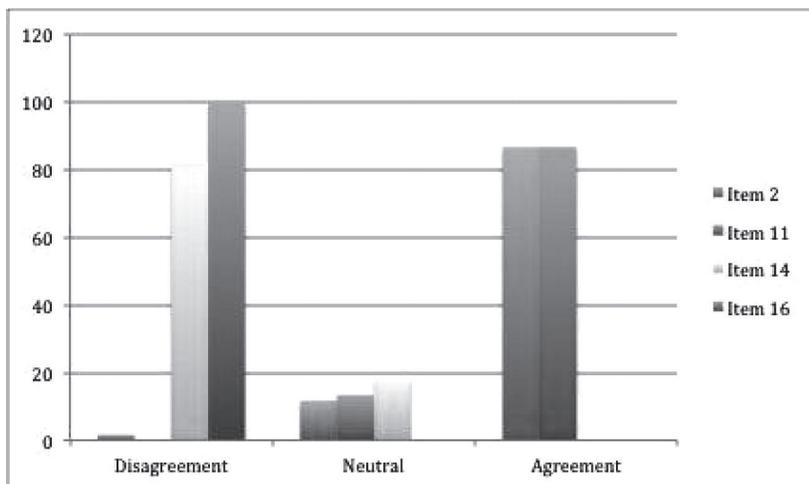
A general overview of the results allows us to think that students have positive attitudes towards technology in education and e-portfolios. Most items obtain favourable answers: in agreement or disagreement depending on if the statement is in affirmative or negative. However, there is an important presence of the answer «either agree or disagree» that suggests possible drawbacks that may need future work and scaffolding.

Answers given by student seem to be coherent as related affirmative and negative items obtain values in agreement or disagreement. This is the case, for example, of items related to technological learning (2, 11, 14 and 16) and the future use of technology (7 and 12) (See Annex 1).

The following figure represents and compares the percentage of agreement and disagreement and also neutral opinions of items 2 «I have gained greater confidence in learning new technology applications such as working with hypermedia software» and 11 «I was able to review my existing technology skills while gaining additional ones» (in affirmative) and 14 «I felt challenged and overwhelmed

with technology»— and 16 «I did not learn any additional technology skills»— (in negative). The representation of all answers in agreement or disagreement in one column makes data obtained specially clear of the coherence of students' answers and also of the tendency in their attitude in favour of technology.

FIGURE 2  
Students' answers. Items about technological learning



Some quotes have been selected to illustrate the quantitative data about the development of technological skills and the expansion of their PLEs:

Without really being aware of it and in a short period of time, I have learned to use services such as «flickr», «photopeach», «scribd», «googledocs», «animoto»... I have also had the opportunity to participate in «Kuentolibros» and to read very interesting bloggers [...] (E.T., 2011-2012)<sup>2</sup>.

My PLE was limited to social networks (facebook), search engines (google), youtube, powerpoint and online newspapers. It's obvious that it has improved considerably!!! (D.B., 2012-2013)<sup>3</sup>.

It can be seen that the personal learning environment in the virtual world has been extended considerably, so this will become knowledge (M.T., 2011-2012)<sup>4</sup>.

2. Retrieved from: <http://primercursoevatorres.blogspot.com.es/2012/01/un-proces-daparentat-ge-en-evolucion.html>.

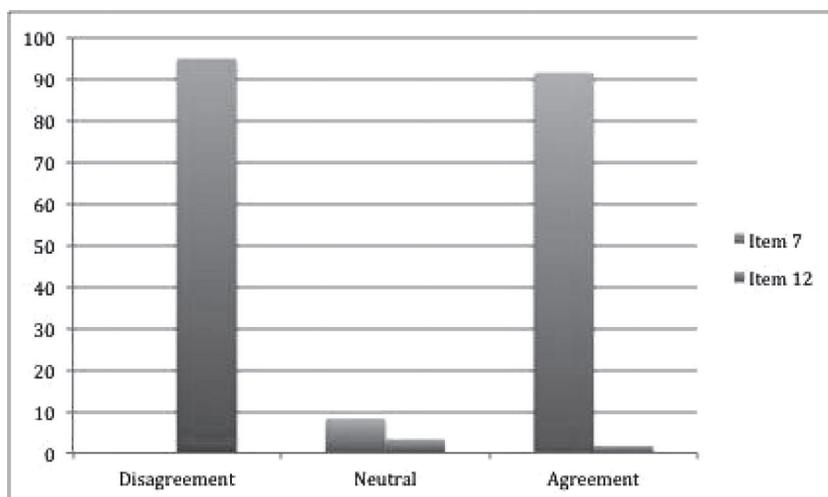
3. Retrieved from <http://elprimerblogdedelia.blogspot.com.es/2013/01/10-entrada.html>.

4. Retrieved from <http://carpetamarian.blogspot.com.es/2011/12/conclusiones-finals.html>.

Youtube, photopeach, voki, flickr, animoto and ivoox have been the tools that we have used [...]. they have surprised me a lot. I have to confess that the first impression I had was not very positive, but finally I think they are very useful and can be very much effectively (A.T., 2012-13)<sup>5</sup>.

The same occurs with items 7 –«I have gained greater confidence in integrating technology in future classrooms»– (in affirmative) and 12 –«I became less confident in using technology in my future classrooms»– (in negative), which are about students' opinion of their own future use of technology. All the groups of students share approximately the same opinion: they all understand that in their future teaching careers they will use technology for educational aims. Graphical representation of all agreement and disagreement answers in one column each clearly demonstrates the totally positive attitude towards the topic. The low number of neutral opinions on these items is also remarkable.

FIGURE 3  
 Students' answers. Items about technology use in their future teaching careers



The following texts are examples of the way students observe the use of ICT in their future teaching careers. Also, some references to the transformative role of technology have been selected in order to show some of the justifications that students argued to use digital resources.

5. Retrieved from <http://atorresj.blogspot.com.es/2012/12/punto-y-aparte.html>.

I think that Technology has transformed the way I see education. Opening doors to new Technology and web 2.0 tools are a great advantage for knowledge achievement in education (P.P., 2011-12)<sup>6</sup>.

When I become a teacher, I want that my students to use the tools and so they can teach others what they have learned (A.G., 2012-13)<sup>7</sup>.

I haven't been able to do it but I hope I will apply ICT in my future lessons, as long I have enough resources to do it (P.C., 2011-12)<sup>8</sup>.

As for artefacts, more than contributing to my own learning, I think that they have been useful for me to know how to use them with my future students (I.P., 2012-13)<sup>9</sup>.

Items about eportfolios are the ones that receive either higher (Figure 5) or lower scores (Figure 6). However, there are some other items (4, 6 and 8) that have diverse results, which is also evidence of the greater difficulty encountered by students when addressing authentic e-portfolio processes than when using technology for learning purposes. Items 4 («I understood better my strengths and weaknesses as a future teacher»), 6 («I revisited my prior learning experiences in more specific and complex ways») and 8 («I could see my growth and achievement throughout the years») have to do with self-regulated learning which is specially related to the pedagogical aims of eportfolios and obtain ambiguous results, since items 4 and 6 get a relevant number of neutral answers and item 8 is valued positively in general. It is also rather incoherent that item 4, again about the students vision of their professional future, achieves a high amount of neutral answers although students are quite positive about their future teaching with technology, as Figure 3 has highlighted.

On the one hand, the items that achieve higher scores are numbers 1, 5, 7, 9, 11, 13, 14 and 16 because they have a high level of positive answers and no (or almost none) negative answers. They are about diverse topics, which allow us to think about the general satisfaction of participants. Likewise, items related to technology, the usefulness of the learning experience and the integration of technology in their future teaching careers are among these items.

The following figure shows graphically the most positive results (except for items 7, 11 and 14 previously commented on). Thus, items in affirmative (1 –«I thought about the connections between what I learned and what I'm

6. Retrieved from <http://primer-patri.blogspot.com.es/search/label/Bases%20did%C3%A0ctiques%20i%20disseny%20curricular>.

7. Retrieved from <http://primerandregalve.blogspot.com.es/2013/01/avui-vaig-reflexionar-sobre-tot-allo-que.html>.

8. Retrieved from <http://pce-patrick.blogspot.com.es/2011/12/reflexio-final.html>.

9. Retrieved from: <http://irenepratsprats.blogspot.com.es/2012/12/el-canvi-esta-en-lull-que-mira.html>.

going to teach»– and 13 «I could showcase my work to future employers»–) obtain a majority of answers in agreement, and items in negative (5 «I didn't see any value of reflection»– and 9 «I didn't learn anything from this experience»–) obtain a majority of answers in disagreement. Neutral answers are not relevant in these items.

On the other hand, items that achieve lower scores are numbers 10, 15 and 17, all written in affirmative (Figure 4). The percentages of favourable, unfavourable and neutral attitudes show less of a consensus of opinion although the positive replies still outweigh the negatives. It is important to highlight that these items with the lowest marks refer to specific e-portfolio processes such as collaboration (items 15 «I learned a lot from communicating, interacting and collaborating with peers»– and 17 «I learned from reviewing my peers' e-portfolios online»–) and possibilities for learning self-organisation (item 10 «I became more organized and understood its importance»–).

FIGURE 4  
 Students' answers. Items about self-regulation of learning on eportfolios

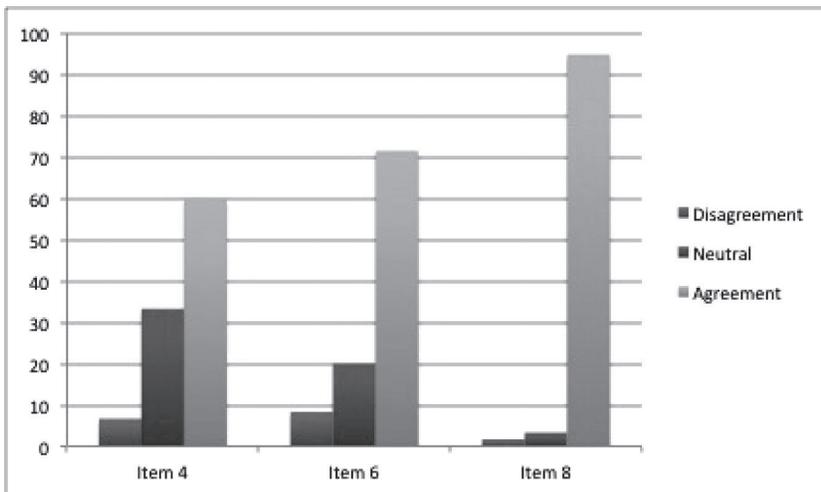


FIGURE 5  
Students' answers. Items with the most positive answers

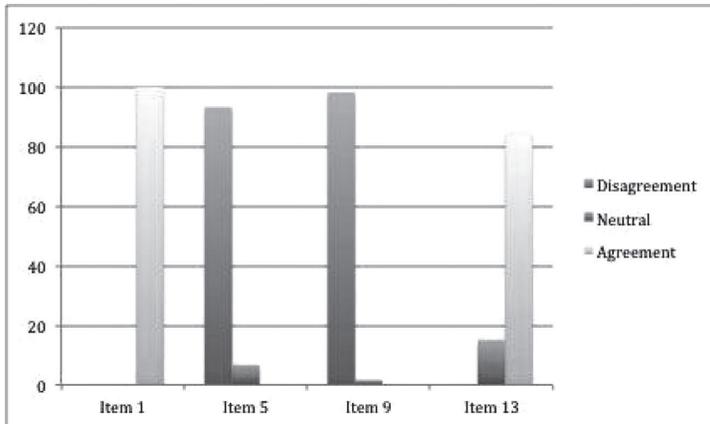
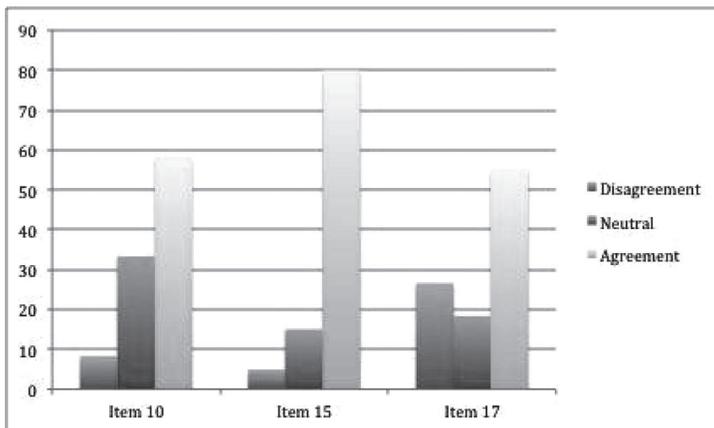


FIGURE 6  
Students' answers. Items with the most negative answers



As has been said, the items that obtain less of a consensus are the ones related to eportfolio processes. However, among the ones with better results there are some items related to reflection, which has actually been considered as the most important process, without which eportfolio are simple collections of works (Barrett, 2011; Zubizarreta, 2009). These may be explained as the difficulties experienced by students to carry out the processes, but once initiated they can also become very satisfying for students. The following references may show successful

students' feelings about their eportfolio processes and the learning impact for self-regulation that it has had on them:

I think that we are «constructing» our learning, expanding structures which become more interrelated and everything is better «anchored». It's a good reflection about what we are learning, we are doing what is called «meta-learning (F.T., 2011-12)<sup>10</sup>.

Also I have to say that I am learning to reflect step by step, actually every blog entry is better than the previous one. Previously nobody had ever asked me to reflect on what I have learned and that's why I think it is more difficult than learning concepts. Reflection on my own learning have made learning more significative that it has ever been (P.B., 2012-13)<sup>11</sup>.

The creation of this blog has been useful for me to realise what I have learned and what I need to learn more (M.L., 2011-12)<sup>12</sup>.

The eportfolio is a good way to assess reflection and processual learning (N.F., 2011-12-13)<sup>13</sup>.

## 6. CONCLUSION

Regarding our initial research questions, we can confirm that students have positive attitudes towards the current learning experience, technology in education and e-portfolio processes such as reflection. Moreover, they have positive expectations towards future integration of technology into their teaching careers. These elements are relevant since self-directed learning and reflection are, as mentioned above before, key skills for teachers in order to become lifelong learners and empower their students to be reflective (Master, 2013). This positive attitude can be explained by the successive enhancement of the e-portfolio project, for example, scaffolding in the e-portfolio construction.

Initial research on the pilot implementation of the e-portfolio project in Ibiza local branch of the University of the Balearic Islands highlighted students' difficulties (Tur, 2011). A deeper research on the same pilot implementation allowed us to observe greater difficulties for collaboration and reflection than for the use of technology in the construction of e-portfolios (Tur, 2013). Students were initially worried by technology, its use and the time spent to learning about it. However, technology was the aspect in which students particularly improved their learning. Collaboration and reflection were not a topic of concern for the students at the

10. Retrieved from: <http://felisauib2.blogspot.com.es/2012/01/reflexio-final-la-fi-del-cami.html>.

11. Retrieved from <http://patriciaborras.blogspot.com.es/2013/01/fins-la-proxima.html>.

12. Retrieved from [http://quadriviumxxi.blogspot.com.es/2011/12/conclusions\\_13.html](http://quadriviumxxi.blogspot.com.es/2011/12/conclusions_13.html).

13. Retrieved from <http://nfsibiz.blogspot.com.es/2012/12/reflexion-final.html>.

very beginning but data obtained show the lowest level of improvement. Therefore, some changes were introduced into the e-portfolio project design and related research showed students' positive evolution in the construction of e-portfolios (Tur & Urbina, 2012b). These changes were aimed at scaffolding reflection in order to help students to move from description of learning to its analysis. Collaboration was enhanced by giving students the opportunity to exchange opinions in face-to-face lessons. The scaffolding of collaboration consisted in helping students to go from celebrating peers' learning to commenting their reflection and asking questions in order to enhance the reflection process.

The results of this new research confirm the positive e-portfolio development described by Tur and Urbina (2012b). In general, students show a generally positive attitude towards the documentation of their learning and reflection although answers related to collaboration present lower results than those related to technology, which confirms previous data obtained (Tur, 2013). Also, these results confirm Lin's research (2008) –especially the ones related to the development of technological skills– although the author's results about collaboration and reflection gave higher scores than in this current experience. Moreover, this project implementation and research confirms the work of Hermans *et al.* (2008), which concludes that students who have used technology for learning develop positive attitudes towards technology and envision it in their future teaching. However, the results of this research contradict those of Lambert, Gong and Cuper (2008) who after a year-long research could not confirm the positive evolution of student teachers' attitude and beliefs after having experienced the integration of technology in their education programme. Further research could consider a longitudinal study to be able to confirm these results. The fact that our current study is transversal rather than longitudinal could have been an influencing variable which had not been contemplated in the research design. As highlighted in the introduction, e-portfolios represent one of the main components of the PLE as far as creating and reflecting by doing is concerned. Although the other components are also considered in the e-portfolio, a closer connection between them would be recommended, especially the one related to sharing and interacting with others, in order to make the process of learning from peers more valuable.

Having observed the generally positive attitudes of student teachers' participating in this project, the chances are that they are going to transfer their learning experience to their future teaching. However, further research should be able to follow the students' future teaching careers in order to see their real use of technology in their own teaching. Furthermore, future research should try to analyse their beliefs towards technology and if their approach to technology is based on student-centred methodologies and fosters the improvement of cognitive and high-level thinking skills.

Another interesting topic that would take us a step further in this research would be how to deal with the third-order barrier to successful technology integration in education, the one related to the lack of «design thinking», by approaching

teacher education with models such as the Technological Pedagogical Content Knowledge (TPACK), which identifies the knowledge that teachers need in order to teach effectively with technology (Tpack.org, 2012) and could be considered as a framework for Web 2.0 learning design (Bower, Hedberg & Kuswara, 2010). The design of the eportfolio assignment has been a way of integrating technology focusing on content and pedagogy. Further research could explore students' reflection on their views of the design of the eportfolio implementation and their expectations for its implementation in their future careers.

Finally, it could be interesting to go deeper into the topic of the development of student teachers' attitude and their learning performance. It is important to see that the advantages of e-portfolios for reflection and collaboration observed in the literature review are not the aspects which obtain the best results in our research, which allows us to think that there are difficulties for students to fully achieve these theoretical advantages. All these future research lines have to look at the importance of developing the current necessary key skills for teachers: self-directed learning and reflection, which, in turn, would be transferred to their students.

#### REFERENCES

- Adell, J. (2010). Educació 2.0. In C. Barba and S. Capella (Coords.). *Ordinadors a les aules: La clau és la metodologia* (pp. 19-32). Barcelona: Graó.
- Adell, J. & Castañeda, L. (2010). Los Entornos Personales de Aprendizaje (PLEs): una nueva manera de entender el aprendizaje. In R. Roig Vila & M. Fiorucci (Eds.). *Claves para la investigación en innovación y calidad educativas. La integración de las Tecnologías de la Información y la Comunicación y la Interculturalidad en las aulas. Stumenti di ricerca per l'innovazione e la qualità in ambito educativo. La Tecnologie dell'informazione e della Comunicaciones e l'interculturalità nella scuola*. Alcoy: Marfil-Roma TRE Università degli studi.
- Aliaga, M. & Gunderson, B. (2002). *Interactive statistics*. Virginia, America: Pearson Education.
- Attwell, G. (2007). Personal learning environments - the future of eLearning? *eLearning Papers*, 2, 1-8.
- Attwell, G. (2012). Who owns the e-portfolio? *Pontydysgu. Bridge to learning* [Web log comment]. Retrieved 30 June 2013 from <http://www.pontydysgu.org/2012/09/who-owns-the-e-portfolio/>.
- Barbera, E. (2009). Mutual feedback in e-portfolio assessment: An approach to the netfolio system. *British Journal of Educational Technology*, 40 (2), 342-357.  
<http://dx.doi.org/10.1111/j.1467-8535.2007.00803.x>
- Barrett, H. (2011). Balancing the two faces of eportfolios. In S. Hirtz & K. Kelly (Eds.). *Education for a digital world. Innovations in education*, vol. 2 (pp. 291-310). British Columbia Ministry of Education. Retrieved 30 June 2013 from [http://www.openschool.bc.ca/info/edu/7540006133\\_2.pdf](http://www.openschool.bc.ca/info/edu/7540006133_2.pdf).
- Batson, T. (2010). EPortfolios, finally! *Campus technology* [Web log comment]. Retrieved 26 July 2013 from <http://campustechnology.com/articles/2010/04/07/eportfolios-finally.asp>.
- Bower, M.; Hedberg, J. G. & Kuswara, A. (2010). A framework for Web 2.0 learning design. *Educational Media International*, 47 (3), 177-198.  
<http://dx.doi.org/10.1080/09523987.2010.518811>

- Boza, Á.; Tirado, R. & Guzmán-Franco, M. D. (2010). Creencias del profesorado sobre el significado de la tecnología en la enseñanza: influencia para su inserción en los centros docentes andaluces. *Relieve*, 16 (1). Retrieved 1 May 2014 from [http://www.uv.es/RELIEVE/v16n1/RELIEVEv16n1\\_5.htm](http://www.uv.es/RELIEVE/v16n1/RELIEVEv16n1_5.htm).
- Cabero, J.; López Meneses, E. & Jaén, A. Los portafolios educativos virtuales en las aulas universitarias. Instrumentos didácticos para la innovación docente y la calidad de los procesos de enseñanza y aprendizaje. *Enseñanza & Teaching*, 31 (1), 43-70. Retrieved de <http://revistas.usal.es/index.php/0212-5374/article/view/11604>.
- Cambridge, D. (2009). Two faces of integrative learning online. In D. Cambridge, B. Cambridge & K. Yancey (Eds.). *Electronic Portfolios 2.0. Emergent Research on Implementation and Impact*. Virginia: Stylus.
- Cambridge, D. (2010). *Eportfolios for Lifelong Learning and Assessment*. San Francisco: Jossey-Bass.
- Castañeda, L. & Adell, J. (2013). La anatomía de los PLES. In L. Castañeda & J. Adell (Eds.). *Entornos Personales de Aprendizaje: Claves para el ecosistema educativo en red* (pp. 11-27). Alcoy: Marfil.
- Cheng, G. & Chau, J. (2012). A study of the effects of goal orientation on the reflective ability of electronic portfolio users. *The Internet and Higher Education*, 16, 51-56. <http://dx.doi.org/10.1016/j.iheduc.2012.01.003>
- Chuang, H. (2010). Weblog-based electronic portfolios for student teachers in Taiwan. *Educational Technology Research and Development*, 58 (2), 211-227. <http://dx.doi.org/10.1007/s11423-008-9098-1>
- Cohen, L.; Manion, L. & Morrison, K. (2011). *Research Methods in Education* (7th Edition). USA: Routledge.
- Crichton, S. & Kopp, G. (2008). The value of eJournals to support eportfolio development for assessment in teacher education. *Canadian Journal of Learning and Technology/La Revue Canadienne de l'Apprentissage et de la Technologie*, 34 (3).
- Curtis, W.; Murphy, M. & Shields, S. (2014). *Research and education*. Oxon: Routledge.
- Davis, I. (2005). «Talis, Web 2.0 and All That». Entry blog in *Internet Alchemy*. Retrieved 26 July 2013 from <http://blog.iandavis.com/2005/07/04/talis-web-2-0-and-all-that/>.
- De Benito, B.; Escandell, C.; Ordinas, C.; Salinas, J. & Sastre, C. (2012). El e-portfolio como herramienta para la construcción de los Entornos Personales de Aprendizaje en la materia de Tecnología Educativa. Proceedings of Edutec 2012, Las Palmas de Gran Canaria. Retrieved 24 July 2013 from <http://gte.uib.es/pape/gte/publicaciones/el-e-portfolio-como-herramienta-para-la-construccion-de-los-entornos-personales-de-apr>.
- Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: strategies for technology integration. *Educational Technology Research and Development*, 47 (4), 47-61. <http://dx.doi.org/10.1007/BF02299597>
- Ertmer, P. A. (2005). Teacher pedagogical beliefs: the final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53 (4), 25-39. <http://dx.doi.org/10.1007/BF02504683>
- Ertmer, P. A. & Ottenbreit-Letwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic-enabled learning. *Computers & Education*, 64, 175-182. <http://dx.doi.org/10.1016/j.compedu.2012.10.008>

- Ertmer, P. A.; Ottenbreit-Leftwich, A.; Sadik, O.; Sendurur, E. & Sendurur, P. (2012). Teacher beliefs and technology integration practices: a critical relationship. *Computers and Education*, 59 (2), 423-435.  
<http://dx.doi.org/10.1016/j.compedu.2012.02.001>
- Garrett, N. (2011). An e-portfolio design supporting ownership, social learning, and ease of use. *Educational Technology & Society*, 14 (1), 187-202.
- Garrett, N.; Thoms, B.; Alrushiedat, N. & Ryan, T. (2009). Social eportfolios as the new course management system. *On the Horizon*, 17 (3), 197-207.  
<http://dx.doi.org/10.1108/10748120910993222>
- Hermans, R.; Tondeur, J.; van Braak, J. & Valcke, M. (2008). The impact of primary school teachers' educational beliefs on the classroom use of computers. *Computers & Education*, 51, 1499-1509.  
<http://dx.doi.org/10.1016/j.compedu.2008.02.001>
- Hilzensauer, W. & Schaffert, S. (2008). On the way towards Personal Learning Environments: Seven crucial aspects. *Elearning Papers*, 9. Retrieved 7 January 2014 from [http://www.elearningpapers.eu/en/elearning\\_papers](http://www.elearningpapers.eu/en/elearning_papers).
- Ivanova, M. (2008). Learning eportfolio deployment in social network NING. In Electronics' Bulgaria 2008. Retrieved 30 June 2012 from [http://ecad.tu-sofia.bg/et/2008/Contents\\_ET2008.htm](http://ecad.tu-sofia.bg/et/2008/Contents_ET2008.htm).
- Jonassen, D. H. (1996). *Computers in the classroom: Mindtools for critical thinking*. Columbus, OH: Merrill/Prentice Hall.
- Kabilan, M. K. & Khan, M. A. (2012). Assessing pre-service English language teachers learning using e-portfolios: Benefits, challenges and competencies gained. *Computers & Education*, 58 (4), 1007-1020.  
<http://dx.doi.org/10.1016/j.compedu.2011.11.011>
- Kagan, D. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research*, 62, 129-169.  
<http://dx.doi.org/10.3102/00346543062002129>
- Karsenti, T.; Dumouchel, G. & Collin, S. (2014). The Eportfolio as Support for the Professional Development of Preservice Teachers: a Theoretical and Practical Overview. *International Journal of Computers & Technology*, 12 (5), 3486-3495.
- Lambert, J.; Gong, Y. & Cuper, P. (2008). Technology, Transfer and Teaching: The Impact of a Single Technology Course on Preservice Teachers' Computer Attitudes and Ability. *Journal of Technology and Teacher Education*, 16 (4), 385-410.
- Lin, Q. (2008). Preservice teachers' learning experience of constructing eportfolios online. *The Internet and Higher Education*, 11 (34), 194-200.  
<http://dx.doi.org/10.1016/j.iheduc.2008.07.002>
- Masters, J. (2013). Scaffolding pre-service teachers representing their learning journeys with eportfolios. *Journal of Learning Design*, 6, 1.  
<http://dx.doi.org/10.5204/jld.v6i1.115>
- Mishra, P. & Koehler, M. J. (2006). The technological pedagogical content knowledge: a framework for teacher knowledge. *Teachers College Record*, 108 (6), 1017-1054.  
<http://dx.doi.org/10.1111/j.1467-9620.2006.00684.x>
- Montero, M. & Gerwerc, A. (2010). De la innovación deseada a la innovación posible. Escuelas alteradas por las TIC. *Revista de Currículum y Formación del Profesorado*, 14 (1), 303-318.

- Moon, J. (1999). *Reflection in learning and professional development: Theory and practice*. London: Kogan Page.
- Oner, D. & Adadan, E. (2011). Use of web-based portfolios as tools for reflection in pre-service teacher education. *Journal of Teacher Education*, 62 (5), 477-492.  
<http://dx.doi.org/10.1177/0022487111416123>
- Ottenbreit-Leftwich, A. T.; Glazewski, K. D.; Newby, T. J. & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: addressing professional and student needs. *Computers and Education*, 55 (3), 1321-1335.  
<http://dx.doi.org/10.1016/j.compedu.2010.06.002>
- Parkes, K. A.; Dredger, K. S. & Hicks, D. (2013). ePortfolio as a Measure of Reflective Practice. *International Journal of ePortfolio*, 3 (2), 99-115.
- Parkes, K. A. & Kajder, S. (2010). Eliciting and assessing reflective practice: A case study in web 2.0 technologies. *International Journal of Teaching and Learning in Higher Education*, 22 (2), 218-228.
- Pérez Juste, R. (1997). *Pedagogía experimental*. Madrid: UNED.
- Prestridge, S. (2010). The beliefs behind the teacher that influences their ICT practices. *Computers & Education*, 58, 449-458.  
<http://dx.doi.org/10.1016/j.compedu.2011.08.028>
- Raposo, M. & Sarceda, M. C. (2010). El trabajo en las aulas con perspectiva europea: medios y recursos para el aprendizaje autónomo. *Enseñanza & Teaching*, 28 (2), 45-60.
- Ravet, S. & Attwell, G. (2007). POLE: Personal & Organisational Learning Environment. In *EPIC Proceedings 2007* (pp. 299-302). Retrieved 30 June 2013 from: <http://www.epforum.eu/sites/www.epforum.eu/files/eportfolio%202007.pdf>.
- Ruiz Palmero, J. & Sánchez Rodríguez, J. (2012). Expectativas de los centros educativos ante los proyectos de integración de las TIC en las aulas. *Revista de Educación*, 357, 587-613.
- Salinas, J. (2013). Enseñanza Flexible y Aprendizaje Abierto, Fundamentos clave de los PLES. En L. Castañeda & J. Adell (Eds.). *Entornos Personales de Aprendizaje: Claves para el ecosistema educativo en red* (pp. 53-70). Alcoy: Marfil.
- Salinas, J.; Marín, V. I. & Escandell, C. (2011). A Case of an Institutional PLE: Integrating VLES and E-Portfolios for Students. In *Proceedings of the The PLE Conference 2011*. Southampton, UK. Retrieved 26 July 2013 from <http://gte.uib.es/pape/gte/publicaciones/case-institutional-ple-integrating-vles-and-e-portfolios-students>.
- Shada, A.; Kelly, K.; Cox, R. & Malik, S. (2011). Growing a new culture of assessment: Planning eportfolios in the metro academies program. *International Journal of ePortfolio*, 1 (1), 71-83.
- Shroff, R.; Trent, J. & Ng, E. (2013). Using e-portfolios in a field experience placement: Examining student-teachers' attitudes towards learning in relationship to personal value, control and responsibility. *Australasian Journal of Educational Technology*, 29 (2), 143-160.
- Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology*, 24 (4), 413-424.
- Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education*, 52 (2), 302-312.  
<http://dx.doi.org/10.1016/j.compedu.2008.08.006>
- Teo, T.; Lee, C. B. & Chai, C. S. (2008). Understanding pre-service teachers' computer attitudes: applying and extending the technology acceptance model. *Journal of Computer Assisted Learning*, 24, 128-143.  
<http://dx.doi.org/10.1111/j.1365-2729.2007.00247.x>

- Tirado-Morueta, R. & Aguaded-Gómez, J. I. (2014). Influencias de las creencias del profesorado sobre el uso de la tecnología en el aula. *Revista de Educación*, 363, 230-255.
- Tosh, D. & Werdmuller, B. (2004a). Creation of a learning landscape: Weblogging and social networking in the context of e-portfolios. Retrieved 25 July 2013 from <http://benwerd.com/wp-content/uploads/2012/07/learning-landscape.pdf>.
- Tosh, D. & Werdmuller, B. (2004b). EPortfolios and weblogs: One vision for eportfolio development. Retrieved 26 July 2013 from [http://s3.amazonaws.com/academia.edu.documents/31070654/ePortfolio\\_Weblog.pdf?AWSAccessKeyId=AKIAIR6FSIMDFXPEERSA&Expires=1374909001&Signature=zizBDeHDX38yF7o4odPW%2Bfl3lvo%3D&response-content-disposition=inline](http://s3.amazonaws.com/academia.edu.documents/31070654/ePortfolio_Weblog.pdf?AWSAccessKeyId=AKIAIR6FSIMDFXPEERSA&Expires=1374909001&Signature=zizBDeHDX38yF7o4odPW%2Bfl3lvo%3D&response-content-disposition=inline).
- Tosun, N. & Baris, F. (2011). E-portfolio applications in education. *The Online Journal of New Horizons in Education*, 1 (4), 42-52.
- Tpack.org (2012). *TPACK*. Retrieved 26 July 2013 from <http://www.tpack.org>.
- Tsai, C. & Chai, C. (2012). The «third»-order barrier for technology-integration instruction: Implications for teacher education. *Australasian Journal of Educational Technology*, 28, 1057-1060.
- Tur, G. (2011). Eportfolios and PLES in Teacher Education. First results. In Proceedings of the The PLE Conference 2011 (pp. 1-10). Southampton, UK. Retrieved 26 July 2013 from [http://journal.webscience.org/578/1/EPORTFOLIOS\\_AND\\_PLES\\_IN\\_TEACHER\\_EDUCATION\\_FIRST\\_RESULTS.doc](http://journal.webscience.org/578/1/EPORTFOLIOS_AND_PLES_IN_TEACHER_EDUCATION_FIRST_RESULTS.doc).
- Tur, G. (2013). Projecte de portafoli electrònic amb eines de la Web 2.0 als estudis de Grau d'Educació Infantil de la UIB a la Seu d'Eivissa. Estudi de cas. Thesis. University of the Balearic Islands. TDX database. Retrieved from <http://www.tdx.cat/handle/10803/111339>.
- Tur, G. & Urbina, S. (2012a). PLE-based ePortfolios: Towards Empowering Student Teachers' PLES through ePortfolio Processes. In Proceedings of the The PLE Conference 2012. Aveiro, Portugal. Retrieved 25 July 2013 from: <http://revistas.ua.pt/index.php/ple/article/view/1438>.
- Tur, G. & Urbina, S. (2012b). Documentando el aprendizaje en portafolios electrónicos: una experiencia con herramientas de la Web 2.0. In Congreso Internacional Edutec 2012 (pp. 656-669). Retrieved 30 June 2013 from <http://gte.uib.es/pape/gte/publicaciones/documentando-el-aprendizaje-en-portafolios-electronicos-una-experiencia-con-herramient>.
- Tur, G. & Urbina, S. (2013). Blogs and Web 2.0 tools to open student teachers' eportfolios: student teachers' perceptions on eportfolio openness. In ePIC Proceedings, 2013 (pp. 41-51). Retrieved 27 July from [http://www.epforum.eu/sites/www.epforum.eu/files/ePIC%202013\\_0.pdf](http://www.epforum.eu/sites/www.epforum.eu/files/ePIC%202013_0.pdf).
- Van Dalen, J. & Meyer, W. J. (1981). Manual de técnicas de investigación educacional. Buenos Aires: Paidós.
- Yancey, K. B. (2004). Postmodernism, palimpsest, and portfolios: Theoretical issues in the representation of student work. *College Composition and Communication*, 55 (4), 738-761.  
<http://dx.doi.org/10.2307/4140669>
- Zubizarreta, J. (2009). The learning portfolio: Reflective practice for improving student learning (2nd ed.). San Francisco, CA: John Wiley & Sons.

## ANNEX 1

e-Portfolio survey (Lin, 2008: 200) with the items selected for this study:

Directions: In the scale of 1-5, give your responses to the following statements (5 = strongly agree, 4 = agree, 3 = neither agree nor disagree, 2 = disagree, and 1 = strongly disagree):

After the process of constructing my e-portfolio, I...

1. I thought about the connections between what I learned and what I'm going to teach.
2. I have gained greater confidence in learning new technology applications such as working with hypermedia software.
3. I was confused at the whole experience.
4. I understood better my strengths and weaknesses as a future teacher.
5. I didn't see any value of reflection.
6. I revisited my prior learning experiences in more specific and complex ways.
7. I have gained greater confidence in integrating technology in future classrooms.
8. I could see my growth and achievement throughout the years.
9. I didn't learn anything from this experience.
10. I became more organized and understood its importance.
11. I was able to review my existing technology skills while gaining additional ones.
12. I became less confident in using technology in my future classrooms.
13. I could showcase my work to future employers.
14. I felt challenged and overwhelmed with technology.
15. I learned a lot from communicating, interacting and collaborating with peers.
16. I did not learn any additional technology skills.
17. I learned from reviewing my peers' e-portfolios online.