

Towards Evidence-aware Learning Design for the Integration of ePortfolios in Distributed Learning Environments

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Abstract: The benefits of using ePortfolios in widespread Distributed Learning Environments are hindered by two problems: students have difficulties in selecting which learning artifacts may demonstrate the acquisition of certain learning skills; and, both teachers and students have difficulties in collecting evidences produced by means of distributed and heterogeneous tools. This paper proposes a model aimed at enhancing the description of learning activities with information about the evidences they are expected to generate. This model is a first step towards the definition of an evidence-aware learning design process by means of which teachers make explicit pedagogical-informed decisions involving the generation and subsequent utilization of learning evidences. As a proof of concept, we apply this model in an authentic learning scenario, trying to alleviate the two aforementioned problems.

1 INTRODUCTION

Technology Enhanced Learning (TEL) is a research field that promotes the use of information technologies to better support learning. Following this approach, it is common to use VLEs (*Virtual Learning Environments*) (Dillenbourg, 2000) to orchestrate the involved activities by managing students and groups of them, as well as learning tools and resources. In addition to VLEs, teachers typically make use of external tools, specially Web 2.0 ones such as blogs or wikis, in their learning settings. Indeed, there are a number of approaches to integrate third-party tools in VLEs such as IMS LTI (IMS-LTI, 2012) or GLUE! (Alario-Hoyos et al., 2013). As a result, the term DLE (*Distributed Learning Environment*) (MacNeill and Kraan, 2010) is employed to refer to the technological setting composed of VLEs and external tools.

On the other hand, ePortfolios, may be understood as an organized compilation of selected work samples (evidences), which show the process and results of a learning path (Barberà-Gregori and Martín-Rojo, 2009). ePortfolios are gaining momentum, due to their benefits over the cognitive process of the students (Barrett, 2007b) (Buzzetto-More, 2010) (Reese and Levy, 2009).

By using ePortfolios, learners get a better understanding of their own learning progress and their level

of accomplishment of the targeted competences, as well as increase their motivation for learning (Sweatguy and Buzzetto-More, 2007). At the same time, teachers may complement traditional summative evaluation with formative assessment and feedback on the on-going work, considering ePortfolios as both a *process* and a *product* (Barrett, 2011).

However, when putting together ePortfolios and technically heterogeneous DLEs, the assessment of individual students becomes specially difficult, due to learning evidence dispersion among the employed tools (Bubaš et al., 2011) (Barrett, 2007a). Teachers' workload increases when trying to gather those work samples. At the same time, students find it difficult to understand and choose the suitable pieces of work which allow showcasing the acquired competences (Buzzetto-More, 2010). These problems are exacerbated in group work due to the complexity of collaboration (Koschmann, 1996).

Hence, teachers should be helped to gather evidences, plan and carry out assessment; while students should be guided to exploit the advantages of ePortfolios in these environments (Barberà-Gregori, 2005). In order to reach this purpose, learning evidences need to be identified among all the artifacts generated by students in a learning situation. Also, learning evidences need to be linked to learning objectives, as to clearly state which work samples help

reaching which goals.

This way, it seems important that teachers are asked to make explicit the aforementioned guidelines. Learning design (Conole, 2012) (Laurillard, 2012) has evolved during the last decade as the approach for helping educators to make their pedagogical decisions, as well as the use of educational technology, explicit and sharable. However, no attention has been paid so far, within the learning design community, to the inclusion of learning evidences (and their purpose) in the design of learning situations. Therefore, this paper proposes a so-called learning evidence-aware model that defines how a teacher might define learning evidences and how he might relate those evidences with the components of current learning designs.

This contribution is seen as a first, necessary step to build a solution aimed at avoiding the main drawbacks of integrating ePortfolios in DLEs. That is, in order to be able to exploit technology for the automation of evidence collection (and, therefore, mitigate the workload increase due to ePortfolios), teachers are required to explicitly identify those artifacts which will be considered learning evidences and the purposes and learning objectives they will serve to. At the same time, the link between learning evidences and objectives will be explicit, therefore helping students to exploit ePortfolios to build their digital identity, by showcasing what they have learned.

The structure of the document goes as follows. Section 2 explains the most important problems which students and teachers need to face, when using ePortfolios in DLEs. Section 3 presents a learning evidence integration model, which will enable tackling the aforementioned problems; and applies it to a DLE-based learning situation. Finally, conclusions and future work are given in Section 4.

2 ePortfolios AND DLEs

ePortfolios are known for their capability of documenting the learning process, being an ordered store of work samples, called *learning evidences*. In order to do so, evidences must go through the following processes: *collection*, *selection*, *reflection* and *presentation* (Barberà and Bautista, 2006).

That is, students need to take samples of their work, decide whether they are suitable to show the achievement of some learning objectives, self-evaluate their work on the selected samples and finally publish the contents of their portfolio so that the audience may understand how far they got in reaching a given competence.

By doing so, ePortfolios help students to become aware of their self-progress, increasing their understanding of what, why and how they learnt (Barrett, 2007b). This capability (providing a glance at the learning path) also enables the use of ePortfolios as assessment tools (Balaban et al., 2011).

Three main approaches may be followed in the use of ePortfolios (Barrett, 2011). On a first approach, ePortfolios may be seen as a way to centralize digital work samples. That is, the main purpose of this kind of portfolios is *storage*, paying special attention to evidence collection.

Secondly, the selection of evidences allows the use of ePortfolios as a *workspace*, focused on the ongoing learning situation. Students execute short-term reflection on the learning process, while teachers should provide feedback and formative assessment towards the aimed learning objectives.

Finally, students may present the level of achievement of certain competences by using the ePortfolios as a *showcase* of their final retrospective on what they learned, either after a given learning situation or across several ones.

This way, in order to exploit those benefits in distributed learning environments, some proposals appear, for the joint use of VLEs, web 2.0 and ePortfolio systems (Salinas et al., 2011) (Bubaš et al., 2011) (Hämäläinen et al., 2011).

However, even when a conceptual link is established among VLE, tools and ePortfolios, there is not a real connection among them, thus hindering the management of learning evidences. This means that, at the end of the learning situation, the work samples are scattered along the different tools or the VLE itself, difficulting their gathering and the teacher's tasks to provide assessment (either summative, formative or feedback). This problem gets more complicated in collaborative flows, including portfolios. The teachers' workload increases, while their confidence in portfolio benefits decreases (Balaban et al., 2011) (Sweat-guy and Buzzetto-More, 2007). Additionally, lack of consistency among different teachers for the same learning objectives may appear (Barberà-Gregori, 2005).

From the students' perspective, the main problem in evidence selection is their lack of experience in doing so. It may be difficult for them to identify which parts of their work better match the learning objectives (Barrett, 2007b) (Barberà-Gregori, 2005) (Buzzetto-More, 2010).

Taking all this into account, it seems reasonable for teachers to devote some time to decide which learning evidences are most interesting to fit the learning objectives they aim at. That is, they should be

able to explicitly identify what to collect, what for and how that links to the learning objectives they defined (Venn, 2004).

This kind of decisions should be taken when designing the learning situation. At that point, the flow of activities to be executed is specified, where students and teachers play roles and use services and tools with the aim of accomplishing their learning goals (Conole, 2012) (Laurillard, 2012). Some research works criticize that current *Learning Design* (LD) approaches do not allow the specification of data flow among tools and activities (Palomino-Ramírez et al., 2007) (Prieto et al., 2011). To address this limitation, they propose workflow models for automating the flow of learning artifacts in a learning situation. However, their focus is mainly technological, leaving out assessment considerations, as well as the use of those artifacts for showcasing learning competences.

This paper, on the other hand, tries to go a little further, by providing meaning to those artifacts, highlighting the most relevant ones, and linking them to the learning goals. Gathering all this information in a structured manner is the first step towards automation of collection and management of learning evidences. This way, technology can help to reduce teacher workload in DLEs and to create better designs, as well as to tackle students' lack of experience in evidence selection.

3 LEARNING EVIDENCE AWARE DESIGN

Along the previous sections, the main difficulties in the adoption of ePortfolios in DLEs have been spotted.

The need of teachers taking learning evidences into account in the design phase is identified as a necessary step to provide technical aid to overcome those difficulties. In order to do so, LD authoring tools, such as *Collage* (Hernández-Leo, 2006) (Villasclaras-Fernández et al., 2009), may be used. Design tools offer certain possibilities to describe a learning situation, by using the model they implement as reference. However, none of those models explicitly talk about learning evidences, nor ePortfolios (Prieto et al., 2011) (Palomino-Ramírez et al., 2008).

Therefore, Section 3.1 proposes a design model to integrate learning evidences in the design of learning situations, while Section 3.2 instantiates a CSCL situation in which learning evidences play an important role. By doing so, the basis of an evidence-aware design process is set, which will allow overcoming the main problems in the integration of ePortfolios

in DLEs. The aim of this process is to help teachers elaborate an evidence-aware design, by applying the proposed model.

3.1 Learning Evidence Integration Model

Figure 1 depicts the proposed integration model to include learning evidences in the design of learning situations.

Learning objectives are inherently linked to the **learning design** itself, which will contain some **learning activities**, leading to those goals. **Learning activities** are supported by different **tools** (either inside or out of the VLE), which produce work samples to evidence the student's progress.

There are several purposes an **evidence** may pursue (as detailed in Section 2). First, simple **storage** will allow later use and summative assessment. For example, the mind map at the end of a given activity may be evaluated by the teacher when the learning situation is over.

However, **learning evidences** may be also used along the enactment of the learning situation, in order to provide **feedback** on the student's learning path, either by the teacher or the students themselves.

Finally, it is important to indicate which **learning evidences** demonstrate which **learning objectives**, so that students may use this information to **showcase** the acquired competences.

By specifying all this information, a cyclic workflow is established. Learning evidences are the output product of given steps in the learning process, but may also become input resources in forthcoming learning and/or assessment activities; as shown in the example in Section 3.2.

3.2 Application Scenario

This section applies the evidence-aware learning design model described in Section 3 to a collaborative scenario, inspired in a course in the study plan for Telecommunications Engineering at the University of Valladolid (*Networks and Telematics Systems*, 3rd semester¹). This course, among other topics, covers the analysis of network diagrams, and the use of network discovery and routing tools.

One of the learning situations in that course has the following learning objectives:

- LO01: Depict and read network diagrams.

¹[http://www.tel.uva.es/docencia/ asignaturas/ descripcion.htm?controlador\(titulacion\)=Pcomun &controlador\(asignatura\)=A45016](http://www.tel.uva.es/docencia/ asignaturas/ descripcion.htm?controlador(titulacion)=Pcomun &controlador(asignatura)=A45016)

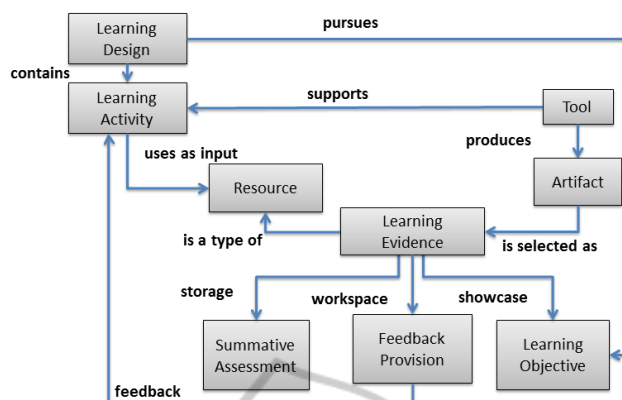


Figure 1: Learning Evidence Integration Model.

- LO02: Learn how to use network routing and diagnosis tools
- LO03: Understand that other’s work is important to reach my objectives (positive interdependence)
- LO04: Learn how to use collaborative editing tools

Focusing on those aims, the teacher decides to use the pyramid collaborative pattern depicted in Figure 2 (Hernández-Leo, 2006). The leading thread along the learning situation will be held by the VLE Moodle², but different activities will make use of specific tools: Network Notepad³, Google Docs⁴.

Additionally, the teacher decides to exploit the main capabilities of ePortfolios, by setting up an instance of Mahara to be used as evidence meeting point, so that teachers and peers may provide feedback over the generated artifacts. At the same time, work samples may be shared across phases and students.

A schema of this learning situation is depicted in Table 1

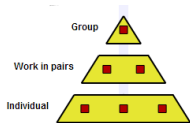


Figure 2: High-level overview of the learning situation.

Being an example of DLE, generated artifacts are scattered among tools, services and platforms. Counting all evidences (networks diagrams, test results and reports), the number of relevant artifacts goes up to almost two and a half times the number of students. That is, in a classroom of 40 people, the teacher ends up facing 90 artifacts.

²<http://moodle.org/>

³<http://www.networknotepad.com/>

⁴<http://docs.google.com/>

Both teacher assessment and peer review imply an extra piece of work for authors of the artifacts, as they need to manually gather their results and place them in Mahara⁵. Also there is a lot of extra generated items (drafts, execution logs...), needed to get to the final product, whose link to learning objectives is not clear to students.

By following the design model in Section 3.1, as shown in Table 1, the teacher completes the traditionally provided information (activity description, tool, ...), by explicitly picking up some artifacts (e.g. [LE01]) to be considered as evidences. Those work samples should go into the ePortfolio management system (Mahara in the example), easing feedback provision and avoiding evidence dispersion.

Also, evidences may be identified as the output of an activity, but also as input resources to some learning and/or assessment activities (e.g. [LE02]). These pieces of information will be eventually used to indicate an automation engine where to find and where to place the necessary learning evidences to enact the provided design.

Finally, evidences are clearly related to learning objectives, which will help students understand what, how and why they learnt.

To sum up, using the evidence-aware learning model as reference is the first step to build a consistent solution for the integration of ePortfolios in DLE. Next lines of work are identified in Section 4.

4 CONCLUSIONS

Along this document, the challenges of using ePortfolios in DLEs have been identified. First, students lack of experience in evidence selection, which hinders the task of linking work samples to learning ob-

⁵<http://mahara.org/>

Table 1: Evidence-aware design of a pyramid (Learning Evidences in bold font).

Phase	Learning Activity	Tool	Resource	Artifact	Learning Objective
Individual	Depict first draft of the ETSIT Network, theoretical base	Network Notepad	-	Network Diagram [LE01]	[LO01]
Work in pairs	Review the first network draft by my colleague	Mahara	[LE01]	Feedback [FB01]	-
	Consume feedback	Mahara	[FB01]	-	-
	Depict second draft of the ETSIT Network, empiric base	email	-	Collaboration mails between students	-
		ping, tracert, lookup, whois	-	Execution logs	-
		Network Notepad	-	Network diagram [LE02]	[LO01], [LO02], [LO03]
	Answer test	Google Form	-	Questionnaire Response [LE03]	-
	<i>Teacher</i> Assess questionnaire response	Google Form	[LE03]	-	-
Groups	Review the network diagram generated by my colleagues	Mahara	[LE02]	Feedback [FB02]	-
	Consume feedback	Mahara	[FB02]	-	-
	Create report, include network diagram, support decisions on theory	email	-	Collaboration mails between students	-
		chat	-	Collaboration conversations among students	-
		ping, tracert, lookup, whois	-	Execution logs	-
		Network Notepad	-	Network diagram	-
	Google Docs	-	Written report [LE04]	[LO01],[LO02], [LO03],[LO04]	
<i>Teacher</i> Assess written report	Google Docs	[LE04]	-	-	

jectives. On the other hand, assessment of students becomes harder when using ePortfolios in distributed and heterogeneous environments, due to learning evidence dispersion. Teachers are exposed to a larger workload which decreases confidence in the benefits of ePortfolios as assessment tools.

This paper supports the idea of making pedagogical decisions explicit on what evidences may be used to prove the achievement of some learning objectives and at which point within the learning situation they must be taken. Teachers use learning design to untangle their ideas to organize learning situations. However, current learning design approaches do not consider the use of learning evidences. To overcome this limitation, a model for the integration of learning evidences has been presented in Section 3. This model has been used on a sample scenario, to highlight the use of evidences within a collaborative learning pattern.

This way, by considering learning evidences in the design phase, technology can be used to alleviate the workload of teachers, as well as guide students to understand which work samples relate to which competences.

However, evidence collection remains a big problem in the chosen distributed and technically heterogeneous scenario, composed of VLE, external tools and ePortfolio management systems. The development of technical solutions for evidence gathering in DLEs based on this model is the following step in this research work. Additionally, the definition of a learning design process also based on the proposed model is aimed, so as to influence teacher-oriented authoring tools presented along this paper.

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