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Collaboration and Social Networking in Higher Education **Colaboración y redes sociales en la enseñanza universitaria**

Abstract

This paper presents an exploratory analysis of the experience of educational innovation in the configuration of a social learning network in a subject for of the Education degree course at the University of Santiago de Compostela (Spain). This innovation is based on the premise of student-centered teaching (independent learning, self-regulated, authentic and breaking boundaries between formal and informal areas) enriched with collaborative activities. The study aims to analyze the intensity and relevance of the student's contributions in this collaborative framework. We used learning analytics tools with two types of techniques: social network analysis (SNA) and information extraction, to measure the intensity, centrality and relevance of collaboration among students. The results obtained allow us to confirm: 1) The consistency and coherence between the pedagogical approach and the option of using a social network in university education; 2) A dense network with a high level of interaction, a moderate degree of centrality and a low centralization index (structure moves away from star), with a group with the capacity to influence the rest (degree of betweenness); 3) High level of relevance to the content analyzed; 4) The usefulness of learning analytics techniques to guide teacher decision-making.

Resumen

El presente trabajo analiza, de forma exploratoria, la experiencia de innovación docente en la configuración de una red social de aprendizaje en una asignatura del Grado de Pedagogía de la Universidad de Santiago de Compostela. La innovación se justifica en las premisas de la enseñanza centrada en el alumno (aprendizaje autónomo, autorregulado y auténtico, ruptura de fronteras entre ámbitos formales e informales), enriquecida con actividades colaborativas. El estudio pretende analizar la intensidad y pertinencia de las aportaciones del alumnado en este marco colaborativo. Para ello se han utilizado herramientas informáticas de la analítica del aprendizaje (learning analytics) con dos tipos de técnicas: análisis de redes sociales y extracción de información, que dan cuenta de la intensidad, centralidad y relevancia de la colaboración entre los estudiantes. Los resultados obtenidos posibilitan concluir: 1) la consistencia y coherencia entre la propuesta pedagógica y la opción de utilizar una red social en la enseñanza universitaria; 2) la existencia de una red densa con alto nivel de interacción, grado de centralidad medio e índice de centralización bajo (estructura que se aleja de la forma estrella), con un grupo con capacidad de influencia en el resto (grado de intermediación); 3) alto nivel de pertinencia de los contenidos analizados; 4) la utilidad de las técnicas de analítica de aprendizaje para orientar la toma de decisiones del docente.

Keywords / Palabras clave

University teaching, learning, innovation, collaboration, social networking, e-portfolio, personal learning environments, learning analytics.

Enseñanza universitaria, aprendizaje, innovación, colaboración, redes sociales, portafolio electrónico, entornos personales de aprendizaje, analítica del aprendizaje.

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1. Introduction

Teaching at university is a complex social activity that takes place within institutions that are loaded with social, cultural and political meaning; there is not only one university, but rather the polyhedron of faculties, departments, institutes, and people. Nor is teaching as uniform as the predominant transmissive teaching approach would suggest. Changes in the ways of addressing teaching and learning processes at university are not a novelty of the European Higher Education Area (EHEA), however, in this context innovation becomes «mandatory». Nevertheless, internal innovations produced on the job, often the result of academic independence, have demonstrated the wisdom and good work of so many university professors who have made a place for research in their teaching space, in line with calls from the English-speaking world in favour of «scholarship for teaching» (Lueddeke, 2008; Shulman, 2004) and for a greater appreciation of teaching with respect to research (Aguaded & Fonseca, 2009). It is in this context that we frame the content of this article which aims precisely to facilitate critical analysis of an extended experience of professional collaboration in higher education virtual learning environments. Collaboration in several ways: among teachers, among students and students together with teachers.

We have long been working with student e-portfolios (Gewerc, 2009; Gonçalves, Montero & Lamas, 2012; Montero Alvarez & Seoane, 2010) as artifacts spanning the length and breadth of teaching, learning and assessment processes (Agra, Gewerc & Montero, 2003). Ours is a continuing process of inquiry regarding practice, in which we try to be true to the premises of teaching centered on students who learn in collaboration with others. This teaching approach aims to address student diversity, foster their independence, and enhance each person's strengths. Thus, students are encouraged to explore their interests while transcending the limits of formal learning to appreciate the value of informal learning spaces. This proposal requires students to self-regulate their learning (Pintrich, 2004; Vermunt & Vermetten, 2004; Zimmerman, 2001; Salmerón & Gutierrez-Braojos, 2012) and teachers to be committed to a perspective of situated (Lave & Wenger, 1991) and authentic learning (Herrington, Oliver & Reeves, 2003). Within this framework, students are conceived as partners in the work of teaching and learning who have initiative and the ability to reflect on their own processes. Fur-

thermore, metacognition is given priority as a pedagogical strategy along the lines of cultural and socio-constructivist learning (Saz, Coll, Busts & Engel, 2011).

This combination of axes around which our understanding of university teaching gravitates has led us to explore the following: the collaboration generated by the use of social networking in education, the characteristics taken on by our students' Personal Learning Environments (PLE) (Castañeda & Adell, 2013), how personal learning networks are set up (Casquero, 2013), and, finally, how all this can facilitate the construction of e-portfolios that demonstrate what and how students are learning.

In the process, we help students become aware of their own PLE, encourage collaboration in the class social network, support individual learning and provide feedback (Rubia, Jorri & Anguita, 2009). A number of issues come into play here: the use of an academic social network as a collaborative environment for consultation in knowledge construction; the confluence of diverse learning resources that reveal the blurred boundaries between formal and informal settings; and the use of individual spaces for posting opinions, reading material, and text analyses (blogs, micro blogs, personal files, bookmarks, pages, etc.). All of which lead to the formation of a personal e-portfolio in which to view the knowledge built and demonstrated by students.

Now then, what processes come into play in this complex map involving a variety of learning tools? The diverse information sources and the vast potential available on Internet have enriched teaching and learning processes, while also making their analysis and evaluation more complex.

The analysis of our experience responds to the need for increasingly accurate ways of understanding how learning occurs when it is mediated by these technologies. Specifically, we need network analysis to understand the complex learning ecology faced by students in collaborative environments (Gros, 2012; Saz, Coll, Busts & Engel, 2011; Uden, Wangsa, & Damiani, 2007). This openness to the use of social networks in teaching represents a management problem with respect to the amount of student information that must be monitored and evaluated. Hence, we consider the potential of learning analytics as a tool for «peering inside» records of student activity stored on the platform.

In short, our goal is to describe and understand what happens when students use a social network as a context for carrying out their learning. By analyzing this experience, we aim to identify the type of mediation produced by the social network in this teaching proposal. To do so, we review other studies on the use of social networking in higher education and apply learning analytics tools to the social network content in the subject selected for this study. Finally, we will discuss our results in light of previous research and present our main conclusions.

2. Social networks in higher education

The penetration of social networks in Europe is a confirmed fact (ONTSI, 2011). In some circles, this has produced pedagogical enthusiasm under the assumption that using social networks in education will enable some long-standing educational goals such as greater democratization, fostered by the apparent flatness of social media (Buckingham & Martinez, 2013), and a much closer relationship be-

tween educational institutions and the social environment, to be achieved. The possible educational virtues of social networks are based on their enormous communication potential, and there is already evidence that students may respond positively to their use (Gómez-Aguilar, Roses & Farías, 2012). Some teachers argue that students are already present in social networks with their relationships and interests, and this offers an opportunity to make learning more attractive by joining informal and formal channels together (Bugeja, 2006).

In contrast to the pedagogical optimism extolling the value of these environments to encourage collaboration, content generation and meaningful learning, there are detractors who suggest that these networks produce alienation and a superficial analysis of reality. These critics also allude to privacy issues and the advertising that goes along with free usage (Zaidieh, 2012). In sum, the use of social networks continues to be controversial in the field of education (Selwyn, 2009). Most studies have shown only tangential academic achievement, which comes out in the communication that goes on among groups (Selwyn, 2009; Gomez-Aguilar & al., 2012). The study by Gómez-Aguilar and colleagues (2012) attributes this to the low value given by university faculty to interpersonal relationships. In contrast, almost 40% of the students surveyed would prefer a social network over the current university content management platform. Students use social networks to resolve their doubts, stay informed about classes, do group work and share information (Espuny, González, Lleixá & Gisbert, 2011).

Many suggest that if they want to continue to be an option for framing e-learning proposals, the next generation of learning management systems (LMS) should incorporate different forms of participation (Mott, 2010).

We have observed that most of the experiences involving social networks undertaken in formal settings have used commercial networks, which raises questions about the conditions of use. Teachers are «forced» to resort to these external «agents» in order to use a variety of Web 2.0 resources (Canole, 2010), because the LMS that continue to prevail do not respond to the emerging needs of teaching and learning. The specific environment that is selected comes along with a conception of knowledge, a particular way of defining what is private or public, the inclusion of advertising in academic spaces, and other concerns that affect the very meaning of university teaching.

Facebook is the most widely used social network by academics aiming to improve teaching methodology, create an attractive learning environment and develop communities of practice (Ractham & Firpo, 2011; Piscitelli, Adaime & Binder, 2010). However, studies have shown that using social networks in formal settings requires teacher supervision and support so that students do not feel lost in the Web (Garrison, 2005).

Due to the commercial nature of free Web 2.0 environments and their privacy problems, we opted for adapting an open source software (ELGG) (<http://elgg.org>) with social networking features where students can create content, build friend networks, as well as import and syndicate information with content sharing formats. Research involving this software tailored to specific situations of university teaching and learning (Valetsianos & Navarrete, 2012; Valetsianos, Kimmos, & French, 2013; Koulocheri & Xenos, 2013) has revealed that tension and a degree

of complexity are inherent to this topic. An interdependence exists between the pedagogical framework used in the context of the social network and the results obtained. Thus, it is not simply a question of the tool that is used, but a question of conceiving an whole ecological scheme for carrying out the processes we are studying.

3. Material and methods

The experience that we report is a «case study» of the subject of Educational Technology. It is a core subject in the third year of the degree in Education at the University of Santiago de Compostela with 58 students in the 2012-13 academic year.

To analyse this experience we used digital tools based on learning analytics, a scientific discipline whose main aim is to measure, store and analyze student activity data collected by virtual environments in order to understand and optimize teaching and learning processes (Siemens & Gasevic, 2012). With these tools, it is possible to explore what is happening in the «black box» of student processes carried out in the virtual environment of social networks through friend relationships and student blog posts. Table 1 shows the number of records generated by students in the subject of «Educational Technology».

Records	Number
Blog Posts	474
Blog comments	2,434
E-mails	1,014
Files uploaded	361

Table 1. Contents generated by the students in «Educational Technology»
(Academic year 2012-13).

With these data and friend relationships, two types of analysis were conducted to discover, on the one hand, the intensity of collaboration occurring among the students and, on the other, its degree of relevance. To do so, the following learning analytics techniques were used:

- -Social network analysis (SNA) (Long & Siemens, 2011), that examines the relationships established during the course and creates a graph to illustrate the interactions. This analysis was done with Unicet and NetDraw tools that make it possible to display interactions, i.e. friend requests, and obtain the following parameters:
 - Network density: the proportion of actual links between the nodes in the graph with respect to total possible links. This parameter indicates the intensity of collaboration.
 - Node Centrality: indicates the importance of a particular node in the social network as a result of its relationships with other nodes. A centralized network has a set of relevant nodes with which the remaining nodes establish a large number of relationships. We have considered the degree of centrality and the degree of intermediation

to be indicated by the frequency with which a node connects to two others over the shortest distance.

- Information extraction: analyzes the content of blog posts generated by students and automatically extracts the terms that characterize each of them. This makes it possible to determine the relevance of each blog post. For this, ADEGA (Lama & al., 2012) was used. This is a tool that identifies the terms that characterize a text document (blog posts in this case) and puts them in order of relevance. The relevance of a term for a given post was obtained by means of TF-IDF, a technique used for information retrieval which measures the frequency of a term in the blog post (TF) and in the other blog posts (IDF): if a term appears often in all blogs, then it is too common and is not relevant, in terms of the subject's concepts.

3.1. The Stellae Group social network

Since 2006, subjects from different degree programs in the Faculty of Education at the University of Santiago have been using the ELGG open source platform, hosted on an institutional server (<http://stellae.usc.es/red>). This is a social network that includes discussion forums, blogs, micro-blogging in a central space, user profile information, friend lists, an activity screen, personal walls, calendars, bookmarks, and pages. When a user adds content to the platform (i.e., texts, images, sounds), the user can select who to share it with by choosing one of the following options: private, friends, all platform users or public. Under the last option, the content is fully open to the network and can be shared. When uploading content to Internet, it is vitally important that students consider authorship and privacy issues.

The subject is taught in blended learning mode with weekly classroom sessions where students discuss syllabus topics or practice with a particular resource. Projects are also done in small groups that cooperate to achieve a shared aim. Then, each student makes a personal quest to show how they have resignified the concepts addressed in class and adds a new blog post or file to their personal social network with reflections on class work and outside reading. Although this is invisible and reflects the individual process of each student's knowledge construction, once uploaded to the platform the issues are shared with other classmates so that everyone can read, comment, and discuss them. The set of elements that make up one's personal environment is evaluated by the teacher using a rubric at two points in the process. In short, although e-portfolios are individual, they are carried out under social network conditions which gives the whole process a collaborative approach.

4. Analysis and results

Figure 1 shows the evolution of the student group at different times during the course. Each member is represented by a node and connecting lines showing the friend relationships between them. The arrows indicate the direction of these relationships. The outgoing arrows show the direct connections initiated by each participant, the incoming arrows show the number of relations that contact each. The red node is the teacher of the course.

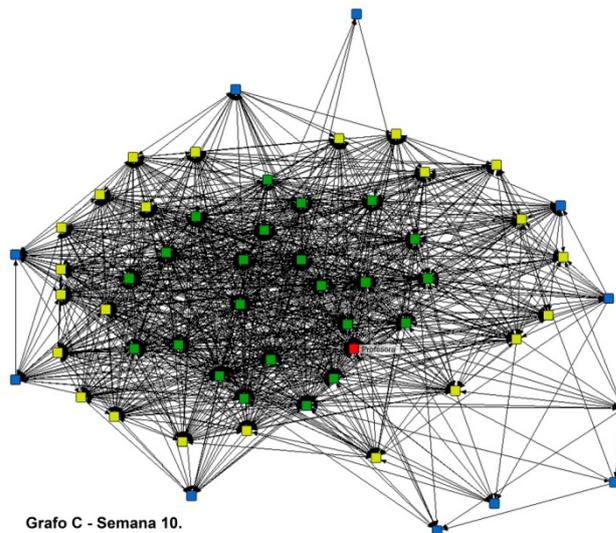
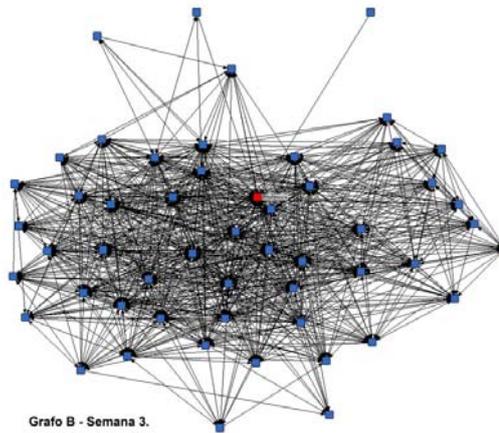
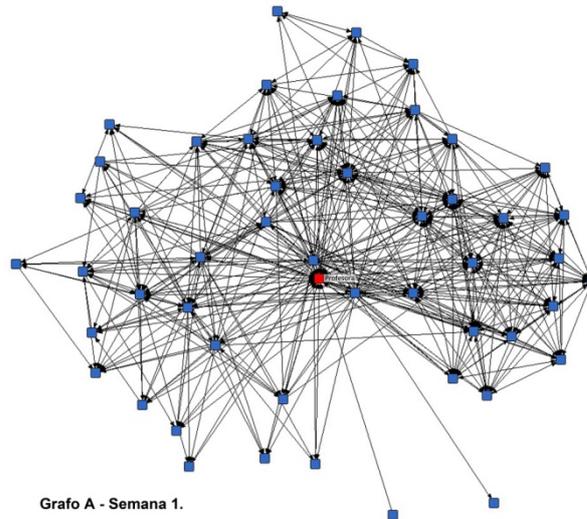


Figure 1: Evolution of the social network in the subject of «Educational Technology» in (A) the first week, (B) the third week, and (C) the tenth week of the course.

The network is a living environment that moves constantly, and relationships take shape from the first week of class (figure 1, graph A). At first, the teacher is in the middle (in red on the graph), then she gets repositioned to one side, though still within the central core. The average density is 46%.

In the tenth week of the course (figure 1, graph C) we can see a core consisting of green nodes that account for the greatest number of interactions. Surrounding this core there is a set of yellow nodes with less interactions. A third group, the blue colored nodes, is further away and has little interaction with the rest. If we remove some of the green nodes, the structure remains, but is less dense. The out-degree of centralization is 37.93% and the in-degree is 48.63%. This presents a picture showing a group of key actors with cross connections who do not depend on the work of one person. In figure 2, the teacher has been removed to see what happens. The resulting graph is similar to figure 1 (graph C), indicating there is no dependency on the teacher to maintain participation.

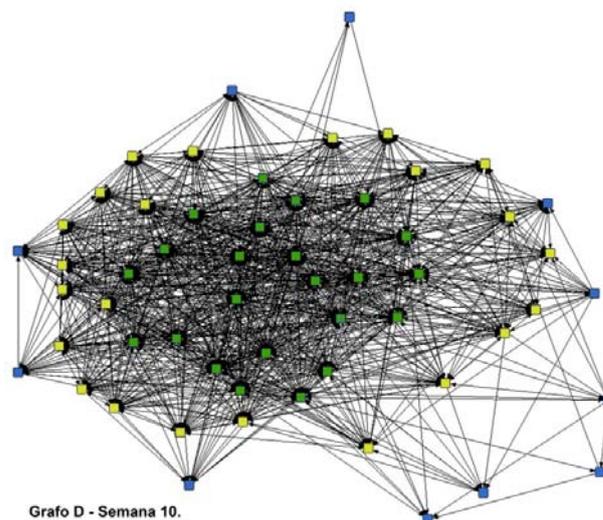


Figure 2. Social network in the subject of «Educational Technology» without taking the teacher into account.

The graph shown in Figure 2 is based on degree of centrality. The average of all friend relationships is 46.11. The maximum and minimum levels are 48 and 2, respectively. The core group (green nodes) represents students with a degree of centrality ranging from 48 to 29. The yellow nodes range from 28 to 9. The remaining group has the lowest degree of centrality, ranging from 9 to 2.

Figure 3 shows the nodes in terms of their level of intermediation. The green nodes in the center are the ones with the highest levels of intermediation (from 4085 to 1180). The yellow nodes represent students with a level of intermediation from 1045 to 0.217 and, finally, the blue nodes range from 0.200 to 0.000. In this case, the green nodes have the most links; thus, they are more independent and have more alternatives and resources. An individual with many links in the social network is said to be prominent or prestigious.

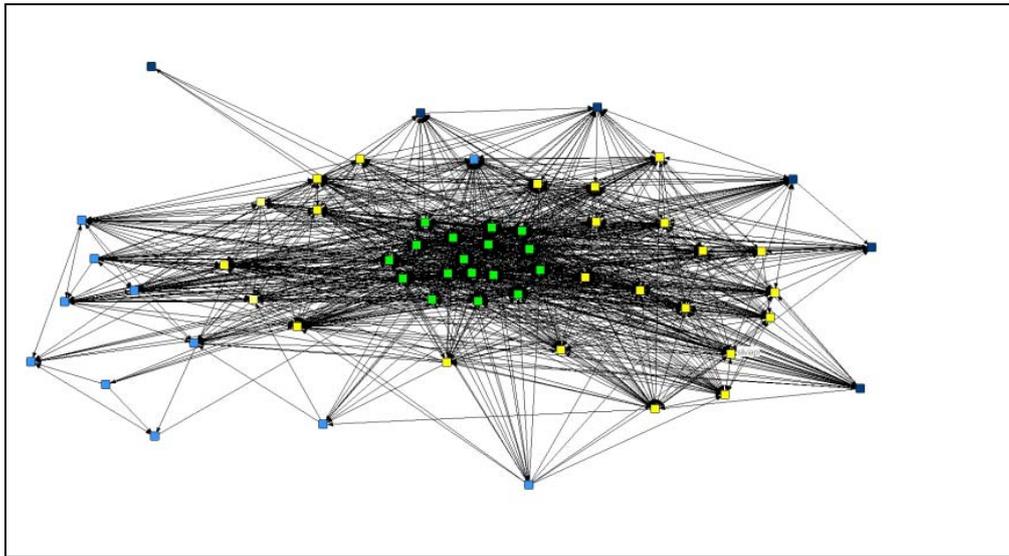


Figure 3. Social network in the subject of «Educational Technology» grouped according to intermediation.

Thus, we can see that this network has a medium density, and a significant core group with potential to influence the rest of the members. This description provides valuable information regarding network composition and features, because it makes it possible to discover which students are less involved and which are doing work that helps network density. It also helps to carry out teaching support activities such as scaffolding to help students that need it.

To obtain a more complete and thorough view of the process, a qualitative analysis of blog posts or pages would be necessary. Given the amount of information which this represents, it is very helpful to pre-select relevant entries. To do so, we applied information extraction techniques which automatically provide the terms characterizing student blog posts. If those terms correspond to the keywords that should be addressed in the blog as defined by the teacher, then student are considered to have constructed relevant content. Otherwise, these contributions are considered to be inadequate.

With this in mind, a preliminary study was carried out analyzing 474 blog entries, of which 89.87 % turned out to be relevant reflections on various topics related to educational technology. A post was considered to be relevant if it contains at least 10 keywords defined by the teacher and the relevance of those keywords is greater than 5. A low relevance threshold was chosen in order not to exclude blog posts with many keywords that are not repeated in the post itself (low frequency). It can be concluded, therefore, that this social network is not only strongly interconnected, but that it also generates valuable information.

5. Discussion and conclusions

The analysis of findings allows us to draw some conclusions regarding the study questions. First, we would like to point out the consistency and coherence of our pedagogical proposal and the use of a social network in higher education. An interdependence was found between student-centered teaching --characterized by

independent, collaborative, authentic and self-regulated learning-- and the resulting learning analytics indicators. It should be noted that the level of participation in the social network was not evaluated, nevertheless, the social network has become a substantial aid for promoting individual growth through group support (Dillenbourg, 1999). A number of other studies using this software adapted to their own pedagogical situations report similar findings (Valetsianos & Navarrete, 2012; Valetsianos, Kimmos, & French, 2013; Koulocheri & Xenos, 2013). We would like to highlight that it is not only a question of the tool that is used, but rather the interdependence of the tool and the pedagogical proposal, underlining the ecological framework within which university teaching and learning processes take place. Collaborative environments are not generated magically by the existence of a specific software. They require approaches and proposals that mobilize, sustain and enrich collaboration.

Our group presented a manifestly high degree of interaction. The density findings demonstrate that the network offered ample opportunities for collaboration and visibility. Therefore, we can trust that the content contributions and subsequent reflections are complementary and provide feedback, meaning greater and richer learning opportunities, as well as an awareness of the process. Along these lines is the research by Casquero (2013) and Wenger (1998). These interactions provide a consistent foundation that enables quality exchange and the joint construction of knowledge. Above all, they provides the social support for work, as reported by Ballera, Lukandun and Radwan (2013).

The network centralization index shows that participation was not only focused on one dominant node, but that «power» was distributed. We saw that at the beginning the teacher was the system «connector», but afterwards a core group was empowered and gained autonomy to produce exchanges and interrelations. This knowledge can spur the generation of activities that get a greater number of students to join in, which is consistent with the subject's pedagogical aims.

The density and centrality indicators are related to «teacher presence» (Garrison, 2005), which is essential for giving specific attention to those students who need more scaffolding to achieve the desired results in terms of knowledge construction.

Finally, the information extraction technique has served to filter out those posts that are not relevant to the content of the course. This filter helps the teacher to make an initial classification and facilitates the qualitative analysis of posts. The results of the exploratory study conducted using this technique demonstrate its usefulness and reveal that the content elaborated by students has a high level of relevance. This is extremely interesting given the freedom to delve into the theoretical and practical topics studied in class, which is an indicator of self-regulated learning skills. Students have set goals, done searches and carried out self-reflection processes.

The findings obtained in this exploratory study reveal the value of using learning analytics techniques to delve deeper into university teaching. These techniques can serve as lights to guide us in the analysis of the huge amount of data confronting teachers who work with e-portfolios under the current institutional conditions at Spanish universities. They enable better-informed decisions to improve

teaching and contribute to change along the line proposed by Long & Siemens (2011). Further research is necessary in this direction by means of methodological triangulation involving qualitative analysis of the teacher-elaborated records (field notes, diaries, practical assessments) and student comments and self-assessments. These records would allow us to investigate issues regarding rigor as well as autonomous, situated and authentic learning in collaborative experiences mediated by digital environments.

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