



PLEs in Higher Education: towards the iPLE Concept and Development

Los PLEs en la Educación Superior: hacia el concepto y desarrollo del iPLE

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ABSTRACT

While Personal Learning Environments (PLEs) emerged as an alternative to Learning Management Systems (LMS), today, we find that many universities incorporate their students' PLE in the institutional LMS. This kind of PLE has been called institutional PLE or iPLE and, in some cases, Personal Learning Organizational Environments (POLE). This article introduces some of the data gathered in the CAPPLE project. The project aimed to analyse the PLE of 2054 final-year university students through exploratory research. Although students today are considered digital natives, the data show that most students prefer more traditional activities, such as participation in face-to-face classes or keeping documents on their computers instead of in the cloud. Women use the Internet to communicate information more than men, and they also use social networks more to develop learning tasks. To consider the study's results, this paper presents some recommendations for higher education institutions to improve the iPLE of their students.

RESUMEN

A pesar de que los Entornos Personales de Aprendizaje (PLE) surgieron como una alternativa a los Sistemas de Gestión de Aprendizaje (LMS), hoy en día nos encontramos con que muchas universidades incorporan los PLE de sus estudiantes en el LMS institucional. Este tipo de PLE se ha denominado PLE institucional o iPLE y, en algunos casos, Entornos Personales de Aprendizaje Organizado. Este artículo presenta algunos de los datos recogidos en el proyecto CAPPLE. El proyecto tiene como objetivo analizar el PLE de 2054 estudiantes universitarios de último curso, mediante una investigación de tipo exploratorio. Aunque los estudiantes de hoy en día se consideran nativos digitales, los datos muestran que la mayoría de ellos prefiere actividades más tradicionales, como la participación en clases presenciales, y prefieren guardar documentos en su ordenador en vez de en la nube. Las mujeres utilizan más Internet para comunicar información que los hombres y también utilizan más las redes sociales para realizar tareas de aprendizaje. Teniendo en cuenta los resultados del estudio, este trabajo presenta algunas recomendaciones para que las instituciones de educación superior logren una mejora en el iPLE de sus estudiantes.

1. Personal Learning Environments in Higher Education

The PLE (Personal Learning Environment) is a relatively new phenomenon, yet one with an important trajectory thanks to the efforts in recent years that have reflected on and provided a grounding for this concept. PLEs “are not an application but rather a new approach to use of new technologies for learning” (Attwell, 2007, p. 7), so they provide spaces in which learners can take control

of their own learning by deciding which resources to consult and which actions to carry out, all of which affect how they learn online (formal, non-formal or informal). Likewise, there seems to be a consensus in understanding the PLE not as a specific site or tool to reflect the applications the users draw on, but rather as new focus on how technologies for learning are being used (Adell & Castañeda, 2010; Marín *et al.*, 2014).

Since its appearance in Higher Education the PLE concept has been developed in depth. Thus, Väljata and Laanpere (2010) state that one of the motivations for its arrival is as a response to the closed institutional Learning Management Systems (LMS).

LMS has been an important step in the evolution of distance learning, especially in higher institutions. According to an analysis of the generations of distance learning by Caladine (2008), following the fifth generation, which Taylor (2001) calls the virtual institutional campuses of processes and resources, where technology begins to form part of the institutions' fabric (Sánchez-Vera, 2012). Caladine (2008) cites the generation known as advance of the interactive environment, which included web 2.0 tools, since all the possibilities that these generated supposed a new way of understanding education. Web 2.0 tools have increased the possibilities of connecting anytime-anywhere, and specially the ability to personalize the learning experience (Torres *et al.*, 2019).

This is what sparked the view that technologies enable people to use other ways to access information that interests them and thus build up knowledge together with others. The student begins to establish other types of connections and creates a personal environment for his or her learning (Castañeda & Sánchez, 2009). This goes beyond the idea of the LMS understood as an environment in which an institution chooses the tools and resources to use, and moves towards the PLE, since the Internet can now make it possible for the users themselves to choose the tools and resources (institutional or other) they wish to use in their learning, as well as the connections to develop their learning.

Research and works in recent years (Adell & Castañeda, 2010; Buchem *et al.*, 2011; Downes, 2010) have developed the PLE concept to the point that it has acquired various dimensions and is understood today as a learning movement that goes beyond the traditional paradigms and delves into how we learn online and the relation this has with other learning contexts (Alburquerque *et al.*, 2011). PLE concept implies not only the way that a student learns, but it is also important to research into how the students learning in online environments is affected by different contexts.

This has led to a trend in recent years to study how PLEs can be incorporated into the Higher Education institutional contexts, especially universities (Coll & Engel, 2014; Marín *et al.*, 2014; Meza *et al.*, 2016; Saz *et al.*, 2015). It should be considered that, like individuals, "organisations have an identity: legal, physical and, increasingly digital" (Ravet & Atwell, 2007, p. 2).

Since the concept of PLE started from the inclusion of social software and connections created by the individual himself, it has, traditionally, focused on the "non institutional" side (informal learning). However, the philosophy of the PLE and the possibility of applying it to institutional teaching-learning processes cannot function properly if those institutions restrict the technological learning environments solely to the tools that they themselves provide (Johnson *et al.*, 2017).

This does not mean, though, that institutions have no influence in the design and development of their students' PLEs, nor that the philosophy of how we learn with PLEs cannot be incorporated into university spheres. In fact, there is a research and development specification within PLE known as iPLE (Institutional Personal Learning Environment).

According to Millard *et al.* (2011), institutional PLE can be defined as "an environment that provides a personalised interface to University data and services and at the same time exposes that data and services to a student's personal tools". The development of iPLE, like the concept of PLE, may not be related exclusively to the development of tools but rather with the integration of certain learning resources or strategies. An interesting example is Salinas *et al.* (2013), they include portfolios as a strategy for the development of an integrated system within a Moodle institutional environment.

If higher education institutions and universities have had a virtual learning environment (VLE) from years, we can ask ourselves why it is necessary to talk about institutional PLE. In this sense, Moccozet *et al.* (2012) explain that while the VLE focuses on the teaching-learning processes of students, the iPLE would also make it possible to provide institutional personality in networks.

A valid question is how the connection between PLE and iPLE works. Do they converge at certain points or are they really equivalent concepts? Davis & White (2011) offer an interesting reflection in this respect from a technological perspective: technology provided by an institution will never be personal, since the decision has already been taken by the institution as to which tools and services it will provide to its users. Ravet and Atwell (2007, p. 3) go in depth into this relation and incorporate a new term to refer to institutions' learning environments, with reference to the organizations: "an Organisational Learning Environment (OLE) is a space where individual Personal Learning Environments are connected and aggregated with other organisational

information systems into a single space, contributing to the identity of the organisation". From this perspective, the concept of OLE cannot be independent of the PLE concept since an organization cannot separate itself from its component members. On the other hand, the inverse is possible, i.e., we can develop a PLE without any institutional space. In fact, this close interaction between PLEs and OLEs is what some authors have referred to as POLE (Personal Learning Organisational Environments).

Since higher education institutions are educational organizations, it is interesting to reflect on this close relation with PLE. How do higher education institutions influence students' PLE? And, how does the PLE of the students influence the institution? What is clear is the importance of the institution's capacity to influence its members' PLEs and the possibility it has of improving its training activities and to develop transversal competencies and implement teaching and training actions that can change and enhance the digital competence of its students, which is indispensable if they are to continue to develop their PLE either within or outside the university context. Also, there are already previous studies that address the importance of deepening in the way we learn and if there is any difference around gender (Wehrwein *et al.*, 2007). It was considered that it might be interesting to know whether there are differences in the tools that men and women use on the Internet for learning, as well as whether different strategies for online learning were developed.

The emergence of social software and ubiquitous learning makes it necessary for universities to pay attention to their iPLE, as it allows them to expose institutional services, merge the personal and institutional spheres by providing iPLEs, gain greater visibility with the society using iRepositories, strengthen links with students and create collective intelligence based on data mining (Casquero *et al.*, 2010).

2. Method

The CAPPLE project (Competences for lifelong learning based on the use of PLEs: analysis of future professionals and proposals for improvement) is of an empirical nature and, following the classification of Ato *et al.* (2013), we consider it to be a non-experimental type of research of an exploratory nature that is based on the questionnaire as an evaluation tool.

3. Aim

The project seeks to ascertain the PLEs of university students and to go in depth into what makes up these environments, their peculiarities, the types of strategies used to build them and which of these are associated to formal education, while also looking for the types of shortcomings they present in cross-disciplinary education.

The project has the following specific aims: to describe the specific strategies and tools most commonly used by final year university degree students in all courses; to analyse the PLE that these students show concerning possible differences regarding sex or area of study, and to use these data to propose methodological and institutional strategies. The latter is the final aim of this paper.

4. Procedure

The process was divided into 4 research stages: (1) Design and validation of the tools used to collect data on PLEs, and the data collection strategy. Following an initial review of the literature and two rounds of expert judgment, it was considered that university students' PLE included the four following dimensions: Self-perception; Management of information; Management of the learning process; Communication. Using this theoretical model, the questionnaire was prepared and was validated according to three procedures. (2) Collection of data on PLE and analysis of the same. Once the questionnaire was complete, information was collected from all the Spanish universities. The questionnaire was emailed to direct contacts, with teachers of final year students on all courses and at all universities. (3) Descriptive and comparative analysis of the underlying PLE models. Finally, (4) analysis and forecast of the educational and institutional implications of the findings. After the preliminary reports on the results of the statistical analysis a series of organizational and pedagogical proposals were established. This work meets all the ethical requirements of our university's ethics committee.

5. Participants

The sample comprised 2054 final year students on Spanish university degree courses and the sampling was intentional. Considering the sample universe and assuming a 95% confidence interval and 50% heterogeneity,

the sampling error is 2.2%. The total comprised 69.67% (n = 1431) females and 30.33% (n = 623) males and they came from 50 Spanish universities. The data producing group was as appears in Table 1.

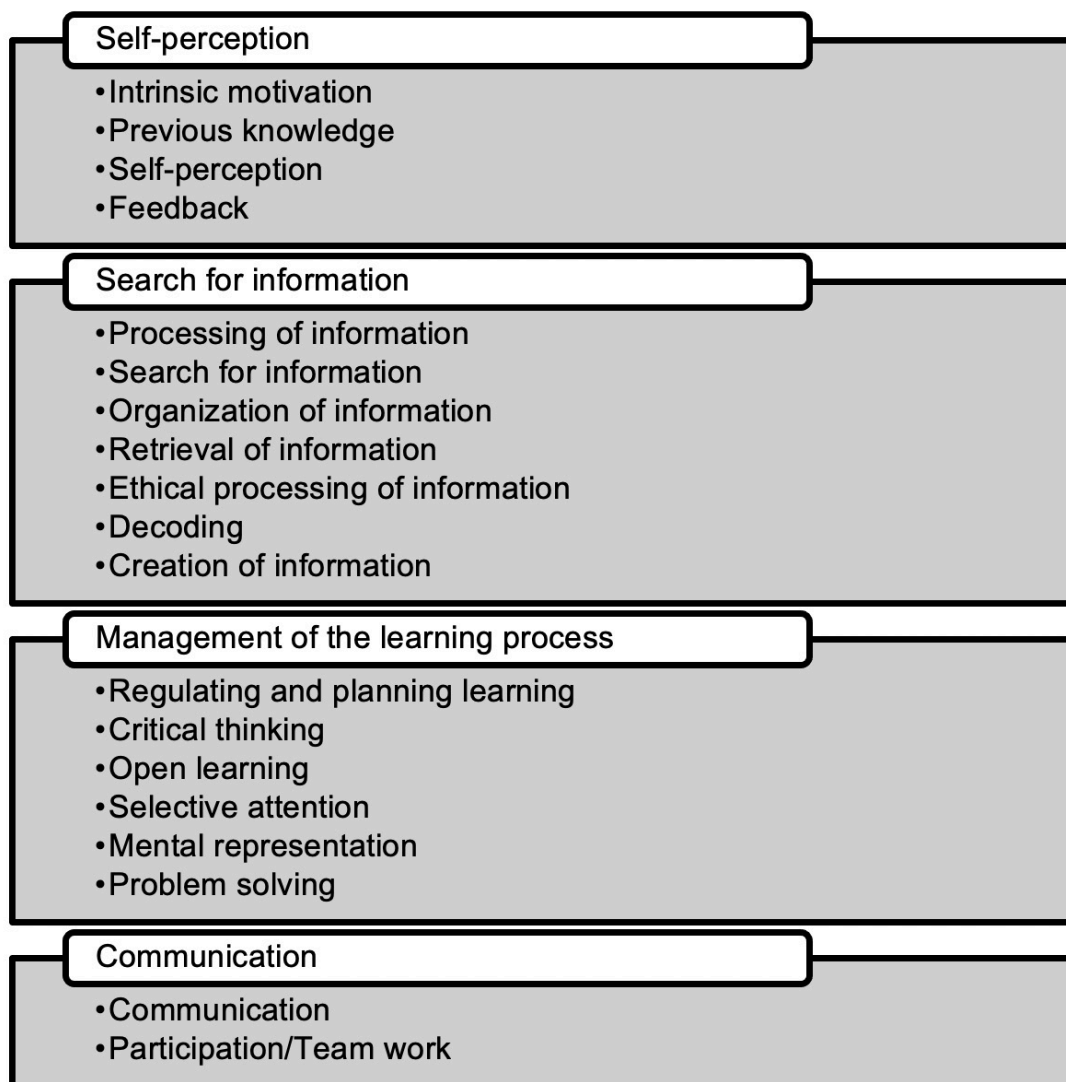
Table 1. Population of final year degree students in Spain (official data) and the sample.

Area of knowledge	Total number of students in Spain	Sample
Social and Legal Sciences	153952	879
Engineering and Architecture	78265	277
Arts and Humanities	19966	308
Health Sciences	29844	352
Sciences	16044	238

The instrument

The project used a questionnaire with items organized into four large dimensions (Figure 1): Self-perception, information management, management of the learning process and communication. These

Figure 1. Dimensions of the questionnaire.



dimensions uphold the models which make them converge: Self-regulated learning (Anderson, 2002; Midgley *et al.*, 2000; Pintrich *et al.*, 1991), communication and ICT competencies (Prendes Espinosa, 2010; Prendes Espinosa & Gutiérrez, 2013), and the concept of PLE (Castañeda & Adell, 2011; Castañeda & Soto, 2010). Prendes Espinosa *et al.* (2014) offer the definition of the process and the tool's dimensions. Three successive procedures were used in its validation: expert judgment, cognitive interviews, and a pilot test with a sample of 224 students. Prendes Espinosa *et al.* (2016) describe the whole validation process for the questionnaire and the tool itself. The tool returned a very high overall reliability, Cronbach's alpha = .944. The alpha value obtained for each of the dimensions also shows a high internal consistency of the instrument: self-perception = .861; information management = .946; management of the learning process = .885; and communication = .772.

6. Analysis

Due to the exploratory nature of the study, a descriptive analysis was carried out using frequency tables as categorical variables. Contingency tables and Pearson's Chi-Square were used for the differences in the variables relating to gender and areas of knowledge. The SPSS 24.0 statistical program was used.

7. Results

One of the aspects students were asked about related to their interest in learning. It was notable that 77.3% considered that attendance in class was always or often motivating. Specifically, females, with 80.2%, versus 70.9% for males, reported more interest, and the association was significant, $\chi^2(3, 2044) = 31.19, p < .001$. However, only 43.65% considered it was motivating to participate in talks, conferences, and sessions, with and no difference between genders. Likewise, when focusing on the communication tools as learning motivators, it is observed that students are not much motivated by Twitter, with just 26.1% affirming that it motivated them always or often. Neither did they find social networks (Facebook, Tuenti) particularly motivating, although in this case the percentage rose to 43.6%. It was observed that females (49.5%) were more motivated by social networks than males (30.1%), and the difference was significant, $\chi^2(3, 2047) = 78.78, p < .001$.

Students mainly made exploratory searches using widely used engines in terms of resources used for information searches, like Google (83.6%), and only 26.7% searched in specialized journals. The main reasons that final year students use the Internet are to access information and to be in communication, with 98.3% and 91% expressing agreement with these reasons, respectively. When using the Internet for communication, there was a higher percentage of females (92.5%) than males (87.7%), and the difference was significant, $\chi^2(3, 2039) = 14.62, p = .002$.

Another aspect which the students were asked about was credibility of the information. Only a very small percentage questioned the credibility of the information they received from experts (13.2%) or from their teachers (19.7%). In contrast, when the information came from a digital environment, many questioned its credibility. 70% considered information on social networks questionable. The figure fell to 57.2% in the case of Twitter. Information from media, both traditional and online, is also questioned by a high number (57%). Table 2 shows that males question all information more.

Table 2. Credibility of information received by sex and chi square.

	Males	Females	χ^2	C
	n (%)	n (%)		
Traditional media	421 (67.6%)	762 (53.2%)	36.63***	.132
Online media	435 (69.8%)	848 (59.3)	22.01***	.103
Blogs and websites	413 (66.3%)	845 (59%)	16.91***	.09
Twitter	368 (59.1%)	806 (56.3%)	5.88 ns	-
Social Networks	469 (75.3%)	1012 (70.7%)	33.59***	.127

Note: ns = Not significant; *** $p < .001$; C = Contingency coefficient

More specifically, it was found that students give more credibility to information recommended by an expert (89.8%) or to that which comes from various sources –articles, books, videos – online (79.6%) than to that from social networks (13.4%) or from a trending topic on Twitter (6.4%). In this regard, it is interesting that 31.1% of students give credibility to information that appears in the first positions in Google searches.

When students wish to learn something new they go mainly to blogs or websites (72%), to Wikipedia or online encyclopaedias (67.4%) or to online media (65.5%). However, they go much less to Forums (24.7%) or Social Networks (21.5%). It is noteworthy that more females (24%) use Social Networks to learn something new than do males (15.7%), $\chi^2(3, 2054) = 37.84, p < .001$.

If we focus on the tools used when doing group projects, we find that over half (64.5%) prefer Google Drive, while social network tools are used by 22.3%. Strikingly, only 8% use virtual environments like Moodle or Sakai.

In terms of organization and management of information it was found that the vast majority of students (94.7%) preferred to use folders in their computers. However, they rarely, if ever, use social bookmarkers (80.43%), wikis (79.45%), blogs (76%) or social network tools (63.68%) to organize and manage information.

When students were asked about their preferences regarding the information format that was easiest to understand, the preference was for information presented simply and often in iconic form (75.6%), in video format (65.92%) and in multimedia format (57.83%).

As a complement to their education, students expressed a preference for face-to-face courses (50.9%), followed by unpaid practical work (40.7%). In contrast, blended courses (21.7%) and MOOCs (10%) were those least chosen.

When we look at group work, almost all the students (88.1%) considered building together important. Likewise, sharing resources (88%) and interacting with others (86.5%) are valued by students when working in groups. In terms of gender, females gave more weight to interaction with others (88.8%) than did males (81.2%), $\chi^2(3, 2054) = 22.53, p < .001$. The same occurred when prioritizing building together with females giving it more importance (90.6%) than males (82.2%), $\chi^2(3, 2054) = 30.07, p < .001$.

One aspect that we consider to be key in PLEs is learning motivation. It is important that institutions consider whether the talks, conferences, and sessions they offer serve to motivate the students. In our study, we observed that only 43.6% of our sample indicated that they found this type of activity motivating, while 23.3% did not consider them to be at all motivating.

Elsewhere, the data showed that most students usually respect copyrights (78.4%), while more than half (67.5%) respect the type of license with which these are protected. The vast majority cite their sources and authors always or often (83.35%). In terms of gender, females tend, in general, to respect copyright more and cite more (Table 3).

Table 3. Respect for copyright and license type and chi square.

	Males	Females	χ^2	C
	n (%)	n (%)		
I respect copyright	418 (67.1%)	1193 (83.4%)	74.97***	.188
I respect the type of license	358 (57.5%)	1028 (71.8%)	41.82***	.141
I cite sources and authors	474 (76.1%)	1238 (86.5%)	52.3***	.158

Note: *** $p < .001$; C = Contingency Coefficient

Regarding the generation of new information for online publication, it is observed that when the majority of students wish to do this they never or rarely know how to go about it (41%), or they resort to a specific tool, e.g., a blog (37.83%). Moreover, 30% never or rarely use one type of tool or another according to the information in question (blog, social network, Google Sites, etc.), maybe because they have little expertise in the various services available online. Males (15.6%) seem to use more tools than females (11.2%), $\chi^2(3, 2054) = 16.52, p = .001$. However, the prevailing use of social networks means that 35.9% publish information on the social network they use most, although in this case it is females (38.6%) who publish more than males (29.7%), $\chi^2(3, 2054) = 17.18, p = .001$.

More than half the sample (54.14%) stated that they agreed that reading their colleagues' blogs was enriching when carrying out activities. A somewhat lower number (42.9%) stated they agreed that interacting on colleagues' blogs also enhanced their own activities. A large proportion (81.5%) are connected up with their colleagues via social networks, and more than half (63.7%) consider social networks a tool that favours

connection with people related to their learning aims. However, only 27.2% use link managers with colleagues for the joint organization of the contents of their activities.

Also, 76.6% of the sample state that setting objectives helps them to make better use of their Internet time. In terms of gender, more females (77.1%) agree with this than do males (75.4%), although the difference is not significant, $\chi^2(3, 2054) = 2.43, p = .488$.

8. Discussion and conclusions

The first objective of the research was to find out about the strategies and tools used by the students. From the data, we can observe a traditional student body that prefers to attend classes in person, that the main use they make of the Internet is to search for information and communicate, that they give more credibility to what the teacher says than to what they can find on the Internet and that they organise information in folders on their own computer and not in the cloud. This information is consistent with another research (López *et al.*, 2017, Prendes Espinosa *et al.*, 2019). It can also be observed that group work is usually organised in Google Drive, which may be related to the idea of constructing the task together as one of the possibilities it offers. It also highlights the fact that the main Google results have a higher credibility for them, as well as indicating that they respect the licences of the works. Within this student profile, it is worth noting that they tend to relate to their classmates through social networks and that reading or participating in classmates' blogs can be useful for learning.

The second objective of the project was to identify possible gender differences. The results show that women use the Internet more to communicate or interact with their peers, they are more motivated and share more via social networks, they are also more respectful of the licenses of works and are more in favour of setting goals for efficient use of the Internet. Whereas men are more questioning of information coming from the Internet or traditional media, as well as using more specific tools to publish information on the Internet, such as blogs (Prendes *et al.*, 2019).

Finally, using the data given in the previous section, a series of suggested proposals are made for Spanish universities to consider as ways of improving their final year degree students' Personal Learning Environments. These proposals fall into the next three categories.

A) Teacher training and non-formal education of students at institutional level

This category refers to the kind of training available to university teachers and to the extracurricular training activities for students. Recommendations for institutions, related to the kind of tasks demanded by students, are included.

As the findings show, attendance at class is what most motivates the students in our sample. Recent statistics on Spanish universities, centres and degrees show that of the 2723-degree courses given in the academic year 2015-2016, 113 were online and 14 were blended. The number of degrees offered in the 2018-2019 academic year was 2920, and the online universities had the highest drop-out rates.

This number is especially low, having into account that in Spain there are 6 online universities, and comparing with other countries, like the USA, where 25% of the students are in online courses at the postsecondary level (MECD, 2019). This led us to consider the need to propose that institutions increased their offer of blended and online subjects and degrees, and thus ascertain whether the preference for face-to-face classes is due to the way of teaching or to the planning of the educational action, and hence to what is expected of the students in these contexts. The effects of the pandemic on universities have highlighted the need for institutions to promote training for online teaching, improve the supply of resources and propose guidelines based on the principles of educational technology. Research such as that carried out by Penado *et al.* (2021) emphasized the lack of training of a sector of the teaching staff at non face to face universities, and the demands that a large part of the teaching staff at these universities make on the instructions and guidelines given by their organisation. Along the same lines, Nuere and de Miguel (2021) conclude that when a university is not prepared to teach online, it must change its organisational model.

Developing technological and digital competence has become a key transversal competence of initial training of professionals in all spheres of knowledge (Prendes Espinosa *et al.*, 2010). The sample used in this study can be considered as generation Y, i.e., those born between 1980 and 2000, who have grown up surrounded by digital technology, including videogames (Savage *et al.*, 2011). According to Bernal (2015), despite possessing

multitasking skills and being able to carry out quick searches for digital information and being continuously connected with others, these future professionals are probably lacking in the skills that the world of work demands most. This generation is not equipped to triumph in leadership and problem solving (Aslop, 2008; Cavatio & White, 2011). This will be the generation that will soon qualify as future professionals and towards whom universities must direct their digital competence training proposals.

The competencies reported by the students in our sample highlight the need for educational actions by the university libraries or other services that promote the development of information competence and management. The students in our sample use just one search engine (Google), so it would be convenient to make them aware of other resources for searching for information, such as scientific and academic meta-searchers or specific tools to manage bibliographies.

According to our findings, students are familiar with some tools for planning and organizing their learning, but they do not make use of them and stick to analogical methods. The difficulty does not lie in the technology or in the shortage of tools, since universities even create technologies that are adapted to the university community. So, institutions could encourage their use (with their clear advantages) by examples of good practices based on the experiences of established students who could pass on their knowledge to new arrivals. An example is the activities collected in the framework of the centres' Tutorial Action Plans.

MOOCs are an increasingly popular way of non-formal and informal learning in universities, and not only for the teachers but also, fundamentally, for the students, since they afford a series of advantages like broadening their knowledge in a specific area or interacting with other learners, and this can enhance their professional potential (Sánchez-Vera *et al.*, 2015). Even so, few university students are signing up for them according to our data. Universities should promote MOOCs to students on subjects of interest that are not covered in their courses, because, as we have seen in the results, motivation is a key aspect of the student engagement. Logically, MOOCs as informal learning activities require a strategic selection of dates when students can participate, and a clear definition of the competences to avoid overlaps, etc. Another important aspect to reduce student dropout in MOOCs is to define strategies and procedures based on learning analytics, in the terms proposed by Martínez Navarro and Despujol Zabala (2021).

Lastly, even though these skills and competencies, or the lack of them, are revealing of the profile of today's university students, it is important to deduce from them the training needs of the university teachers. In fact, an interesting study by Ordaz and González (2019) has found that the approaches to student learning are really traditional and with little use of technologies to complement their training. Therefore, in a context where students can collaborate and communicate, the institution should offer training courses to teachers on how to use interactive methodologies in the classroom. "The lecture is giving way to a whole range of alternative methodologies: cooperative and collaborative learning, problem-based learning ABP-PBL), competencies-based learning and New Age methodologies, or, among others the case method" (García & Martín, 2013, p. 605). To these we can add task-based learning, telecollaborative projects Service-Learning and game-based learning. One experience of using these methodologies is analysed in Solano *et al.* (2015). The incorporation of novel methodologies requires training on the part of teachers and students alike since they "lack the prior skills that the new methodologies demand" (García & Martín, 2013, p. 609).

B) ICT tool integration in universities

This category includes the conclusions and proposals referring to the potential of integrating digital tools into academic and curricular activities to enhance students' teaching-learning processes. Beyond the transversal educational activities of informal learning that aim to improve the students' competencies, we conceive the need for the degree subjects to incorporate technologies into their methodological planning.

Students show a clear preference for communication through tools like email and social networks. This supports what has been found in other studies (Dabbagh *et al.*, 2019), which confirms that most participants perceive that technology is effective in fostering collaboration and interaction.

We also find that they prefer contact with others through spaces that they find more natural (familiar). Thus, university institutions should advocate greater integration of social networks or tools with a social network structure for use within the classroom, and these should be appropriately linked to the virtual campus platforms or in a space apart. We are talking here about using social media to show students how to become efficient and self-regulating. Also, to acquire the basic and complex skills that are necessary in personal knowledge management, and which are essential for the creation, management, and maintenance of PLEs (Dabbagh & Kitsantas, 2012). As regards the preferred tools for collaborative projects, Google Drive stands alone. If the university is to

respond to students' needs for workspaces and collaborative online editing, it needs to study the incorporation of collaborative tools among the tools on its virtual campus, such as the one designed by Scott *et al.* (2013). Worthy of consideration are tools like that promoted in the OAE (Open Academic Environment) project, led by the Fundación Apareo.

In general, when students work individually, they tend to be more conservative (they use more popular tools, they prefer paper to the computer when writing and representing ideas and knowledge and they organize information hierarchically in folders). So, encouraging them to use technologies to search for, manage and organize information when working alone may be of interest. It may also be useful to give them training in learning to create and publish information online.

The data show that students also use the Internet to communicate and that they rate social networks positively. So, it may also be worthwhile training teachers in activities that foster student participation and collaboration strategies through these types of technological tools. The use of social networks, such as Facebook, improves the feeling of community, the educational commitment of students, and some authors even consider that they contribute to the improvement of academic results (Chugh & Ruhi, 2018; Arteaga-Sánchez *et al.*, 2019). The pertinent university services could also collect and disseminate innovative experiences through social networks and other tools to favour student participation and collaboration according to areas of knowledge.

An important number of students in this study highlighted that reading colleagues' blogs is enriching. Advocating the use of blogs in the classroom may be an interesting option for improving students' learning. Experiences like that of García and Martín (2013) on the use and wikis in a subject are revealing of the potential of these social tools for work in active methodologies.

Since students use the Internet to add to the information they receive on their degree courses, it is recommendable that the teachers select and design a variety of online resources for their students. They can draw on the services the universities provide, such as digital repositories, multimedia audio-visual repositories, Open Course Ware portal, etc. It is advisable to follow the guidelines of the 2015 UNESCO Open Educational Resources platform for Higher Education to encourage institutions to invest in the production and use of open resources in Higher Education and so improve teaching and reduce costs.

As we mentioned before, we need to promote the use of these methodologies and teaching strategies to make full use of the possibilities the peer group offers. As Wartzman (2014) says, a new education model could be developed that combines lifelong experience, training, and mentoring.

C) On the improvement of teaching coordination tasks

This section takes in the conclusions regarding the actions that can be adopted to improve the coordination among university teachers at both university level in general and at faculty and course level. Universities possess a formal organizational structure in which different relations exist among its members, who have their own conceptions and beliefs. All of this has an impact in the classroom, where the lecturer will be conditioned by them (Bolarín, 2016). It therefore becomes indispensable to improve all the coordination processes within the university since this is fundamental in improving education and the professional and organizational development (Bolarín & Moreno, 2015).

As Torrego and Ruiz (2011) point out, coordination can be understood at two levels: the vertical and the horizontal. From the former, considering that our sample of students indicated that seminars, talks, and sessions were not usually motivating for their learning, it would be necessary to use these to develop some tool to be used by tutors and coordinators to ascertain students' interests and so adapt these talks to suit them.

According to Pertile *et al.* (2016), many research works report that up to 36% of degree students admit to having copied or paraphrased sentences from the Internet without any accompanying reference. Our data show that many students do respect copyrights, but a large number do not, with males respecting copyright less. It is, therefore, necessary for degree coordinators to organize courses or sessions to train students in the use of referencing rules (APA, Harvard, Chicago, etc.) and that these be established as an assessment criterion in subjects.

Blogs are a tool that foster reflection, critical thinking, and knowledge building among students (Bernal, 2015), and it is likely that students do not make use of a personal blog until a teacher gets them to do it as one of the subject requirements. However, the isolated use of a blog in a subject is not sufficient for students to move from the analogical to the digital. Coordinators of degree courses should therefore collaborate with course coordinators and tutors to promote the creation of blogs among students which can be used, for example, as portfolios for the different subjects. The university, for its part, could create, at the very least, repositories with the links to these blogs, organized by degrees, years, and subjects. Clearly, it would be recommendable for such

a repository to be open to all. The idea is that universities do not “completely lose” the products their students generate online.

Since the role of teachers seems to be a key element, it would be interesting in future research to deepen on how teachers use these web tools or in what way they promote certain kind of learning in their students. The interaction of the PLE of the teacher and the PLE of the students (within the institution) seems to play a fundamental role that implies a more detailed analysis.

In conclusion, we could understand these three proposals (to incorporate ICT tools into the curriculum, to enhance the teaching-learning process, and to improve the teaching coordination tasks) as three fundamental goals for the institutions to get students to develop their PLE in the University, and thereby to improve their professional expectations.

9. Declarations

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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