Assessing the presence of the 'Personal Learning Environment' concept across the web domains of Spanish Higher Education institutions: a web mention study

Evaluación de la presencia del concepto 'Entorno Personal de Aprendizaje' en los dominios web de las instituciones de Educación Superior en España: un estudio de menciones web

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Abstract

The concept of 'Personal Learning Environment' (PLE) has generated considerable levels of attention among researchers and practitioners concerned with technology-mediated education. By introducing students and educators to this concept, Higher Education Institutions (HEIs) may enable their communities to make better informed decisions on the resources they use in their day-to-day academic practice. Moreover, it may help them develop autonomy as self-regulated learners and enhance their agency in lifelong learning. This article is part of a study looking at the presence of that concept across the web domains of universities and other HEIs in Spain, a country that stands out due to the amount of research on PLEs it has produced. The article presents the findings of the first phase of the study and concludes that the concept is relatively well established in the Spanish HE arena. Nevertheless, the presence of the term is unevenly distributed across the sector, as it is higher among public universities and distance education institutions.

Key words: Personal Learning Environments; web mentions; higher education; digital education; Spain

Resumen

El concepto de 'Entorno Personal de Aprendizaje' ha generado niveles atención considerables en el ámbito de la tecnología educativa. Familiarizar a estudiantes y docentes con dicho concepto es algo que puede ayudar a las instituciones de educación superior a que sus comunidades tomen decisiones mejor informadas en cuanto los recursos que emplean para el desarrollo de su actividad académica. Asimismo, es algo que puede ayudar a los estudiantes a mejorar su autonomía para la autorregulación de sus procesos de aprendizaje y mejorar su agencia para el aprendizaje a lo largo de la vida. Este artículo forma parte de un estudio que analiza la presencia de dicho concepto en los dominios web de universidades y otras instituciones de educación superior en España, un país que ha destacado por la cantidad de investigación que ha generado en torno a esta temática. El artículo presenta los resultados de la primera fase del estudio y concluye que el concepto de entorno personal de aprendizaje está establecido en el sistema de educación superior español. No obstante, la presencia del término está distribuida de manera irregular en el sector, ya que ha tenido mayor alcance entre universidades públicas e instituciones dedicadas a la educación a distancia.

Palabras clave: Entornos Personales de Aprendizaje; menciones web; educación superior; educación digital; España

1. Introduction

Lifelong learning and digitising education are two interconnected priorities for societies all over the world. In the current context of relentless socio-technical transformations that permeate each and every dimension of contemporary life, it is essential for people in all age groups to keep acquiring new knowledge and skills through their lives (Laal and Salamati, 2011; European Commission, 2020). Thus, it is increasingly important that educational institutions support their communities in the development of academic literacies that enable them to 'learn to learn' within such complex (digital) media and information ecologies.

The concept 'Personal Learning Environment' (PLE) can play a central role in such an endeavour, as it has the potential to help students – and citizens at large as (lifelong) learners – to critically engage in self-reflection around their use of technology for educational purposes. The term is used to describe "the tools, communities, and services that constitute the individual educational platforms that learners use to direct their own learning and pursue educational goals" (Educause, 2009). In other words, it can be defined as the unique assemblage of resources – understood in the broadest possible sense – that are mobilised by each individual on a regular basis to enable their learning – including tools, infrastructures, information, people, communities and institutions.

As a theoretical concept, PLE reconciles technological and pedagogical approaches to (lifelong) learning and has had a meaningful influence on the development of innovative pedagogical practices and self-regulated learning (Castañeda et al. 2022; Dabbagh et al. 2015). Moreover, it has been proposed as a way of addressing the complexity of digital and networked educational practices beyond the Virtual Learning Environment (VLE) or Learning Management System (LMS) of educational institutions (Attwell, 2007; Chan et al., 2005; van Harmelen, 2006; Wilson et al., 2006).

Empowering individuals to intentionally build and cultivate their PLE can enhance their agency in lifelong learning (Dabbagh & Castañeda, 2020) and prepare them to engage in new ways of development, both within and beyond formal education, improving their digital competence and readiness to participate in technology-mediated learning. Likewise, gaining awareness of our own PLE can lead to a better understanding of our learning processes and our own digital practices and competence (Kuhn, 2017; Laakkonen 2015).

In this regard, formal education institutions can benefit from introducing the concept to their students with a twofold purpose. On the one hand, as a way to enhance their ability to engage in formal education and make the most of technology, and on the other hand, as an early intervention to prepare students to take ownership of their learning after graduation.

Although the concept is now consolidated within the academic literature and considering its potential for students' digital competence development, there is a surprising research

gap on the overall level of attention that Higher Education Institutions (HEIs) devote to it. This paper partially addresses that gap, reporting the results of the first phase of a study that looks at the online presence of the PLE concept across the HE sector in Spain. While the term was first coined in the UK (Martindale & Dowdy, 2010; Schaffert & Hilzensauer, 2008), Spain stands out as the most active country in terms of indexed research publications on this topic.[1]

Our study looks at the presence of the PLE concept in the web domains of HEIs. The overarching research question guiding the overall study asks: "to what extent, and for what purpose is the PLE concept present on the web domains of Spanish HEIs?". In this article we focus primarily on the first part, which we unpack by answering two more specific research questions (RQ):

- RQ1: How often is the PLE concept mentioned on the web domains of Spanish HEIs?
- RQ2: What are the key characteristics of those HEIs with a higher number of web pages mentioning the concept?

The insights generated by answering those questions may have important implications for educational policymaking and practice, as they reveal patterns regarding the type of institutions that contribute more actively to raising awareness of the PLE concept; which can in turn better prepare students to effectively manage their own learning and take better lifelong learning decisions in the future.

2. Methods

In order to respond to our research question, we examined the presence of the PLE concept across the web domains of universities and other kinds of HEIs in Spain, as indicated by the quantity of web pages (i.e. URLs) mentioning the term in any of the following languages: English, Spanish and/or three other co-official regional languages in Spain. The main assumption in our analysis is that the higher the presence of the term within the web domain of a given institution, the higher the opportunities for students – and educators – in that institution to get familiar with the concept.

Web mentions, also known as web citations, can be defined as the occurrence of certain terms (e.g. titles of documents, names of individuals, organisations or products) in specific web pages or entire web domains. They are taken as an indicator of relevance or impact on organisations and wider populations. This is not to imply that the absence of a given term in a web domain inevitably means a lack of awareness or interest on the part of the people behind it, but that the fact that they mention it can be interpreted as a valid proxy for attention, commitment or, at the very least, awareness (Villar-Onrubia, 2014)

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[1] As evidenced by searches in both the World of Science and Scopus databases. According to the latter, out of 844 documents published between 2005 and 2021 that mention the term PLE, 184 were authored by researchers affiliated with Spanish universities, while 111, 89 and 68 were authored by researchers in the UK, Germany and the US respectively.

Web impact analyses typically rely on data from commercial search engines, most often retrieved by means of digital research tools "capable of automatically submitting queries to search engines and then downloading, saving, and processing the results" (Thelwall, 2009, p. 57). It is important to bear in mind that our ability to observe the online landscape by means of this technique, and to reach conclusions, is shaped by the breadth and depth of those search engines (Stuart, 2014). There are significant variations in the results retrieved by different search engines after submitting equivalent queries, and even when using the same search engine in different moments (Bar-Ilan, 2019). Therefore, analyses based on web mentions should always be treated as 'coarse' (Rogers, 2010) or 'indicative' (Thelwall, 2009). However, it is a technique that may still be extremely valuable as a way of generating an overview of the resonance of ideas across populations, especially for comparative studies looking at relative magnitudes instead of absolute measurements.

In this study we used the Lipmannian Device,[2] a tool developed by the University of Amsterdam's Digital Methods Initiative, to assess the extent to which the PLE concept is present on the web domains of Spanish HEIs. The tool can be used to research "the presence as well as the ranking of particular sources within search engine results" (Digital Methods Initiative, 2018).

Our analysis revealed which HEIs in Spain mention, on their web domains, the term PLE most often and allowed us to rank Spanish HEIs based on the level of presence of the concept as implied by this indicator. As said before and following the logic of web impact studies, we assume that those HEIs mentioning PLE more actively are more likely to have actors concerned with the topic and to transmit the importance of the concept to its community.

2.1. Data collection

Since our case study focuses on the Spanish HE sector, we queried all the web domains from that country as included into the Ranking Web of Universities. Conducted since 2004 by the Consejo Superior de Investigaciones Científicas (CSIC) – the largest public research body in Spain –, the ranking aims to be as inclusive as possible and currently covers 31,000 HEIs from more than 200 countries. Its aspiration is to include any legitimate organisation in the HE sector worldwide (Cybermetrics Lab - IPP-CSIC, n.d.).

The ranking is released twice a year and in January 2022 it included 265 web domains from HEIs in Spain. It should be noted that, despite its name, the ranking covers not only universities but also other types of organisations that deliver HE degrees, in most cases issued by partner universities.

After extracting the list of web domains, we then used the Lipmannian Device to query all those sources for URLs mentioning the term PLE in English, Spanish, and the three other co-official languages in Spain (i.e. Catalan, Euskera and Galician), both in singular and plural (see table 1).

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[2] Available at https://tools.digitalmethods.net/beta/lippmannianDevice

Table 1.
Terms included in the search

Languages	Singular	Plural
Spanish	"entorno personal de aprendizaje"	"entornos personales de aprendizaje"
English	"personal learning environment"	"personal learning environments"
Catalan	"entorn personal d'aprenentatge"	"entorns personals d'aprenentatge"
Euskera	"ikasteko ingurune pertsonala"	"ikaskuntza-ingurune pertsonalak"
Galician	"ambientes persoais de aprendizaxe"	"ambientes persoais de aprendizaxe"

Source: Own elaboration.

The Lipmannian Device was originally developed to submit queries to Google, but it is currently possible to choose from ten search engines in total. After using a smaller sample of web domains to compare the results obtained with Google and Bing, the two largest search engines available, we decided to work with the latter as it retrieved a larger number of matches from many of the queried domains.

While it is possible to use Boolean operators (e.g. AND, OR) when querying Bing by means of the Lipmannian Device, search engines are known to handle combined queries inconsistently, meaning that the number of URLs retrieved may vary depending on which term comes first in the string (Bar-Ilan, 2019). Therefore, we decided to submit the queries separately, both by language and singular vs plural.

When used in conjunction with Bing, the Lipmannian Device does not capture the original URLs of web pages mentioning the queried terms. Instead, it records web addresses generated by Bing that redirect to the original URLs. In order to unmask those web addresses and record the original URL, we used a third-party tool developed by the Data Design Group.[3]

Only after adding the unmasked web addresses to the database we were able to perform the data cleansing, a critical "time-consuming and iterative process, that includes deduplication (especially when data are collected from several sources), identifying outliers and deciding how to handle them, resolving inconsistencies, and correcting obvious mistakes" (Bar-Ilan, 2019, p. 789). We provide further details on the data cleansing process in the next section.

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[3] The CovertCSV URL Extractor For Web Pages and Text, available at https://www.convertcsv.com/url-extractor.htm

2.2. Analysis

After merging into one single database all the search results that we had collected separately – by language, singular and plural occurrences –, we then deleted duplicate URLs and made other adjustments to enable us to work with HEIs as our main unit of analysis, rather than web domains by themselves.

Firstly, we identified three campuses that, despite being registered by the Spanish Government as separate institutions, share the same branding and web domain. Therefore, we counted them as one single university. Secondly, we found three universities who owned two or more web domains included in the Ranking Web of Universities. In those cases, we aggregated all the results per institution. Thirdly, one of the queried web domains emerged as a clear outlier, being an international bibliographic database with metadata of scientific literature. Therefore, we excluded from the analysis all the URLs retrieved from that sub-domain.

After performing all the data cleaning operations, we ended up with a database of 4,839 unique web pages (i.e. URLs) mentioning the PLE concept from 100 HEIs in total. Apart from the URLs of web pages mentioning the queried terms, our database also included the titles and descriptions of those documents as recorded by Bing. In order to better understand the reliability of URL counts as a meaningful indicator, we ran complementary checks using two alternative indicators that are more specific: the number of URLs with the PLE concept in the title as well as those mentioning it in their description, as compared to those mentioning the term in only other parts of the page.

Beyond offering a general overview of the Spanish HE sector, we focused parts of our analysis on those institutions with university status as granted by the Spanish Government (Gobierno de España, 2021), meaning that they have the powers to award HE degrees. Other types of HE providers tend to be smaller organisations specialising in certain fields (e.g. business, health, education, arts and design) who deliver degrees issued by a university.

We complemented the online data with details about the nature of HEIs (i.e. public vs private) and mode of delivery of education (i.e. campus-based vs distance). Moreover, and only for universities, we also took into consideration the size of institutions as indicated by number of academics and students.[4]

Drawing on such additional attributes, we were able to answer RQ2 and look for potential commonalities and differences across HEIs mentioning the concept in their domains. To determine if statistically significant differences between the groups existed and considering the size of our sample and the fact that it does not follow a normal distribution, we used the non-parametric Mann-Whitney test.

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[4] For building these variables we complemented the data available from the Spanish Government, only for recognised universities, (Gobierno de España, 2022; Gobierno de España Estadísticas - Ministerio de Universidades, n.d.) with ad-hoc data collected by the researchers from the websites of the other types of institutions in the sample. When researchers collected data we used double blind coding and crossed the results in order to guarantee quality of these data.

2.3. Sample

In Table 2 we describe the sample of HEIs mentioning the PLE concept on their web domains, in relation to four categorical variables: nature (public vs private); mode of delivery (on-campus vs distance education), status (universities vs other HEIs). Likewise, the table includes details on the size of institutions in the subsample of institutions with university status, as defined by number of lecturers and students.

Table 2.
Description of the sample of institutions analysed

Attributes	N	%
Nature		
Public HEIs	55	55%
Private HEIs	45	45%
Mode of delivery		
Campus-based	87	87%
Distance	13	13%
Status		
University	77	77%
Other HEI (non-university)	23	23%
Size (only universities)[5]	**N**	**Mean (Std.error)**
Lecturers (full time)	74	1,721.8 (1,364.2)
Students	76	2,1762.5 (2,2327.2)

Source: Own elaboration.

The majority of HEIs in Spain who mention the concept on their web domains are universities, 50 of them public and 27 private. It is worth noting that all public universities mention the concept, while we were not able to find any mentions in the domains of only seven private universities. Among other HEIs (i.e. those without university status) mentioning the concept, the vast majority are private (18) while only five are public.

Regarding mode of delivery, we found 13 institutions mentioning the concept, out of which one is a public university (the only distance university in the public sector), five are private universities, and seven are other type of HEIs.

As already noted, beyond providing an overview of the overall HE sector in Spain, we focused parts of the analysis on HEIs with university status exclusively and used the number of students and lecturers as proxies for their size. This allowed us to gain insight

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[5] Both the Universidad Internacional Menéndez Pelayo and the Universidad Internacional de Andalucia are classed by the Government of Spain as special universities, because they only offer postgraduate studies and do not have educators in their main payroll. ESIC Universidad and CUNEF Universidad have university status but the MoE dataset does not report on their size in the academic year 2021-22. Consequently, the two latter institutions were excluded from the analysis when the number of students was taken as a variable, while the four of them were removed when the number of educators was a variable.

into the intensity of use of the concept, looking at mentions not just in absolute but also relative terms. About 1,7 million students – including both undergraduate and graduate – were enrolled in Spanish universities in 2020-21. Most of them (n=1,333,896) studied at one of the 50 public institutions in the country, while the 34 private universities attracted about 20% of students (n=345,622).

It is worth noting that there is only one distance public university in the country, catering for about 12% (n=158,326) of students enrolled at public universities. In the case of private universities, there are 5 distance education providers, which cater for almost 40% (n=132,839) of students at private universities.

In terms of academic staff working on full-time contracts at Spanish universities, the vast majority (n=64,966) work at campus-based public universities. The remaining 10% (n=7,689) work for private campus-based providers, while just 1% work for private distance education and another 1% for the only public distance education university.

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Among other HEIs mentioning the concept, the vast majority are private (18%) while only a handful are public (5%). Regarding the mode of delivery, only a minority specialise in distance education (13%).

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3. Results

Out of the 265 web domains of HEIs in Spain that we queried, 159 (60%) did not return any mentions of the PLE concept at all, while 106 (40%) domains contained at least one matching URL. As already noted, our key unit of analysis is HEIs, rather than web domains per se. Therefore, we aggregated some of the data and ended up with a total of 100 institutions mentioning the concept (see section 2.2) which are the focus of the following analysis.

Table 3 presents the frequency of HEIs mentioning the concept in a) 50 or less URLs, b) between 51 and 100, c) between 101 and 200, d) between 201 and 300, e) or in more than 300.

Table 3. Spanish HEIs by frequency of web pages within their domains mentioning the term PLE

	1-50	51-100	101-200	201-300	>300
TOTAL	71	11	13	4	1

Source: Own elaboration.

The average number of URLs mentioning the term PLE per HEI was 48.39, while the median was 14 and the mode 1. Only 5% of HEIs contained more than 200 web pages mentioning the PLE concept and the largest number of matches was 321 URLs.

Web mentions of the PLE concept can be found in the title, description and/or the main body of retrieved web pages. Table 4 shows the average number of URLs returned per HEI, along with the average number of mentions within the description and the title of web pages.

Table 4. Number of URL mentioning the term PLE (in any of the queried languages) per institution

	Anywhere in the web page	in the description	in the title
Mean (Std. Error)	48.39 (68.67)	17.89 (29.55)	2.43 (5.62)

Source: Own elaboration.

Figure 1 shows the frequency of web mentions per HEIs, differentiated by status and mode of delivery. Four public campus-based universities and one private online university returned more than 200 URLs each matching our queries. Indeed, 69,6% of mentions of the term appear in the websites of the top 15 institutions within the sample. This suggests that in Spain there is a set of HEIs very actively involved in the use of the PLE concept.
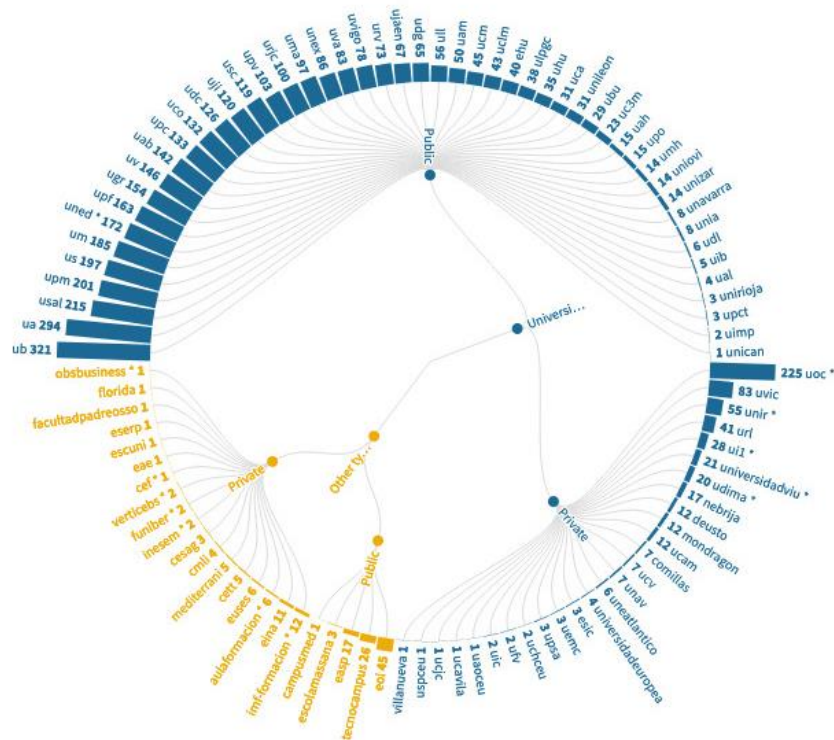
Figure 1. HEIs by number of URLs matching the PLE queries by status, nature and modality. Interactive chart available at
https://public.flourish.studio/visualisation/10459350/

The web domains of many public universities returned a large number of mentions, with 18 of those institutions returning more than 100 matching URLs each. Only nine of those institutions returned less than 10 matching URLs. The term is also present in the web domains of private universities but less frequently, with only one of them returning more than 100 URLs and 16 of them (around 60%) with less than 10 matching URLs each.

The concept seems to have generated less attention among other HEIs, as suggested by a much lower number of mentions per institution. In total, only six non-university HEIs, namely three public and three private ones, returned more than 10 web pages matching the queries.

The size of universities is a key factor explaining variations in the number of URLs with the term PLE. Table 5 shows that the correlation between the number of students, lecturers and URLs mentioning the PLE concept (anywhere, in the title and in the description) is relatively high. In Figure 2 we can observe how the larger the universities are, the more likely they are to have the PLE concept mentioned within their web domains. Campus-based universities are represented by means of a dot, while distance education ones are represented by a cross. The size of these figures represents the number of pages mentioning the PLE concept. The results of these analyses are clear but only apply to universities.

Table 5. Pearson correlations between size of the Universities and number of URLs mentioning the term PLE (in any of the queried languages)

	Anywhere in the web page	in the description	in the title
N lecturers (All)	0.54	0.48	0.37
N students (All)	0.58	0.49	0.31
N lecturers (Campus-based)	0.61	0.51	0.36
N students (Campus-based)	0.64	0.57	0.42
N lecturers (Distance)	0.16	0.38	0.97
N students (Distance)	0.74	0.88	0.55

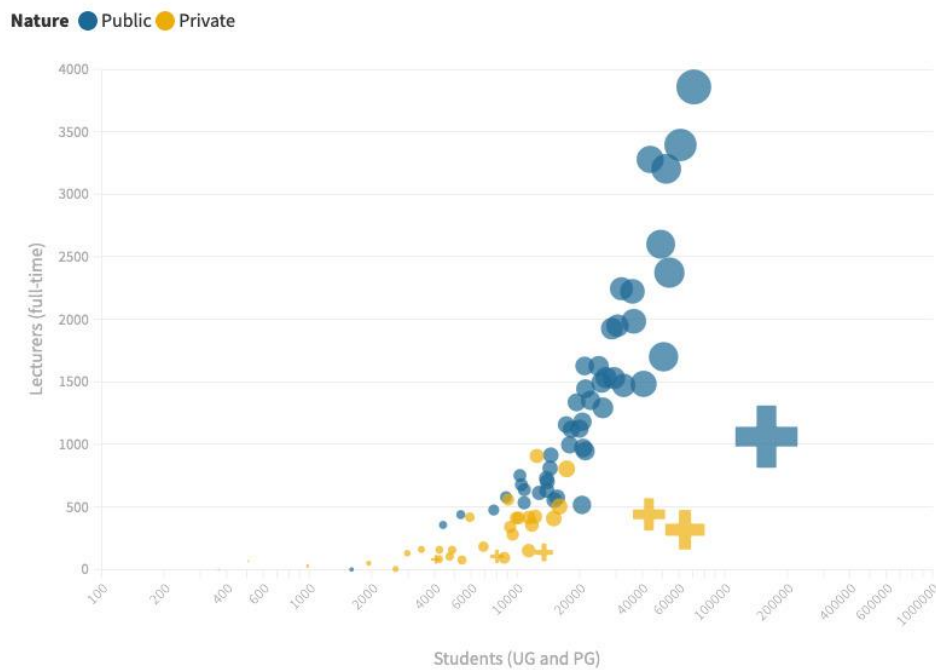Source: Own elaboration. Note: Only with data of universities reported by the Spanish Government

Figure 2. Universities by size (number of lecturers and students), nature (public vs private) and number of URLs mentioning the term PLE. Interactive chart available at https://public.flourish.studio/visualisation/10460580/

Next, we explore in more detail patterns based on the mode of delivery of teaching and learning. Table 6 presents a comparison of the number of times that the term appears in distance and campus-based institutions. The average frequency of mentions across the domains of both types of institutions is rather similar, 42.1 and 49.3 respectively. However, this scenario changes when we focus only on universities. In this case, distance

institutions mention the term more often than campus-based ones, with an average of 86.8 and 58.6 mentions respectively.

Moreover, when we compare the average frequency of mentions across the six distance universities in relation to all the other institutions, including other (i.e. non-university) distance HE providers, this difference increases and becomes significant at the 95% confidence level (Mean=86.8 vs. 45.96, z=1.934; p>z=0.05). Such a higher frequency among distance universities could be due to the central role that technology plays in mediating teaching and learning processes within those institutions, as well as more reliance of pedagogical models that promote self-regulated and autonomous work based on internet resources.

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Table 6. Different mentions of the term PLE between distance and campus-based institutions: Mean (Std.error) and results for Mann-Whitney test.

	N	Total URLs	Total URLs in the description	Total URLs in the title
Distance vs Campus (All)	13 vs 87	42.1 (71.9) vs 49.3 (68.3) z=-0.703; p>z=0.48	13.4 (20.5) vs 18.5 (30.7) z=-0.526; p>z=0.60	1.3 (2.5) vs 2.6 (5.9) z=0.024; p>z=0.98
Distance vs Campus (Univ)	6 vs 71	86.8 (89.0) vs 58.6 (72.6) z=1.312; p>z=0.19	27.3 (23.7) vs 21.9 (32.7) z=1.380; p>z=0.17	2.5 (3.3) vs 3.2 (6.4) z=0.380; p>z=0.70
Distance non-univ vs Any other HEI	6 vs 94	86.8 (89.0) vs 45.9 (67.0) z=1.934; p>z= 0.05	27.3 (23.7) vs 17.3 (29.29) z=1.948; p>z=0.05	2.5 (3.3) vs 2.4 (5.7) z=0.844; p>z=0.40

Source: Own elaboration.

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Considering the small number of distance universities and the fact that only one of them is public, we excluded this category from the analysis comparing the adoption of the term in public and private institutions. Table 7 shows that the number of PLE mentions is substantially higher in public universities. These results are robust and stand independently of the nature of HEIs (universities and non-universities). However, when we analyse the subgroup of institutions without university status the difference is non-significant as the sample is too small and the difference lower.

Table 7. Different mentions of the term PLE between public and private: Mean (Std.error) and results for Mann-Whitney test. Only campus-based institutions

	N	Total URLs	Total URLs in the description	Total URLs in the title
Public vs Private (All)	54 vs 33	74.5 (76.0) vs 8.1 (15.4) z=5.814; p>z=0.00	27.9 (35.6) vs 3.4 (7.2) z=5.129; p>z=0.00	4.1 (7.1) vs 0.2 (1.2) z=4.600; p>z=0.00
Public vs Private (Univ)	49 vs 22	80.3 (77.4) vs 10.3 (18.5) z=4.971; p>z=0.00	29.7 (36.5) vs 4.7 (8.5) z=4.106; p>z=0.00	4.5 (7.3) vs 0.3 (1.5) z=3.997; p>z=0.00
Public vs Private (Non-Univ)	5 vs 11	18.4 (18.1) vs 3.5 (3.14) z=1.573; p>z= 0.12	9.8 (17.0) vs 0.6 (1.5) z=1.565; p>z=0.12	0 (0) vs 0 (0) ---

Source: Own elaboration.

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In order to guarantee the robustness of our results, we also used an alternative metric based on the ratio between web mentions of the concept and the number of academics employed full-time by universities. It allowed us to detect different levels of intensity of usage across types of institutions, a metric that is robust to the size of the university.

The results in table 8 show that our previous analyses are robust using this alternative metric and confirm that distance universities mention the PLE concept more intensively than campus-based ones. At first glance, private universities tend to mention slightly more intensively the PLE concept, however this result changes radically when we exclude distance institutions and focus just on campus-based universities. In this case, public universities mention the PLE concept more intensively that their private counterparts, regardless of their size. This reveals that the initial difference between public and private was driven by the fact that distance universities tend to be private and disproportionally mention the concept more often. Overall, the data showed above imply that our previous findings are not simply driven by the fact that bigger universities produce more websites in general, and because of that are more likely to mention the PLE concept more often (as it would happen with any other term), and confirms that PLE mentions are linked to other institutional characteristics.

Table 8. Intensity of use. Mentions per full-time academics. Only University status

	N	Intensity
Campus-based vs distance universities	68 vs 6	0.030 (0.028) vs 0.17 (0.228) $z=3.089$; $p>z=0.00$
Public vs private universities	48 vs 26	0.039 (0.033) vs 0.046 (0.12) $z=-2.351$; $p>z=0.03$
Public vs private universities (only campus-based)	47 vs 21	0.036 (0.029) vs 0,014 (0.016) $z=-3.325$; $p>z=0.00$

Source: Own elaboration.

While an in-depth content analysis is beyond the scope of this article, being a part of our study not reported here, we will discuss some examples selected from our dataset in order to illustrate a diversity of contexts and purposes behind the use of the PLE concept. For instance, by looking at the first page of results returned by Bing from the HEI with highest number of URLs in our sample, the University of Barcelona, we can find the term being used in 1) articles of an academic journal published by that institution, the Digital Education Review; 2) a blogpost, published in the site of its lifelong learning institute, with tips on how to build your own PLE and use with students and collaborator; and 3) research outputs, such journal articles or a doctoral thesis, produced by staff and students of that university and archived in its open access repository.

In the case of UNED, the only public distance university in Spain, apart from finding the term mentioned in articles published by one of its academic journals or dissertations available from its repository, we also found it into the programme of a professional development course and a summer school aimed at educators. Within the web domain of

UOC, the distance university with the highest number of URLs, the term can also be found in the syllabus of a module.

Among HEIs without university status, EOI – which belongs to the Spanish Ministry of Industry – stands out as it has embedded the concept into its pedagogical model, meaning that it is mentioned in the programme of its courses.

4. Discussion and conclusions

Enabling students and citizens to intentionally curate their PLE may empower them to engage more effectively in technology-mediated learning and lead to enhanced autonomy as self-regulated learners (Castañeda et al. 2022; Drexler 2010). Therefore, HEIs may benefit from raising awareness and introducing the concept to both students and educators.

Spanish universities have shown high levels of interest in PLEs as an object of study and they are indeed leading the number of indexed publications on the topic, which makes the country a relevant case study. In this study we go beyond that indicator of attention to examine the extent to which the web domains of HEIs in Spain mention the PLE concept, as this offers a more complex and comprehensive picture.

Our study revealed that the PLE concept can be found in many of the web domains of Spanish HEIs. Namely, out of the 265 domains we queried, 40% – belonging to 100 HEIs in total – returned at least one web page mentioning the term in one or more of the five languages included in the study. More specifically, in the case of universities almost all the queried domains mentioned the term.

These findings suggest that the term is relatively well established in the sector, but our data also show that attention is unevenly distributed across HEIs. By means of the web mentions analysis presented in this paper we were able to identify relevant actors and reveal key patterns, which may be helpful to educational policymakers, leaders and educators interested in further promoting use of the concept.

Differentiating by institutional status enabled us to realise that mentions can be found in almost all Spanish universities' web domains, except for just a very small set of private universities (n=7). On the contrary, most of the HEIs without university status do not mention the concept in their domains. The descriptive analysis we conducted indicate that the size of universities (as defined by number of students or lecturers) works as a reliable predictor of the number of mentions (URLs) of the concept within their web domains, but other characteristics help to explain higher levels of attention.

Our data show that there are two key institutional characteristics linked to the usage of the term PLE regardless the size of the institution. On the one hand, public HEIs are more likely to mention the PLE concept on their domains than private ones, especially when we only compare campus-based universities. This could mean that institutions and actors within the public sector are particularly interested in preparing students to engage in

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technology-mediated education and self-regulated learning, as well as enhancing their autonomy and agency in lifelong learning (Dabbagh & Castañeda, 2020).

On the other hand, our results also suggest that among universities, distance education institutions are more likely to mention the concept. A plausible explanation for this could be found in the role that self-directed learning and technology-mediated interactions play in that modality of education. This result shows that despite the recent digitisation of all the sector, distance universities still play a differentiated role regarding the provision of skills for digital lifelong learning, what makes sense as their clientele is mainly made of mature students that usually are already part of the labour market (Carnoy et al. 2012).

It is important to be aware of some limitations that come with the use of data collected by means of search engines, as they always offer just a partial view of the full 'territory' (i.e. the Web) they attempt to chart. However, all in all, web mentions analyses like the one presented in this article can offer a valuable overview of the level of attention or interest generated by certain ideas across comparable organisations. Further research is needed to better understand the impact of PLEs as a concept in the Spanish HE sector and we aim to continue this venue of inquiry with a more in-depth qualitative analysis of the database we have generated.

The second part of our study will be key in order to fully understand the educational implications behind web mentions of the PLE concept, as it involves an in-depth qualitive content analysis looking at the context of usage of that concept. The high variety of online documents we found – such as learning objectives, description of continuous development programmes, pedagogical approach statements, blogs posts or interviews with experts – suggests that the term is already more than a research topic and that it has indeed permeated other dimensions of educational policy and practice. Even though such an analysis is beyond the scope of this article, we included some examples of the purposes associated with web mentions of the concept; focusing on some of the HEIs that somehow stood out within our sample.

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