Academic tasks for fostering the PLE in Higher Education: International Insights on Learning Design and Agency

Tareas académicas para promover el PLE en educación superior: perspectivas internacionales sobre diseño educativo y agencia

Linda Castañeda
Universidad de Murcia. Murcia, Spain
lindacq@um.es

Victoria I. Marín
Universitat de Lleida. Lleida, Spain
victoria.marin@udl.cat

Patrícia Scherer Bassani
Universidade Feevale. Novo Hamburgo, Brazil
patriciab@feevale.br

Araceli Camacho
Universidad Autónoma de San Luis Potosí. S.L.P., Mexico
araceli.camacho@uaslp.mx

Ximena Forero
Universidad de Antioquia. Medellín, Colombia
ximena.forero@udea.edu.co

Lucila Pérez
Universidad Casa Grande. Guayaquil, Ecuador
lperez@casagrande.edu.ec

Abstract
The concept of Personal Learning Environment (PLE) is considered as a possible lens to understand and analyse learning conditions in different educational contexts from an ecological perspective, connecting with student's agency in their learning. Previous literature shows partial approaches on how it is implemented in higher education practice, which leave a research gap regarding how it is promoted from the learning design considering student agency. It is in this space that the present study is framed. Through a qualitative approach, semi-structured interviews have been conducted with 20 faculty members from 5 different countries, to find out about the educational tasks that promote the PLE in their courses. A sample of 34 academic tasks has been analysed through a coding system based on the learning design, the parts of the PLE and the student agency involved. The results show that the implementation of tasks for the promotion of the PLE still has room for improvement, affecting aspects of assessment, the promotion of metacognition and student self-direction. As conclusions, future lines of work that can be considered in practice and research on PLE are provided.
Keywords: Personal Learning Environment (PLE), Higher Education, learning design, student agency

Resumen
El concepto de Entorno Personal de Aprendizaje (PLE) se considera como una posible lente para entender y analizar las condiciones de aprendizaje en diferentes contextos educativos desde una perspectiva ecológica, conectando con la agencia del estudiante en su aprendizaje. La literatura previa muestra enfoques parciales de cómo se implementa en la práctica educativa universitaria, que dejan un vacío de

investigación respecto a cómo se promueve desde el diseño educativo considerando la agencia del estudiante. Es en este espacio en que se enmarca el presente estudio. A través de un enfoque cualitativo, se han realizado entrevistas semiestructuradas con 20 profesores universitarios de 5 países diferentes, para averiguar sobre las tareas educativas que promueven el PLE en sus asignaturas. Se ha analizado una muestra de 34 tareas académicas a través de un sistema de codificación basado en el diseño educativo, las partes del PLE y cómo aparece la agencia del estudiante. Los resultados muestran que la implementación de tareas para la promoción del PLE todavía tiene margen de mejora, incidiendo en aspectos de evaluación, la promoción de la metacognición y la autodirección de los estudiantes. Como conclusiones, se aportan futuras líneas de trabajo que puedan considerarse en la práctica y la investigación sobre PLE.
Palabras clave: Entorno Personal de Aprendizaje (PLE), educación superior, diseño educativo, agencia del estudiante

1. Introduction

Personal Learning Environment (PLE) is a term that has been revealed as important in the educational landscape, since it appears in the international discourse almost with its current meaning around 2004 (Castañeda, Tur, et al., 2022). There are already even varied literature reviews around PLE, it has been the subject of special issues of academic journals (Bagriyanik, 2017; Serhan & Yahaya, 2022), and its impact has been particularly strong in Europe and Latin-America (Hernández, 2016).

After some discussions about the pedagogical/technological/techno-pedagogical nature of the concept, current conceptualizations consider PLE as "*a lens or framework that helps us understand and analyze from a learning ecology perspective how the learning conditions, resources and opportunities are related to each other in the current digital landscape*" (Dabbagh & Castañeda, 2020, p. 3045) […], integrating formal and informal learning experiences, and as "*a social and technological reality*" (p. 3043). In addition, recent literature connects the concept of PLE to student agency (Jääskelä et al., 2017), especially considering the shift of control and ownership of learning from educators to learners, and PLE are believed to support it in the learning activity (Castañeda & Tur, 2020; Dabbagh & Castañeda, 2020; Marín et al., 2020).

However, the concept and the use of PLE have limitations mirrored in questions as how the international community publishes about it (Hernández, 2016), and other very evident issues are related to their effective implementation. After almost two decades of the development and study of the PLE concept (Serhan & Yahaya, 2022), educational practices around the PLE development are still understudied (Castañeda, Attwell, et al., 2022). Some studies present a partial approach to the concept of PLE in different study levels, some of them focusing on the development of concrete competencies as the digital competence, the learning to learn competence, or specific approaches to teachers' professional development (Chen et al., 2021; Korhonen et al., 2019; Ramirez Ramos, 2022; Xu et al., 2020). Nevertheless, how the academic tasks are configured to foster students' PLE is not fully shared and studied (Cosgrave, 2021; Perifanou & Economides, 2021). This lack of literature on pedagogical practice regarding PLE is coherent with the lack of pedagogical approaches in Educational Technology in general (Bartolomé et al.,

2018; Zawacki-Richter et al., 2019), and makes the PLE contribution to the educational improvement just a wish in a world that is only worried about the theoretical debate.

Against this backdrop, this study contributes to this PLE literature gap by exploring the learning design of academic tasks that intent to foster students' PLE, from the instructors' perspective, in the context of higher education (HE). Providing an international view of faculty members involved in promoting students' PLE from a qualitative lens also contributes to the discussion about the implementation of the PLE concept, the learning design and the pedagogical practice of PLE, and its impact on student agency. It also provides insights into the elements of learning design that could be optimized in order to take the most of PLE approaches in higher education and, therefore, recommendations for research and practice.

2. Method

The main aim of this study is to explore how the academic tasks that faculty members implement to help students to develop their PLEs are shaped in different international contexts. To do this, the study focuses on exploring three main aspects: (1) how these academic tasks can be characterized from the learning design perspective, (2) what relationships can be established between these PLE tasks and student agency, and (3) how these tasks contribute to the development of students' PLE.

The paradigm from which we base this study is the interpretivism, considering that the PLE pedagogical practice is viewed from the human experience and cannot, therefore, objectively be known (Farrow et al., 2020). Semi-structured interviews with HE instructors as qualitative method has been chosen to deepen into the learning design of academic tasks that promote students' PLE and related student agency.

2.1 Sample

This exploratory study uses a mixed purposeful sampling method (Shaheen et al., 2019). Tasks developed by faculty members from five different countries and educational contexts were included in this purposive sample (Yin, 2010) to try to obtain a broad range of perspectives on the subject of the study, to mirror different notions and conditions to develop PLE, and different approaches to the impact of the implementation of this concept in the real HE process. Nevertheless, an intensity sampling – non-extreme experiences - was used to select the participants from 5 countries from the Latin-American area and Spain (Onwuegbuzie & Collins, 2007), considering that Europe and Latin-America are the areas with the highest impact of the PLE concept (Hernández, 2016). The five countries included in the sample were chosen as an opportunistic sample (Shaheen et al., 2019), understanding that the goal of this study is not to generalize, but to explore and provide international insights that would contribute to this line of research, which would be complemented by other studies in the future.

In each context a criterion sampling was implemented (Shaheen et al., 2019). Four participants were selected based on three basic criteria: (1) currently teaching in a university or HE institution, (2) declare to carry on academic tasks to develop student's

PLE, and (3) officially rewarded or well recognized by their educational community for their digital pedagogical innovation activity.

It is important to remark that the sample of this paper is constituted by the HE instructors, and that they selected the tasks that they considered as more important to develop their students' PLEs. Even if such a subjective selection –dependent on the individual– would be understood as a limitation because of making the possible range of tasks studied too wide; nevertheless, this is precisely part of the interest of this study. This individual subjective selection of the tasks that each instructor considers as more relevant to develop the PLE enriches the possible variety of the sample of tasks that this study includes and give us a more accurate opportunity for exploring the current situation of the PLE implementation.

Considering this, the 34 HE academic tasks included in the sample of the study came from 20 faculty members (17 women and 3 man), from five different countries: Brazil, Colombia, Ecuador, Mexico and Spain. These instructors have an average of 15.25 years of teaching experience (min. 2, and max. of 34) with 70% of them (n=14) having a specific level of education related to Educational Technology (9 are PhD on Educational Technology or similar, and 5 have a master's degree). The remaining 30% (n=6) includes: two engineers (one with a master and one with a PhD), and 3 Education PhD holders and one with an Educational Master (these "Education PhD or Masters" mentioned are not directly related to the impact or use of technology in education). They worked on 15 different HE institutions.

2.2 Data collection instrument

The interviews were designed *ad hoc* for this study in Spanish and translated into English and Portuguese - in this case, simultaneously -, and included three basic sections. An initial section was focused on the participant's professional overview with a series of background questions (Hatch, 2002) centered on their professional and demographic conditions (Initial training/qualification, current level of education, years of teaching experience, and years of seniority at the current affiliation), which help us to identify expertise and build rapport. A second section of the interview was focused in the PLE centered academic tasks they develop, and a third part explored the faculty members' perception about other aspects of the development of the PLE in HE.
The second part of the interview, which is the object of the current study, includes a general open-ended descriptive question (Hatch, 2002) that asks the participant to create a narrative about two of the tasks they carry out to help students develop their PLEs:

> "*In the context of your teaching, we know that you work with students to develop their Personal Learning Environment (PLE) and we would like you to tell us a bit about this. How do you do this? Could you tell me in as much detail as possible about two examples of teaching activities you carry out with your students that you think help to develop their PLE?"* (Interview guide, section 2, question 1)

In addition, and complementary to each of the stories, they are asked some structural questions (Hatch, 2002) that deepen their vision of each of the tasks:

(1) How many times have you implemented them (years, course's versions, courses)?
(2) Why do you think this exercise fosters the PLE of your students?
(3) In any of the courses that you use this type of pedagogical strategies, is the PLE a concept that is part of the contents of that course?

2.4 Data analysis

Among the researchers of this study, there was a standardization of questioning and a schedule co-developed prior to the interviews. The full interview took on average approximately 70 minutes.

Interviews were held during January and February 2022, and all the interviews were carried out by videoconference - except from one that was conducted in presence - and were recorded. Researchers closer to the faculty members' context were in charge of doing local interviews, and the interview was carried out in the faculty member's and researcher's mother tongue to maximize participant's comfort and ensured some flexibility associated with context – mainly in Spanish, except for Brazilian faculty members, which was done in Portuguese. All interviews were coded directly from their recording and the digital treatment adhered to ethical requirements (Ethics Ref. 2897/2020, University of Murcia). In order to identify each task of the sample to analyze it, participant's names were anonymized and each of them was given a number, followed by the number of the task (e.g., 1.1, 1.2, 2.1, 2.2, etc.).

A first cycle of descriptive coding on each interview was developed by the same researcher that conducted the interview to maximize the complementarity of the narrative of the participant with the notes of the interviewer. This coding was based on the research questions (learning design of academic tasks / relation to student agency / student PLE's development). After this first coding, a second simultaneous coding method (Saldaña, 2015) that used a deductive concept-driven approach was used in all the interviews. For this second cycle of coding, the researchers' team collaboratively developed the code-frame (Benaquisto, 2008) before viewing the data, based on research questions and main topics (See final code-list in Appendix 1 and an example on how the categories, codes and subcodes were developed in the Figure 1). The analysis' framework is detailed below.
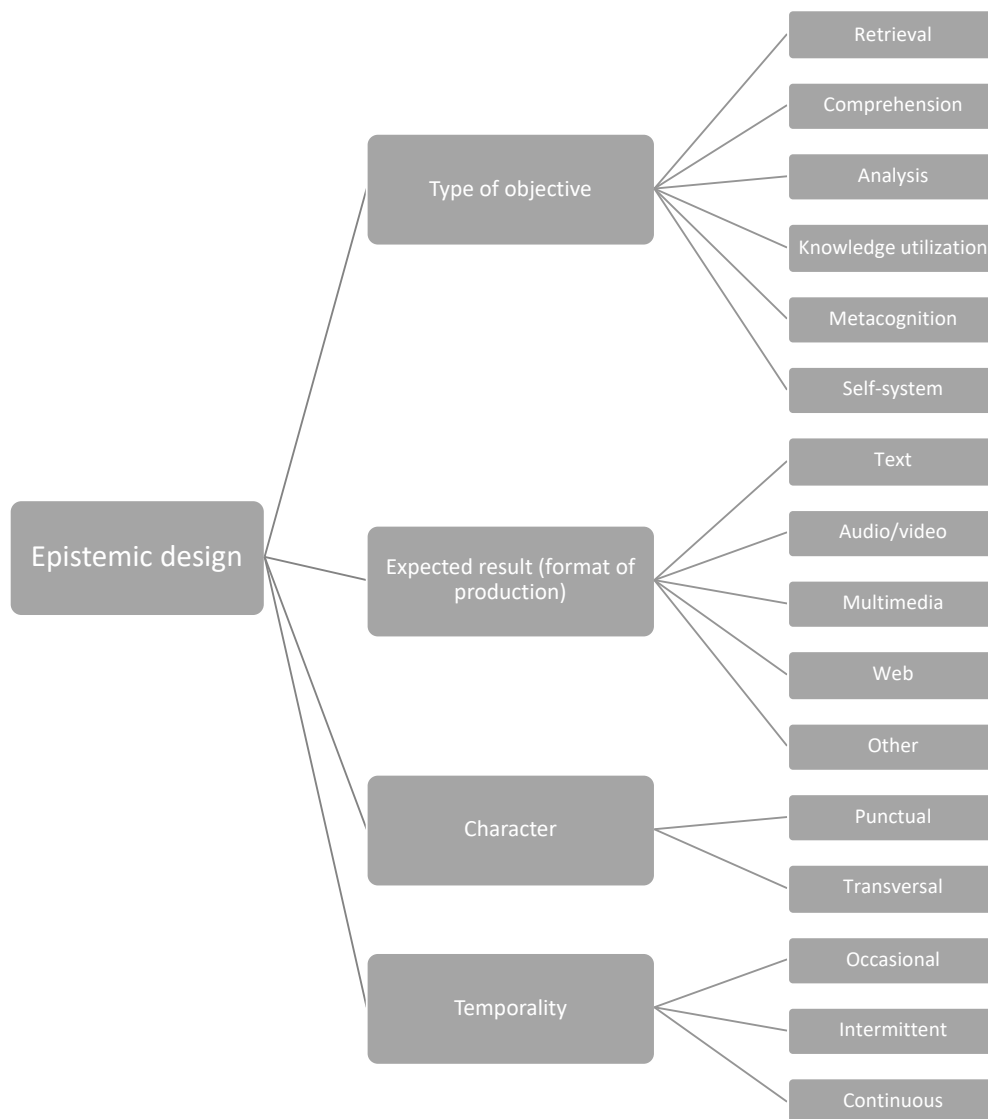
Figure 1. Epistemic Design Code-frame

The results have been organized in a narrative way following the research questions.

2.5 Analysis' framework

Taking into account the research questions, and in order to analyze the interviews, three main foci have been considered: learning design, the PLE contribution and student agency.

● **Learning design**

Based on the ACAD (Activity-Centred Analysis and Design) framework developed by Goodyear and Carvalho (2014), three main aspects of the learning design were analyzed in the interview data: the epistemic design (tasks), the social design (division of labor)

and the set design (tools and physical resources). In this framework, "activity" means "what students are actually doing" and cannot be designed, instead emerges from those three elements related to the learning design and is situated (Goodyear et al., 2021).

The tasks' *epistemic design* has been analyzed differentiating some main aspects. Firstly we have analyzed the kind of goal pursued in the task, by following the Marzano and Kendall's taxonomy (2006) that differentiate 6 levels, four of them are included in the cognitive system, (1) Retrieval, (2) Comprehension, (3) Analysis, and (4) Knowledge Utilization; one for the metacognitive system, (5) Metacognition, and a final one included in the internal system, (6) Self-direction. Moreover, the analysis of the epistemic design of these tasks included the expected format for the product (or artefact) that students created (McCarthy, 2015), if any: Text, Audio/video, Multimedia, Webpage or others. In addition, the tasks where characterized, regarding how they appear in the course – One-off (in a concrete moment) or transversal (during the whole course)–, and how frequently they were developed in the course –occasional (just once in the course), intermittent (occasionally) or continuous.

Also, the assessment of the tasks is considered as a crucial part of the epistemic design. For analy¡zing it, categories were identified for the assessment element as pointed out by Pimienta (2008). This task is not exclusive to someone in particular during this process, which is why, according to the intervening agents, they are defined as self-assessment, co-assessment and hetero assessment. The tasks were also categorized by the time the assessment mechanisms were carried out, such as continuous, initial and final (Castañeda, 2019). In addition, Barberà (2016) recognizes a first influence in the assessment: "*the motivational influence, and it refers to the tension recognized in the students as soon as their results have a social impact*" (p. 10). Based on that premise, the weight in the assessment of the tasks proposed by the faculty members was categorized, whether they had a percentage in the final grade of the course or in a fraction of the final grade of the course. When doing the analysis, responses from tasks that had no weight were also identified, which is why a section was added to classify them and give an option to those that had little weight or were presented under some special situation. Finally, the assessment is seen from the reflection that is fostered through some methodological approaches with specific instruments and methods such as the portfolio; for this reason, a categorization was made to identify this range of possibilities in the activities carried out by the faculty members.

Social design refers to proposals about ways students may work with their peers (Goodyear, Carvalho, & Yeoman, 2021). To analyze the social design, we used 3 initial categories related to the type of interaction: group work, individual or pair work (Goodyear, Carvalho, Yeoman, et al., 2021). Two additional categories were also created according to the supervision characteristics derived from the social design: autonomous work and group work (Adell & Castañeda, 2015). Two more categories were added in relation to the possibility of choice given to the student for social interaction in the activities: by student choice or by instructor's assignment (Castañeda & Tur, 2020). Finally, 4 more categories were added to address the establishment of roles during social interaction, based on what was proposed by Goodyear et al. (2021): with roles, without roles, with roles defined by the students, with prescribed roles by the instructors.

Regarding the *set design*, and concretely the tools, was analyzed using three categories: type, access mode and business model. The type comprises a set of tools based on the same characteristics in relation to their functions, and it was organized according to their description on the popular list Top Tools for Learning (https://www.toptools4learning.com/). The access mode refers to the way we can access the tool (online or offline by download). The business model considers the availability for the use of the tool, with five different types: a) the limited free version business model which allows only limited use (resources, functionalities, and so on); b) the platform model to which everyone has free and unlimited access; c) the subscription model which offers different kinds of access according to different prices; d) free version; e) open source.

- **PLE contribution**

For analysing the tasks' contribution to the students' PLE, it was first highlighted whether the PLE was part of the content of the course. Once this was clear, the instructors' testimonials were analyzed using the 3 main PLE areas identified by Attwell (2007) as crucial for learning, which are included as main parts of PLEs in Castañeda and Adell (2013): (1) Reading, collecting and decoding new information, (2) Re-elaborate-reflect-recreate information, (3) Discuss and debate (also related to the personal learning network). With the ambition of capturing those tasks that foster the Metacognitive action of thinking and reflecting on the PLE itself, the analysis included it in a fourth category (4).

- **Student agency**

Student agency in the HE context is understood as "*access to (and use of) resources for purposeful action in study contexts, i.e. personal, relational (i.e., interactional), and context specific resources to engage in intentional and meaningful action and learning, as experienced or interpreted by students*" (Jääskelä et al., 2017, p. 2067). The aspects of the learner's agency that are enhanced through the task have been categorized as follows (Jääskelä et al., 2017): (1) Personal resources (e.g., self-efficacy, beliefs about own competence, intentionality, intrinsic motivation etc.), (2), Relational resources (e.g., equality/equity between learners, reciprocal teacher-student relationships, peer support, safe learning environment), and (3) Contextual opportunities (e.g., the learner can make choices between different possibilities, can influence course progress or participate reciprocally in teaching, etc.).

3. Results

Thirty-four (34) academic tasks were finally collected in the data collection process. Although each participant was asked to provide information about two tasks, 6 of them only provided enough data about one task. Half of the tasks are delivered in undergraduate programs related to education, and the other are included in a variety of programs that includes Philology, Gastronomy, Digital Design and International Commerce, Computer

Science, Journalism, Medicine, Management, Actuarial Science, Administration or Fashion Design. The final distribution of tasks by country can be seen in Figure 2.
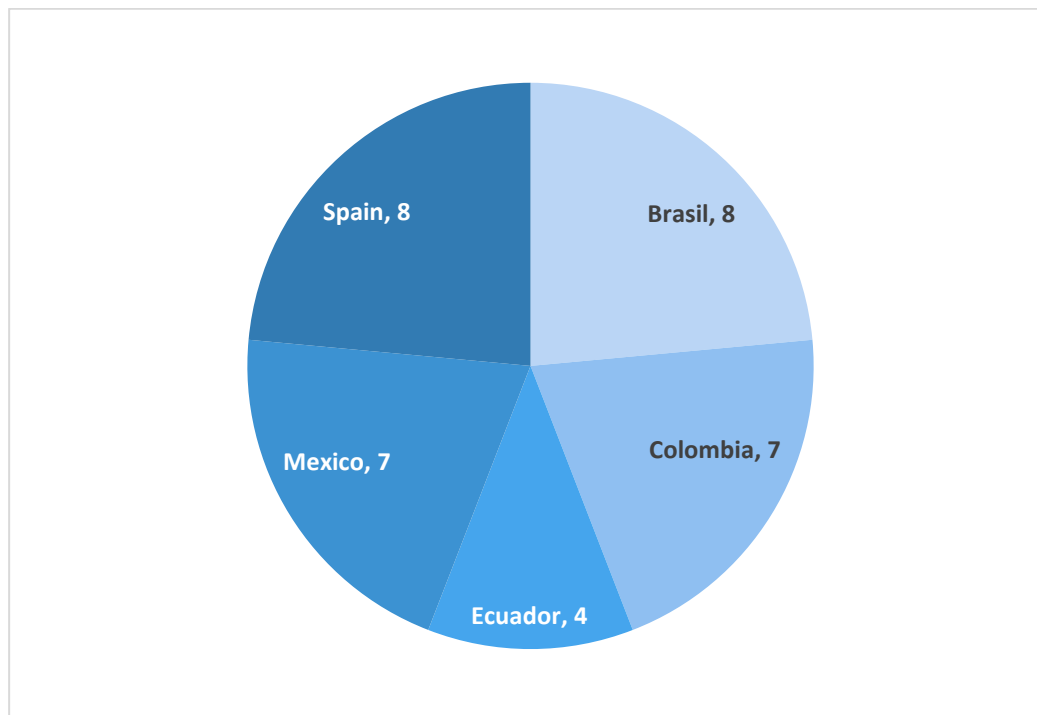

Figure 2. Distribution of the tasks sample by countries.

As mentioned above, each participant decided which tasks they wanted to share with us and characterize. They were asked for tasks that - in their own opinion - help students to develop their PLE, whether or not they included the PLE topic or the term PLE in the task itself or in the course that framed them.

3.1 Learning design of PLE Tasks

As previously explained, to understand the type of activities (*epistemic design*) that the faculty members declared we used the Marzano and Kendall's Taxonomy, which includes not just the "cognitive system", but also the "metacognitive system" and the "self-system" as levels of processing competencies (see Table 1).

In general terms, over the half of the tasks declared by the faculty members (n=19) are focused on delivering the level of processing called "Knowledge utilization". It means that they are focused on "decision making, problem solving, experimenting and /or investigating" (Marzano & Kendall, 2006, p. 51). This level is conceived as the higher level of processing for the cognitive system and includes skills from the three previous levels. Consequently, in most of the cases (n=11), this utilization of knowledge is the only goal of the task:

> "*We ask them to choose an example of an advertising campaign and to make a connotative and denotative analysis [...], that is, an objective and subjective analysis describing that advertising campaign. And then we ask them to try to*

create an artefact, in a counter-advertising format, [...] to create their own counter-advertising campaign." (Task 1.1, Ana)

Ten tasks include actions related to the "metacognitive system" (level 5, metacognition), which means that the tasks are related to "specifying goals, process monitoring, monitoring clarity and monitoring accuracy" (Marzano & Kendall, p. 53). In one of the tasks, the metacognitive system is included as the main –-and only-– goal of the tasks:

"*With this task they explain the reflective part of what I have contributed to the group, what I have done for the group, what it has done, what I have learned.*" (Task 16.2, Paula).

In other tasks, the goals related to metacognition are combined with other goals, three times combined with level 4 (knowledge utilization), two with level 3 (Analysis) and one task includes level 2 (comprehension) and metacognition, together.

It is interesting to remark that level 6, regarding the self-system thinking, which is directly related to the development of self-direction in students (i.e., examining importance, emotional response, efficacy, and overall motivation, see Marzano & Kendall, 2006), has been delivered in six of the declared tasks. In every opportunity, the tasks that included level 6 did it with other levels of processing. In three occasions the task included levels 5 and 6, altogether:

"*Students are asked to graph their own PLE… … They draw it, share it through technological mediations and conclude through guiding questions to see the individual views from a socialization… ...Step by step … … Presentation of the concept, what it includes, invites them to include in the graph certain items based on the theoretical recommendations, to do it by hand and then share it by Classroom and WhatsApp, together with 3 guiding questions for reflection. She [the instructor] shows them examples. Then comes the conversation based on the graphs and the answers to the questions.*" (Task 4.1, Diana)

In other three tasks, level 6 appears combined with level 4 and 5 at the same time:

"*We are interested in what is uploaded, but, above all, we are interested in how they connect this incorporation into the PLE with their own teaching competence at a digital level and, above all, the analysis and reflection they make on this production in relation to their identity and their professional future as a teacher.*" (Task 2.2, Bruno)

Only one task analyzed is focused only on retrieval (level 1), and just three are focused only on Comprehension, level 2 of the cognitive system (i.e., integrating and symbolizing).

Table 1.
Tasks according to type of goal (N=34)

Level	Type of goal (according to Marzano & Kendall's taxonomy)	Number of tasks
1	Cognitive system: Retrieval	1
2	Cognitive system: Comprehension	8
3	Cognitive system: Analysis	9
4	Cognitive system: Knowledge utilization	19
5	Metacognitive system: Metacognition	12
6	Self-system: Self-direction	6

Note: Some tasks covered more than one type of goal; therefore, the total surpasses the N.

Considering the format of the production, all formats were represented through the tasks' sample (see Figure 3), including textual artefacts (n=6), video or audio (n=4), the creation of a webpage (n=4) or the creation of a multimedia (n=7). Remarkably, 17 tasks leave open the possibilities for students to create the production in the format they decide depending on the decisions they take in the task.
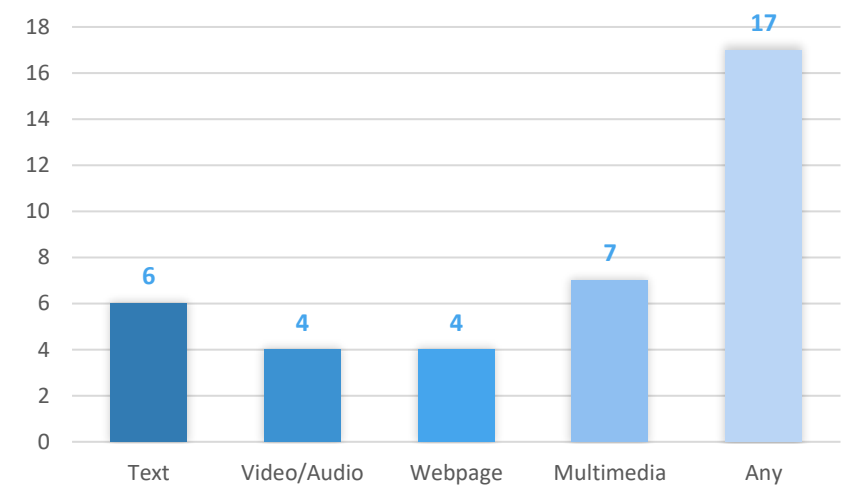
Figure 3. Format of the production (N=34)
Note: Some tasks included more than one format; therefore, the total surpasses the N.

On the other hand, regarding temporality, many of the tasks explored in the interviews (n=24) were mainly one-off, which means they are not subtasks in the whole course or included in the other tasks of the course. The others are considered transversal, as they "affect" all the other tasks of the course in different ways. Nevertheless, regarding time scheduling, it is interesting to remark that 22 of the tasks happened during the entire course, and 3 of them intermittently. Just 8 of the tasks studied are clearly occasional and just happened once in the course.

Regarding how the tasks are assessed, most of them refer to a continuous or formative assessment and it is predominantly done by an expert (the faculty member). Following the explicit declaration of faculty members, 10 of the tasks just included expert assessment processes in the task, 3 were assessed using a self-assessment process, and

one was assessed using just a peer-assessment technique. Two (2) tasks combined expert and self-assessment techniques, and other 2 included expert and peer-assessment, whereas 2 tasks included the three techniques as complementary to each other.

Tasks were mainly assessed using rubrics (n=7), and some others used checklists and scales (n=5):

> *"Assessment rubrics and checklists are used. Overall, the strategy is weighted 5 points out of 10 in the final grade."* (Task 6.1, Fiona)

> *"Classroom projects are explosions of student creativity. I share with them the rubric of what I am going to assess when I give them the instructions."* (Task 7.1, Gabriel)

The tasks have different impacts on the final grade of the course. Around 41% of them (n=14) had a direct impact on the final grade by their own, and others involved a percentage in one of the parts that is accumulated in the course's final grade. Five (5) of the tasks analyzed did not have any impact on the final course assessment:

> *"It was only to do a review of the midterm in the course and provided extra points for the winners of the first three positions in the application at the time of the task"* (Task 10.2, Jane)

> *"The use of the PLE is not part of the course assessment. It is used as a support strategy. Students' interaction was assessed with 60% of the final grade (discussions and group work)"* (Task 3.1, Carla)

Regarding the *social design*, faculty members declared in 11 tasks that students worked autonomously, in one that students worked individually, and instructors explicitly declared in 12 tasks that students worked in groups:

> *"We emphasize throughout all the tasks that everything, before anything is presented, is reviewed by all members, that it is not enough to divide up the work, but that there has to be a discussion about it."* (Task 1.1, Ana, group work)

> *"we have [...] defined the development of the PLE as essentially an individual production. Probably because the origin was not so much in the idea of a broad PLE but in the idea of a portfolio. That doesn't mean that we can't do tasks where there has to be that kind of interaction, of course not. But at the moment there isn't."* (Task 2.1, Bruno, individual work)

Regarding the use of performance roles, just in 2 tasks faculty members declared they have prescribed compulsory performance roles. Nevertheless, in one case the faculty member commented:

> *"We do not ask them to organize themselves into roles, but we do explain the importance of organizing themselves into roles."* (Task 1.2, Ana)

Concerning the *set design*, half of the tasks (n=17) involved a mix of tools, but some tasks were performed using only one tool (n=8). It is also interesting to highlight that only 2 of the 26 tools mentioned in the interviews have additionally an offline version to download, apart from the online version (cMap and GeoGebra) and only 2 are open source from the perspective of the business model (Moodle and GeoGebra), being the norm the tools with limited free version and subscription (see Table 2).

Table 2.
Analysis of set design based on tools

Type	Description (https://www.toptools4learning.com/)	Tool	Access mode	Business Model
Graphic tools	graphics tool	Geneally Glogster* Canva	Online	Limited free version and subscription
	mindmapping tool	cMap*	Online & download	Free
Online board	organize content on bulletin boards	Padlet	Online	Limited free version and subscription
	online whiteboard	Jamboard	Online	Free
Website	blogging/website platform	Wordpress	Online	Limited free version and subscription (open source with own hosting)
	website development platform	Wix Google sites	Online	Limited free version and subscription
Virtual learning environment	learning platform	Moodle	Download	Open Source
		Google Classroom Schoology*	Online	Limited free version and subscription
	video meeting platform	Flipgrid	Online	Free
Social networking sites	photo sharing	Instagram	Online	Platform
	microblogging	Twitter	Online	Platform
	curation platform	Pinterest	Online	Platform
	live engagement tool	Kahoot	Online	Limited free version and subscription

Type	Description (https://www.toptools4learning.com/)	Tool	Access mode	Business Model
Engagement tool	google slides add-on designed to help teachers create engaging slide show-style content	Pear Deck	Online	Limited free version and subscription
Survey tool	online forms/survey tool	Google Forms	Online	Limited free version and subscription
Messaging	messaging app	Whatsapp Discord	Online	Platform
File sharing	file sharing platform	Google Drive OneDrive	Online	Limited free version and subscription
	video hosting and sharing platform	YouTube	Online	Limited free version and subscription
Specific applications	tools for geometry and graphing	GeoGebra	Online / Download	Free - Open Source
	English learning platform	Write & Improve*	Online	Limited free version and subscription
	online platform developed to help HE instructors implement peer feedback	Synergy	Online	Free

*These tools are not included in Top Tools for Learning.

However, there is a group of tasks where the faculty members did not inform about the used tool (or commented just on suggestions), because the students can choose it for the task (n=9):

> "*I don't concentrate as much on the type of the used tool, but I focus more on the learning goals, on things they need to develop from the point of view of competences and abilities.*" (Task 17.2, Rose)

In some tasks, the faculty members commented that they indicate some tools, but leave the choice for students, for example:

> "*The premise is that they can make the concept map with whatever they want. The tool does not matter at all. We recommend them to use Cmaptools because we are used to it. In fact, sometimes we negotiate, or they try to negotiate. We say "do as you like, it's not a problem. I don't recommend you, [for example], to do it with Word, because you're going to suffer a bit, but well, if someone wants to do it with Word... that is ok; the tool is not interesting.*" (Task 2.2, Bruno)

3.2 Agency

In terms of student agency, almost half of the tasks developed in order to promote students' PLE include at least one element (n=16) or two of them (n=15). In 3 cases no student agency components were identified in the tasks.

The most frequent student agency component detected in the tasks were contextual opportunities (n=30), and concretely concerned to be able to choose among different possibilities (see Figure 4). This was also specifically asked for during the interviews.
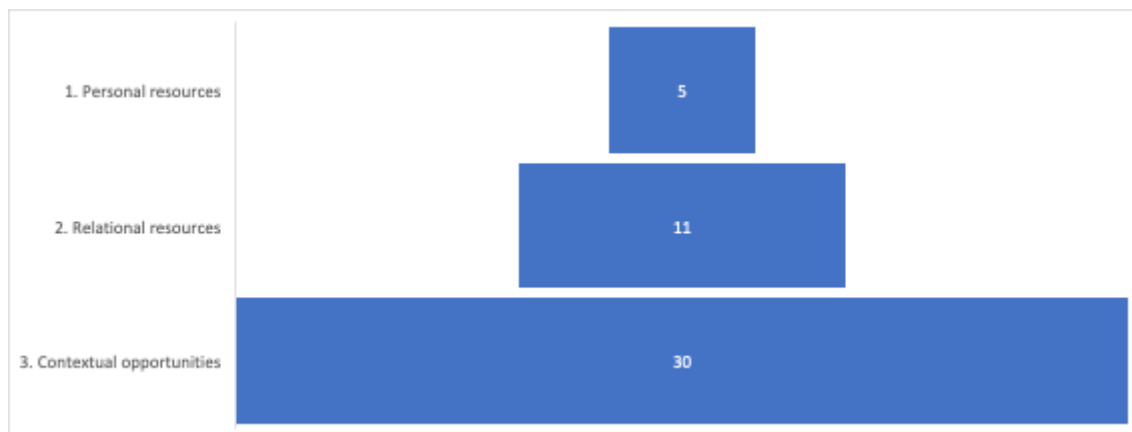

Figure 4. Student agency components promoted in the tasks (N=34)

Aspects among which students could choose were, most commonly:
- The tools to use to do the tasks, for example:
  "The most interesting and clearest thing, and I believe that we are not going to go back on this, is that the tool or tools with which they build their PLE are no longer important to us at all. Everyone can decide what they want to do it with, as long as it is very interactive, so it is very easy to move around within the tool, and above all, it allows them to enjoy the construction of that environment." (Task 2.2, Bruno)

- The classmates to form the groups to do the tasks, for instance:
  "*We leave them free to group together with whomever they want.*" (Task 1.1, Ana)

  Selecting different contents/tasks and formats, for example:
  "I think the task is very open, there are many possibilities to choose, because they can make a diagram by hand or digitally, with images, just text... you would have to ask them how free they feel, because there is never a single way of doing it, although I do assign the PLE to each one. There they can't choose, because I tried, but as they are large groups, there are 30 students, so I do it in list order, so they don't get messed up." (Task 8.1, Helena)

- Finally, some mentions were done to negotiating the curriculum:
  "*I really like the topic of negotiating the curriculum because I had to adapt the topics and negotiate the units."* (Task 7.2, Gabriel)

Also, relational resources for student agency were mentioned in some tasks (n=11). They mostly referred to teamwork or collaborative work, equity between students and peer review. For example:

> *"Students choose the topic, the type of project, the peers they are going to work with, the tools they want to use, as well as the languages, formats and publication channels, depending on the type of project, and the visual identity of the project.*" (Task 7.1, Gabriel)

> "*The students are matched and form a body of experts, who not only elaborate but also assess the work. They also incorporate resources into the experience."* (Task 18.1, Sara)

> *"The collective work of the students empowers them because of the importance given by their peers to the resources they have found."* (Task 19.2, Teresa)

The least common element of student agency identified in the results were personal resources (n=5), specifically in relation to intentionality, intrinsic motivation, and beliefs about their own competence. For instance:

> *"100% [flexibility], that is to say that this is the part that interests us the most, thinking about their training. We want them to have that part of connections with their reality. What is it? The fact is that to guide them more there is to influence them [...]. Therefore, there is total flexibility. In terms of the type of content or production, exactly the same."* (Task 2.1, Bruno)

3.3 PLE contribution

Only 9 tasks included PLE as a specific content of the course where the task takes place. The others are carried out without dealing with the term PLE in the courses.

The most common PLE part promoted through the tasks was reworking, reflecting, and recreating information (n=24), followed by reading, gathering, and decoding new information (n=17), thinking/reflecting on the PLE (n=12), and the least PLE part implemented was discussing and debating (n=4) (see Figure 5).
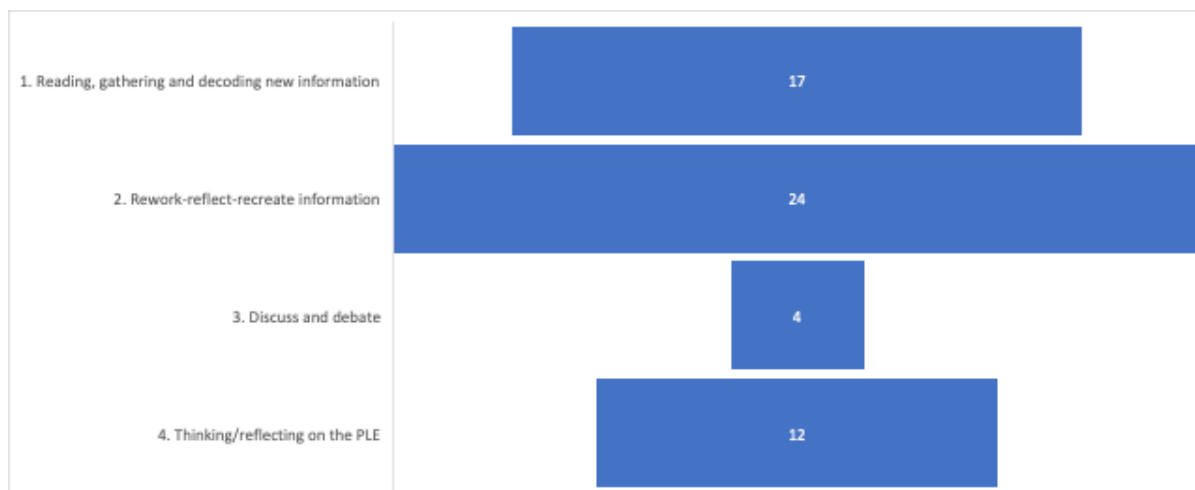
Figure 5. Parts of the PLE promoted by the activities (N=34)

We include some quotes reflecting the different parts of the PLE; in some tasks more than one was present:

> *"It involves them creatively with the contents, through an activity for which they need information and the use of tools that allow them to use different languages such as graphic, written, sound and audiovisual, in a teaching sequence that includes moments of individual, team and plenary work, where they share their comments and conclusions on the subject."* (Task 3.2, Carla. Parts of the PLE: 1 and 2)

> "*Because being formative courses in the degree allows them to develop their creativity and autonomy in the development of the tasks without ambiguities in the assessment at the time of carrying them out, students use new tools that not only require them to copy and paste, where they have to look for the elements that they are going to integrate in each of the works and discern among their teammates which one is better than another.*" (Task 9.1, Iris. Parts of the PLE: 1 and 2)

> *"This task encourages the autonomous search for information, content curation, collective re-elaboration of information and sharing, because it is left open."* (Task 15.1, Olivia. Parts of the PLE: 1, 2 and 3)

> *"And what was analyzed after doing that for four months, how your PLE has improved, in which part your PLE has improved and how you have worked on the three parts of your PLE, what actions, what activities and what mechanisms you have put in place to integrate that tool..."* (Task 15.2, Olivia. Parts of the PLE: 2 and 4)

> *"The student manages to understand their reading, the comprehension of what is written, they can produce, they can do, they can bring to that activity, to that platform, to that resource, that possibility, which can be of different forms, not only writing, but images, today audio.... ...all of this contributes to what we do.... ...and the possibility of sharing, because they are all there, at that moment, doing*

the task and, later, being able to contribute.” (Task 18.1, Sara. Parts of the PLE: 1, 2 and 3)

4. Discussion

Understanding educational practices from complex visions of what teaching and learning - including education - are, far from merely instrumental perspectives, is a complex issue. This study confirms the difficulty of overcoming the barrier of the theoretical formulation of PLE and enacting them in the pedagogical reality of diverse contexts - specialized and non-specialized (Castañeda, Tur, et al., 2022; Serhan & Yahaya, 2022).

The approaches are incredibly diverse and reflect the diversity of the pedagogical practices themselves and the contexts in which they are situated. Everything makes the experiences differ from each other; the educational systems in which they are framed, the institutional particularities that condition them, and the beliefs of the educators who implement them (Abad-Segura et al., 2020; Gourlay, 2021; Jackson, 2019). Everything makes them diverse and, therefore, makes their analysis more complex and requires deep and different perspectives that dare to understand only parts of those entangled experiences.

However, it is desirable to explore and offer alternative, complementary and diverse visions of praxis, which enrich the perspective of those who put these experiences into practice in order to broaden the perspective of these experiences (Biesta, 2013; Cochran-Smith, 2003).

The findings of our qualitative study show us that the implementation of teaching and learning tasks to promote PLEs in HE has still room for improvement in terms of learning design, development of students' PLE and student agency, despite the term dating from 2004 in the literature (Castañeda et al., 2016).

When looking at the epistemic level of the learning design of the tasks, most of them reach the level 4 (knowledge utilization), but levels 5 (metacognition) and 6 (self-system thinking) are less common. The same happens with training students' digital competence. These two last levels are more directly connected to personal resources of student agency, but not so looked upon. This can also be observed in the parts of the PLE that are less promoted, being the one about thinking/reflecting on the PLE the second one. Previous studies also highlight the students' difficulties for self-regulation with regards to designing and managing their PLE (Lim & Newby, 2021; Prendes et al., 2016) and the need for working further on the depth of reflections for self-regulated learning (Tur et al., 2016). In addition, Pérez et al. (2018) and Tur et al. (2022) noted that self-regulated learning in the context of the development of students' PLE is scarcely explored and suggested strategies that may support it, specifically in teacher education, based on Dabbagh and Kitsantas' (2012) pedagogical framework for using social media to create PLEs that support student self-regulated learning.

On the other hand, our data show that many of the tasks are rather one-off and occasional, and this is contradictory with the conceptualization of PLE from a perspective of being

core for developing agency in lifelong learning (Dabbagh & Castañeda, 2020). It is more desirable a transversal and in parallel development, also giving importance to PLE as content – also, in our sample many tasks were conducted without addressing the PLE concept. Looking at the literature, mostly one-time experiences for promoting students' PLE were reported (Castañeda & Tur, 2020); however, there are tasks that are kept in time in the same course(s) and even evolve (e.g., see Pérez et al. (2019)).

Assessment is another topic worthwhile highlighting. The most notable aspect is that alternative assessment methods, which delegate some responsibility to other actors different from the instructor (e.g., self-assessment, peer assessment), are only a few, and none among the choices students had in their contextual opportunities as part of their agency in the course. In this sense, instructors and institutions may present some resistance to do some concessions in this aspect, but also students may prefer traditional ways of doing (Hernández et al., 2018). On the other hand, instructors may have difficulties to handle open approaches to assessment. In this sense, co-design strategies such as the co-assessment could be considered (Marín & Pérez Garcias, 2016; Santana Martel & Perez-i-Garcias, 2020). Finally, PLE is about learning, but learning in an academic formal context needs to be assessed in order to be taken seriously by students, and this was not considered in some tasks. In some of them, limitations may be due to the institutional guidelines.

In terms of set design, many tasks force students to use specific digital tools, whereas several leave this choice open. It is also noticeable that a big majority of the 'forced' tools are proprietary tools and platforms, which supports the current platformization phenomenon in education (Decuypere et al., 2021; van Dijck, 2013), in opposition to practices that promote the decentralization of the Web use (e.g., independently-hosted web publishing, (Villar-Onrubia & Marín, 2022) and the use of open educational resources (OER) infrastructures (Keller, 2021; Marín & Villar-Onrubia, 2022; Ochieng & Gyasi, 2021), as well as the promotion of open pedagogies (Clinton-Lisell, 2021; Kop et al., 2011).

Among the main components of the PLE, personal learning networks (PLN) as part of the social design have been noted as key for promoting connections and supporting personal and professional learning (Marín et al., 2014; Ramírez-Mera et al., 2022), as well as being the core of relational resources within student agency. However, our results show that most of the tasks are individual, but also these possibilities are rather unexploited in the tasks where teamwork is expected since the groups cannot take major decisions within the learning process of a task (Billett, 2017; Eteläpelto et al., 2013). Also, considering the parts of the PLE that are promoted, the element related to discussion and debating is scarcely addressed and is connected to this topic too. This also may relate to the instructor agency –and pedagogical frailty (Kinchin & Winstone, 2017) – when the limits are imposed at an institutional level and restrict the opportunities and resources of instructors for enacting their digital competence and their engagement with fostering the learning to learn competency (Albion & Tondeur, 2018; Castañeda et al., 2021; Priestley et al., 2015).

Finally, student agency is limited mostly to contextual opportunities that are reduced to specific aspects to make choices, such as selecting tools to do the tasks or the groups with whom to work, or among contents/tasks, which is also observed in the literature (Marín et al., 2020). In this line, some previous literature has focused on the opportunities given to students to make choices between different itineraries or paths (De Benito et al., 2020; Salinas et al., 2022; Salinas & De Benito, 2020), even considering assessment (Lindín & Bartolomé, 2021). Other aspects, such as opportunities to influence, are rare in our data and in the literature (Castañeda & Tur, 2020). Also, little is said about personal resources and relational resources, which opposes findings from Marín et al. (2020) of technology-enhanced learning scenarios in connection to student agency, where personal resources were the most common ones.

5. Conclusions

One of the main goals of this study was to systematically open up the analysis of how initiatives for the development of PLE are implemented in HE in a way that goes beyond local formulations (Castañeda, Attwell, et al., 2022; Serhan & Yahaya, 2022). Therefore, with the aim of exploring how HE academic tasks implemented to foster the development of the student's PLEs are configured in different international contexts, 34 tasks have been qualitatively analysed and categorized. The study contributes to the literature gap regarding the learning design of the PLE concept and its implementation and provides valuable insights into the pedagogical practice of PLE and its impact on student agency.

Firstly, the academic tasks were characterized from the learning design perspective, considering the ACAD model, and showed that improvements connecting the levels aimed to reach through the learning goals, temporalization of the tasks, and the implementation of alternative assessments are recommended in order to effectively tackle the development of students' PLE. Also, concerning the tools used, many tasks were prioritizing the use of specific platforms, mostly proprietary, and this leads to a deeper reflection regarding the platformization of HE. The data also showed that the social design could be improved and better exploited to make the most of PLNs and contribute to students' PLE.

Secondly, clear relationships were established between the PLE tasks and student agency, especially in terms of contextual opportunities for choices, but aspects regarding personal and relational resources, and other contextual opportunities regarding assessment, could be still further explored/worked.

Thirdly, and consistently with the previous conclusions regarding the first and second aspects of the research aim, the development of the PLE is mostly focused on the rework-reflect-recreate level, but less attention is given to discussion and debate, or thinking/reflecting on the PLE.

In addition, it is worthwhile to highlight that instructors' agency appears in the study as a key factor in the development of these initiatives. The resources and opportunities to enact their teaching competence, and implement these alternative educational ideas and practices, are mediated by the institutional conditions. Teachers' agency –as we have just

mentioned the students' agency– is not just an individual skill (Biesta & Tedder, 2007), and the implementation of educational practices that develop the PLE –or any other disrupting educational idea–, do not concern only to the individual development of the instructor, but to institutional approaches that give space (opportunities and resources) to the teachers' agency.

As limitations of the study, we need to acknowledge the intentionality of the sample, the always limited extension of the data collection, and the possible difficulties to maintain the exact meanings in the translation of the interviews' data into English.

The international character of the sample of HE instructors that participated in this study, as well as the answers they provided about their academic tasks for the development of their students' PLEs, show us very diverse perspectives among the participants (what they understand by academic task, by PLE, by product). However, we found no substantial differences between the cultural or national contexts concerning major issues. The diversity in understanding tasks, commonalities, and issues related to agency does not seem to be specific to each national space but shared instead. However, this is an exploratory study with a very small sample size, and no more definitive conclusions can be drawn from such a design.

As recommendations derived from the study, we can only agree with Castañeda and Tur (2020) that we still need more ambitious and sustainable learning designs for promoting student agency as a whole, but this would also need an ensured instructor agency (Albion & Tondeur, 2018; Castañeda et al., 2021) and, at least, non-restrictive institutional support. We suggest that pedagogical practice to foster the development of the students' PLE and agency should specifically consider the elements that we have analyzed (epistemic design, social design, set design, PLE contribution and student agency) in a more balanced way to impact on the development of students' PLEs effectively. For instance, alternative assessment strategies that may promote agency as personal and relational resources and contextual opportunities, and discussion and debating actions to foster PLNs, may be considered.

As future research lines, we will analyze the faculty members' profile for fostering the development of students' PLE, connecting to the (digital) competencies of HE educators. We will also look deeper into the facilities and constraints that institutions have, from the perspective of the faculty members, in order to carry out academic tasks with these characteristics.

Nevertheless, it is essential to note that the instructors' perspective is only one of the possible perspectives. This study does not address the social responsibility of HE instructors in relation to the competence of students' future professional activity. It would, therefore, be interesting to address the impact of tasks for the development of PLE on this future professional performance (e.g., through longitudinal studies). Also, it is of interest that HE academic tasks do not only rely on the instructor as the only responsible party for the assessment processes and integrate other external stakeholders.

Similarly, it would be worthwhile to complement educators' opinions with data collected from students in order to fully understand the real impact of this type of learning tasks, both in the short and long term.

References

Abad-Segura, E., González-Zamar, M.-D., Infante-Moro, J. C., & Ruipérez García, G. (2020). Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability*, *12*(5), 2107. https://doi.org/10.3390/su12052107

Adell, J., & Castañeda, L. (2015). Las pedagogías escolares emergentes. *Cuadernos de Pedagogía*, *462*. https://bit.ly/3jwCLv6

Albion, P. R., & Tondeur, J. (2018). Information and Communication Technology and Education: Meaningful Change through Teacher Agency. In J. Voogt, G. Knezek, R. Christensen, & K.-W. Lai (Eds.), *Handbook of Information Technology in Primary and Secondary Education* (pp. 1–16). Springer International Publishing. https://doi.org/10.1007/978-3-319-53803-7_25-1

Attwell, G. (2007). Personal Learning Environments—The future of eLearning? *ELearning Papers*, *2*, 8.

Bagriyanik, S. (2017). Personal learning environments: A systematic literature review based on study keywords using thematic analysis. *New Trends and Issues Proceedings on Humanities and Social Sciences*, *4*(4), 122–130. https://doi.org/10.18844/prosoc.v4i4.2603

Barberà, E. (2016). Aportaciones de la tecnología a la e-Evaluación. *Revista de Educación a Distancia (RED)*, *50*. https://doi.org/10.6018/red/50/4

Bartolomé, A., Castañeda, L., & Adell, J. (2018). Personalisation in educational technology: The absence of underlying pedagogies. *International Journal of Educational Technology in Higher Education*, *15*, 14. https://doi.org/10.1186/s41239-018-0095-0

Benaquisto, L. (2008). Coding Frame. In L. M. Given (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods* (Edición: 1, pp. 88–89). SAGE Publications, Inc.

Biesta, G. (2013). Giving Teaching Back to Education: Responding to the Disappearance of the Teacher. *Phenomenology & Practice*, *6*(2), 35. https://doi.org/10.29173/pandpr19860

Biesta, G., & Tedder, M. (2007). Agency and learning in the lifecourse: Towards an ecological perspective. *Studies in the Education of Adults*, *39*(2), 132–149. https://doi.org/10.1080/02660830.2007.11661545

Billett, S. (2017). Developing Domains of Occupational Competence: Workplaces and Learner Agency. In M. Mulder (Ed.), *Competence-based Vocational and Professional Education: Bridging the Worlds of Work and Education* (pp. 47–66). Springer International Publishing. https://doi.org/10.1007/978-3-319-41713-4_2

Castañeda, L. (2019). Formación inicial del profesorado en el uso educativo de la tecnología, una propuesta curricular. *Quaderns Digitals*, *89*, 49.

Castañeda, L., & Adell, J. (Eds.). (2013). *Entornos personales de aprendizaje: Claves para el ecosistema educativo en red.* Marfil.

Castañeda, L., Attwell, G., & Dabbagh, N. (2022). Entornos personales de aprendizaje como marco de la educación flexible: Explorando consensos, enunciando preguntas y marcando desafíos. *Edutec. Revista Electrónica de Tecnología Educativa*, *79*, 80–94. https://doi.org/10.21556/edutec.2022.79.2347

Castañeda, L., Cosgrave, M., Marin, V., & Cronin, C. (2016). Personal Learning Environments: PLE Conference 2015 Special Issue Guest Editorial. *Digital Education Review*, *0*(29). http://revistes.ub.edu/index.php/der/article/view/16118

Castañeda, L., Esteve-Mon, F. M., Adell, J., & Prestridge, S. (2021). International insights about a holistic model of teaching competence for a digital era: The digital teacher framework reviewed. *European Journal of Teacher Education*, *0*(0), 1–20. https://doi.org/10.1080/02619768.2021.1991304

Castañeda, L., & Tur, G. (2020). Resources and Opportunities for Agency in PLE-Related Pedagogical Designs: A Literature Exploration. *Interaction Design and Architecture(s) Journal - IxD&A*, *45*, 50–68.

Castañeda, L., Tur, G., Torres-Kompen, R., & Attwell, G. (2022). The Influence of the Personal Learning Environment Concept in the Educational Research Field: A 2010-

2020 Systematized Review. *International Journal of Virtual and Personal Learning Environments (IJVPLE)*, *12*(1), 1–16. https://doi.org/10.4018/IJVPLE.2022010102

Chen, C., Meng, X., Liu, J., & Liu, Z. (2021). Do College Students Adapt to Personal Learning Environment (PLE)? A Single-Group Study. In Z. Deze, H. Huang, R. Hou, S. Rho, & N. Chilamkurti (Eds.), *Big Data Technologies and Applications* (pp. 34–47). Springer International Publishing. https://doi.org/10.1007/978-3-030-72802-1_3

Clinton-Lisell, V. (2021). Open Pedagogy: A Systematic Review of Empirical Findings. *Journal of Learning for Development*, *8*(2), 255–268.

Cochran-Smith, M. (2003). The Unforgiving Complexity Of Teaching: Avoiding Simplicity In The Age Of Accountability. *Journal of Teacher Education*, *54*(1), 3–5. https://doi.org/10.1177/0022487102238653

Cosgrave, M. (2021). Deeper Mapping: PLE diagrams, PKM Workflows and Scholarly Ontologies. *Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21)*, 492–494. https://doi.org/10.1145/3486011.3486501

Dabbagh, N., & Castañeda, L. (2020). The PLE as a framework for developing agency in lifelong learning. *Educational Technology Research and Development*, *68*(6), 3041–3055. https://doi.org/10.1007/s11423-020-09831-z

Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education*, *15*(1), 3–8. https://doi.org/10.1016/j.iheduc.2011.06.002

Decuypere, M., Grimaldi, E., & Landri, P. (2021). Introduction: Critical studies of digital education platforms. *Critical Studies in Education*, *62*(1), 1–16. https://doi.org/10.1080/17508487.2020.1866050

Eteläpelto, A., Vähäsantanen, K., Hökkä, P., & Paloniemi, S. (2013). What is agency? Conceptualizing professional agency at work. *Educational Research Review*, *10*, 45–65. https://doi.org/10.1016/j.edurev.2013.05.001

Farrow, R., Iniesto, F., Weller, M., & Pitt, R. (2020). *GO-GN Research Methods Handbook*. Global OER Gradate Network. http://go-gn.net/wp-content/uploads/2020/07/GO-GN-Research-Methods.pdf

Goodyear, P., & Carvalho, L. (2014). Framing the Analysis of Learning Network Architectures. In L. Carvalho & P. Goodyear (Eds.), *The Architecture of Productive Learning Networks* (Edición: 1). Routledge.

Goodyear, P., Carvalho, L., & Yeoman, P. (2021). Activity-Centred Analysis and Design (ACAD): Core purposes, distinctive qualities and current developments. *Educational Technology Research and Development*, *69*(2), 445–464. https://doi.org/10.1007/s11423-020-09926-7

Goodyear, P., Carvalho, L., Yeoman, P., Castañeda, L., & Adell, J. (2021). Una herramienta tangible para facilitar procesos de diseño y análisis didáctico: Traducción y adaptación transcultural del Toolkit ACAD. *Píxel-Bit. Revista de Medios y Educación*, *60*, 7–28. https://doi.org/10.12795/pixelbit.84457

Gourlay, L. (2021). There Is No 'Virtual Learning': The Materiality of Digital Education. *Journal of New Approaches in Educational Research*, *10*(1), 1–10. https://doi.org/10.7821/ naer.2021.1.649

Hatch, J. A. (2002). *Doing Qualitative Research in Education Settings*.

Hernández, M. A. (2016). Gestión del conocimiento, actividad científica y entornos personales de apredizaje (PLEs): Una bibliometría de la PLE conference. *Edutec. Revista Electrónica de Tecnología Educativa*, *0*(55), 329.

Hernández, N., Muñoz, P., & González, M. (2018). La e-evaluación en el trabajo colaborativo en entornos virtuales: Análisis de la percepción de los estudiantes. *Edutec. Revista Electrónica de Tecnología Educativa*, *65*, 16–28. https://doi.org/dx.doi.org/10.21556/edutec.2018.65.997

Jääskelä, P., Poikkeus, A.-M., Vasalampi, K., Valleala, U. M., & Rasku-Puttonen, H. (2017). Assessing agency of university students: Validation of the AUS Scale. *Studies in Higher Education*, *42*(11), 2061–2079. https://doi.org/10.1080/03075079.2015.1130693

Jackson, N. C. (2019). Managing for competency with innovation change in higher education: Examining the pitfalls and pivots of digital transformation. *Business Horizons*, *62*(6), 761–772. https://doi.org/10.1016/j.bushor.2019.08.002

Keller, W. (2021). One Year Reflection of Using Open Education Resources from a Department Chair's Eyes. *About Campus*, *25*(6), 29–31. https://doi.org/10.1177/1086482220962094

Kinchin, I. M., & Winstone, N. E. (2017). Pedagogic Frailty. In I. M. Kinchin & N. E. Winstone (Eds.), *Pedagogic Frailty and Resilience in the University* (pp. 211–225). SensePublishers. https://doi.org/10.1007/978-94-6300-983-6_15

Kop, R., Fournier, H., & Mak, J. S. F. (2011). A pedagogy of abundance or a pedagogy to support human beings? Participant support on massive open online courses. *The International Review of Research in Open and Distributed Learning*, *12*(7), 74–93. https://doi.org/10.19173/irrodl.v12i7.1041

Korhonen, A.-M., Ruhalahti, S., & Veermans, M. (2019). The online learning process and scaffolding in student teachers' personal learning environments. *Education and Information Technologies*, *24*(1), 755–779. Scopus. https://doi.org/10.1007/s10639-018-9793-4

Lim, J., & Newby, T. J. (2021). Preservice teachers' attitudes toward Web 2.0 personal learning environments (PLEs): Considering the impact of self-regulation and digital literacy. *Education and Information Technologies*, *26*(4), 3699–3720. https://doi.org/10.1007/s10639-021-10432-3

Marín, V. I., Crosetti, B. de B., & Darder, A. (2020). Technology-Enhanced Learning for Student Agency in Higher Education: A Systematic Literature Review. *IxD&A*. https://doi.org/10.55612/s-5002-045-001

Marín, V. I., & Pérez Garcias, A. (2016). Collaborative e-Assessment as a Strategy for Scaffolding Self-Regulated Learning in Higher Education. In *Formative Assessment, Learning Data Analytics and Gamification* (pp. 3–24). Elsevier.

https://doi.org/10.1016/B978-0-12-803637-2.00001-4

Marín, V. I., & Villar-Onrubia, D. (2022). Online Infrastructures for Open Educational Resources. In *Handbook of Open, Distance and Digital Education* (pp. 1–20). Springer Singapore. https://doi.org/10.1007/978-981-19-0351-9_18-1

Marzano, R. J., & Kendall, J. S. (2006). *The New Taxonomy of Educational Objectives*. Corwin Press.

McCarthy, J. (2015). Evaluating Written, Audio and Video Feedback in Higher Education Summative Assessment Tasks. *Issues in Educational Research*, *25*(2), 153–169.

Ochieng, V. O., & Gyasi, R. M. (2021). Open educational resources and social justice: Potentials and implications for research productivity in higher educational institutions. *E-Learning and Digital Media*, *18*(2), 105–124. https://doi.org/10.1177/2042753021989467

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A Typology of Mixed Methods Sampling Designs in Social Science Research. *The Qualitative Report*, *12*(2), 281–316.

Pérez, A., Marín, V. I., & Tur, G. (2018). Information Management Tools for the Development of Self-Regulated Learning Skills in Pre-service Teacher Education. *@tic Revista d'innovació Educativa*, *21*, 31–39. https://doi.org/10.7203/attic.21.12134

Perifanou, M., & Economides, A. (2021). Digital Skills for Building and Using Personal Learning Environments. *Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21)*, 527–532. https://doi.org/10.1145/3486011.3486506

Pimienta, J. H. (2008). *Evaluación de los aprendizajes: Un enfoque basado en competencias*. https://elibro.net/ereader/elibrodemo/74168

Prendes, M. P., Castañeda, L., Gutierrez, I., & del Mar Roman, M. (2016). Still far from personal learning: Key aspects and emergent topics about how future professionals' PLEs are. *Digital Education Review*, *29*, 15–30.

Priestley, M., Biesta, G., & Robinson, S. (2015). *Teacher Agency: An Ecological Approach*. Bloomsbury Publishing.

Ramirez Ramos, E. F. (2022). Entornos personales de aprendizaje y competencia informacional en estudiantes de una universidad pública de Lima, 2021. *Repositorio Institucional - UCV*. https://repositorio.ucv.edu.pe/handle/20.500.12692/78373

Saldaña, J. (2015). *The Coding Manual for Qualitative Researchers Third Edition* (Edición: Third). SAGE Publications Ltd.

Santana Martel, J. S., & Perez-i-Garcias, A. (2020). Codiseño educativo haciendo uso de las TIC en educación superior una revisión sistemática de literatura. *Edutec. Revista Electrónica de Tecnología Educativa*, *74*, 25–50. https://doi.org/10.21556/edutec.2020.74.1799

Serhan, S. A. L., & Yahaya, N. (2022). A Systematic Review and Trend Analysis of Personal Learning Environments Research. *International Journal of Information and Education Technology*, *12*(1), 43–53. https://doi.org/10.18178/ijiet.2022.12.1.1585

Shaheen, M., Pradhan, S., & Ranajee, R. (2019). Sampling in Qualitative Research. In M. Gupta, M. Shaheen, & K. P. Reddy (Eds.), *Qualitative Techniques for Workplace Data Analysis* (pp. 25–51). IGI Global. https://doi.org/10.4018/978-1-5225-5366-3.ch002

Tur, G., Challinor, J., & Marín, V. I. (2016). Digital Artefacts for Reflection on Identity in Teacher Education. *Reflecting Education*, *10*(1), 4–25.

Tur, G., Ramírez-Mera, U., & Marín, V. I. (2022). Aprendizaje autorregulado y Entornos Personales de Aprendizaje en la formación inicial docente: Percepciones del alumnado y propuestas de herramientas y recursos. *Revista Complutense de Educación*, *33*(1), 41–55. https://doi.org/10.5209/rced.71002

van Dijck, J. (2013). *The Culture of Connectivity: A Critical History of Social Media*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199970773.001.0001

Villar-Onrubia, D., & Marín, V. (2022). Independently-hosted web publishing. *Internet Policy Review*, *11*(2). https://doi.org/10.14763/2022.2.1665

Xu, X., Chan, F. M., & Yilin, S. (2020). Personal learning environment: An experience with ESP teacher training. *Interactive Learning Environments*, *28*(6), 779–794. https://doi.org/10.1080/10494820.2018.1552872

Yin, R. K. (2010). *Qualitative Research from Start to Finish*. The Guilford Press.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, *16*(1), 39. https://doi.org/10.1186/s41239-019-0171-0

Appendix 1. Code-list

Families	Categories	Subcategories
Epistemic design	Type of objective	Retrieval
		Comprehension
		Analysis
		Knowledge utilization
		Metacognition
		Self-system
	Expected result (format of production)	Text
		Audio/video
		Multimedia
		Web
		Other
	Character	One-off
		Transversal
	Temporality	Occasional
		Intermittent
		Continuous
Assessment (part of epistemic design)	Agents	Self-assessment
		Co-assessment
		Hetero assessment
	Temporal moment	Continuous/formative assessment
		Final/summative assessment
		Initial/diagnostic assessment
	Mechanisms / assessment tools	Final project
		Rubrics
		Checklists
		Portfolio
		Simulation
		Scale
		Observation
		Questionnaire
		Other
	Weight	Percentage in the final course grade
		Percentage in a part of the final course grade

Families	Categories	Subcategories
		Without weight
		Other
Social design	Group	Group
		Individual work
		Work in pairs
	Supervision	Autonomous work
		Work in group
	Possibility of choice	By student choice
		By instructor's assignment
	Roles	With roles
		Without roles
		With roles defined by the students
		With prescribed roles by the instructors
Set design (tools)	Type	
	Access mode	Online
		Download
		Both
	Business model	Limited free version
		Platform (free and unlimited access)
		Subscription model
		Free version
		Open source
PLE contribution	PLE as content of the course	Yes
		No
	Parts of the PLE	Reading, gathering and decoding new information
		Reworking, reflecting and recreating information
		Discussing and debating
		Thinking/reflecting on the PLE
Student agency	Personal resources	
	Relational resources	
	Contextual opportunities	