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PLE en la formación inicial docente: instrumento para la reflexión y autorregulación

Rakel Gamito Gómez
Universidad del País Vasco - EHU
Soledad Rappoport
Universidad Autónoma de Madrid
Elena López-de-Arana Prado
Universidad Autónoma de Madrid
España

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Rakel Gamito Gómez
rakel.gamito@ehu.eus
Universidad del País Vasco - EHU
Soledad Rappoport
soledad.rappoport@uam.es
Universidad Autónoma de Madrid
Elena López-de-Arana Prado
elena.lopezdearana@uam.es
Universidad Autónoma de Madrid
España

ABSTRACT

The digital era has created new ecosystems of personal and professional development. In order to face this model in a reflective and autonomous way, it is necessary for university students to be aware of, reflect on and self-regulate their own teaching-learning process. The development and analysis of the Personal Learning Environment (PLE) allow such actions. The present work is a case study that analyzed and compared 100 initial and final PLEs, as well as their respective reflective tasks of students of Primary Education Degree belonging to two universities in Spain. It sought to respond to three objectives: to evaluate the teaching-learning process of university students in the field of education, to identify the training needs of future teachers in the area of digital competence in teaching, and to verify the reflective and self-regulatory potential of the PLE in initial teacher training. The data had been analyzed and categorized with the help of NVivo Release 1.7.1 software. The results show the progression of the elaboration of the PLE, and the reflections on learning. Therefore, it highlights the usefulness of the PLE as an instrument to provide feedback on training practice, as well as to prioritize the needs for a transformative teacher professional development.

KEYWORDS

PLE, REFLECTION, SELF-REGULATION, INITIAL TEACHER EDUCATION

RESUMEN

La era digital ha creado nuevos ecosistemas de desarrollo tanto personal como profesional. Para poder afrontar dicho modelo de manera reflexiva y autónoma, resulta necesario que el alumnado universitario sea consciente, reflexione y autorregule su propio proceso de enseñanza-aprendizaje. El desarrollo y análisis del Personal Learning Environment (PLE) permiten dichas acciones. El presente trabajo es un estudio de caso que analiza y compara 100 PLEs iniciales y finales, así como sus respectivas tareas

reflexivas del alumnado del Grados de Educación Primaria pertenecientes a dos universidades de España. Se busca responder a tres objetivos: evaluar el proceso de enseñanza-aprendizaje del alumnado universitario del ámbito educativo, identificar las necesidades formativas del futuro profesorado en el área de la competencia digital docente y comprobar el potencial reflexivo y autorregulador del PLE en la formación inicial docente. Los datos se han analizado y categorizado con ayuda del software NVivo Release 1.7.1. Los resultados muestran la progresión de la elaboración del PLE, y las reflexiones sobre el aprendizaje. Por tanto, destaca la utilidad del PLE como instrumento para retroalimentar la práctica formativa, así como para priorizar las necesidades de un desarrollo profesional docente transformador.

PALABRAS CLAVE
PLE, REFLEXIÓN, AUTORREGULACIÓN, FORMACIÓN INICIAL DOCENTE

THE PLE AS A REFLECTIVE INSTRUMENT OF SELF-REGULATION

For many years, learning was limited to specific places, people, and moments: schools provided sources of information (teachers and textbooks) to build (or memorize) theoretical knowledge; behaviors and values of coexistence were learned at home or in the street through imitation; and learning was a process exclusively linked to childhood and/or adolescence (Trujillo, 2014). The traditional model of teaching began to appear obsolete with the rise of new technologies and globalization processes. In this scenario, the competency-based approach in education has emerged as an alternative to the old formats, better suited to new contexts (Latatu & Urbieta, 2019; Pozos & Tejeda, 2018). The new model adopted and promoted by various international organizations (e.g., UNESCO, 2023) and national educational systems (e.g., LOMLOE, 2020) proposes among its principles lifelong learning, the need to "learn to learn," the utilization of different learning contexts, and a commitment to personal/professional development (Valle et al., 2023).

In the specific case of the teaching profession, among the numerous competencies deemed necessary for professional performance is the ability to use digital technologies both to enhance teaching and learning and to properly carry out all tasks related to professional practice (INTEF, 2022). Despite this, recent studies indicate that it is still necessary to strengthen the digital competence of future Early Childhood and Primary Education teachers, especially in the early years of their initial training (Alastor et al., 2024).

Additionally, the rapid changes occurring in the digital world require teachers to be especially aware of their teaching-learning process regarding digital skills and to self-regulate it (Korhonen et al., 2018). In this regard, the Personal Learning Environment (PLE) proves to be a highly useful and valuable resource.

The PLE is defined as "a set of tools, information sources, connections, and activities that each person uses regularly to learn" (Adell & Castañeda, 2010, p. 23). In it, students explore the tools and resources they use for learning, such as institutional virtual learning environments, social networks, infographics, rubrics, and/or gamified quizzes

(Tur et al., 2022). Thus, the PLE is understood as "an educational idea and approach" (Castañeda et al., 2022, p. 80).

This instrument is considered an essential component linked to the reflective dimension and the autonomy of university learning. On one hand, it allows teachers to understand students' ideas and preferences in the digital realm to create support strategies that enhance their autonomy (Cabrera et al., 2022). On the other, it offers a mechanism for controlling metacognitive skills of planning, execution, and reflection (Tur & Ramírez-Mera, 2020).

Therefore, despite its scope is still limited in the university environment, there is abundant evidence highlighting the importance of implementing the PLE as an innovative source to strengthen teaching-learning processes at the university level (Castañeda et al., 2022; Castañeda et al., 2023). Additionally, in the case of initial teacher training, it undoubtedly provides great benefits and directs the teaching-learning process toward a true educational transformation (Castañeda et al., 2022; Soria & Carrió, 2016).

This work analyzed and compared the initial and final PLEs of university students in Primary Education Degree at two universities in Spain to respond to three related objectives:

1. To understand students' initial and final digital ecosystems and thereby be aware of their learning process.
2. To identify the training needs of university students in initial teacher training through the reflection promoted by the PLE on the digital competence of future teachers.
3. To evaluate the possibilities offered by the PLE as a learning strategy for university students in the field of Education.

METHODOLOGY

Design

A qualitative case study design had been implemented (Stake, 1998). This had allowed for the description and evaluation of PLE-related productions to capture the complexity of students' training process in the specific cases of the University of the Basque Country (UPV/EHU) and the Autonomous University of Madrid (UAM) (Bores, 2016; Merriam, 1988; Rodríguez-Gómez et al., 1996; Sandin, 2003). Students' prior knowledge was collected through the initial PLEs, and the knowledge acquired and reflections on the developed training process were gathered through the final PLEs. Additionally, the case study allowed going beyond the described experience, aiming to obtain insights to improve educational practices (Vázquez & Angulo, 2003).

Participants

100 university students participated (Table 1). 57 were taking the subject Information and Communication Technologies (ICT) for the Digital Society, offered in the first year of the Primary Education Degree at UAM, and 43 were taking the subject Information

and Communication Technologies in Primary Education, offered in the second year of the Primary Education Degree at the Faculty of Education and Sports at UPV/EHU. The selection of cases and participants was entirely intentional (Rekalde et al., 2014; Vizcarra et al., 2016); they were chosen based on accessibility to the group by the researchers (Barbour, 2013).

Table 1.
Participants

	UAM	UPV/EHU	Total
Women	55	21	76
Men	2	22	24
Total	57	43	100

Instruments for Data Collection
Two tasks were collected: the PLE and the reflection. The PLE aimed to raise awareness of the digital tools used and the relationships established during the learning process. Students created a PLE organized around the dimensions proposed by Castañeda and Adell (2013): Strategies for Reading Multimedia Resources, Writing and Reflecting, and Sharing, or what they call the Personal Learning Network (PLN).
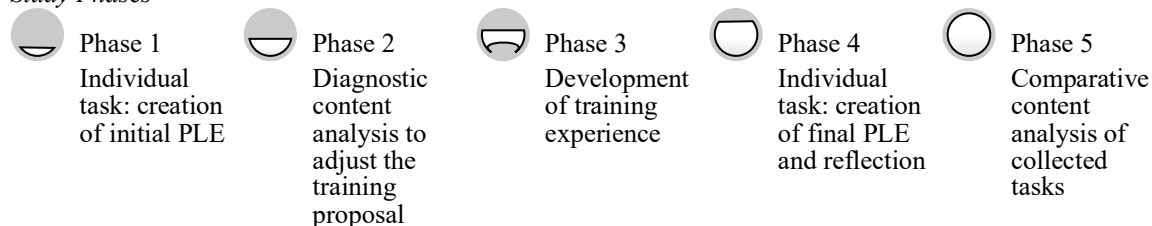In contrast, the reflection was based on the requirements of the teaching profession to establish individualized goals and promote autonomous learning from the perspective of continuous professional development. Students were encouraged to review the Digital Competence Framework for Educators (INTEF, 2022) as a guide to foster deeper and more grounded reflection.

Procedure and Analysis
The study was structured into 5 phases (Figure 1): preparation of an individual PLE (initial PLE) at the beginning of the course (phase 1), content analysis of the PLEs for diagnostic purposes to establish the starting point of the group (phase 2), feedback on the PLEs during the training experience (phase 3), creation of a new PLE (final PLE) at the end of the course along with reflections considering the Digital Competence Framework for Educators (phase 4), and finally, content analysis comparing the collected tasks to derive the final categorization.
For the analysis, all productions were first coded according to the following pattern: university + participant + PLE quality. Each university was assigned a letter: UAM was assigned the letter A and UPV/EHU the letter B. Each participant was coded with a randomly assigned number, ensuring participant anonymity.

Figure 1
Study Phases

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Individual task: creation of initial PLE	Diagnostic content analysis to adjust the training proposal	Development of training experience	Individual task: creation of final PLE and reflection	Comparative content analysis of collected tasks

Finally, the categorization of both initial and final PLEs was based on their quality:

very low (vlq), low (lq), acceptable (aq), good (gq), and very good (vgq) (Table 2). Each category was assigned a numerical value from 1 to 5, providing a numeric representation called grade. This allowed for the calculation of common statistical descriptors (mean, median, standard deviation).

Table 2
Analysis Categories

Category (code)	Definition	Value
Very Low Quality (vlq)	No PLE is proposed; organization is no based on formative dimensions, tools are not for educational use, and/or lack a personal dimension.	1
Low Quality (lq)	Dimensions are proposed but not all are clearly defined (e.g., overlaps and/or some categories are poorly defined), and/or most applications are not educational.	2
Acceptable Quality (aq)	Dimensions are proposed and some applications have a clear educational use.	3
Good Quality (gq)	All dimensions are well-defined (each category is recognized), and most applications have an educational use.	4
Very Good Quality (vgq)	All dimensions are well-defined, all applications have an educational use, and there is a professional focus on the proposed tools.	5

For the analysis of reflections, NVivo Release 1.7.1 qualitative analysis software was used. Through an inductive process, were identified emerging themes such as: weaknesses and strengths, training needs, interests, and the potential of the PLE for developing digital teaching competence. All material was individually analyzed by the researchers, who then shared, compared, contrasted, and agreed on the results obtained.

RESULTS

The analyses conducted showed that the initial PLEs received lower scores than the final PLEs. The difference in scores is especially noticeable among the UAM student group, as initial PLEs predominantly received a score of 2 (tasks present dimensions, but not all are clearly defined and/or most applications do not have a clear educational use), while final PLEs typically scored 4 (dimensions are well-defined and delineated, and applications have educational uses) (Table 3).

Table 3.
Grades of Initial and Final PLEs by University

	UAM		UPV/EHU	
	Initial PLE	Final PLE	Initial PLE	Final PLE
Mean	1,74	3,95	3,94	4,57
Median	2	4	4	5
Standard Deviation	0,58	0,67	0,8	0,71

For the UPV/EHU group, there is also an improvement in the scores obtained in the final PLEs compared to the initial ones. This group achieved a higher average score for

final projects than their UAM peers, with the typical value being 5, indicating a more professional use of the PLE.

Regarding minimum scores, approximately 30% of UAM students did not manage to make their initial PLE dimensions formative (score of 1). In contrast, the initial PLEs created by UPV/EHU students were organized around formative dimensions (scores of 3, 4, and 5).

For final PLEs, 100% of students from both UAM and UPV/EHU successfully organized them according to formative dimensions. Additionally, 27% of students from the UPV/EHU modified dimensions according to their own formative needs, distinguishing the dimension of information search into search and information management and/or adding a new dimension related to work organization processes.

Regarding the tools collected by the students, for the UAM group, the category "Generate new content and share it" was the dimension that most increased in applications in the final PLEs compared to the initial ones. For UPV/EHU students, there were no significant changes in any category; however, all final tasks included new tools compared to initial PLEs, primarily those used in the course, such as Scratch and/or Mindomo.

Furthermore, the analysis of students' reflective texts on their respective PLEs identified the following issues related to the development of digital teaching competence:

- Students from both universities managed to analyze their PLEs and identify strengths and weaknesses in their digital competencies. They also defined training priorities based on needs identified in their PLEs, as well as personal and professional interests.

   I want to keep learning new ways to create content for the classroom since technological resources are increasingly influential and involved in education. (A.24)

   My main improvement has been in content creation. Initially, I only used PowerPoint, but, during the course, I started using Wix, Scratch, Makey Makey, Kahoot, etc. Additionally, I feel much better about security. (B.03)

- The most mentioned training gaps by UAM students to develop their digital competence are related to security (digital identity protection, data protection, safe and sustainable use, etc.) and the ability to search for and organize information.

   I consider that I need to keep training in the area of security since it is a very important factor, and I would like to know more about it. (A.11)

   As a future teacher, I think that, because new technologies are increasingly present in schools, it would be appropriate to continue training in communication, searching, and creating content. (A.01)

   My final PLE is still somewhat lacking in terms of digital resources for information search. (A.54)

- Unlike the UAM group, UPV/EHU students primarily mention their interest in increasing their digital competence regarding digital resources and tools applicable to formative processes. This group also concludes the course by questioning the use of proprietary software and promoting the use of free software in education.

   I would like to analyze the change in my digital competence. At first, I thought I had several strengths (I could evaluate information, knew the tools to share information and content, collaborated through digital means, and protected my digital identity), but currently, besides developing these competencies, I can use technology for innovation and creativity (training in programming,

understanding free software as a philosophy, thinking of technological responses according to needs -special or not-...). I am eager to keep learning. (B.12)

- Lastly, reflections from both groups highlight the explicit appreciation of the PLE as a learning tool and even as a facilitator of professional teaching development.

  Before, the PLE was the set of applications we used daily, but now I would define it as training to be a teacher. (B.06)

  I consider the PLE as a very interesting and useful learning concept because it has helped me in the learning process. It allows organizing all the resources that I use and will use in the future as a teacher. I am sure that over the years my PLE will grow up. (B.19)

DISCUSSION AND CONCLUSIONS

Focusing on the obtained data, it is observed that UAM and UPV/EHU students arrive at ICT courses with different levels of digital competence. At UAM, it is quite low, while at UPV/EHU, it is significantly higher. This may be because the ICT course at UAM is taken in the first year of the Degree, whereas at UPV/EHU it is in the second year. Another reason for this difference could be the training received before starting university, that is, the curricula of the educational systems of each autonomous community.

Despite this initial difference, improvements in PLEs are evident in both contexts. The range of improvement differs; it is more notable at UAM, but the final score is higher at UPV/EHU. This is attributed to the feedback obtained from their tutors during the teaching-learning process of the course.

Similar to other studies (Cabrera et al., 2022), this analysis shows the progression of students in the development of the PLE and reflections on their learning. Initial PLEs focus primarily on known environments, while final PLEs include a greater diversity of digital tool use, with a strong emphasis on actions related to content creation and communication or dissemination of personal work. Additionally, final PLEs demonstrate a better alignment of dimensions and specified tools within them.

Therefore, based on the calculated average scores, it can be stated that initial PLEs achieved a more deficient organization in formative dimensions compared to final PLEs. This suggests positive learning outcomes for participating students and underscores the importance of teacher feedback to understand how to leverage the PLE as a self-regulating instrument for the current training process and future teaching practice (Durán et al., 2015).

Moreover, during the PLE analysis, students had the opportunity to reflect on their learning process, a crucial factor in their professional development (Arroyo-Sagasta & de la Iglesia, 2023; Sánchez-Tarazana et al., 2022). Thus, the participating students were able to identify their strengths and weaknesses to later enumerate their training priorities (Tur & Ramírez-Mera, 2020). In most cases, students express interest and desire to continue learning and improving their digital teaching competence based on the Digital Competence Framework for Educators. They highlight security, the use of free software, and particularly the pedagogical and/or didactic orientation of digital tools as topics to continue working on in the future with a perspective of continuous professional development (Pinto & Pérez, 2022).

Additionally, many students have valued the PLE as a valid resource for analyzing individual learning processes and sharing knowledge with peers, thereby strengthening

initial teacher training and, in the future, their professional development, especially their digital teaching competence. Thus, the results allow the conclusion that the PLE is a self-guiding tool that helps future teachers learn to learn throughout life (Alemán-Ramos, 2018; Ausín & Delgado, 2015).

Therefore, it is recommended that the management of PLEs be part of the university curriculum to improve both the academic and professional skills of students (Cabrera et al., 2022; Serrano-Sánchez et al., 2021). This issue is of vital importance because if the teachers´digital competence is improved, the students entering the Education Degrees will also start from a higher level of digital competence.

This work has certain limitations that should be considered when interpreting the results. Firstly, the design applied in this research facilitates understanding the phenomenon studied in each case (UAM and UPV/EHU) but does not allow for the generalization of the results. Furthermore, even for the specific cases examined, the results obtained should be interpreted with caution as they refer to a single academic year.

Based on this study, future research should consider conducting quantitative studies to measure the impact of PLEs as a tool for reflection and teacher training. Additionally, qualitative studies are suggested where the case involves student groups from the first to the fourth year of the Education Degree, aiming to identify possible changes, continuities, trends, and particularities in the use of PLEs at different stages of professional teacher development. Given the rapid changes in the virtual environment, it is also important to investigate the flexibility and adaptability of the PLE tool to respond to new and future technological transformations and, consequently, new learning needs, such as those associated.

Personal contribution of each author:
Rakel Gamito and Elena López-de-Arana worked mainly on the conceptualization; Rakel Gamito and Soledad Rappoport participated mainly in the formal analysis; the methodology was the responsibility of Soledad Rappoport; Rakel Gamito and Soledad Rappoport were involved in the first draft and Elena López-de-Arana was responsible for revising the draft.

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