
Learning Ecologies and Teacher Professional Development: opportunities and challenges in a changing educational context

Ecologías de Aprendizaje y Desarrollo Profesional Docente: oportunidades y retos en un contexto formativo cambiante

学习生态学与教师专业发展: 不断变化的教育背景下的机遇与挑战

Экологии обучения и профессиональное развитие учителей: возможности и проблемы в меняющемся контексте обучения

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Abstract

Currently, teachers are exposed to various changes that make clear a need for permanent updating. Thus, it is inescapable that teacher professional development can no longer be understood as an option, but rather as the only effective tool to respond to rapid social transformations, such as those caused by the COVID-19 pandemic. Within this framework, the concept of Learning Ecologies emerges as an effective perspective to holistically integrate the various existing training opportunities in each individual's environment. The aim of this study is to analyse the professional development process of Primary Education teachers, through an ecological perspective. In other words, it is intended to identify and interpret those elements that make up the Learning Ecologies of teachers in this educational stage. This research has been carried out through a qualitative design and, specifically, through the tradition of the Case Study. Five teachers who carry out their work in Primary Education in different public schools in the province of A Coruña (Galicia, Spain) participated in the study. For the collection of information, the semi-structured interview has been used, and the software Atlas.ti (8.1) for the data analysis. Regarding the personal dimension of Learning Ecologies, the results show the importance given to lifelong learning, and the clear intrinsic motivational orientation of the participants to get involved in their training process. In connection with the contextual dimension, it should be noted that teachers carry out different activities, use multiple resources and carry out various interactions with the aim of keeping up to date and improving their teaching practice. The ecological approach contributes to the design of a personalised learning itinerary better aligned with the interests and training needs of each teacher.

Keywords: Learning Ecologies, Teacher Professional Development, Further Training, Case Study, Primary Education.

Resumen

En la realidad actual, los docentes están expuestos a diversos y frenéticos cambios que hacen patente una necesidad de actualización permanente. Así pues, es ineludible el hecho de que el desarrollo profesional docente ya no puede ser entendido como una opción, sino como la única herramienta eficaz para dar respuesta a las rápidas transformaciones sociales, como las sobrevenidas por la pandemia de la COVID-19. Es en este marco en el que emerge el concepto de Ecologías de Aprendizaje como una perspectiva eficaz para integrar de forma holística las diversas oportunidades de formación disponibles en el entorno del individuo. El objetivo del presente estudio es analizar el proceso de desarrollo profesional del profesorado de Educación Primaria, a través de la identificación e interpretación de los elementos y dimensiones que configuran sus Ecologías de Aprendizaje. Esta investigación se ha llevado a cabo mediante una metodología cualitativa y, concretamente, a través de la tradición del Estudio de Caso. El caso estuvo compuesto por un total de cinco docentes que desempeñan su labor en la etapa de Educación Primaria en diferentes centros públicos de la provincia de A Coruña (España). Para la recogida de información se ha empleado la entrevista semiestructurada, y para el análisis de la misma el software Atlas.ti (8.1). Con respecto a la dimensión personal de las ecologías, los resultados informan de la importancia cedida al aprendizaje permanente, y la clara orientación motivacional intrínseca de los participantes para implicarse en su proceso formativo. En lo que concierne a la dimensión contextual, es preciso destacar que el profesorado realiza diferentes actividades, emplea múltiples recursos y lleva a cabo diversas interacciones con el objetivo de mejorar su *praxis* docente.

El enfoque ecológico contribuye al diseño de un itinerario de aprendizaje personalizado y mejor alineado con los intereses y necesidades formativas de cada docente.

Palabras clave: Ecologías de Aprendizaje, Desarrollo Profesional Docente, Formación Continua, Estudio de Caso, Educación Primaria.

概要

在当前的现实中, 教师面临各种巨大的变化。面对这些变化, 老师们需要进行持续不断地技能更新以适应当前情况。在这种情况下, 教师专业发展不可避免地成为应对快速的社会变革 (例如由COVID-19疫情引起的变革) 的唯一有效工具, 而不仅仅被视为是一种选择。在该背景下, 学习生态学的概念应运而生, 它有效地将个人环境中各种可能的培训机会进行了整体整合。本研究的目的是通过识别和阐释构成该学习生态学的要素和维度来分析小学教育教师的专业发展过程。这项研究使用定性方法, 具体来说通过案例研究的传统方法进行研究。该案例总共由五名教师组成, 他们在阿科鲁尼亚省 (西班牙) 的不同的公立小学工作。我们通过半结构化访谈收集信息, 并使用Atlas.ti软件 (8.1版本) 对其进行分析。关于生态的个人维度, 研究结果显示了终身学习的重要性以及参与者参与其培训过程的明确内在动机取向。关于环境维度, 结果突出显示教师为改善其教学实践, 开展了不同的活动, 使用多种资源并进行多种互动。生态学方法有助于设计个性化的学习计划, 使其更好地与每个老师的兴趣和培训需求协调一致。

关键词: 学习生态学, 教师专业发展, 继续教育, 案例研究, 小学教育。

Аннотация

Кризис, вызванный пандемией COVID-19, привел к закрытию образовательных центров, переносу образования из школы в дом. Дистанционное образование представляет собой проблему для семей, которые иногда прилагают дополнительные усилия, чтобы соответствовать требованиям школы. Поэтому основной целью данного исследования является изучение конкретных факторов, затрудняющих адаптацию семей учащихся начальной школы к дистанционному обучению.

Для решения вышеупомянутой задачи был проведен статистический анализ на основе ответов 236 семей учащихся государственных школ нашей страны на вопросник, созданный и проверенный ad hoc, как количественная система получения данных. С другой стороны, был проведен качественный анализ более 600 комментариев 236 родственников на открытый вопрос.

Результаты показывают, что почти половина семей признают трудности в адаптации к обучению на дистанции: нехватка ресурсов, недостаток знаний и организационные проблемы, которые вызывают негативные чувства. Эти трудности усугубляются в домах студентов с безработными членами семьи во время локдауна.

Наконец, отражена необходимость активизации действий, способствующих развитию коммуникации, школы и семьи, а также сокращению цифрового разрыва, обусловленного социально-семейными условиями.

Ключевые слова: государственное образование, виртуальное образование, семья, домашнее задание, COVID-19.

Introduction

During the past year, teachers in all educational stages had to quite unexpectedly face one of the most complex challenges in the history of the Spanish educational system. The COVID-19 pandemic stopped in-person education and obliged teachers to suddenly switch to online teaching, performing what was called emergency remote teaching (Hodges et al., 2020). This was an immense challenge for teachers, particularly those who taught infants and primary school, as there is little knowledge about remote education in these educational stages (Rappoport et al., 2020).

Because the virtual context is not the same as in-person, and online teaching cannot replicate in-person teaching (Sangrà, 2020), many teachers had to embark on taxing, accelerated training. This training should inevitably result in greater effectiveness when it comes to redesigning the teaching-learning process, and allow students to acquire the skills and reach the objectives initially set for them.

Although digital technologies have accompanied teachers for some time, in the past few months the complexity behind implementing virtual teaching-learning models has become painfully clear. On the one hand, although emerging changes in learning theories (suggesting new models for understanding knowledge and how it is acquired) have been in the works for a number of years, the pandemic has acted as a catalyst for those changes, which has meant that some ideas that were still being hammered out had to become the prevailing reality. As González-Sanmamed et al. (2020) warned, this has completely broken down spatio-temporal barriers, allowing teachers to learn when and where they want. This means that subjects make their own decisions about their own learning, and therefore must decide what and how to learn what they want to learn, taking control of their training process (Alexander et al., 2004). In addition, these changes also mean that one must accept that there is learning that is sometimes not seen, that is informal, invisible and silent, but which nonetheless allows teachers to acquire fundamental teaching skills (Burbules, 2014; Cobo & Moravec, 2011; Estévez, 2020).

It is inevitable that teachers' professional development, continual training and lifelong learning can no longer be considered as optional, but instead must be thought of as the only effective tool for responding to the rapid social and educational changes that are occurring. The continual expansion of knowledge, advances society throws up, and the changes around us mean that the initial training that people receive in general, and teachers in particular, is not sufficient, and they need lifelong and life-wide learning (Coll, 2013; González-Sanmamed et al., 2020).

Lifelong learning is an idea that encompasses anyone's learning at any age, in all contexts (formal, non-formal, and informal), using all of the sociocultural resources available (Amador & Esteban, 2019; Coll, 2014; Nygren et al., 2019). It recognizes that learning is not something that only happens at a given time nor only in official educational institutions, it goes beyond that and occurs throughout peoples' lives and careers (Burbules, 2014; Grané & Bartolomé, 2013; Islas & Carranza, 2017; Jackson, 2016).

The main objective of teachers' professional development is to cause changes to ideas, understanding, skills, and abilities which lead to improved teaching practice (Day, 2005). This improvement in teaching expertise will then lead to improved learning for students. One might assume then that professional development, as all learning processes, should go hand in hand with the social changes noted above. That would imply

the need to change the theoretical and practical approaches with which we understand and analyze the teaching and learning processes to incorporate the characteristics that define the current situation. This would necessitate a new approach to be able to identify and interpret all of the elements that make up part of teachers' professional development. This is the framework in which Learning Ecologies (LE) have emerged.

Various authors have addressed the term Learning Ecologies (Brown, 2000; Looi, 2001; Siemens, 2007). One of the more widespread definitions of LE is from Barron (2006), who explained that a LE is "the set of contexts found in physical or virtual spaces that provide opportunities for learning. Each context is comprised of a unique configuration of activities, material resources, relationships, and the interactions that emerge from them" (p. 195). The author places the emphasis not only on the contexts a person is in when they learn, but also on what happens in those contexts. The framework proposed by Barron (2004, 2006) explains how learning is done in all settings, identifying the possible synergies and obstacles between them, including the role of technology to make those barriers more permeable and to encourage new levels of autonomy in learning. Some years later, Jackson (2013) summarized the ideas in the literature to that point about Learning Ecologies, and proposed his own conceptualization of the construct, taking on board previous contributions. Jackson (2013) defined an LE as "the process(es) [one] create[s] in a particular context for a particular purpose that provide [one] with opportunities, relationships and resources for learning, development and achievement" (p. 14).

Analyzing the variety of conceptual approaches, one can infer that LEs are made up of diverse kinds of elements whose interaction lead to an individual's learning. Authors such as González-Sanmamed et al. (2019) and Estévez (2020) have stated that LEs are made up of two clearly distinguishable dimensions, one which is personal and subjective, and the other bringing together contextual and interpersonal elements.

The personal dimension is intrasubjective and includes aspects related to internal character, representing disposition towards learning and doing the job. According to various studies (González-Sanmamed et al., 2019; Estévez, 2020) it is made up of elements such as ideas about professional development and motivations to get involved in learning processes and improving teaching. These ideas relate to what someone thinks about learning and tasks related to updating professional knowledge, or more specifically, how they value the profession and the role of the teacher in the teaching-learning process. These play a fundamental role in how a given learning task is approached and executed. For example, a teacher whose values are based on responsibility and competence would be more involved in professional development processes. In addition, motivations are identified with aspects which lie behind teachers' involvement in training and continuing professional development processes and there are various ways in which people persist in the learning process. While some people are motivated by the desire to understand, curiosity, enjoying the challenge, and interest in learning, others lean more towards the construction of extrinsic goals such as positive evaluations, the approval of others, and avoiding negative evaluations. We would say that the former group had intrinsic motivation because the teacher is interested in developing and improving their capabilities, whereas the latter group have extrinsic motivation, as that reflects a concern linked to their image as a teacher or the desire for rewards rather than interest in learning for its own sake (Ryan & Deci, 2020).

The contextual dimension, which is social, circumstantial, and situational, is made up of elements related to the surroundings and the context the teacher is in. Among these, some authors (González-Sanmamed et al., 2019; Estévez, 2020; Romeu-Fonta-

nillas et al., 2020) have highlighted: a) relationships or interactions with others that have an impact on the process of teachers' professional development; b) resources, particularly digital resources, that mediate and support the learning process and are nowadays considered essential elements in teachers' professional development; and c) training and learning activities that teachers do to improve the quality of their teaching. This last element, which is linked to training events and activities, may occur in various settings (formal, non-formal, informal, or self-taught). In this regard, it is worth noting that each of the elements making up LE has a reciprocal influence on the others. To put it another way, the personal sphere (and the elements which make it up) influences and is influenced by the components of the contextual dimension that articulates the individual's personal and professional path. The choices they make and the opportunities they take to develop themselves professionally are not solely affected by external structures, but also by the various personal and subjective factors that come into play (Biesta & Tedder, 2007).

One issue emphasized by González-Sanmamed et al. (2019) as something particularly important to consider when studying LEs is that the identification and separation of the elements making them up is purely for analytical ends. As noted above, each element is linked by a network of relationships with the others and it makes no functional sense to take them in isolation.

To date, only a limited number of studies have adopted the ecological approach to learning (Han & Ellis, 2020). A recent systematic review of the literature on the topic of ecologies by Sangrá et al. (2019) highlighted that the concept was used in the literature as a mere introductory metaphor, and there has been significant fragmentation of the ontological approaches that have been used, which has produced unsuitable, unclear operational definitions. This may be because of the scarce empirical contribution to date, and the consequent embryonic state of the construct.

These gaps and inconsistencies in the literature about LEs, along with the suitability of this approach to address the study of broad, divergent, deeply-rooted processes like teachers' professional development, mean that the main objective of the present study is to analyze the process of professional development and the learning mechanisms of primary school teachers from an ecological perspective. In other words, the study aims to identify and deeply examine the nature of the various elements that appear in primary school teachers' LEs and the relationships between those elements.

Methodology

The present study used a qualitative design, via case study. We chose this approach for this phase of our research because it is qualitative-interpretive research tradition that allows a deep analysis of specific social realities (Jorrín-Abellán, 2019) and which contributes to the "study of systems that are instances in action" (MacDonald & Walker, 1975, p.1), such as ours. According to Stake (1995), case studies must allow us to thoroughly understand, holistically, empirically, and interpretively, the person or persons, innovation, or program that is the object of study. These contributions lead us to identify the case study as the ideal qualitative research tradition to approach the phenomenon to be studied, primary school teachers' learning ecologies.

Participants

To select the teachers for our case study we used homogeneous sampling (Patton, 2002) as the aim was to describe a subgroup of people who share certain common experiences at the core of the research. The criteria for eligibility that we set for selecting participants were:

- Training being done outside of formal, regulated education. Teachers who are actively and proactively seek alternative information in diverse settings.
- The use of innovative methods in the classrooms and inclusion of a focus on real competencies in planning.
- (At least) Moderate levels of digital competence and use of digital tools in the professional sphere.
- Collaboration in some type of teaching innovation or educational research project.

These criteria were the basis for selecting subjects to participate in this study. Each subject had to meet at least two of the criteria, and each of the criteria had to be met by at least one of the selected teachers. Our case study comprised five teachers teaching in various state-funded primary schools in the Spanish province of A Coruña (Galicia). Participants were given pseudonyms in order to preserve their anonymity and maintain the confidentiality of the information they provided. The participants were Aida, Begoña, Carlos, Diana, and Elisa. They were between 29 and 51 years old. We assigned a letter to each interviewee, giving the codes IA, IB, IC, ID, and IE (see Table 1).

Table 1

Identifying codes for the interview transcripts

Interviewee's pseudonym	Aida	Begoña	Carlos	Diana	Elisa
Code	IA	IB	IC	ID	IE

Information collection instrument

We chose a semi-structured interview as the instrument for collecting information as it is the most appropriate of the various interview types for what we were studying and the research questions being addressed. Semi-structured interviews are characterized by having pre-written specific questions which follow a certain order that is scripted (Verd & Lozares, 2016). The interviewee is free to answer however they wish, within the framework of the question put to them.

More specifically, the aim of the interview was to identify all the elements related to the learning mechanisms that the teachers activate for their continued development and to increase or update their knowledge and teaching skills. In other words, the battery of questions making up the script is related to the various learning contexts or environments, the various resources and relationships used to learn and update knowledge, the motivations behind the teachers involving themselves in continuing development processes, and their values and ideas around teachers' professional development.

Procedure

The selected teachers were first contacted and asked to participate in the study, with assurances that they would remain anonymous and that the information collected would be confidential. Once the candidates accepted the invitation to join the case study, a time and place was arranged for the interviews. The interviews were recorded to ensure record fidelity. Subsequently, the recordings were transcribed prior to data analysis.

Data analysis

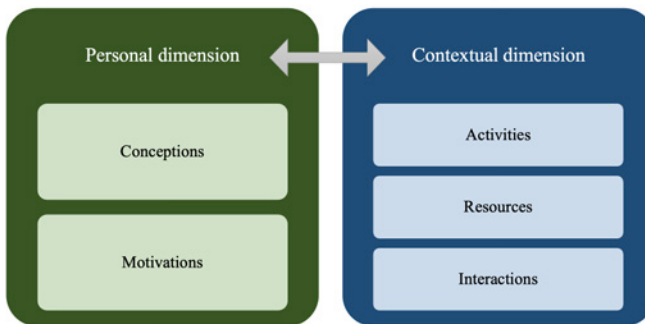
One of the characteristics of qualitative research is the accumulation of large amounts of information to analyze. For this reason, we chose to use the classic interactive model from Miles et al. (2014) to deal with the set of qualitative textual data resulting from the transcription. This model has three recurring steps that are continuously combined: reduction of data, representation of data, and drawing and testing conclusions. To perform these tasks, which make up the basic analytical process common to most studies with qualitative data, we used Atlas.ti (8.1) software.

In the first place, in order to proceed analytically to finding meanings that emerged from the data, we used what in this methodology is called mixed coding, which combines inductive and deductive strategies (Saldaña, 2016). Our approach started with the creation of an analytical categorization system produced from the existing literature about learning ecologies and considering the aim of the study. This categorization system was tweaked based on what was coded and on re-reading the material. After a number of rounds of coding, and after having reached what is called theoretical saturation (Strauss & Corbin, 2002), the final categorization system emerged (Figure 1) which linked all of the fragments of the interviewed cases about the different topics.

Once the data was coded, continuing with the process of analysis and interpretation, we applied strategies to represent the data clearly and intelligibly in order to be able to address the research questions. One example strategy we used was the network diagrams that appear in the Results section. Lastly, to produce and test conclusions, we used triangulation of the data observed, focusing our attention on looking for patterns of convergence in order to be able to corroborate the interpretations produced in terms of the planned study objectives and questions.

Figure 1

Categorization system



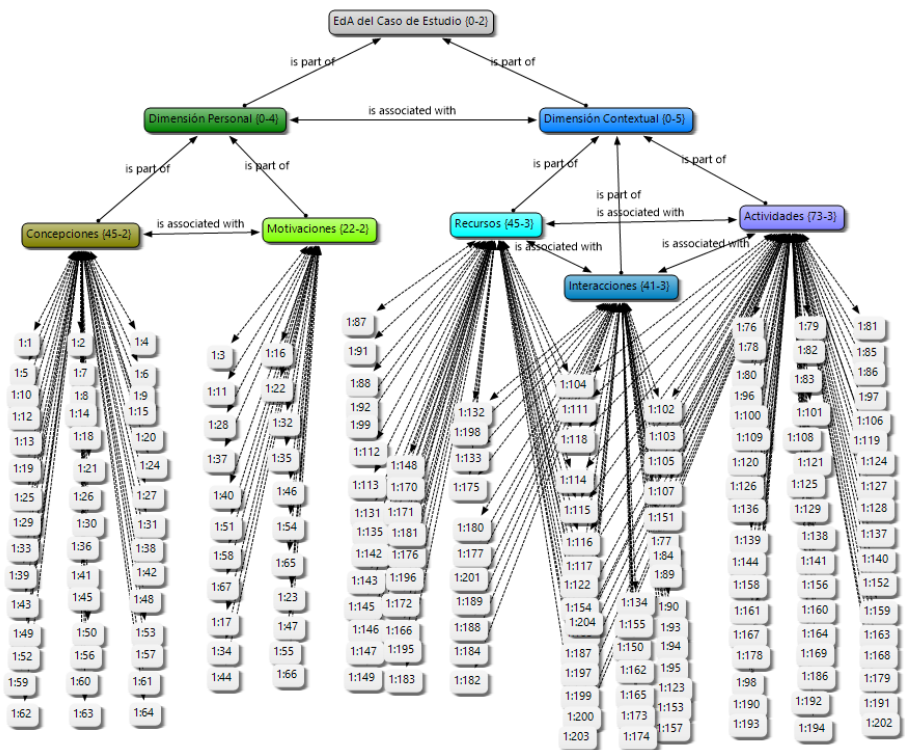
Results

The results of the analysis of the data in our case study allowed us to determine how the participating primary school teachers shaped their learning ecologies to develop professionally. Figure 2 is a network diagram illustrating the results of the analysis in detail. It allows us to identify the emergent elements that make up the teachers' LEs, the relationships between them, how often they appeared, and the density of the quotations produced, in this way demonstrating triangulation of the data.

Below, we describe in detail the peculiarities of the components that came up in the personal dimension (67 of the 226 coded quotations), which represent teachers' dispositions towards learning. Following that, we describe the elements that contribute to the design of the teachers' training paths, and which make up the contextual dimension (159 of the 226 coded quotations).

Figure 2

Network diagram of teachers' learning ecologies



Personal dimension

We begin with the results in relation to two key elements in teachers' professional development. These are the teachers' conceptions of professional learning and development (45 of 226 coded quotations), and their motivations for continuing to learn

throughout their teaching careers (22 of 226 coded quotations). The results show how all of the teachers understood continual training to be a fundamental part of their professional development and an influence on how they shape their teaching identities and the quality of their work in the classroom. These five teachers recognized that their initial training gave them elementary, transversal guidance, but was not sufficient to provide quality teaching in particular contexts which may vary markedly. In consequence, they all agreed that, their university mainly highlighted theoretical issues, often sidestepping the acquisition of skills to be able to put that knowledge into practice in diverse situations, "In reality I didn't learn to learn. They only gave me some concepts, content, and knowledge that I had to assimilate somehow, but I didn't know how to translate that learning into practice" (IB, p. 2). It was when they began to actually teach that they began to be aware of the gaps in their training and the need to keep learning continually, a need that they still recognize see nowadays. Aida stated, "The more I know, the more I realize that I have still to learn" (IA, p. 8).

The five participants in the case study admitted that their work required them to constantly keep learning, as education is part of a society that is characterized by rapid changes, and only by constantly learning can they fill in the gaps left by their initial training. As Carlos put it, "Continued training is everything. It's clear that the initial training is the basis for continued training, but this covers our whole lives. I am what I am thanks to the continued training that I did after starting to work as a teacher" (IC, p. 7).

In general, all of the teachers were very diligent with the learning they talked about, as they were constantly training, whether in formal training offered by the education authorities or via other means and strategies. According to the data, all of their training is done according to their needs and interests, in order to add teaching innovation, to adapt to changes in the classroom, and to be able to give suitable, comprehensive education to their students. We believe that Elisa's valuable contribution illuminates this idea, "I think that continual training is fundamental for a teacher. We must stay current so that our educational practice is up to date and we can go hand in hand with the society we and our students live in... We must learn and change how we work day to day based on what our students need, and to do that, continual training is necessary" (IE, p. 8).

Below, we present the results related to the other key elements that arose in the personal dimension of the teachers' LEs, the motivations that drive their engagement in professional learning and development processes. The five participants exhibited motivations that were principally oriented towards mastery, the reasons they gave were essentially intrinsic. They referred to interest in progressing, in improving their teaching skills, and increasing their knowledge. Carlos said, "by learning continuously I improve my teaching, in some way" (IC, p. 7). In addition, all of them specifically mentioned the central role of their students as a source of motivation in their learning and professional development. Diana explained, "The important thing is to find a motivation... and this motivation is our students, every day they evaluate us and it is them who, to a certain extent, set the agenda of change in the classroom" (ID, p. 13). On similar lines, Elisa demonstrated that her main objective was to improve professionally in order to be able to give her students "quality teaching, suitable for the times, which promotes creativity and autonomy along with the critical and reflexive aspect" (IE, p. 17). Another reason behind teachers' engagement with processes to improve teaching is the sense of responsibility and commitment to the job. Begoña's words illuminate this, "The responsibility I have towards some children, who I have to teach so that they

learn. But learn in the sense of creating within them a critical spirit and teaching them tools so that they can learn" (IB, p. 16).

Contextual dimension

In this section, we detail the results related to the contextual dimensions of the teachers' LEs. These include training activities and learning actions (73 of the 226 coded quotations), digital resources (45 of the 226 coded quotations), and interactions and relationships with others (41 of the 226 coded quotations) as key elements contributing to the participating primary school teachers' professional development.

With regard to training activities and learning actions, the teachers referred to activities in formal, non-formal, and informal settings, as well as self-teaching activities. For example, all of the teachers participated in various online and in-person courses each year organized by resource and training centers, which are institutions run by the Galician education authorities. The teachers indicated that although there is a lot of training on offer on a variety of topics, it is too theoretical, and does not leave enough room for the attendees to discuss and share experiences. Begoña said, "I think that the formal training doesn't help us to grow and develop. To a large extent we depend on non-formal training to develop" (IB, p. 6). According to the information provided by our group, less institutionalized training allows them to learn in a more personalized way, which they value highly. This suggests that they progressively resort to more non-formal actions and activities. It is worth noting the high frequency of attending conferences, seminars, and workshops, the participation in working groups and educational organizations and associations, as well as collaboration in research and educational innovation projects. It is also important to mention the dense discourse alluding to informal, and occasionally invisible informal learning they acquire throughout life. The following extracts illustrate this:

"We are people, and so we are writing our life histories, because everything that happens to us throughout our lives is what differentiates us from others. As professionals, our experiences have made us different... furthermore, our path through the education system has also influenced our way of teaching. So our life experiences affect our day to day lives as teachers" (IE, p. 17).

"travel helps us discover and learn new cultural forms that open up new worlds within the school... My experiences have left their mark on my training, they have helped me to understand what path to follow, and what path not to follow in the learning process" (ID, p. 12).

The high levels of participation in self-taught activities deserves particular consideration as those kinds of activities allow for more individualized training which suits different personal characteristics. This is what Elisa called, "...*a la carte* training" (IE, p. 14). In fact, Begoña said that self-training was the core of her continual training process (IB, p. 15). In this training setting, marked by its autodidactic nature, the five teachers specified that they mainly did web searches, consulted education-related blogs, read books and articles, and took part in forums and social networks.

Continuing with the elements that emerged in the contextual dimension of the teachers' LEs brings us to the results about the role digital resources play in the participants' continuing training and professional development. Although some of the interviewees

had more limited knowledge of technical tools, all of them felt that these tools offered many positive possibilities for learning, “Thanks to the internet, I have learned what great professionals think which has influenced my approach to how I teach now” (IB, p. 12). Of the various resources available, it was notable that the participants used mobile tools and applications that allowed them to interact and work collaboratively (e.g., Dropbox, Google Drive, WhatsApp, Telegram, Skype, Hangouts, Outlook). Social networks merit particular mention, as the teachers valued them very highly, considering them “meeting places and collaboration spaces” (IE, p. 16). More specifically, Diana stated that they helped her develop professionally as they “gave [her] new ideas and helped [her] find information and even methodological strategies” (ID, p. 11). Similarly, Elisa said that they were fundamental to her training process, “they allow me to keep current in the field of ICT and at the same time keep in contact with other teachers who share my concerns and motivations. Through these channels [we] create work groups and collaborative groups that are very useful as they allow [us] to create tools and share ideas about how to improve and make day to day classroom practice easier” (IE, p. 16).

Lastly, another of the key contextual elements of the LEs were the interactions and relationships with others for improving and keeping up to date professionally. These interactions were spread evenly between those in the personal sphere (families and friends) and the professional sphere (colleagues at work and other professionals). The teachers in our study generally thought that learning produced through relationships with other people was meaningful and positive, “Any personal or professional relationship with another changes you, positively or negatively, which influences you as a person and as a professional” (IE, p. 17). “It is people who undoubtedly help us to advance. Their experiences enrich us and day by day we absorb their concerns, their curiosity, and their motivation” (ID, p. 12). “People have always been important to my continued training, I might say that it is the most important aspect because you learn from them without realizing and totally unconsciously” (IA, p. 12). Nonetheless, the scales tipped towards professional interactions, which the participants felt were more influential in their professional development, “I think that keeping up to date through colleagues is one of the most important ways of training and keeping current. Their experiences help you a lot. You always learn something new” (IC, p. 17).

Discussion and conclusions

In this section, we discuss the results and give the main findings from this case study, which allow us to determine the shape of primary school teachers’ professional development processes via an ecological perspective. We will characterize each of the dimensions and elements of the participants’ LEs, specifying the defining traits of their ecological growth.

The results regarding the personal dimension of the LEs show that the participants think that continual training and professional learning are essential for them to be able to adapt to changes in society and to meet their students’ requirements. This need for continual training and development comes from the idea that the initial training they received in university is not sufficient for them to be able to properly teach nowadays. This has already been confirmed by various previous studies (Bozo & Aránega, 2017; Cinque & Rodríguez-Mantilla, 2020) and is based on the thinking that in order to provide high quality teaching, certain skills and abilities are essential that can only be acquired when one actually starts working as a teacher (Álvarez-Álvarez, 2015).

Other results from this study indicate the need to consider the motivational element. As various researchers have stated (González-Sanmamed et al., 2019; Romeu-Fontanillas et al., 2020), motivation is a key ecological component, a *sine qua non* for producing LEs (Barron, 2004, 2006; Jackson, 2013) as it is the motor which drives individuals to engage with and persist in their learning process. More specifically, our results show not only that the teachers were highly motivated to continue their training, but also that the motivational orientation was fundamentally intrinsic, which is in line with the results from other studies (García-Ruiz & Castro, 2012; Souto-Seijo et al., 2020). This is a very encouraging finding, because teachers who engage with their training process for reasons mainly linked to their interest in learning, their commitment and passion for teaching, or the satisfaction of being a better teacher, are identified with a more adaptive profile with better indicators of wellbeing (Hué, 2012). In addition, teachers with intrinsically-oriented motivation or learning-focused motivation may be characterized by having richer, more sustainable LEs (Sangra et al., 2019).

In terms of the contextual dimension, the participants did various activities, used multiple resources, and had a variety of interactions in order to keep themselves up to date and improve their teaching practice. Despite formal training often failing to meet their expectations, our results indicate that teachers regularly attend a variety of courses organized by the educational authorities. This finding, which is in line with information from the study by Fernandez and Montero (2007), may be explained because these training activities are free, and because they are compatible with teachers' working hours (something laid out in the regulations governing continual professional development for teachers in the autonomous community of Galicia). Despite that, because the teachers feel that the learning in these formal setting is not sufficient, they choose to complement it with other types of non-formal activities (e.g., attending workshops, seminars, and conferences, taking part in working groups, educational organizations and associations, and collaborating in research and innovation projects) and informal actions such as unplanned conversations with colleagues. However, our results indicate that out of all of the existing learning settings and methods, the teachers put self-taught activities at the top, as they allow teachers to completely personalize their training path (Marcelo & Vaillant, 2010). This training modality has become richer in recent years thanks to the penetration of digital tools into society and people's day to day lives (He & Li, 2019), an issue that leads to another of the elements of the ecology, digital resources.

Digital tools have become key components in LEs, as noted by Gonzalez-Sanmamed et al. (2020). In the current study there seemed to be a clear preference for a specific type of digital resource. According to the model from Castaneda and Adell (2013), our results indicate that interaction and communication resources (social networks, blogs, WhatsApp, etc.) were what the teachers valued and used most for their own training. This finding again demonstrates the interdependence between the key LE elements, as it leads us to consider the relationships and interactions with others as a substantial piece in teachers' training paths.

When it came to the contextual element referring to relationships and interactions, the teachers predominantly valued those in the professional environment. This means that the exchange of information, ideas, and experiences with colleagues has a significant impact on teachers' learning processes (Marcelo & Vaillant, 2018).

Lastly, it is worth considering that the results of our study support the value of LEs as an analytical perspective for studying learning, updating, and professional development processes. As noted previously, separating the different elements, perspectives,

and functioning of people's ecological machinery is only for analytical purposes, because as González-Sanmamed et al. (2019) underlines, they do not make functional sense when taken separately. Approaching the LE construct from an empirical-analytical perspective is a complex task given the breadth and diversity the term covers and the interrelationships between its components. However, paradoxically, its these very peculiarities which give the LE construct value, making it possible to characterize and interpret very diverse learning processes holistically (González- Sanmamed et al., 2019).

Furthermore, at the individual level, it is also worth highlighting the benefits of taking an ecological perspective to the processes of professional development. This approach contributes to the design of a more individualized learning path which is better aligned with each teacher's interests and training needs. In addition, LEs cover the range of settings, resources, media, strategies, and contexts that are currently available to teachers for learning, establishing links with their own intrapersonal and subjective characteristics.

Nowadays, people in general, and teachers in particular, are exposed to the rapid changes occurring in society. One of the most striking transformations in recent times was thanks to the COVID-19 pandemic, which imposed a new, unprecedented educational model on the very early educational stages. To deal with this new teaching format, teachers needed accelerated multidisciplinary training. In this setting, LEs are an ideal framework for being able to make use of the learning opportunities that each social circumstance brings with it.

Finally, it is important to consider the main limitations of this study. First, the information was collected solely through interviews. Because of that, in future studies information will be sought via other techniques such as observations or documentary analysis of digital materials and complementary texts. It may also be interesting to later carry out a quantitative study in order to analyze whether this ecological model is replicated in other groups of teachers, the significance of the key ecological elements, and how the interrelationships operate between them. This would help to back up or confirm the results presented in this study, and would also produce detailed, transferable ecological patterns that are representative of the group being studied.

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