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Primary school teachers' professional development through the learning ecologies lens: new ways for keeping up to date in uncertain times

Desarrollo profesional de maestros de primaria desde la óptica de las ecologías de aprendizaje: nuevas formas de actualizarse en tiempos inciertos

从学习生态学的角度看小学教师的职业发展：动荡时期提升技能的新方法

Профессиональное развитие учителей начальной школы через призму экологии обучения: новые способы обновления в неопределенные времена

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Abstract

Learning is evolving, just as the world and society are. In this context, teachers are also experiencing new ways for updating their professional development. The metamorphosis of learning is currently being pushed by four main catalysts: the connectivity of networks, the empowerment of the students, the overcoming of space and time barriers, and the assumption of the existence of silent, unnoticed learning. But these uncertain times have added a new, recent catalyst for change in learning and education: the COVID-19 pandemic.

In the framework of the ECO4LEARN research project, a study was designed and carried out to check to what extent the learning ecologies approach could provide information on how primary school teachers organise their learning and how they make decisions about it. A survey was sent to the entire population of primary school teachers in Catalonia, getting 1,253 answers. The calculated margin of error was ±3.14%. Data analysis was conducted along three steps: a) Descriptive statistics; b) Principal Component Analysis (PCA); and c) Multiple Regression.

Results show that the learning ecologies approach proves to be useful for analysing the actual means teachers use for their professional development and updating. Although some teachers are more advanced, practices do not respond to what could be expected regarding the use of less formal training for teachers and its mediation through the use of technologies. Regarding the sample analysed, the digital dimension of teacher professional development practices is still in its inception. Some recommendations are provided.

Keywords: Learning ecologies, teachers' professional development, primary teachers, ICT, COVID-19, informal learning.

Resumen

El aprendizaje está evolucionando tal como lo hacen el mundo y la sociedad. En este contexto, los docentes también están experimentando nuevas formas de actualización y desarrollo profesional. La metamorfosis del aprendizaje está siendo impulsada actualmente por cuatro catalizadores principales: la conectividad de las redes, el empoderamiento de los estudiantes, la superación de las barreras espaciales y temporales, y la asunción de la existencia de un aprendizaje silencioso e inadvertido. Pero estos tiempos de incertidumbre han agregado un catalizador para el cambio en el aprendizaje y la educación nuevo y reciente: la pandemia de la COVID-19.

En el marco del proyecto de investigación ECO4LEARN, se diseñó y llevó a cabo un estudio para comprobar en qué medida el enfoque de ecologías del aprendizaje podría aportar información sobre cómo los docentes de primaria organizan su aprendizaje y cómo toman decisiones al respecto. Se envió una encuesta a toda la población de profesores de primaria de Cataluña, obteniendo 1,253 respuestas. El margen de error calculado fue de ±3.14%. El análisis de los datos se llevó a cabo en tres fases: a) Estadística descriptiva; b) Análisis de componentes principales (PCA) y; c) Regresión múltiple.

Los resultados muestran que el enfoque de las ecologías de aprendizaje resulta útil para analizar los medios reales que utilizan los docentes para su actualización y desarrollo profesional. Si bien algunos docentes están más avanzados, las prácticas no responden a lo que se podría esperar en cuanto al uso de prácticas de aprendizaje menos formales y su mediación a través del uso de tecnologías. De lo que se desprende de la muestra analizada, la dimensión digital de las prácticas de desarrollo profesional docente aún se encuentra en sus inicios. Se facilitan algunas recomendaciones.

Palabras clave: Ecologías de aprendizaje, desarrollo profesional docente, maestros de primaria, TIC, COVID-19, aprendizaje informal.

摘要

随着世界和社会的变化，学习也在不断发展。在这种情况下，教师也正在经历技能更新换代和职业发展的新局面。当前学习的变化是由四个主要催化剂驱动的：网络的连通性，赋予学生的权力，克服空间和时间障碍以及假设存在无声和无意间获得的学习。COVID-19疫情推动了动荡时期的学习和教育的变化并增添了新的催化剂。

在ECO4LEARN研究项目的框架内，我们设计并进行了一项研究，以测试学习生态学方法可以在多大程度上提供有关小学教师如何组织学习及其如何做出决定的信息。研究对加泰罗尼亚的所有小学教师进行了问卷调查，收集到了1253份答复。计算的误差范围为±3.14％。数据分析分三个阶段进行：a）描述性统计；b）主成分分析（PCA）；c）多元回归分析。

结果表明，学习生态学方法对于分析教师在技能提升和专业发展上使用的实际方法很有用。尽管一些教师已取得一些进展，但在通过使用技术以非正规方式的学习实践可能不会达到其预期效果。从分析样本中得出的结果来看，教师专业发展实践的数码维度仍处于起步阶段。本文对此提出了一些建议。

关键词: 学习生态学，教师职业发展，小学教师，信息通信技术，COVID-19，非正式学习。

Аннотация

Обучение развивается, как развивается мир и общество. В этом контексте учителя также сталкиваются с новыми формами профессионального обновления и развития. В настоящее время метаморфоза обучения происходит под воздействием четырех основных катализаторов: соединение сетей, расширение возможностей обучающихся, преодоление пространственных и временных барьеров и допущение существования безмолвного и невидимого обучения. Но в эти нестабильные времена появился новый катализатор перемен в обучении и образовании: пандемия COVID-19. В рамках исследовательского проекта ECO4LEARN было разработано и проведено исследование с целью проверки того, насколько подход «Экологии обучения» может дать представление о том, как учителя начальной школы организуют и принимают решения относительно своего обучения. Опрос был разослан всему контингенту учителей начальных школ Каталонии, и на него ответили 1253 человека. Расчетная погрешность составила ±3,14%. Анализ данных проводился в три этапа: а) Описательная статистика; б) Анализ главных компонент (PCA); в) Множественная регрессия. Результаты показывают, что подход «Экологии обучения» полезен для анализа фактических средств, используемых учителями для профессионального обновления и развития. Хотя некоторые учителя более продвинуты, их практика не соответствует тому, что можно было бы ожидать в плане использования менее формальных методов обучения и их опосредования с помощью технологий. Судя по проанализированной выборке, цифровое измерение практики профессионального развития учителей все еще находится в зачаточном состоянии. Приводятся некоторые рекомендации.

Ключевые слова: Экологии обучения, профессиональное развитие учителей, учителя начальной школы, ИКТ, COVID-19, неформальное обучение.

Introduction

Nobel Prize Bob Dylan composed a song he started to sing in 1964 claiming “the times they are a-changin’”. Several decades later they are still changing faster and with plenty of uncertainty. We are living in a fast, changing world.

Although change has always been present in people's lives, the last generations of technology have accelerated the way they are reaching everywhere, for everyone. As the world is changing, society is changing. Technology and, in particular, the advent of the internet have resulted in profound changes in our style of life. We are adapting to a new economy, to new trading, to a new approach to culture, to work, and, of course, to education and learning (Castells, 2001).

Usual learning theories such as learning from experience, critical reflection, and transformational learning demand a "relatively stable social context even when individuals experience personal disorientation" (Nicolaides & Marsick, 2016, p. 14). However our current society is not a stable one. We are used to moving in fuzzy, unstable contexts, in an environment that Baumann (2007) considered "liquid", because of the difficulty to identify its borders, and its easiness for change. Also Fullan (2001) highlighted complexity as an attribute of today's world, which the author associated in the educational field with unpredictable, non-linear changes.

Because of this, current times are demanding different ways of learning. In 2011, Redecker et al. published a very interesting, prospective study in which they stated some insights of the future of learning. Based on five drivers (demographic trends, globalisation, immigration, labour market trends, and the impact of technology on education and training), they envisaged three main characteristics of future learning: personalization, collaboration, and informalisation. Other studies also pointed out flexibility and interaction (Unger & Zaussinger, 2018; Veletsianos & Houlden, 2019; Molinillo et al., 2018).

Technologies are also driving pedagogies to new scenarios in which the use of specific tools can shape the pedagogical approaches and, therefore, bring them into an on-going conversation as a previous step to be taken in, especially by formal institutions. Thus, besides pedagogical approaches like student co-created teaching and learning, equity-oriented pedagogy, best learning moments or gratitude as pedagogy, we could also find Universal Design for Learning (UDL), enriched realities, using chatbots in learning, telecollaboration for language learning, or data-based evidence for teaching as the new, cutting edge teaching and learning approaches that could be starring the future of learning (Kukulska-Hulme et al., 2021). Beyond the almost traditional use of technologies like blogs, wikis, applications, etc., new ones are arriving into the educational arena that will probably shape the very near future.

In a previous work (González-Sanmamed, Sangrà, Souto-Seijo, & Estévez, 2020), we highlighted that there were four main catalysts for the metamorphosis of learning: a) the increasing connectivity of networks: the society is becoming a huge network, in which we become a set of interconnected nodes (Castells, 2005) between which connectisvism (Siemens, 2005) enables learning; b) the empowerment of the student: people are deciding more and more what and how to learn (Kamenetz, 2010), lifelong learning is no longer something reach in the future, but the actual mainstream, while life-wide learning is also emerging (Jackson, 2013); c) the overcoming of time and space barriers: learning is developing its potential of ubiquity (Cope & Kalantzis, 2010) ; and d) the assumption of the existence of an unnoticed, informal, invisible, silent learning: as learning is often defined by its purpose, content, process and location, the boundaries between what is formal and what can be considered informal, no matter if it is tacit or explicit (Livingstone, 2006) are becoming very blurry, and it could be easier and more appropriate to consider the levels of formality as a continuum (Van Noy, James, & Bentley, 2016).

To these four catalysts we should add a timely new one: the discontinuity or intermittence of learning provoked by the pandemic. The historic situation of emergency we lived when entire school systems had to lockdown, and the later situation, in which because of the infections, entire schools or groups of them should also get locked at home, resulted in the need to design and implement hybrid systems which let teachers and students move smoothly from face-to-face to online, asking ourselves what will happen when we could come back to the "new normal".

Beyond the usual evolution of education, most of these changes have been triggered by external agents. First, the intensive use of technology, not limited to education, but to any single aspect of our society (Drucker, 2011). And second, and more recently, the COVID-19 pandemic, which has accelerated changes that already were on their way and which have landed suddenly and dramatically in our lives (Nicola et al., 2020). Unfortunately, lots of people, especially children, do not have access to technology yet, and the advantages of technology do not guarantee an equitable education yet, as both UNESCO[1] and OECD (2020) have already reported. This accepted and despite it, although it could be arguable, most of us consider that technology has helped a lot to avoid the total interruption of education when the pandemic came.

COVID-19 has shown the need to keep up to date through alternative learning methods and self-learning. Once the traditional face-to-face, formal education was put in check, new ways for responding to the threat and for continuous professional development have become more evident. Non-formal and informal ways of learning also combined with hybrid or fully online formats have taken in the new approaches that will probably definitely take off very early. Although nobody knows how the "new normal" will be, as Fullan (2020) stated: "Change will happen and will settle down" (p.27).

As prospective scenarios for schooling are envisaged (Fuster & Burns, 2020), also teachers will need to adapt to the change provoked by these scenarios by evolving in the way they approach their professional development. Kennedy (2014) reviewed her previous own work because she considered new practices were emerging, as a combination of both communities of practice and action research, and she also added that such continuous professional development approaches "must fundamentally be teacher and student driven" (p. 692), moving from a transmissive model to a more transformative one. In a similar vein, Kjar, Halling, and Pedersen (2015) carried out a study which concluded that 50% of teachers' continuous development programmes were organised on a basis of voluntary individually planned activities, so they decided when, how and what to do. McElearney, Murphy, and Radcliffe (2019) informed that participants in a study carried out with 318 primary teachers in Northern Ireland showed more interest in collaborative and interactive approaches and activities, although only a minority could access to them, so a major problem could be that most of the provision of continuous professional development (CPD) activities are still following traditional designs. Therefore, there are few opportunities for opening up to new methodological approaches, although teachers would like it.

Learning ecologies have proven to be an approach that can be useful to understand how people activate their learning opportunities over time. In the case of teachers, previous research shows that this framework could help to investigate teachers' ICT use, related beliefs and attitudes, and relevant others which influence professional development of teachers (Van den Beemt & Diepstraten, 2016). On the other hand, we have also identified difficulties for analysing the interdependence of formal, infor-

1 See: https://en.unesco.org/covid19/educationresponse/consequences

mal and non-formal or independent teacher learning in a more holistic way (Jones & Dexter, 2014), so learning ecologies could become the framework for such purpose.

The research

Although times, and learning, are changing, formal institutions are still providing the traditional types of continuous professional development for teachers. We hypothesize that teachers have to use alternative means for their updating and personal development. ICTs seem to be a means for expanding learning opportunities for continuous professional development, and that increase of awareness would provide a better management of these learning opportunities.

In the framework of the ECO4LEARN research project, partially funded by the Spanish Ministry of Science, Innovation, and Universities, a study was designed and carried out to check the previous hypothesis of the problem and to see to what extent the learning ecologies approach could provide information on how primary school teachers organise their learning and how they make decisions about it. Two additional research questions were identified: a) What is the role of ICT in shaping the learning ecologies of primary school teachers? and; b) Should some recommendations be given for increasing awareness of their own learning ecologies?

Learning ecologies have been approached from different methods and techniques (Sangrà, Raffaghelli, & Guitert, 2019). Thus, different ones have been used to get deeper into what they are and how education professionals use their learning ecologies or, in other words, what they do to learn. Semi-structured interviews have been used in the case of outstanding primary teachers (Romeu-Fontanillas et al., 2020); biographical interviews and surveys have been utilised for university teachers (González-Sanmamed et al., 2020), as well as Delphi studies for identifying their main elements (González-Sanmamed, Muñoz-Carril, & Santos-Caamaño, 2019) and gathering data through an e-portfolio (Ranieri, Giampaolo, & Bruni, 2019). This article shows the results of the use of a questionnaire for widening the knowledge on the learning ecologies of primary schools teachers.

Methods and Procedures

Data Collection

The instrument adopted was a questionnaire designed on the basis of a prior Delphi study and having carried out 9 qualitative semi-structured in-depth interviews with outstanding teachers that were asked to explain how they approached their learning in their everyday life, both through analogue and digital means (Romeu-Fontanillas, Guitert-Catasús, Raffaghelli, & Sangrà, 2020). The process of theoretical sampling and categorisation within these two prior phases led to the development of the questionnaire, discussed further with the project consortium researchers. Table 1 presents the questionnaire structure and codebook including the variables, type of metrics and codes used within the dataset. An open dataset has been published as subsidiary documentation of the current article.

Table 1

Survey structure and codebook

Question	Type of Variable	Code	Questions' Code
Personal Information			
Gender	Desc	I.1	v.1Gender
Age	Desc	I.2.	v.2Age
Years Teaching	Desc	I.3.	v.3Years_Teaching
Level/Course	Desc	I.4.	v.4Educational Level
Other Courses	Desc	I.5	v.4EDLEVELOther
Online modality	Yes-No	I.5.1	v.6_Onlinestudies
Blended modality	Yes-No	I.5.2	v.8_blendedsemi
Speciality	Comparison	I.6.	v.10.1Speciality_Sciences_1971 -> v.10E_Specialitytotal
Teaching Level	Desc	I.7	v.13_TeachingCourseLevel
Role in institution -> Teacher, principal, cycle coordinator, ICT, other	Yes-No -> Desc	I.8.	v.15_alt_plus_other -> v.15C
Institutional Information			
Province (TGN, BCN, Lleida, Girona)	Desc	II.1.	v.16_Province
Location (Urban/Rural)	Desc	II.2.	v.17_population
School Type: Private, Public, Semi-private	Desc	II.3.	v.18_institutiontype
Centre as part of a Network	Yes-No -> Desc	II.4.	v.19_Fundacion
Centre's educational characterisation	Likert 1-6	II.5.	v.73.1_TrainingProgPromo -> v.73.15_Other2
Learning Ecology: Perceived Professional Knowledge and Learning Needs			
Perceived Professional Knowledge - Curriculum (Learning Design, Contents, etc.) - Teaching Methods (Activities Design, Assessment strategies, etc.) - Technologies (Virtual learning environments, social networks)	Likert 1-6	III.1. 1	Zv.58.1_KnowLeve_Comp -> Zv.58.6_KnowLeve_Oth (curriculum) Zv.60.1_TeachMethod_ ActivityDesign -> Zv.60.7_ TeachMethod_Others (teaching methods) Zv.62.1_KnowTechToolsVirtEnv -> Zv.62.6_KnowTechToolsOther (technologies)

Question	Type of Variable	Code	Questions' Code
Learning Needs - Curriculum (Learning Design, Contents, etc.) - Teaching Methods (Activities Design, Assessment strategies, etc.) - Technologies (Virtual learning environments, social networks)	Likert 1-6	III.1. 2	Zv.59.1_TrainingNeed_ CompDesign -> Zv.59.6_ TrainingNeed_Others (curriculum) Zv.61.1_TeachTrainingNeed_ ActivityDes -> Zv.61.7_ TeachTrainingNeed_Others (teaching methods) Zv.63.1_ TrainingTechToolsVirtEnv -> Zv.63.6_TrainingTechToolsOther (technologies
Place x Activities' Frequency	Likert 1-4	III.2.	v.64.1_TrainingSource_ Workplace -> v.36_ trainingSources_OtherNamed
Overall Training activities frequency	Ordinal	III.3.	v.37_TrainingQuantity3Years
Overall number of hours in the last three years	Cardinal	III.4.	v.38_TrainingQuantityhours
Type of preferred training x frequency Extrinsic-Dependent/Intrinsic/ Independent Onsite - Blended - Online	Likert 1-4	III.5.	v.65.1_FormPresencial_Courses -> v.65.10_FormPresencial_ Debates v.66.1_FormSemiP_Courses -> v.66.10_FormSemiP_Debates v.67.1_FormVirtual_Courses -> v.67.10_FormVirtual_Debates
Learning ecology: Strategies of Self-Directed Learning			
Mechanisms of Self-directed Learning (frequency) Never, Sometimes....	Likert 1-4	IV.1.	v.42_SelfTraining
Perceived orientation to Self-Directed Learning Generally self-directed, Generally organised, Equal....	Likert 1-4	IV.2.	Zv.68.1_Search_google -> Zv.68.21_Search_OnlineLibraries
Type of Mechanisms of Self-directed Learning Information search, Content Creation, Open Educational Resources,	Likert 1-4	IV.3.	Zv.69.1_Generate_Twitter -> Zv.69.21_Generate_ InstituionTools
MOOC as mechanism Participation, types, evaluation	Yes-No-I don't know Descriptive Scale 1-6	IV.4.	v.50_MOOC -> v.71_MOOC_ Evaluate
Other Mechanisms	Text	IV.5.	v.53_OPEN_Extra_AutoFormacio

Question	Type of Variable	Code	Questions' Code
Learning ecology: Management and Evaluation			
Evaluation of peers interactions' strategies supporting professional development (social networking, congress participation, etc.)	Likert 1-6	V.1.	ZImproveDevt_ ProNetworkPresencial -> Zv.54.9_ImproveDevt_Others
Agreement with....personal approach to learning? (social networking, congress participation, etc.)	Likert 1-6	V.2.	Zv56.1_Agree_LearnInformal -> Zv.56.8_Agree_SMColleagues
Comments, Suggestions	Text	V.3.	v.57_Comments

After getting official permission, the survey was sent online to the entire population of primary teachers in Catalonia, by means of the Department of Education. The sampling was purposive, for the respondents were invited to take part in the survey at the school/educational centres level or via social networks. In this regard, the type of respondent was not randomly selected.

The relevant sample (1,253 initial responses and 973 after the elimination of outliers), in any case, ensures statistical power and acceptable margins of error and confidence intervals (CI) for the responses. According to Comrey and Lee (1992) a sample of 1,000 participants can be classified as excellent. Over the basis of a 95% CI and a calculated population size of 64,964 of early childhood and primary education teachers in Catalonia, the calculated margin of error was ±3.14%.

Data Analysis

The data analysis was conducted along three steps: a) Descriptive statistics; b) Principal Component Analysis (PCA); c) Multiple Regression.

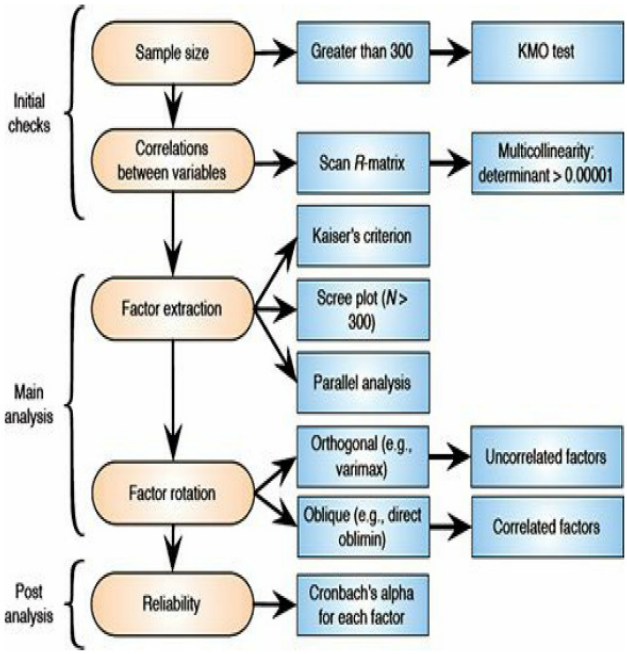
Descriptive statistics are the initial quantitative synthesis of results and are used to describe the basic features of a study's data. They usually refer to the distribution, the frequencies, proportions or percentages, central tendency and dispersion measures. They provide insight for the successive inferential steps. In this article, according to a canonical approach, we introduce the frequencies and distributions, followed by percentages in the case of categorical variables and central and dispersion measures in the case of numerical variables. To complete the descriptive statistics, some initial inferential tests (correlation and non-parametrical signed rank test) are performed, to explore significances in internal distributions or between variables later grouped through PCA).

PCA is a technique aimed at reducing the dimensionality (number of variables in a study). Since the constructs adopted were complex, many variables were measured through the questions (57). As it can be seen in Table 1, the questionnaire adopted

a number of theoretical sections (Personal Information, Institutional Information, Learning ecology: Perceived Professional Knowledge and Learning Needs, Learning ecology: Strategies of Self-Directed Learning; Learning ecology: Management and Evaluation) were considered. The last three related the learning ecologies and included a relevant number of variables exploring beliefs and practices. In this regard, it was important to reduce the number of variables to proceed with focal points in our study connected with the construct of lifelong learning ecologies. The PCA technique is based on the identification of principal components starting from a computation process on the observations (points in the vector space of relationship between variables) which then projects each data point only on the principal components (vectors) to obtain data of smaller dimensions while preserving the data variation as much as possible. In practice, what you get is a smaller number of variables associated under a component in a covariance matrix. The components can then be used for subsequent interpretations and statistical inference. PCA is the simplest of true multivariate analyses based on eigenvectors and is closely related to factorial analysis, although the latter can incorporate more specific hypotheses of the domain on the underlying structure. Considering the complexity of questions deemed theoretically relevant in our initial questionnaire study, PCA could help unravel relationship structures between variables and thus characterize data-based practices more succinctly. Given the exploratory nature of our study, based on research questions that aim to understand the extent of the phenomenon, PCA was considered the most appropriate type of statistical analysis (Gravetter & Wallnau, 2014).

Figure 1

The PCA procedure



Note. Retrieved from *Discovering Statistics Using IBM SPSS Statistics* (edición nº 4, p.684), por A. Field, 2013, Sage.

As for multiple regression, it is a type of statistical process for estimating the relationships between a dependent variable (often called the 'outcome variable') and one or more independent variables (often called 'predictors', 'covariates', or 'features'). Once the PCA's outcome variables were identified, we attempted to find the complex linear combinations between the participant profiles and the variables characterising the learning ecologies.

Prior to the statistical analyses, initial data screening was carried out to check for missing data and violations of assumptions. Scores were standardized in order to investigate the presence of outliers according to the screening techniques of Tabachnick and Fiddell (2013) which postulates that any scores +/- 3.29 SD should be removed. Based on the evidence of both missing data and outliers, a total of 278 cases were removed prior to any further analysis. As such, this left a total of *N* = 981. This can be considered an excellent sample size as it is above the suggestions of both Tabachnick and Fiddell (2013) and Comrey and Lee (1992), both of which suggest 300 as a reliable sample size for Principal Components Analysis.

Normality p-plots revealed potential deviations from normality. However, based on the central limit theorem this should not affect interpretation of results given the large sample (Field, 2013). Moreover, Fields (2013) postulates that the assumption of normality is not necessary unless the analysis is an attempt to generalize the results found beyond the sample collected, which in this case was not the intention.

Results

Descriptive Statistics

Here we report the most relevant categories along the five "blocks" within this study. The full report (in Spanish) will be published as an Open Dataset.

From the whole sample of 1,253, 78% (974) were females and 22% (279) males. The average age was 44.35 years old (with a SD=9.82), with minimum and maximum values of 23 and 63 indicating a group of teachers at a middle stage of their careers. The distribution was quite similar to that described by the years of experience of the respondents (mean 20.01, SD 10.63) (See Figure 2 and 3).

Figure 2

Age of the Respondents

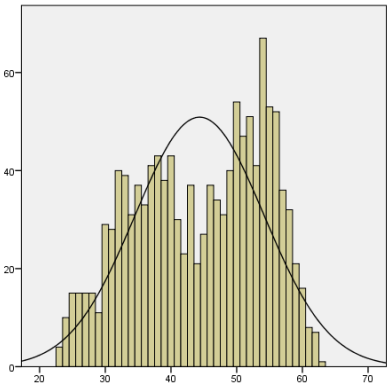
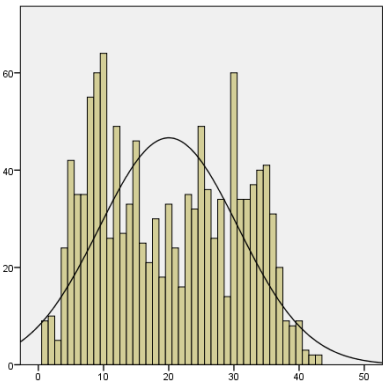


Figure 3

Age of the Respondents



Most participants had a degree in Primary Education Teaching. A significant percentage declares that they have another bachelor's degree (25.6%), a postgraduate degree (19.7%), another diploma (10.1%) or a master's degree (9.7%). Only 2.3% declare having finished another grade. Of the 1,253 teachers, only 13.6% had taken some of these programmes or courses online; even fewer are those who declare having participated in semi-face-to-face training (5.7%). It is important to note that in these items a very high number of teachers did not answer: respectively, it is 14.8% and 22.9%.

Regarding the specialty, the majority of teachers (72.7%) declare having only one: the most represented are Primary Education (LOGSE, 1990, indicated by 22.3% of those surveyed), Early Childhood Education (LOGSE, 1990, 14.2%). The rest of the sample has taken the curriculum established in the 1971 Plan. The participating respondents become a good representation of the entire population of teachers in Catalonia if we take into account the cycle in which they are teaching this year: the most represented cycle is the higher one (23.6% of valid data), just before the initial (21%) and mid cycles (12.9%). 42.5% of teachers have declared that they have been teaching in more than one cycle.

Seven hundred eighty-five (785) teachers out of 1253 (62.6%) indicate having a position in the school (Table 2). Fifty-nine (59) of them said they have more than one. The most represented position on the list is that of director/Head.

Table 2

Respondent's position or responsibility

	N	Percentage
No special position/answer	468	37.4
Head	212	16.9
Coordinator of Unit	139	11.1
Administrator	55	4.4
Pedagogical Coordinator	102	8.1
TAC Coordinator	104	8.3
Languages Coordinator	34	2.7
Intercultural Learning and Inclusion	16	1.3
Cycle Coordinator	48	3.8
Other	139	11.1

As for the geographical areas, the 64.6% of the participants work in the province of Barcelona, while the distribution in the rest of provinces is as follows: Tarragona (13.4%), (10.5%) and Girona (10.1%), and 1.4% of lost responses. An item of the questionnaire (Table 3) analysed the kind of town/city where the respondents work, proposing four alternatives: from urban to rural. The responses obtained allow us to have a good representation of the different contexts in which schools are located.

When coming to the elements characterising the learning ecologies, in general, teachers positively evaluated their own knowledge in key curricular areas (question 21) such as teaching planning (mean 4.85 / 6, SD= .933), attention to diversity (mean 4.45 / 6, SD= 1.092) and knowledge of the contents of their subjects (mean 5.02 / 6, SD= .859). The responses to the other curricular aspects measured in this question of the questionnaire, that is, the competency design and multicultural education, present an approximately normal distribution, and means respectively of 3.88 / 6 (SD 1.096) and 3.97 / 6 (SD 1.199).

Consistent with the above, teachers in general declare that they do not need further training in subject content (mean 3.19 / 6, mode 2), although the dispersion is rather high (SD= 1.571); Instead, they demand training in key aspects such as competency design (mean 4.18 / 6, SD= 1,451, mode 5) and attention to diversity (mean 4.1 / 6, SD= 1,492, mode 6) . This last item, curiously, does not seem consistent with the level of knowledge manifested in this key area. Examining the bivariate correlation between these two responses, which is negative but weak ($r = -.273$, $p < .001$), the situation that emerges is sufficiently evident: teachers claim to know quite a bit, but believe that they still need more training.

The need for training manifested in multicultural education is also quite high (mean 3.97, SD= 1.454) and in teaching planning (mean 3.28, SD 1.547) -another item, the latter, in apparent contradiction or incoherence with the high knowledge declared in the previous question. The data showed also that the teachers know well enough the teaching methodologies that the questionnaire proposed. As an example, teachers declare to have very good knowledge in activity design (mean 4.52/6, SD= .927) and in the guidance and tutoring processes (mean 4.14 / 6, SD= 1.15, mode 5). The analysis reveals that, with the exception of the design of activities, in which the responses were very diverse (mean 3.82/6, SD= 1.456, mode 3), all the other items show that teachers need more training, despite their relatively high levels of perceived knowledge –this is the case of the orientation and tutoring processes (mean 4/6, SD 1,524, mode 5). Most teachers also seem to need training on evaluation strategies (mean 4.13/6, SD= 1.463, bimodal distribution, 5 and 6), collaborative learning (mean 4.14/6, SD= 1.443), project-based learning (mean 4.06/6, SD= 1.532) and problem-based (mean 4.45, SD= 1.377, mode 6). In the question that measured the degree of knowledge of some specific technological tools, it is interesting to note that teachers are well acquainted with digital whiteboards (average 4.05/6, SD= 1.388), but most declare that they have difficulties when creating digital resources (mean 3.03/6, SD= 1.481, mode 2).

The other technological tools that the questionnaire proposed, that is, the level of knowledge of virtual learning environments, the use of social networks for learning and the use of web 2.0 tools, present symmetric distributions. Analysing the items that measure training needs in the field of technological tools, it is clearly seen that the vast majority of teachers consider that they should know much more: the five items of this question present a distribution with a very marked negative asymmetry, and with a mode of 6 over 6 (Figure 4).

Moving from the perceived training needs, there was a focus of attention connected to the types of training activities actually undertaken by the participants. Analysing more in depth the training modality most used by teachers, that is, the course (Table 3), thanks to the Friedman test a significant difference has been found between their three degrees of presence, $X2 (2) = 418.654$, $p < .001$. Wilcoxon signed rank tests (to which the Bonferroni correction was applied). Table 3 have shown that participation

in face-to-face courses is significantly higher compared to that of blended courses (z = -19.22, p <.001, r = - .40) and virtual (z = 14.31, p <.001, r = -.40). In addition, it was seen that participation in virtual courses is significantly higher than participation in blended courses, although the difference is very small (z = -2.78, p <.01, r = -.06).

Figure 4

Training needs

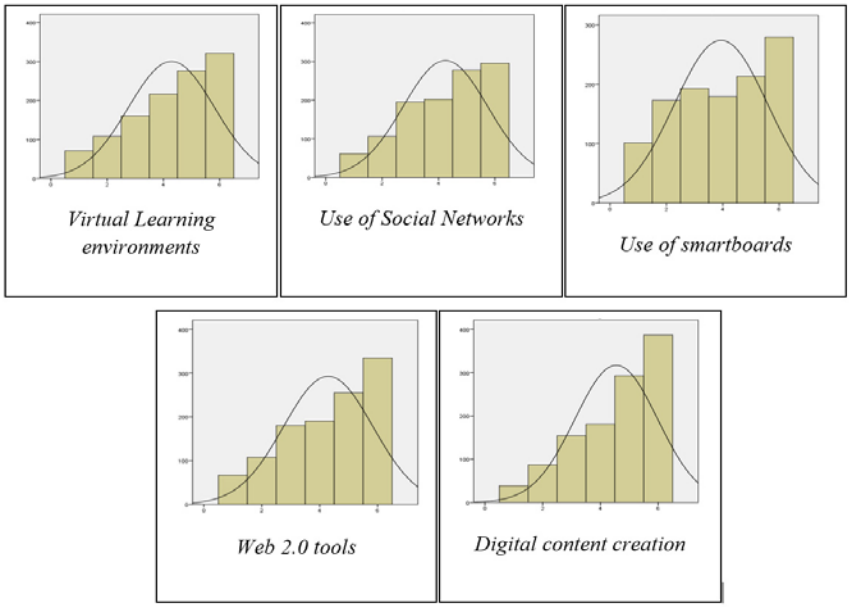


Table 3

Comparison of type of training attended by the participants

		Onsite courses	Blended Courses	Online Courses
N	Valid	1206	1156	1164
	NA	47	97	89
	Mean	3,02	2,30	2,39
	Median	3,00	2,00	2,00
	Min	1	1	1
	Max	4	4	4

	N	Z	Sig. one tail	Effect Size (r)
Blended VS onsite	1131	-19.22	.000	-0.40
Virtual VS onsite	1136	-14.31	.000	-0.40
Blended VS online	1126	-2.777	.003	-0.06

Finally, self-paced learning was considered. Self-learning represents an important aspect of teachers' learning ecologies. The vast majority of those surveyed declared that they frequently use self-learning mechanisms (mean 2.73/4, SD 0.811), although only 18.6% recognize that, for the most part, these are more frequent than participation in organised training activities (Table 4).

Table 4

Level of engagement in self-paced learning

	N	%	Valid %
Mostly self-paced learning	226	18.0	18.6
Mostly organised training	371	29.6	30.5
Both	410	32.7	33.7
I don't know	209	16.7	17.2
Valid	1216	97.0	100.0
NA	37	3.0	
Total	1253	100.0	

Regarding the most common self-paced learning strategies, the questionnaire distinguished between strategies to search for information, strategies to generate new content, and strategies to search and use OER.

Table 5

Self-training strategies (and tools) to search for information.

	N	Min.	Max.	Mean	S.D.
Google	1221	1	4	3.65	.580
Bing	1076	1	4	1.27	.596
Twitter	1085	1	4	1.35	.782
Tumblr	1071	1	4	1.06	.284
Facebook	1122	1	4	2.03	1.090
Google+	1094	1	4	1.79	.957
LinkedIn	1088	1	4	1.33	.651
Ning	1065	1	4	1.03	.199
Quora	1036	1	3	1.02	.145
Portal XTEC	1216	1	4	3.25	.806
Educational associations activities	1099	1	4	2.46	.994
Blogs and webs (personal)	1167	1	4	2.87	.917

	N	Min.	Max.	Mean	S.D.
Publications (analogic)	1141	1	4	2.35	.900
Publications (virtual)	1127	1	4	2.44	.932
Onsite Libraries	1122	1	4	2.15	.931
Virtual Libraries	1104	1	4	2.08	.984

Note. A 4-points Likert scale was used (1: never; 4 = very often).

Last, but not least, the general evaluation of the learning ecologies by the participants was considered. The strategies adopted by the teachers as interactions with others to improve their own professional ecologies were considered.

In this sense, respondents valued being active in a face-to-face professional network more than in a virtual professional network, although the difference is not very wide (average 3.73/6 with SD 1.693 and average 3.17/6 with SD 1,672, respectively) but –as revealed by the Wilcoxon signed rank test- significant ($Z = -9.728$, $p < .001$, $r = .21$). Moreover, the teachers positively valued the fact of holding informal meetings in person, better if it is in the same school -mean 4.21/6 with SD= 1.44- than in teacher associations (mean 3.35/6, SD= 1.59): among these two items there is a moderate positive correlation ($r = .551$, $p < .001$).

Although almost everyone agreed on the importance of carrying out projects at school (average 4.4/6, SD= 1.395), not many considered that participating in research and innovation groups (average 3.21/6, SD= 1.686, mode 1) could help them improve their professional trajectory. These two items are moderately and slightly correlated with the item that mediates the frequency of participation in face-to-face innovation projects ($r = .409$, $p < .001$ and $r = .284$, $p < .001$).

Principal Component Analysis

The principal components were extracted over the basis of factor analysis over the items within each section of the questionnaire (theoretically defined). The Kaiser-Meyer Olkin (KMO) measure verified the sampling adequacy for the analysis. Bartlett's test was used to analyse the percentage of the variance explained. All KMO were above the acceptable limit of .5 (Field, 2013). Moreover, the scree plot method was used to determine the number of factors to extract. All data is available at the Open Dataset (which includes the complete report).

After the PCA, 15 components were characterised. Table 6 introduces such extracted components, the variables within the components and the components' loadings.

The PCA revealed that the teachers feel they know with regard to pedagogical methods, though active learning shows a huge variability in the responses. Consistently, two teachers' learning needs can be grouped into two main components: active methods, and digital environments and resources.

With regard to the strategies of self-directed learning, it appears that the teachers are keener on searching information via traditional channels and to a lesser extent in social media. The components showed consistently that the teachers are less used producing publications or digital content.

Table 6

PCA extracted components.

PCA Analysis Variables	KMO	Explained Variance (Bartlett's test P=0.000)	Cronbach a moderate reliability >.90 high reliability	PCA Label (assigned theoretically)	PCA Variables
Knowledge Level and Training Needs - Q21, 23, 25					
PC1	.71	47.58%	.72	Teachers Pedagogical Approach	1 factors of 5 items
PC2	.84	54.17%	.83	Active Methods in Class	1 factors of 6 items
PC3	.78	65.71%	.83	Digital Environments & Resources adopted	1 factor of 5 items
PC4	.66	62.13%	.70	Diversity in learners' need	1 factor of 5 items
PC5	.71	72.92%	.81	Professional Development needs related to active methods	1 factor of 6 items
PC6	.70	71.59%	.80	Digital environments and resources training need	1 factor of 5 items
Strategies of Self-Directed Learning Q35, 38					
PC7	.77	52.39%	.62	Information Search	2 factors of 16 items
PC8			.56	Social Media Search	
PC9	.73	46.86%	.75	Generating Publications	3 factors of 16 items
PC10			.79	Generating Social Media Content	
PC11			.62	Blogging	
Learning Ecology Evaluation and Management Q45,47					
PC12	.83	49.07%	.77	Collaborative Research Engagement	1 factor of 8 items
PC13	.62	58.46	.74	Independent learner	3 factors of 8 items
PC14			.84	Training Resources	
PC15			.36	Learning from Others	
PC16	.83	47.34	.68	Active Onsite Training	1 factor of 10 items
PC17	.87	57.18%	.72	Formal Blended Learning	1 of 10 items
PC18	.83	57.41%	.77	Online Formal Learning	1 of 10 items
PC19	.87	58.46%	.53	Open Online Formal Learning	3 of 8 items

As for the Learning Ecology Evaluation and Management, the most solid components were training resources (preference for accessing traditional training); online formal learning (as opportunity, but preferred with guidance); collaborative research engagement (as the activity undertaken at the schools or education centre). Less clear was the engagement in open professional learning communities (learning from others) or open learning.

Multiple Regression

Once the PC were identified, a multiple regression analysis (backwards) was used to test the relationship between Demographic information (indicating the type of personal and cultural profile of the participants) and variables connected to the teachers' knowledge and learning needs (as predictors) and the learning ecology strategies (response variables). The relationship between the participants' profile and the strongest elements in the learning ecologies were:

1. Information search. A significant regression was found ($F(11.19, .94) = 11.92$, $p < .01$, $R2 = 0.86$. Age, kind of location and size of population, teacher pedagogical approach, learner diversity and active methods were all significant predictors of information search.
2. Social media search. A significant regression was found ($F(23.98, .871) = 27.54$, $p < .01$, $R2 = .10$. Age and digital environments and resources were both significant predictors of social media search.
3. Generation of published content. A significant regression was not found ($F(5.49, 1.07) = 5.09$, $p < .01$, $R2 = .13$. Teacher Pedagogical Approach, Active Methods, Digital Environments and Resources and learner diversity were all significant predictors of generation of published content.
4. Generation of social media content. A significant regression was not found ($F(10.25, .93) = 11.02$, $p < .01$, $R2 = .07$. Digital Environments and Resources was a significant predictor of generation of social media content.
5. Generation of blog content. A significant regression was not found $F(41.46, .78) = 52.77$, $p < .01$, $R2 = .20$. Location (Province) and Digital Environment and Resources were significant predictors of participants' generation of blog content.
6. Self-guided learning. A significant regression was not found $F(13.54, .96) = 13.98$, $p < .01$, $R2 = .06$. Teacher pedagogical approach, digital environments resources and knowledge relating the learners' diversity were all significant predictors of self-guided learning.
7. Collaborative research and engagement. A significant regression was found $F(18.78, .88) = 21.19$, $p < .01$, $R2 = .11$. Teacher pedagogical approach, digital environments resources and knowledge relating the learners' diversity were all significant predictors of collaborative research and learning.

In synthesis, the teachers' age as well as the population magnitude (as proxy of the school geographical location); and the good knowledge of digital resources creation as well as the active pedagogical approaches and diverse learning needs, were good predictors of the engagement in more traditional professional learning activities (information search), on self-guided learning, and on collaborative research and engagement.

Discussion

Responses of a large sample of teachers from schools in Catalonia (1,253) could be collected. A considerable percentage of those surveyed declare that, in addition to their degree that qualifies them for teaching in Primary Education, they also have some other undergraduate or postgraduate degree. An important item of the questionnaire has revealed information on possible additional positions of teachers in the school to which they belong: almost two thirds of the teachers who answered the questionnaire take over some other responsibility in the educational centre. Two out of every three responses to the questionnaire were located in the province of Barcelona. Tarragona, Lleida and Girona are equally represented with a percentage of just over 10%. Two thirds of the respondents work in public schools: this is another essential item to analyse in detail the other answers, because it has allowed us to draw a picture in which the private sector seems to be significantly ahead of the public in a few areas potentially related to elements of learning ecologies. The reasons for this could depend on many variables (Bonal, 2002), however this was not the focus of the current study.

The questionnaire measured the levels of perceived knowledge and the need for training in some key areas: teachers have positively evaluated their knowledge in the content of their subjects and in cross-cutting or methodological aspects such as attention to diversity or teaching planning. However, and in line what Czerniawski, Guberman, and MacPhail (2016) call "need of up-skilling in new pedagogies", respondents would like additional training on a broad set of instructional methodologies including assessment strategies, mentoring and guidance processes, collaborative learning, project-based, and problem-based Learning.

As for ICT usage, except for digital whiteboards -which, above all, the most expert teachers declare that they know how to use satisfactorily- the levels of knowledge of the other tools that the survey proposed (virtual learning environments, web 2.0 tools, social networks and digital resources) present medium-low values. While, as it has been seen, the items that measure the levels of knowledge of these ICT tools reveal a quite varied situation and a wide range of responses, the situation with regard to training needs in these same fields is much more obvious: the data recommends that the institutions organise more training on the use of new technologies in teaching, considering what Ottenbreit-Leftwich et al. (2018) recommend: "school resources and environment had a strong impact on beginning teachers' practices, regardless of strong internal enabling factors" (p. 283).

Teachers prefer formal channels (such as the same centre in which they teach or the Department of Education) than through mechanisms of self-learning or informal and non-formal training. This is especially true for a group of teachers who have one or more of the following characteristics: many years of experience, a job in the private sector and the position of pedagogical coordinator of the centre. These formal channels tend to provide face-to-face training activities in which ICT does not play an important role. In self-learning, on the other hand, almost all teachers positively value the role of new technologies: participation in self-learning activities through the Internet is significantly higher than that carried out through traditional channels. This is especially true for those who use self-learning more often, such as Learning & Knowledge Technologies (TAC) coordinators.

Although there are more teachers that have a preference towards formal activities, collected data show that self-learning and informal activities should not be discarded. Indeed, as the study from Liao, Ottenbreit-Leftwich, Karlin, Glazewski, and Brush

(2017) pointed out, professional development "should incorporate flexibility and variety into formats and content to better address a wide range of teachers' PD preferences and needs" (p. 538).

Consistent with the most used channels, the modalities used by teachers (courses and seminars) are also formal. It has also been seen that participation in face-to-face courses is significantly higher than in virtual courses. These formal channels tend to provide face-to-face training activities in which ICT does not play an important role

In self-learning, on the other hand, almost all teachers positively value the role of new technologies: though it is mainly connected to information search rather than with content creation, participation in self-learning activities through the Internet is increasing amongst the participants, as learning is increasingly embodied whatever you do and wherever you do it. (Lankester, Hughes, & Foth, 2017). It also has to be highlighted that even in a still reduced number, informal learning is starting to be considered by primary school teachers as a flexible and appropriate way to keep up to date, especially as a complement to formally organised training programmes (Grosemans et al., 2015)

Peer interaction showed a huge variability in the responses. Although Kennedy (2014) stated communities of learning and networks were emergent means for training, it appears that the teachers tend to consider that social networks are not the most appropriate place in which to carry out these interactions, or to maintain the contacts. However, onsite peer interaction is deemed relevant. The vast majority of teachers attach great importance to the internal projects of the teaching school. In contrast, the situation is much less defined as regards participation in innovation projects. The educational centre seems to promote rich contexts (particularly in important urban spaces). The creative activities on the Internet are mostly connected with the type of education centre, in fact.

Finally, it is important to point out that this survey was launched when the pandemic did not already have the huge impact it has had on education. Professionals working in the educational context are adapting their practices to the new situation provoked by the COVID-19 and, by extension, the way they are keep up to date. Although most of the conclusions will probably be useful regarding the move to digital solutions for teaching and learning and, by extension, for continuous professional development (Gomez, 2020), they have not been analysed from this perspective.

Conclusions

As learning is changing, teacher professional development will. However, current practices do not respond to what could be expected regarding the use of less formal training for teachers and its mediation through the use of technologies. Regarding the sample analysed, the digital dimension of teacher professional development practices is still in its inception. The study also shows that there still is a gap between current teacher preferences and capabilities regarding professional development and actual practice (McElearney, Murphy, & Radcliffe, 2019)

Learning ecologies have provided a good lens to identify what Jones and Dexter (2014) already advanced: "While investing significant time and money into formal teacher PD, they are missing opportunities to enhance the teacher and student outcomes by not supporting, recognizing, connecting to, and building upon teachers' informal and

independent learning processes already in place" (p. 383). From this study we can conclude that there is still a long way to go to integrate formal, non-formal and informal professional development activities as a holistic system for teacher learning.

If the idea of teaching considers a 360º educational approach, including all the actors and elements that one can find in their close community, this digital dimension cannot be forgotten. The opportunities for professional learning through digital non-formal and informal activities linked to the communities belonging to every single centre environment are increasing. As stated by Lankester, Hughes, and Foth (2017), "learning is embodied across everyday activities and places, can help identify opportunities for enhancing digital participation, learning, literacy and inclusion" (p. 1).

Primary school teachers should be aware of their own learning ecologies to identify all the learning opportunities they may have in both dimensions, analogue and digital, and make decisions regarding this fact. On the other hand, administrations and centres should also take into consideration the diverse ways in which teachers can keep up to date and promote resources through each of these means to get teachers professional development opportunities increased.

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