
Teachers' Digital Learning Ecologies: School at Home During COVID-19 in the Valencian Region

Ecologías de aprendizaje digital de los docentes: la Escuela en casa durante
la Covid-19 en la Comunidad Valenciana

老师的数码学习生态: 瓦伦西亚大区的Covid-19期间居家教学
情况

Цифровые учебные экологии учителей: домашнее обучение во время
Ковида-19 в Валенсийском сообществе

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Abstract

This article describes a study conducted between March and June 2020, examining how schooling at home functioned while schools were closed. It was designed as a descriptive, correlational survey, with non-probabilistic snowball sampling, using two online questionnaires for teachers and families, focusing on teachers in the autonomous community of Valencia. The starting point was the concept of teacher learning ecologies as the elements that teachers use to train themselves and find new learning opportunities. The study examined how teachers configured their learning ecologies to cope with the sudden need to teach from home and the role of ICT in this process. It looked at the association between teachers' learning expectations for their students and other variables linked to these ecologies (training and previous experience in ICT, support in this process, online methodologies used), using both simple and multiple Correspondence Analysis and decision trees. The results indicate that despite the difficulties, some teachers had higher expectations of student learning. There were teachers with better training and greater experience using ICT tools for teaching, teachers who used more support for their own performance, and teachers who used more online strategies. The use of video tutorials was the main explanatory variable in the three analyses. The results also showed that self-taught learning predominated through networks and platforms, along with the support of colleagues. The study concludes that a broader view of teachers' learning ecologies is needed, which includes ICT as a training objective and as a strategy. It is also important to reinforce the roles of schools and administrations in encouraging this process.

Keywords: learning ecologies, teachers, online training, COVID-19.

Resumen

El artículo parte del estudio realizado entre marzo y junio de 2020 sobre el funcionamiento de la escuela en casa, mientras los centros educativos estuvieron cerrados. Se planteó como estudio de encuesta, descriptivo y correlacional, con muestreo no probabilístico por bola de nieve, utilizando cuestionarios online. El estudio presentado en este artículo se centra en los datos de docentes no universitarios de la Comunidad Valenciana. Parte del concepto de ecologías de aprendizaje docente como los elementos que el propio profesorado utiliza para formarse y observar nuevas oportunidades propias de aprendizaje. Desde ahí, el estudio analiza cómo se configuraron las ecologías de aprendizaje del profesorado para hacer frente a la necesidad sobrevenida de atender la docencia desde casa, y el papel de las TIC en ese proceso. Estudia la asociación entre la expectativa de aprendizaje que el profesorado tenía para su alumnado, con otras variables vinculadas con esas ecologías (formación y experiencia previa en TICs, apoyos en ese proceso, metodologías online utilizadas), utilizando Análisis de Correspondencias, tanto simples como múltiples, y árboles de decisión. Los resultados muestran que, pese a las dificultades, tenía una mayor expectativa de aprendizaje de sus alumnos el profesorado con mejor formación y más experiencia previa sobre herramientas TIC para la docencia, el que más apoyos utilizó para su propio desempeño y el que más estrategias online empleó, siendo el uso de videotutoriales la principal variable explicativa. Muestra además que prevaleció el aprendizaje autodidacta a través de redes y plataformas, y también el apoyo de compañeras y compañeros. Se concluye que es necesario abrir la perspectiva respecto a las ecologías de aprendizaje del profesorado, incluyendo las TIC como objeto y como estrategia de formación, y que es importante reforzar el papel dinamizador de la administración y de los centros en ese proceso.

Palabras clave: ecologías de aprendizaje, profesorado, formación online, COVID-19.

摘要

本文介绍了2020年3月至2020年6月由于疫情学校关闭期间有关居家教学情况的研究。本研究使用了在线调查问卷,进行了描述性和相关性分析,通过非概率性雪球采样方式获取样本,其样本数据来自瓦伦西亚大区非高等教育阶段的教师。从教师学习生态学概念出发,分析教师自我培养和捕捉新的学习机会的要素。研究分析了如何配置教师的学习生态系统以面对居家上课的需求,以及信息通信技术在这一过程中的作用。我们分析了教师对学生的期望和与不同生态学相关的其他变量(信息通信技术培训和以往经验,在此过程中的支持,所使用的在线教学方法)之间的简单关联和多重关联及其决策树分析。结果表明了尽管遇到了困难,但在信息通信技术教学中受过最好培训和经验最丰富的教师对学生保持较高的学习期望,这类老师最常使用在线策略,通过自己的努力获得相关支持。在这一分析中,教师对视频教程的使用为主要解释变量。此外,分析结果还表明了很多教师通过网络和平台以及同事帮助的进行自我学习。研究结论为,我们有必要拓展有关教师学习生态学的视野,包括将信息通信技术作为培训对象和策略,并且在此过程中加强行政部门和学校的重要推动作用。

关键词: 学习生态, 教师, 在线培训, COVID-19.

Аннотация

Статья основана на исследовании, проведенном в период с марта по июнь 2020 года, о функционировании школы на дому, в то время как школы были закрыты. Исследование планировалось как обзорное, описательное и корреляционное, с невероятной выборкой по принципу «снежного кома», с использованием онлайн-анкет. Исследование, представленное в этой статье, сосредоточено на данных, полученных от учителей доуниверситетских учебных заведений Валенсийского сообщества. Оно исходит из концепции экологии обучения учителей как элементов, которые сами учителя используют для самоподготовки и наблюдения за новыми возможностями обучения. Далее в исследовании анализируется, как экология обучения учителей была настроена на то, чтобы справиться с возникающей необходимостью преподавать из дома, и роль ИКТ в этом процессе. В нем изучается связь между ожиданиями от обучения, которые учителя возлагали на своих учеников, и другими переменными, связанными с этими экологиями (подготовка и предыдущий опыт работы с ИКТ, поддержка в этом процессе, используемые онлайн-методики), с использованием простого и множественного анализа соответствий и деревьев решений. Результаты показывают, что, несмотря на трудности, учителя с лучшей подготовкой и большим предыдущим опытом использования ИКТ в преподавании, те, кто использовал больше поддержки собственной работы, и те, кто использовал больше онлайн-стратегий, а использование видеуроков является основной объясняющей переменной, имели более высокие ожидания в отношении обучения студентов. Он также показывает, что преобладало самообучение через сети и платформы, а также поддержка коллег. Сделан вывод, что необходимо открыть перспективу в отношении экологии обучения учителей, включая ИКТ как объект и как стратегию обучения, и что важно усилить динамизирующую роль администрации и центров в этом процессе.

Ключевые слова: экологии обучения, преподавательский состав, онлайн-обучение, COVID-19.

Introduction

The COVID-19 pandemic has forced society in general, and schools in particular, to change suddenly. A state of emergency due to COVID-19 was declared in Spain on the 14th of March. Schools were closed and national and regional governments proposed the use of technological solutions to continue with teaching. This situation led to families taking on the responsibility of supervising their children's learning processes at home. Teachers were forced to use remote technologies, synchronously or asynchronously, to ensure students maintained or improved their skills as well as continuing their study habits.

From within the Evaluation and Measurement Group at the University of Valencia (GemEduco, GIUV2016-290), we examined the situation in the School at Home (SH) study (*[Escuela en Casa]*) which took place between March and June 2020 via a survey, paying particular attention to families' and teachers' difficulties in non-university education (Jornet et al., 2020). Looking more deeply at the information collected by that study, in this paper we focus on analyzing the teachers' learning ecologies during this period of enforced digital teaching. More specifically, we analyze how teachers had to train themselves in online methods in this unforeseen situation, paying particular attention to how they did it, what support they had, and what actions they took.

Study approach

Information and communications technology (ICT) has become a keystone in the sudden leap from in-person schooling to online schooling. Most people might assume that technology is something that has been incorporated into everyday life, but in reality, schools have not yet made the jump to true integration of the virtual. The use of technology in teaching is generally limited to methodological-didactic support but is not particularly extensive in ordinary teaching practice (Jornet, 2012; San Martín-Alonso et al., 2014).

The most vulnerable groups (whether because of lack of economic resources, cultural issues, or other kinds of difficulties) clearly suffered the most during confinement, which translated to greater loss of skills and habits in students from the most disadvantaged families (Alexander et al., 2001; Martínez Rizo, 2019; Díez-Gutiérrez & Gajardo, 2020). Nonetheless, there were other types of situations that should also be examined. Some parents had to continue working outside the home, so who took care of their children's online schooling? In other situations, parents were at home but working remotely, and so had limited time available to monitor what their children were doing academically. Many social situations had an impact on this experience and they were not all connected solely with poverty (Jornet et al., 2020).

Teachers faced the situation without clear guidance from educational authorities and without good digital skills (Jornet et al., 2020; Hortigüela-Alcalá et al., 2020), despite digital teaching and learning processes having been promoted for many years, often marked by continuous change and the need for constant updating of teacher training (Lorenzo-Quiles & Vélchez-Fernández, 2016; González-Sanmamed et al., 2018). In this regard we can determine what elements we use as teachers to train ourselves and identify new learning opportunities in the framework of analyzing current teacher learning ecologies (González-Sanmamed et al., 2019; Sangrà et al., 2019). Clearly, these types of digital teacher training and refresher processes highlight how essential

technology is in relation to these new learning and research spaces, and how it is a central element in these new scenarios as an object of learning and as a learning procedure (Gorard et al., 2003; Mahmud, 2018).

In addition to the study by GemEduco (Jornet et al., 2020), other studies have been carried out to understand the situation of education during confinement. Some focused on analyzing the impact on education, at the national and international levels (Aznar-Sala, 2020; Beltrán & Venegas, 2020; Tejedor et al., 2020), while others focused on the difficulties teachers and families had to deal with to produce quality learning during confinement (Fernández-Rodrigo, 2020; Hortigüela-Alcalá et al., 2020). This situation has occasionally been particularly complex due to strict confinement to the home (García-Aretio, 2021), deterioration in children's mental health (Paricio & Pando, 2020), or prior inequalities, aggravated by the closure of school (Cabrera, 2020). In this research context, this current paper takes a deep look at the GemEduco study, focusing on the teachers' situation, with the following objectives:

General objective

- Analyze the learning ecologies activated by non-university teachers in order to teach during the COVID-19 confinement.

Specific objectives:

- Describe teachers' prior competencies in ICT as an educational resource, and the individual situations in which they had to teach from home.
- Describe what strategies they reported using in their online teaching, and what learning they expected their students to achieve during this term.
- Describe what ecologies they activated and what mechanisms and support they used in order to bring themselves up to date in a new learning ecosystem affected by online teaching.
- Analyze whether there was an association between teachers' expectations of academic achievement and the variables that describe their learning ecologies (prior ICT skills, learning strategies and support received, and online methodologies implemented).

Methodology

The starting point for this paper was the technical report from the School at Home study (Jornet et al, 2020) and it provides an analysis of how teachers organized their learning ecologies to deal with the challenges thrown up by the COVID-19 confinement in spring 2020. This descriptive, correlational study was planned using a survey methodology. It was carried out via questionnaires which were applied online to the group being studied, which was identified via non-probabilistic snowball sampling (Goodman, 1961), given the impossibility of managing other types of access to schools. Participation was voluntary and anonymous. Given that more appropriate resources were impossible, participation was encouraged via networks of contacts, which might have introduced biases into the participating groups. Nevertheless, we believe that the group reflects the reality of teachers in those educational levels in the autonomous community of Valencia (CV) (Jornet et al., 2020).

The study is part of a process of improvement of educational action. We were particularly interested in learning the realities teachers experienced. That puts us in a research position that advocates for the understanding and interpretation of social phenomena in order to introduce changes aimed at improving specific situations and contexts. However, this paper includes secondary analyses of the teachers' responses to the survey. In subsequent studies, using mixed methods approaches (Martín-Cilleiros & Sánchez-Gómez, 2016), we will expand on this information with qualitative data from focus groups.

Study group

In the study, 2,390 surveys were collected, resulting in 1,708 following a data review. Although there were participants from 15 of the 17 autonomous communities in Spain, most (1,351) were from the region of Valencia, which is why we focused our study on this group, which taken as a whole, was representative of the population of teachers (estimated at 74,908 people (MEFP, 2021)) with a confidence level of 99% and a margin of error of 3.4%. We used the overall report (Jornet et al., 2020) to be able to complete the information, and there were no significant differences between the group as a whole and the Valencian group.

Most of the participating teachers taught in public schools (68%) with fewer teaching in subsidized/private schools (27.7%) [subsidized schools are partly state-funded but educationally independent] and private schools (3.6%). Just over two-fifths (41.9%) of the participants taught in secondary school, slightly less than two-fifths (37.4%) taught in primary schools, and the remaining fifth (20.7%) taught infants. Most of the participants were women (79.2%), the mean age was 44.37 years old, and the mean amount of teaching experience was 17.69 years. Almost two-thirds (60.3%) reported that they were form/homeroom tutors. Almost a quarter (23.1%) indicated that they were specialist primary teachers. There were 16 secondary school specialties, the most common being Spanish language and literature (10.1%), geography and history (8%), English (6.9%), and physical education (6.4%).

Instrument

The instrument given to the teachers was a questionnaire with 34 questions about the teaching situation during the pandemic (Jornet et al., 2020). It included dichotomous (yes/no) questions, questions asking for percentage estimations, questions with 4 or 5 Likert-type responses, and open questions. It was validated based on criteria given in previous research (Jornet, Perales, & González-Such, 2020).

Information analysis

The analysis we present here is exploratory in nature, although it does include descriptive techniques and hypothesis tests in order to explore various hypotheses related to the final specific objectives. We present: a) descriptive results of the survey questions related to the objectives noted above, b) analysis of associated factors via simple correspondence analysis and multivariate categorical principal component analysis, and c) analysis of key differential variables extracted from decision trees.

As indicated above, there were various types of questions. Occasionally, these needed to be grouped for analysis, counting the number of responses for questions that could not be dealt with together (e.g., Before the pandemic, did you use any kind of ICT resource for teaching online? With 6 response options). This meant that we also had transformed variables that were the total number of selected responses.

All of the analyses were carried out using SPSS v26, licensed to the University of Valencia.

Analysis and results

Descriptive analysis. ICT before the pandemic.

The study gave us a better understanding of the situation of teachers who suddenly found themselves having to accompany their students' learning online, without in-person teaching. The way in which SH was provided largely depended, among other factors, on the starting situation (resources, working conditions, personal conditions, etc.) which was not the same for each teacher. Table 1 shows how the participating teachers described the conditions they had at home.

Table 1

Percentage responses to question 14 [How would you describe your situation at home for teaching online?]

	CV	EI	EP	ESO	P
I have my own space at home to be able to work remotely.	65.3	60.4	67.9	65.4	°
I have a suitable internet connection.	81	78.2	80.2	83	°
I have a computer and/or tablet for teaching online.	85.6	84.3	83.8	87.8	°
I have a mobile phone with data and wi-fi.	75.9	75	78	74.5	°
I have enough time.	44.6	46.6	46.5	41.9	°
I have a specific timetable for teaching online.	24.3	22.7	25.4	24	°
I have people who support me in other tasks so that I can work remotely.	23.8	20.5	23.5	25.8	°
I am responsible for children at home whose remote schooling I have to deal with.	35.3	36.7	31.5	38	°
I must look after older or infirm people who I am responsible for.	14.1	10.8	16.1	13.9	°
I have to do household tasks myself (cleaning, shopping, medical care, etc.).	70.7	68.8	71.6	70.7	°
I have an illness that does not allow me to work properly.	1.3	0.4	1.2	2	°

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. CV: overall data from the Community of Valencia; EI: Infant-school teachers; EP: Primary-school teachers; ESO: Compulsory secondary education (the same for all tables) P: level of significance via χ^2 : * = significant, at least to 95%; ** = significant, at least to 99%; ° = differences are not significant.

As the report indicates, resources were not a problem for the teachers who responded to the survey. This is clear from the numbers who reported having computers or tablets for online teaching (85.6%), good internet connections (81.0%), mobile phones with data and Wi-Fi (75.9%), and a suitable place to work (65.3%). What was more problematic was time management (only 44.6% said that they had sufficient time, and only 41.9% in ESO), and balance (35.3% had children to look after, and 14.1% had to look after older or sick people). Looking at the issue from the type of school, there were significant differences in various variables (Jornet et al, 2020). More teachers in private and subsidized schools reported having specific times for giving online classes and people to help with domestic tasks, whereas more teachers in state-funded schools reported having obligations to deal with in the home or having some kind of illness that made it harder for them to work properly. No significant differences were found in the other variables, nor with regard to the educational level. The published SH report presents a detailed study of the social and digital divides (Jornet et al, 2020) faced by families and teachers, with important data about the difficulties that it is not necessary to summarize in this study, as it is already published.

From the results of the report (Jornet et al. 2020), in terms of the starting point of ICT resources teachers had or had used, almost a third (29.5%) reported having had no training, while the remainder had little (27.4%), some (22.1%), or a reasonable amount (18.6%), with less than a quarter of teachers (23.5%) feeling that they had a lot of training in teaching platforms (see Table2). We found a significant association between knowledge of platforms and educational level, with a 99% confidence level, with teachers of infants and primary schools knowing less about these kinds of platforms than secondary school teachers.

Table 2

Percentage responses to question 16 [Have you had previous training in online teaching platforms?]

	CV	EI	EP	ESO	P
No, none (I use the basics at a personal level: social networks, email, word processors, etc.)	29.5	44.7	31.6	20.3	°
Very little (I know a little about online teaching because I have had online courses about other topics)	27.4	27.6	31	24.3	°
Some (I have been on courses to learn how to use online teaching platforms)	22.1	17.1	21.2	25.2	**
A reasonable amount (I have used it in my teaching practice)	18.6	10.1	14.3	26.6	°
A lot (I give courses about online teaching platforms and ICT in education)	2.3	0.4	1.9	3.6	°

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. P: level of significance via c²: * = significant, at least to 95%; **= significant, at least to 99%; °= differences are not significant.

Most of the teachers reported having used ICT resources for online teaching prior to the pandemic, with only 11.2% reporting never having used any technological resourc-

es (Jornet et al, 2020). The most commonly used resources by teachers were those provided by their schools or education authorities (43.2%) and email (42.6%), while the least-commonly used was instant messaging (26.6%). Looking at the results by educational level, the percentage of teachers reporting never having used any ICT resources was smaller in secondary school. There were significant differences between educational levels (at 99%), with the profile of what resources were used changing, as Table 3 shows.

Table 3

Percentage responses to question 17 [Before the pandemic, did you use any ICT resources for teaching online? Mark the options that best represent your situation]

	CV	EI	EP	ESO	P
None	11.3	14.4	14.7	6.8	**
What the school or education authority provided	43.2	42.7	40.4	45.9	
Email with families	42.6	38.7	34.1	52.2	**
Instant messaging (Whatsapp, Telegram, etc.) to communicate with families	26.6	39.4	27.7	19.2	**
Some platform for the students to do tasks or activities at home	32.5	15.2	23.5	49	**
I have used the IT classroom in the school with my students	31	17.3	33.2	35.7	**

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. P: level of significance via χ^2 : * = significant, at least to 95%; ** = significant, at least to 99%.

Descriptive analysis. Online methodologies used during the pandemic

Teachers adapted their teaching methodologies during the pandemic, using a wide variety of resources (this question was offered with a list of responses for teachers to note all that applied to their situations) —see Table 4. As the SH report noted (Jornet et al., 2020), 76% of teachers used email to answer questions, 40.3% used instant messaging, and 40.2% used textbooks guiding tasks.

There was a clear, strong, statistically significant association between this variable and educational level. Forums were little-used in general, most often in secondary school. Similarly, little use was made of video tutorials for families, most often in infants' school. Finally, more use was made of YouTube tutorials in primary than in infants' or secondary school. With regard to the other resources, the use of textbooks with guided tasks, group video calls, and email increased through the educational stages, while the use of instant messages and video tutorials for families were most common in infants' school, and fell off progressively at more advanced stages. The level of significance for the differences in terms of educational levels was 99% for all responses, except recording video tutorials for the family, where the level of significance was 95%, as Table 4 shows.

Table 4

Percentage responses for question 19 [How have you adapted your methodology for teaching online? Mark all of the options that best represent your situation]

	CV	EI	EP	ESO	P
I have used textbooks and guided the tasks	40.2	13	43.8	50.4	**
I have done real-time video conferences with the class group to give explanations	36.2	29.2	27.2	47.5	**
I have done video conferences to answer group questions in real time	30.5	14	25.9	42.8	**
I have answered emails to clear up individual questions	76	61.6	75.6	83.4	**
I have used question forums	16.7	2.2	6.6	32.9	**
I have used instant messaging (Whatsapp, Telegram, etc.)	40.3	50.7	46.2	29.9	**
I have used YouTube tutorials to support my teaching	37.6	18.8	45.5	39.7	**
I have recorded video tutorials for families	16.7	34.7	19.7	5.2	**
I have recorded video tutorials for students	35.9	40.8	38.2	31.4	*

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. P: level of significance via χ^2 : * = significant, at least to 95%; **= significant, at least to 99%.

Descriptive analysis. Achievement expectations: expected learning

The study was carried out between May and June 2020. Teachers were asked at that time about their expectations for learning that would be achieved during the lockdown term. Almost two-thirds of the teachers (64.8%) felt that they would have achieved between 25% and 75% of the learning that they had in previous years. A very small group felt that they would have achieved almost no learning and a slightly larger group felt that they would have achieved more than 75% (Table 5). The results by educational level were very similar, and did not exhibit any statistically significant differences.

Table 5

Percentage responses to question 28 [What percentage of learning do you think you will have achieved in this term compared to previous years owing to pandemic-related difficulties]

	CV	EI	EP	ESO	P
Less than 5%	4.4	5.1	4.6	3.8	°
5-25%	19.3	22.6	20.3	17	
25-50%	34.7	32.3	37.2	33.6	
50-75%	30.1	29.8	27.9	32	
More than 75%	8.6	7.2	8.5	9.2	
Almost 100%	3.0	3	1.4	4.4	

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. P: level of significance via χ^2 : * = significant, at least to 95%; **= significant, at least to 99%; °= differences are not significant.

Relationships between variables. Was there an association between expectations of learning and the situation prior to the pandemic?

Taking expectations of success as an indicator of the result, we explored what it was linked with, first examining its associations with teachers' prior knowledge of ICT (training and previous experience). In the Simple Correspondence Analysis (SCA) of the variables [What percentage of learning do you think you will have achieved in this term compared to previous years, owing to pandemic-related difficulties] and [Have you had previous training in online teaching platforms?], the first two dimensions in the factorial solution explained 88.2% of the overall inertia of the point cloud and, according to the chi square statistic, there is an association between the two variables to 99% ($p \leq .000$)—see Table 6. Note that this analysis is strictly exploratory.

Table 6

Summary. SCA between expectations of success and training in online teaching platforms before the pandemic

Dimension	Singular value	Inertia	Chi squared	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard deviation	Correlation 2
1	.199	.040			.673	.673	.039	.095
2	.111	.012			.209	.882	.028	
3	.076	.006			.098	.980		
4	.034	.001			.020	1.000		
Total		.059	68.880	.000 ^a	1.000	1.000		

Note. ^a. 20 degrees of freedom.

In the first factorial plane, made up of the two primary factorial axes, all of the categories used as response options to the previous questions are represented. There is a group with low or moderate prior training in online platforms and a lower levels of perceived learning, along with a group with higher percentages of learning and greater training in online teaching platforms in the positive side (Figure 1).

In Table 7 we present the association with *use of ICT resources before the pandemic* via the SCA using the variables [What percentage of learning do you think you will have achieved in this term compared to previous years, owing to pandemic-related difficulties] and the number of different ICT resources used before the pandemic [Sum of: Before the pandemic, did you use any ICT resources for online teaching?]. Table 7 shows that the two first dimensions in the factorial solution explain 97.5% of the total inertia of the point cloud, and according to the chi square statistic, demonstrate an association between the two variables at 99% ($p \leq .000$).

Figure 1

Bidimensional representation of SCA between previous training and perceived learning

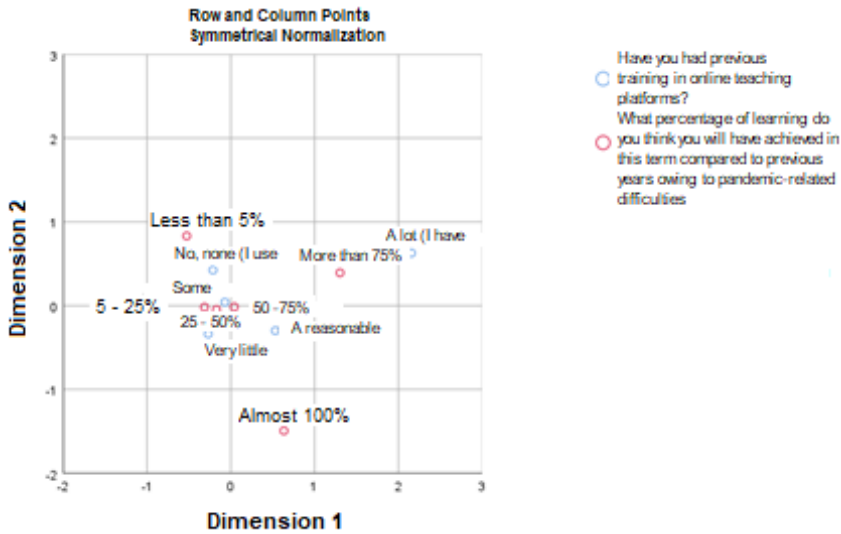


Table 7

Summary. SCA between expectations of learning and number of ICT resources for online teaching before the pandemic

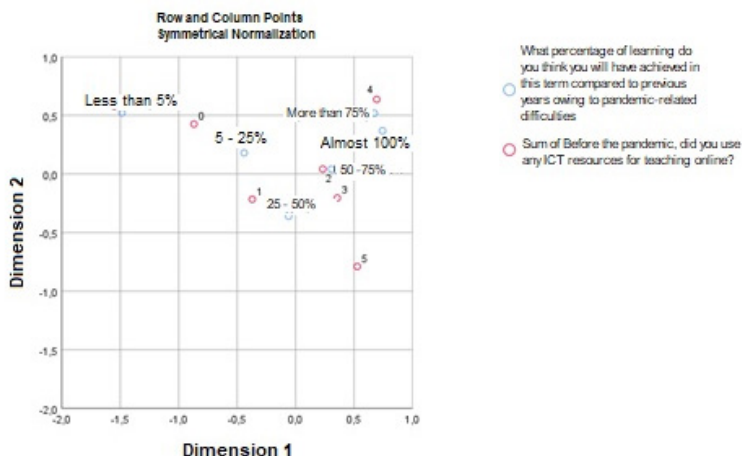
Dimension	Singular value	Inertia	Chi squared	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard deviation	Correlation 2
1	.218	.048			.831	.831	.029	.157
2	.091	.008			.143	.975	.029	
3	.034	.001			.020	.994		
4	.016	.000			.005	.999		
5	.008	.000			.001	1.000		
Total		.057	66.861	.000 ^a	1.000	1.000		

Note. ^a. 25 degrees of freedom.

Again, all of the categories used as response options are represented in the first factorial plane (Figure 2). There is a group made up of low or moderate perceived learning and the use of fewer ICT resources for online teaching before the pandemic. In the positive side, there is a group with greater perceived learning and the use of more ICT resources for online teaching prior to the pandemic.

Figure 2

Bidimensional representation of the SCA between percentage of learning perceived and the number of ICT resources used before the pandemic



Association between variables. Was there an association between expectations of learning and adaptation of methodology to teaching online?

The expectation of learning was also linked to the methodologies that the teachers had to implement during confinement. As noted previously, teachers mostly used email, textbooks, video classes, and YouTube tutorials. In the SCA of the number of methodologies used and the percentage of learning perceived, the factorial solution indicates that the first two factors explain 87.3% of the total inertia of the point cloud and, according to the chi squared statistic, demonstrate an association between the two variables to 99% ($p \leq .000$), see Table 8.

Table 8

Summary. SCA between learning expectations and the number of online methodologies used during the pandemic

Dimension	Singular value	Inertia	Chi squared	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard deviation	Correlation 2
1	.255	.065			.733	.733	.027	.034
2	.112	.012			.140	.873	.032	
3	.090	.008			.092	.965		
4	.052	.003			.030	.995		
5	.022	.000			.005	1.000		

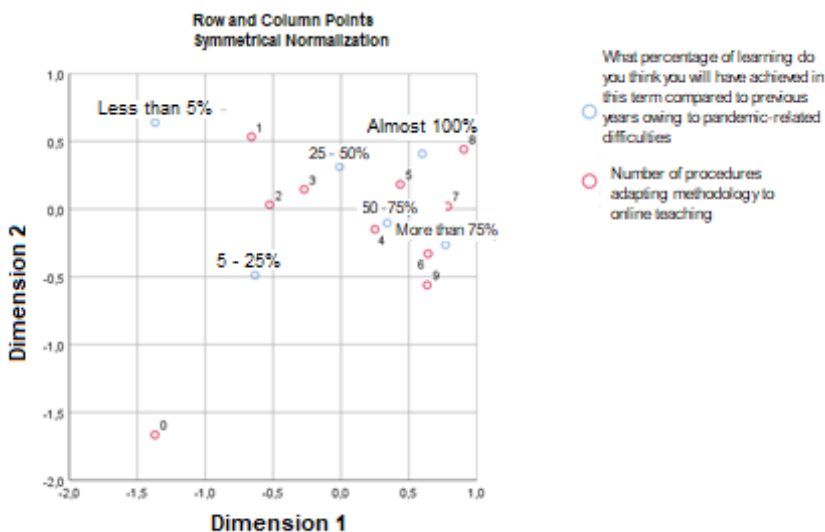
Dimension	Singular value	Inertia	Chi squared	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard deviation	Correlation 2
Total		.089	103.930	.000 ^a	1.000	1.000		

Note. ^a. 45 degrees of freedom.

In this case, all of the categories used in the previous questions as response options are represented in the first factorial plane (Figure 3). There is a clear pattern linking the use of fewer online resources to the perception of less learning, and the use of more resources to greater perceived learning.

Figure 3

Bidimensional representation of SCA between the number of procedures adapting methodology to online teaching and the percentage of perceived learning



Descriptive analysis. Learning ecologies. Support for using ICT resources during the pandemic

Teachers had to resort to their entire learning ecologies to cope with the challenge of online teaching. This included their own training and use of ICT resources for teaching, along with new learning they had to acquire at the time, either on their own or with the support of others. Table 9 shows the teachers' responses to this set of questions (they were asked to mark any responses that applied).

Table 9

Response percentages for question 18 [At the moment, having to teach online, who has provided support for you to use ICT resources? Mark whichever options best represent your situation]

	CV	EI	EP	ESO	P
I have not needed help, and I was able to do it myself	28.0	26.2	25.6	31.1	°
The school where I work or the administration	20.6	15.2	18.1	25.4	**
Support from a publisher	11.6	8.3	16.1	9.2	**
Colleagues with better training	46.4	45.5	47.7	45.6	°
I taught myself (using tutorials, e.g., from teaching platforms and YouTube)	52.9	45.1	53	56.7	°
No one helped me and I did not know how to do it online (I sent work by email and it was returned for marking by email)	6.7	4.3	7.8	6.9	°
I was not able to teach online because family or student circumstances did not allow it	2.8	4	3.6	1.6	°

Note. Adapted from *La Escuela En Casa Jornet. Informe técnico 2020*, por J. M. Jornet, J. González-Such, M. J. Perales, P. Sánchez-Delgado, M. Bakieva, C. Sancho-Álvarez, & S. Ortega-Gaite, 2020. Palmero Ediciones. P: level of significance via χ^2 : * = significant, at least to 95%; ** = significant, at least to 99%; ° = differences are not significant.

Table 9 indicates that only 28% of teachers reported being autonomous in the use of ICT resources. In terms of improving how to use these ICT tools, the most common method was working alone (52.9% taught themselves via online tutorials) and with the help of colleagues (46.4%).

There were various responses in the “other” section for who had helped teachers to use ICT resources, including:

- Colleagues at school, including in the IT department and IT coordinators to greater or lesser extents.
- Students
- Friends who worked in IT
- Family members (children, spouses, partners, extended family)
- Teachers’ classrooms in MOODLE, CFIE
- Online courses and tutorials
- The school, the school management, or other colleagues creating tutorials, video conferences, and IT services
- In some cases, they were unable to teach, the situation overwhelmed them

To explore the association between this set of variables and expectations of success, we created a summary variable using the number of supports used to cope with teaching online, attempting to represent the teachers’ learning ecologies. The contingency table (Table 10) shows what support was most used in each case.

Table 10

Results for question 18. [At the moment, having to teach online, who has provided support for you to use ICT resources?] Number of supports

	1		2		3		4		Marginal total
	Fr.	%Col.	Fr.	%Col.	Fr.	%Col.	Fr.	%Col.	
[The school or administration where I work]	46	9.9%	106	13.6%	101	23.4%	22	25.0%	275
[Support from a publisher]	9	1.9%	49	6.3%	75	17.4%	22	25.0%	155
[Better-trained colleagues]	145	31.3%	322	41.4%	133	30.8%	22	25.0%	622
[Self-taught (e.g., online tutorials from platforms or YouTube)]	263	56.8%	301	38.7%	123	28.5%	22	25.0%	709
Marginal total	463	100%	778	100%	432	100%	88	100%	

The most frequent (Table 10) number of supports that teachers drew on during this period was two (778 cases), followed by one and three. Those who indicated using a single support indicated self-learning via tutorials of various kinds (56.8%). Those who reported using two supports indicated resorting to colleagues (31.3% of those indicating a single support, 41.4% of those indicating two). Support from school administrations and publishers were reported most by teachers resorting to three or four supports, and were much less frequently indicated.

Correspondence analysis. Expectations of learning and support for adapting to online teaching

These supports are fundamental to understanding teachers' learning ecologies. Below, we analyze their relationships to expectations of success, understood as expected learning, via SCA using the variables [How much learning do you think you will have achieved in this term compared to previous years, owing to pandemic-related difficulties] and the total count from [At the moment, having to teach online, who has provided support for you to use ICT resources?]. In the factorial solution, the two first dimensions explain 99.4% of the total inertia of the point cloud although according to the chi square statistic, it does not show an association between the two variables to 99% ($p = .298$). The chart indicates a pattern that is worth commenting on for exploratory purposes (Figure 4).

Table 11

SCA. Summary. Expectations of learning and support received

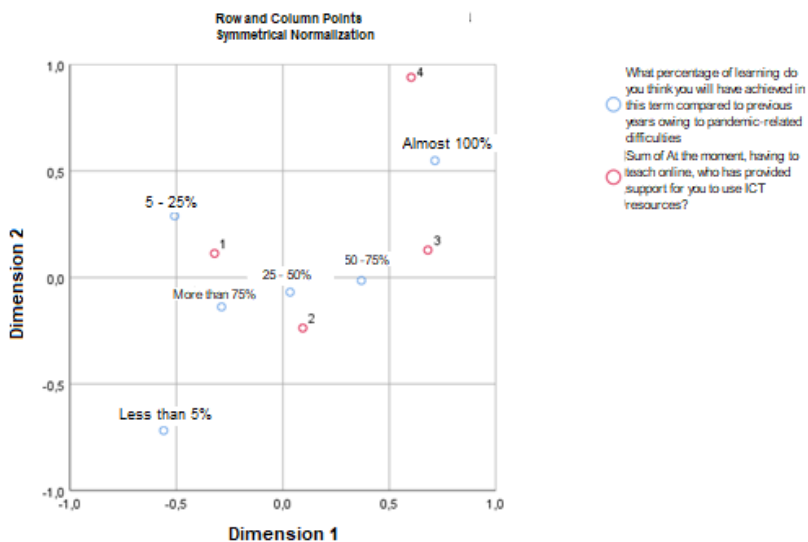
Dimension	Singular value	Inertia	Chi squared	Sig.	Proportion of inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard deviation	Correlation 2
1	.125	.016			.862	.862	.031	-.017
2	.049	.002			.132	.994	.030	
3	.010	.000			.006	1.000		
Total		.018	17.363	.298 ^a	1.000	1.000		

Note. ^a. 15 degrees of freedom.

Again, all of the categories used as response options in the above questions are represented in the first factorial plane. There is a group made up who resorted less to supports for adapting to online teaching and a low or medium percentage of expected learning (except for the group reporting expected learning better than 75%, which is also in this quadrant). In the positive part, there is the group with higher percentages of expected learning and greater use of support for adapting to online teaching.

Figure 4

Bidimensional representation of simple correspondence analysis



Categorical Principal Component Analysis.

Association of variables with learning expectations.

The combined multivariate analysis of these variables showed a clear link between them. Categorical principal component analysis (CATPCA) demonstrated the positive association between expectations for learning and prior training in online methodologies, knowledge of ICT resources prior to the pandemic, the number of resources used during the enforced online teaching, and the resources used to learn about the topic (Table 12 and Figure 5). There were two dimensions that explained the relationships between the variables, the first made up of the transformed variables for adaptation of ICT resources, the number of supports for the adaptation, and prior internet training, while the second comprised the percentage of learning perceived, which also positively saturated with the other factor, indicating a considerable trend. The CAPTCA method allows us to identify and visualize the impact of the variables on the percentage of learning perceived (Table 13).

Table 12

Summary of the model. Categorical principal component analysis (CATPCA)

Dimension	Cronbach alpha	Variance counted for the
		Total (eigenvalue)
1	.507	1.613
2	.160	1.137
Total	.848 ^a	2.750

Table 13

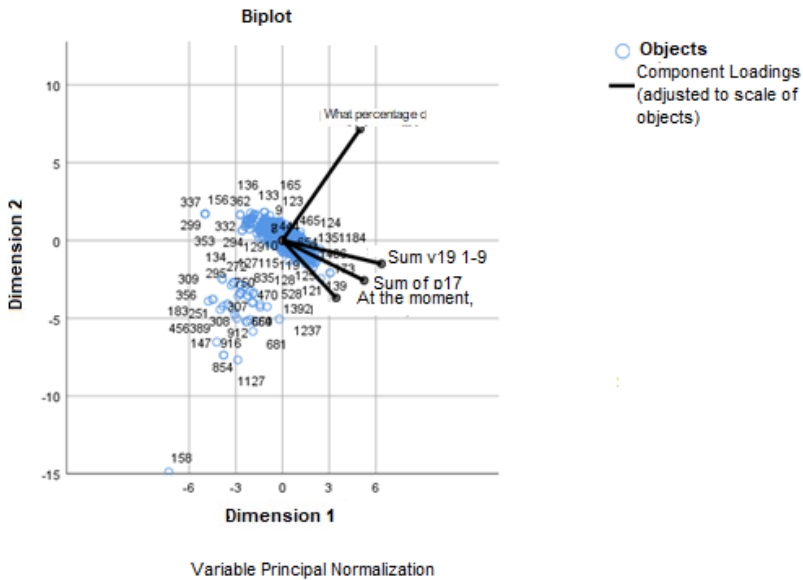
Loadings on the CATPCA components

	Dimension	
	1	2
What percentage of learning do you think you will have achieved in this term compared to previous years, owing to pandemic-related difficulties?	.619	.889
Number of adaptations, Q19 1-9 How have you adapted your methodology for teaching online? Mark all of the options that best represent your situation.	.790	-.186
At the moment, having to teach online, who has provided support for you to use ICT resources? 2-5	.427	-.458
Number of resources, Q17: Before the pandemic, did you use any ICT resources for teaching online?	.651	-.319

Note. Principal normalization of the variable.

Figure 5

Bidimensional representation of the categorical principal component analysis



Overall analysis of learning ecologies.

Analysis of key differential variables extracted from decision trees.

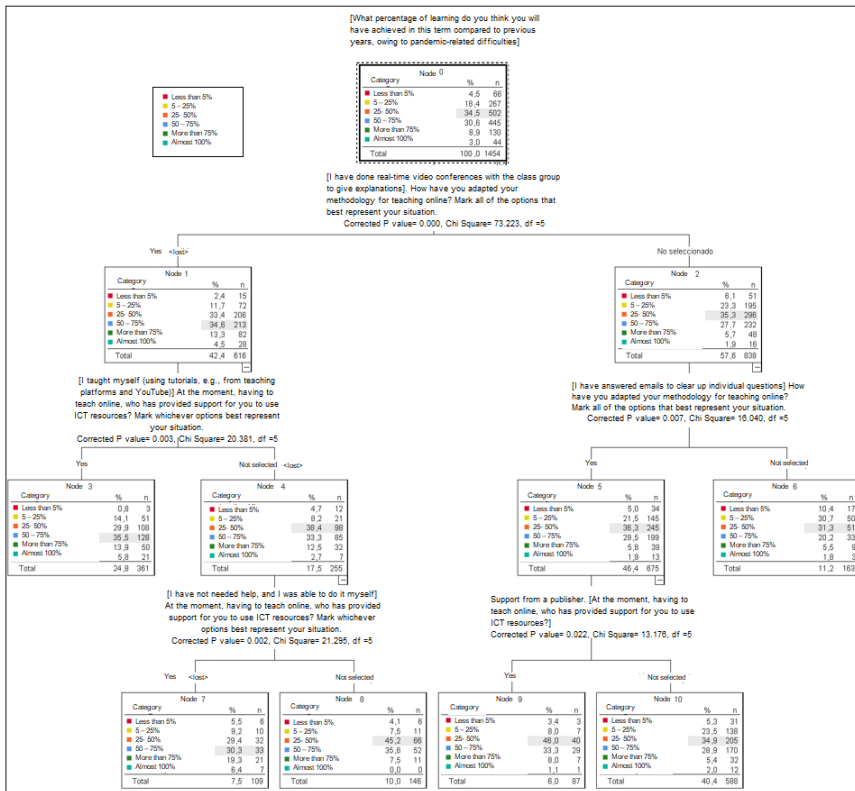
We present a segmentation analysis via the decision tree technique, taking question 28 as the dependent variable [What percentage of learning do you think you will have achieved in this term compared to previous years owing to pandemic-related difficulties?] and questions 18 [At the moment, having to teach online, who has provided support for you to use ICT resources?] and 19 [How have you adapted your methodology for teaching online?] as the independent variables. We used the CHAID procedure. In the decision tree in Figure 6, the (predicted) highest frequency category in each node is highlighted with a grey background.

The variable [I have done real-time video conferences with the class group to give explanations] indicated the principal variable, broken down in node 1, with 42.4% of teachers selecting this option, and node 2, with 57.6% not selecting this option. Within node 1, with a chi square higher than for node 2, there is the response to [I taught myself (using tutorials, e.g., from teaching platforms and YouTube)] which 24.8% of the teachers selected (with “between 50 and 75%” being the most common expected learning band, at 35.5%), whereas 17.5% did not select it (with “between 25 and 50%” being the most common expected learning band at 38.4%), shown in node 4. In both nodes the options “between 25 and 50%” and “between 50 and 75%” were very close in terms of the percentage of learning expected. Within node 4, the variable that best predicts node 4 is [I have not needed help, and I was able to do it myself], with 7.5% not needing help (node 7) and 10% having needed help. In addition, node 5 best explains the variable [I have answered emails to clear up individual questions], with

46.6% of the teachers having done so (node 9). Of the teachers that used email to answer questions, 40.4% did not resort to support from any publishers for using ICT resources, whereas 6% did.

In summary, the principal variable that explains the perceived percentage of learning was the use of video conferences with classes to give explanations, which 57.6% of teachers reported not having done, while 43.4% reported having done so, and most of the teachers who did so were self-taught using tutorials (24.6%).

Figure 6
Decision tree



Discussion and conclusions

Our study shows how teachers responded to the requirements of teaching during confinement, resorting to their full learning ecologies, including training and prior experience, and with immediate learning that they activated at record speed, resorting to training and information available online. This lifelong learning approach, which goes well beyond the traditional processes of continual development (González-Sanmamed et al., 2019; Sangrà et al., 2019), was fundamental for teaching during confinement, as our study has shown, addressing its general objective.

In terms of the specific objectives, we can state the following:

- a. Teachers taught from home in the situations they found themselves in. Our study indicated that respondents generally had the necessary resources at home (internet connection and equipment), although they had other challenges such as juggling other commitments and things taking more time than normal (note that the conditions for accessing the sample made it hard to get a more representative sample).
- b. Prior skills (whether training or experience) with ICT tools for teaching were scarce. There was also an association between those skills and expectations of success. The SCA showed that teachers with better training or teachers with more experience in this area had greater expectations of student learning during confinement.
- c. During confinement, teachers particularly used email, textbooks, video conferences, and tutorials. They incorporated technological resources with which they could offer a known anchor point for all those involved, the textbook. The SCA showed that using more strategies in combination was also associated with greater expectations of success.
- d. The third specific objective focused on the support that teachers resorted to in this process. It is interesting to note that the most common was a single support, the teachers' own learning via social networks and various internet platforms. This confirms that online resources are key for teachers' current learning ecologies (as they are for people in general), something which should be recognized and encouraged in the systems for teacher training and particularly in continued professional development. The second most-commonly identified support was colleagues, highlighting the importance of horizontal learning. Institutional support and support from publishing houses were third and fourth, which shows that they probably lacked support or resources to deal with the situation, or if support was available, the teachers made less use of them. School administrations' response to the situation was not as capable, rapid, or systematic as teachers would have hoped. Even if we never experience a similar situation in the future, the study highlights the need for education authorities to better articulate and publicize a clear, proactive strategy to support the use of ICT resources in teaching so that they become a clear reference point for teachers in that regard. Beyond that, and linked to the breadth of teachers' ecologies, the SCA showed that teachers who resorted to more supports also had greater expectations of their students' learning.
- e. The final specific objective was linked to the multivariate nature of the study. The categorical principal component analysis showed that teachers with greater prior use of ICT, who resorted to more supports, and who used more ICT resources during the COVID-19 confinement indicated greater expectations and perceptions of their students' learning. Despite the difficult teaching situation during confinement, teachers who understood ICT resources and who had experience of using them were probably able to use them more confidently, and had better expectations of the results they could deliver. Similarly, teachers who could use more tools in their methodologies at that time were more confident that they would produce results, and that they would achieve levels of learning that were closer to a normal situation.

To round off this multivariate perspective, the decision tree showed that the use of video tutorials as an online resource was the main explanatory variable of the expected percentage of learning, with most of the teachers who used them being self-taught and having used tutorials and other online resources to help them overcome the situation they faced.

Our study highlights the need to broaden the view of teacher learning ecologies, effectively incorporating ICT resources as elements and as training strategies. Many studies have been published recently about the experience of confinement from a variety of educational and social variables (Díez-Gutiérrez & Gajardo-Espinoza, 2020; Menéndez & Figares, 2020; Crescenza et al., 2021). Some have reached similar conclusions to the study this article discusses, such as the change of evaluation approach from teachers, which has had an impact on continual evaluation and monitoring processes, giving more weight to learning than solely to passing courses (Jornet, 2020; Zubillaga & Cortazar, 2020), and increasing the frequency of communication between teachers and families (Jornet, 2020; Vicente-Fernández et al., 2020). It is worth highlighting the study from Feito (2020), which confirmed that access to teaching content is changing as the situation has signaled to both teachers and students the possibility of learning more autonomously, with similar conclusions to those in our study.

Nonetheless, few studies have focused on teachers' processes during confinement, parallel to those presented here. Future publications will surely offer information that can be used to compare our data. Similarly, this study will be complemented by qualitative, collaborative studies that will give us a better understanding of this socio-educational reality (Sánchez-Gómez & Martín-Cilleros, 2017).

There is no doubt that during schooling at home, teachers generally dealt with the situation using their own resources and largely improvising how to teach remotely (Jornet et al., 2020). The majority used their own means (computers, tablets, mobile phones, and personal internet connections) without all of the support that they needed from the educational authorities or the schools they worked in, even if they were private or subsidized. Teachers' generous work needs to be recognized, which generally it is not, as during this time they have demonstrated their professionalism, coping with unforeseen stressful situations, generally overwhelmed with work, trying to offer the best they can in solidarity with students and families (Jornet, 2020).

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