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THE USE OF MOBILE DEVICES LIKE LEARNING EVALUATION REAL TOOL

EL USO DE DISPOSITIVOS MÓVILES COMO HERRAMIENTA DE EVALUACIÓN EN TIEMPO REAL DEL APRENDIZAJE

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ABSTRACT

The school confinement by COVID19 confirmed the need for the use of mobile devices that facilitate and allow a normal flow of the PPEA in education. It also served to verify that not all schoolchildren could, for various reasons, access them, which is why the educational administration had to intervene to provide schoolchildren and provide families with tools such as tablets, laptops and access points Wi-Fi.Despite this and given the delay in acting, many teachers and families have chosen to include Smartphones as usable devices in order to normalize the situation, thus facilitating the exercise of their functions, something that clashes with the provisions and guidelines legislative and centers that reject such devices as school tools. A study aimed at the teaching community has served to show the previous rejection and a commitment to the future of said technology, after a timely implementation and enhancement. And it is that the teacher is aware that the situation experienced can be repeated at any time and without prior notice, for which he needs to be not only alert but also trained and willing to use them.

Palabras clave:
smartphone, evaluación, tiempo real, herramientas TIC, aula 3.0.

RESUMEN

El confinamiento escolar por COVID19 constató la necesidad del uso de dispositivos móviles que facilitasen y permitiesen un normal discurrir de los PPEA en la educación. También sirvió para constatar que no todos los escolares podían, por diversos motivos, acceder a los mismos, de ahí que la administración educativa tuviese que intervenir para proporcionar a los escolares y facilitar a las familias herramientas tales como Tablet, ordenadores

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	portátiles y puntos de acceso Wi-Fi. A pesar de esto y dada la tardanza en actuar, muchos docentes y familias han optado por incluir los Smartphone como dispositivos usables con el fin de normalizar la situación, facilitando de esta forma el ejercicio de sus funciones, algo que choca con las disposiciones y directrices legislativas y de los centros que rechazan dichos dispositivos como herramientas escolares. Un estudio dirigido a la comunidad docente ha servido para mostrar el rechazo previo y una apuesta de futuro sobre dicha tecnología, tras una implantación y puesta en valor puntual. Y es que el docente es consciente de que la situación vivida, puede repetirse en cualquier momento y sin previo aviso, para lo cual precisa estar no sólo en alerta sino también formado y dispuesto a utilizarlas.

Introduction

The introduction of any tool in an environment where it performs certain functions is associated with a series of intrinsic aspects including: timing, cost, training, expected results vs. results obtained. All this also entails constant evaluation throughout its implementation and use, in order to determine or improve certain aspects that result in results equal to or above expectations.

In the classroom, this process requires a set of elements not contemplated, such as: acceptance and rejection by the agents involved in the training processes, something that will have a direct and decisive impact on the results obtained.

This is because the rejection of them is motivated, to a large extent, by the fact that their implementation and operation in the classroom and in the educational center requires certain training for teachers, something that usually happens to the detriment of time outside the school environment, i.e., taking time away from personal time dedicated to personal matters such as leisure and family.

Looking back, it can be seen that, throughout the history of education, the inclusion of new tools has always raised misgivings, as is currently happening, where the introduction of mobile devices such as the Tablet and Smartphone brings out conflicting positions about the inclusion and use of them in the classroom and in the family environment.

This article aims not only to address, but to put on the table the pros and cons of the use of Tablet and Smartphone and how these tools can impact on real-time, individualized assessment on the students who use them and the teachers who implement them. A detailed study of a real case of implementation in a secondary school will allow us to determine how its use is perceived before and after its introduction and how it affects the teaching-learning processes (from now on PPEA) in schoolchildren, as well as whether its acquisition is economically feasible, replacing traditional tools.

We have to go back to the eighties of the last century to talk about the access of ICT tools to the educational system. A few years earlier, the personal computer, known as the PC (*Personal Computer*), was born. This tool makes the leap from laboratories and research centers to the home, and then to educational centers. Domestic consumption of these technological devices soon began to increase, largely due to the appearance of new manufacturers such as CYRIX and AMD, which competed with IBM and Intel in the race for control of sales in the segment that opened its doors to their introduction, school and education. The new business attracts manufacturers such as Apple, Dell, Xerox, Osborne, to name a few (Today, 2017).

It was not until the early 90's that, through programs of introduction and school integration of equipment and software, in extracurricular activities, that PCs began to occupy a space previously focused on manual practice activities such as EATP (Technical-Professional Education and Activities), a set of optional subjects that students had to choose in the second and third years of BUP (Bachillerato Unificado Polivalente) as stated in the General Law of Education, popularly known as Villar Palasí Law (BOE, 1970). These courses were of a technical-professional nature and included technical drawing, electronics and computer science. The use of PCs was relegated either to this educational practice or to extracurricular education linked to formal education, under the control of parents' associations (AMPAs) or other extracurricular non-formal education, under the control of the different training academies that began to offer PC-based learning classes as a tool for transmitting the PPEAs.

With the so-called democratization of the Internet (García Pascual, 2011**)** in the first decade of this century, components and equipment assembly became cheaper, which allowed access to any home. On the other hand, in the classroom, in line with this process, something similar was happening. Students began to use the PC in part or in all subjects as a complementary tool to the book and as a substitute for the typewriter, required to prepare activities such as reports or papers.

In this second decade of the 21st Century, it can already be observed how something similar is happening with the new ICT tools, specifically with Tablets and smartphones that integrate software capable of connecting to the Internet, with features similar to a laptop, the Smartphone (Saussure-Figueroa Portilla, 2016).

The introduction of these devices has given rise to a series of mixed feelings among the agents involved in the PPEAs, both in favor and against, with arguments that even go so far as to question the statements made previously. But it is not only the agents involved in the PPEAs who are reluctant to integrate these devices. The political class itself, largely responsible for curriculum design, has avoided the use of these devices, based on arguments about the benefits of using traditional tools such as books, or the use of writing devices such as pencils, pens, or pens for the benefit of good writing and correct posture; or at the ophthalmological level because of the less negative repercussions of traditional technologies compared to modern ones. The fact is that the tools, which could be described as traditional, are better suited to the transmission of traditional learning to the detriment of ICT tools that focus on what could be described as active learning.

To this must be added that the introduction of these new tools, which will be qualified as ICT, requires a series of adjustments, which entail an initial cost overrun, since they require a cost for the adaptation of the centers for their discretionary use, both by students and teachers; a material cost, for the acquisition of these tools, a cost considerably higher than that of traditional tools; a human cost, for the training and adaptation requirements in their handling and use; a technological cost, for the need to create and adapt/convert traditional tools to new digital tools in order to ensure their proper use among the members of the educational community.

This brings with it an initial rejection, which can be considered as generalized and independent with respect to the actors of the PPEAs.

Thus, families are opposed to their sons and daughters using, instead of books, ICT tools that require the use of the Internet, that need to feed their batteries with electricity, with the expense that this entails; having the device and the programs for educational and common use constantly updated, and a long etcetera that could be added. Added to this is the cost in terms of time, time for training, adaptation, content creation... which usually comes at the expense of the teacher's personal time, something he/she is not willing to compromise on.

To this must also be added certain reforms at the legislative level, starting from the academic curriculum, making them effective at each and every level: center, classroom, students.

But rejection is not only determined by these variables. A fundamental variable is that related to the results that the implementation has reported in different educational stages throughout the educational community, becoming palpable in electronic newscasts, blogs, and research articles which leads to affirm in the words of Mosquera-Gende (2018) that one cannot live with one's back to technology.

The confinement by COVID that required these tools has led to a new situation, the current one, where not all are positions against (idDOCENTE, 2022), but many of them have a solid scientific-educational basis based on specific studies that collect the implementation of this new methodology, which they consider an educational

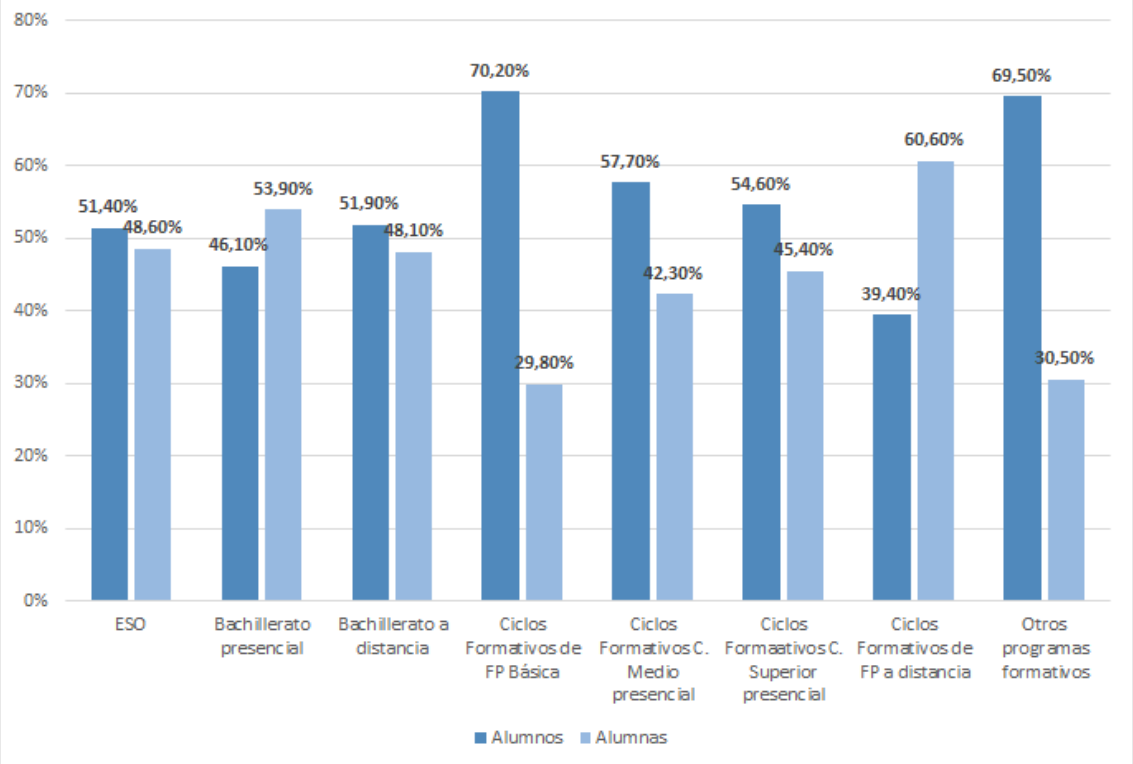
opportunity. Despite the advantages shown by mobile devices as an educational resource, many are the authors who highlight some of the disadvantages that can bring the use of such technology in the classroom such as: addiction, small screens that derive in vision problems, obsolescence as stated by Vega Magro (2018) However there are teachers who believe in its application as a methodological tool as they consider its application as a qualitative improvement in terms of daily evaluation, thanks to the implementation of ICT tools for real-time evaluation, allowing students to know where and what to improve, acquiring the set of the two classrooms, where they have been implemented, the basic competences contemplated in the curriculum of the subject and educational level.

At this point it is necessary to determine how these ICT tools modify the teaching-learning processes, which leads to the realization of a study about the agents involved in learning, carrying it out in the fourth year of Compulsory Secondary Education (ESO), in particular, we have analyzed all students, teachers and families, in order to draw conclusions both individually and as a group, either from one of the participating groups, or intertwined results by considering more than one group.

The analysis of both the teaching population and the sample of the fourth year of ESO was carried out during the third quarter, in a subsidized school in the Autonomous Community of Galicia, where the failure rate is 40% (Chaparro, 2020) and the dropout rate is 8.1%, and where female students account for 44.9% of the school population compared to male students who make up the remaining 55.1% (Statista, 2023). Figure 1 shows the distribution of the ESO school population by gender and type of education received.

Figure 1

Ratio of male and female students in secondary education by type in Spain 2021/2022

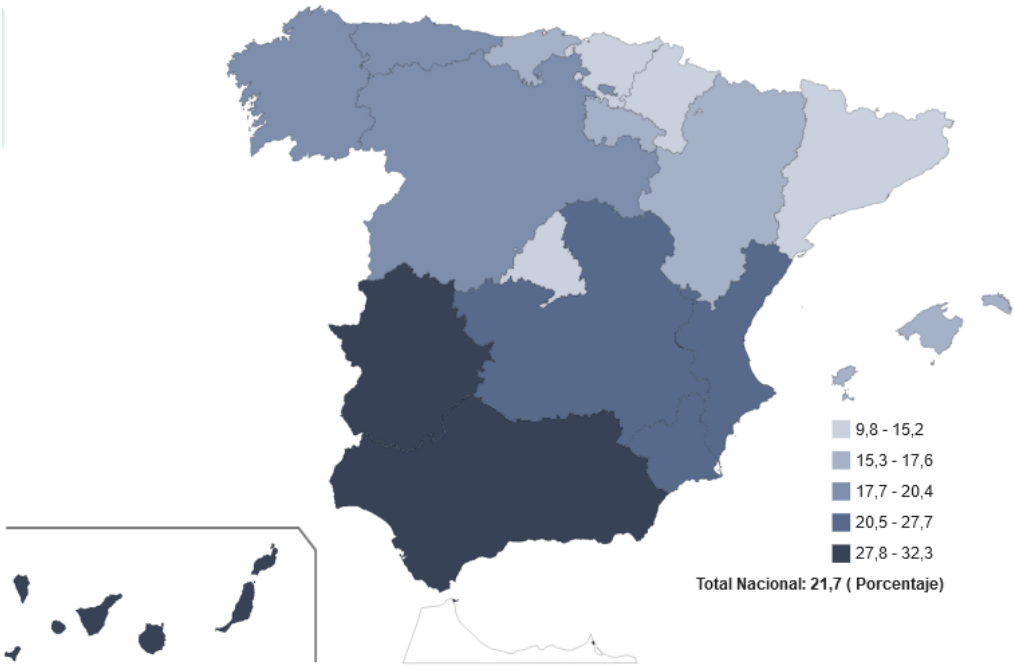


Note. Taken from Statista.com (2023) based on INE (Instituto Nacional de Estadística) data

As for the socioeconomic level of families and students, this can be classified, following Seguí (1996) as medium-low based on data extracted from the INE (2021), which can be seen in Figure 2 showing the poverty risk rate by autonomous communities for the year 2021, with Galicia at a rate below the average.

Figure 2

At-risk-of-poverty rate vs. autonomous communities for 2021



Note. Taken from INE (2021)

The starting point of the study was taken by reviewing the effects observed after confinement by COVID. The first phase of the study was carried out during the 2020-2021 academic year, continuing with a new phase during the second school term of the 2021-2022 academic year. In both cases, the same group of students and teachers has been analyzed, which has made it possible to contrast and determine the particular observations of both groups in the periods before, during and after the pandemic.

At the social level, the latest economic crisis has brought with it the appearance of a new social gap that further deepens, if possible, the differences between autonomous communities and segments of society. At the school level, this gap materializes in the education received, which, although it reaches practically the entire population, does so in very different ways, as Borreguero (2020) points out. Schools have emerged that make use of new technologies and active methodologies that are not available to everyone, nor are they put into practice in all schools.

The COVID brought with it not only the school confinement of practically all schoolchildren, not only Galicians or Spaniards, but also throughout the world (UNESCO, 2023). It also brought a before and after in the way teaching-learning processes were transmitted, from being practiced face-to-face, to become a model that can be described as distance transmission (OECD, 2020).

In addition, confinement led to a reduction in contact between schoolchildren (Ortiz, 2021), reducing the process of socialization and contact between peers, which

resulted in a series of psychological problems, disorders at very early ages, such as ADHD (Salas-Sánchez and Peñas-Rojas, 2021) and other new disorders that are manifesting themselves as time goes by (Cifuentes-Faura, 2020).

The lack of adaptability to the situation, the lack of foresight in the face of such complex scenarios (Ponce & Luján, 2022) and the lack of teachers and specific tools for a distance educational transmission (Villafuerte, 2022), have been factors that may have helped to further deepen, if possible, the existing educational gap, or the emergence of a new one of a specific nature and of a more technological typology (Mur Sangrá, 2016).

Method

Taking the autonomous community as a starting point, since it is the only one that can provide solutions to the problem in all its dimensions: social, economic and educational (Trujillo, 2020), an instrument of analysis of the educational reality is designed for all teachers working in the C.A. of Galicia (Spain). de Galicia (Spain), which will serve, given its relevance and significance, to extrapolate to the educational community as a whole, aspects such as vision of the educational reality, idiosyncrasies in the use of mobile devices in the exercise of their teaching practice, the problems to access them, and the particular vision of families and educational administration, reluctant regarding their use at school level.

A representative and proportionally distributed sample was taken from all the teachers assigned to each of the four provinces that make up the Autonomous Community of Galicia, without distinguishing between the types of centers to which they are assigned. Figure 3 shows schematically the restrictions imposed on the collection and measurement instrument used.

Figure 3

Measuring instrument restrictions

$$\#N=12500|_{95\%\text{-}5\%} \rightarrow \#n=273 \rightarrow \propto \left\{ \begin{matrix} \%\,Coruña \\ \%\,Lugo \\ \%\,Ourense \\ \%Pontevedra \end{matrix} \right\} centros: públicos, privados, concertados \; \text{ł}_{género}$$

Figure 3 refers to the cardinality of the starting set (teaching population of the Autonomous Community of Galicia), i.e., the number of teachers assigned to this autonomous community, as well as the restrictions initially established in terms of reliability and assumed percentage error, while #n refers to the sample size necessary to comply with the previously established conditions of the study.

This sample has been distributed proportionally for each province, according to the total number of teachers assigned to it and with total independence of the type of center and without any distinction as to the gender of the participants. In this last aspect, the approach to parity of the participants has been initially favored. However, this has not been achieved due to the need to observe several extractions-submissions in order to reach the required number of participants based on the sample size.

The methodology followed for the mixed study was based on the treatment of the information collected through a quantitative-qualitative survey addressed to the target population of 1,500 teachers in the Autonomous Community of Galicia who work in public, private and subsidized schools. The sample, 373 individuals, was drawn proportionally with respect to the total number of teachers in each of the provinces that

make up the Autonomous Community of Galicia (INE, 2020), as shown in Table 1. The probabilistic and anonymous nature of the study in the extraction of the participants and the collection of their responses, gives it the representativeness required in any study that follows the scientific method.

Table 1

Sample and its segmentation by provinces

	La Coruña	**Lugo**	**Orense**	**Pontevedra**	**Total**
Population	1.120.185	324.419	304.104	942.849	2.691.557
%	41,62	12,05	11,30	35,03	100,00
Sample	155	45	42	131	373

Note. Own elaboration based on INE population data (2020)

This survey focuses on the characterization of the situation in the periods before, during and after the COVID confinement, which will provide a more objective analysis of the changes it caused at the school level in each of the periods analyzed.

On the other hand, a follow-up survey on the implementation of new mobile devices in two classrooms of the fourth year of ESO (Compulsory Secondary Education) in a school in the province of Pontevedra belonging to the Autonomous Community of Galicia has been used as a basis for the analysis of the ICT context. This survey will make it possible to determine the degree of acceptance and availability in terms of the use of mobile devices as educational tools, as well as to evaluate in real time, thanks to software tools integrated in the same, both the teacher's training action and the degree of acquisition of competencies and skills among the participating students. Table 2 and Table 3 show the data on the sample in terms of students, teachers and families participating in this second analysis.

Table 2

Description of the sample in terms of the participating students

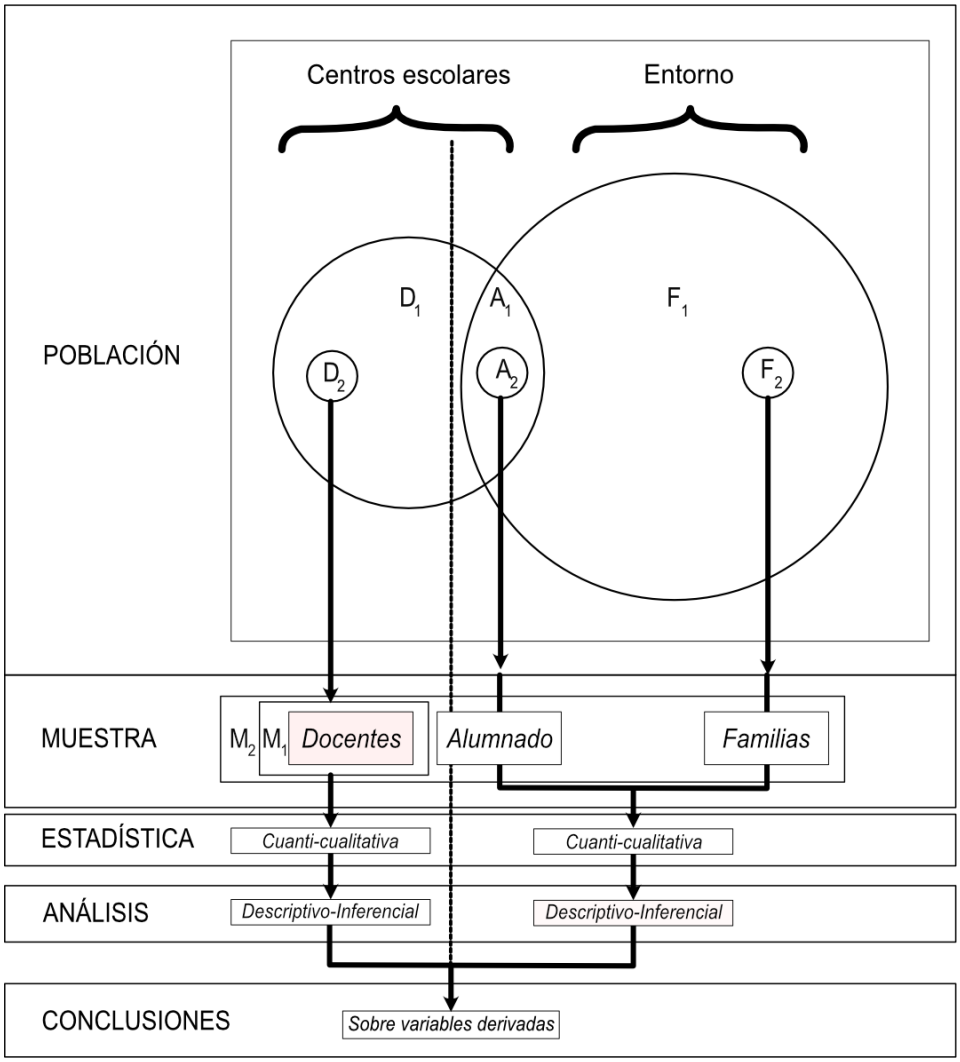
	4th A		**4th B**	
Alumni	**no**	**%**	**no**	**%**
Boys	6	0,353	11	0,647
Girls	11	0,647	6	0,353
Totals	17	1	17	1

Table 3
Description of the sample of participating teachers and families

Teachers	no	%	Families	no	%
Men	6	0,261	Parent	9	0,265
Women	17	0,739	Parent	25	0,735
Totals	23	1	Totals	34	1

Figure 4 shows the diagram of the methodology applied to the statistical study contemplated in this article. The differentiated treatment of the 2 samples can be observed in the same, so that after obtaining the respective statistical results, conclusions can be drawn as a whole.

Figure 4
Diagram of study execution



The main objective addressed in the present study consists of: *To study the relationship between the use of mobile devices in the classroom in conjunction with real-time assessment tools and the improvement in the degree of acquisition of competencies by the participating students*.

In order to determine this relationship, the study poses a series of questions by collecting the answers to the same through an electronic form that will allow us to determine whether the use of devices and tools designed to integrate them in schools lead to substantial improvements in terms of educational transmission and evaluation, determine a change of position in teachers regarding the introduction and use of these devices in the classroom and how families and teachers see the change of reality in their use, going from a mere object of entertainment to an educational tool, as well as their functionality in situations of absence of educational presence due to confinement or other similar situations.

The following specific objectives are derived from this objective:

- To assess whether mobile devices can be introduced in the classroom because they are considered as tools that facilitate and improve the acquisition of skills among students in Compulsory Secondary Education.
- To observe the degree of acquisition of competencies among students, after the implementation of mobile devices in the classroom containing real-time assessment software tools.
- To analyze how the perception of the actors involved in the teaching-learning processes has changed regarding the use of mobile tools and devices in the classroom and at home.
- To determine their influence on the degree of acquisition of the competencies established in the academic curriculum of the fourth year of ESO.
- To contrast the functionality in situations that prevent face-to-face presence in the teaching-learning processes.
- To verify the existence of an educational gap caused by the use and introduction of mobile devices after the COVID pandemic.

The methodology used for the present study is characterized by a two-sample analysis of related target populations. The first of these is aimed at teachers in the Autonomous Community of Galicia who carry out their academic work in educational stages below university level.

A quantitative-qualitative analysis has been applied to this sample, which has a set of initial or starting variables, as well as other derived variables, obtained from the initial variables by means of a set of arithmetic rules that define them. The existence of derived variables is determined by an affinity between the participants in the definition. Thus the derived variables will be defined by the equations: v'_1, v'_2, v'_3, v'_4, v'_5 y v'_6 respectively.

In that equation v'[i] corresponds to the derivative variable and v_i the initial or starting variable. Thus, the analysis "will make it possible to describe the reality-object of study, an aspect of it, in order to clarify a truth, corroborate a statement or verify one or more hypotheses", as Niño (2021) states. The study involves extrapolating it to other populations and centers, either in the same or different autonomous community or nation, which would substantially favor not only the acquisition of results, but also the reaffirmation of the conclusions pursued.

The second of the samples is addressed to students, teachers and family of fourth grade of ESO. In the first case, sample selection criteria and the collection of confidential and automated information will be applied, using an electronic form to avoid duplication of responses, modification and/or manipulation, guaranteeing the anonymity of the participants at all times.

Table 4 shows the data sheet for the first of the surveys analyzed in this article.

Table 4
Galicia-COVID 19 Teachers Survey Fact Sheet

Galicia and COVID19 Teachers' Survey Technical Sheet	
Sample universe	Teachers of the Autonomous Community of Galicia
Objective of the survey	Analyzing the current educational situation after a situation of school confinement by COVID
Type of sample	Simple random proportional to the number of teachers in each province
Realization time	1 school term
Data collection technique	By anonymized electronic form linked to a spreadsheet with limitation to 1 attempt
Type of study	Quantitative-qualitative
Population size	12500
Confidence level	95%
Margin of error	$\pm 5\%$
No. individuals studied	373

The second of the populations studied has the particularity that it is limited to only 34 individuals, so it was decided to consider the sample in its entirety, so that $E \subseteq \Omega$being #E the cardinality of the sample (number of participants) and Ω the cardinality corresponding to the population studied.

In order to determine the degree of reliability of the study, a series of instruments were applied, such as: sample normality analysis, to determine the reliability in each of the samples studied; hypothesis testing for each of the objectives based on the Kolmogorov-Smirnov test (2) in the first of the samples, to determine which of the hypotheses proposed, the null (H0) or the alternative (H1), should be adopted, given that the sample is larger than 50 individuals (Zachs 2020a). On the second sample, shown in Figure 4, a Shapiro-Wilk test (1) will be performed, since the sample studied is smaller than 50 individuals, a restriction imposed by this statistic in its definition (Zachs 2020b).

$$W = \frac{(\sum_{i=1}^{n} a_i \, s_i)^2}{\sum_{i=1}^{n} (x_i - \overline{x})^2} \tag{1}$$

$$F_{n(x)} = \frac{1}{n} \sum_{i=1}^{n} \begin{cases} 1 \; si \; y_1 \leq x \\ 0 \; alternativa \end{cases} \tag{2}$$

For two tails the statistic is given by:

$$D_n^+ = máx\ (F_n(x) - F(x))$$

$$D_n^- = máx(F(x)\ - F_n\ (x))$$

In order to determine the validity and reliability of the instruments used in this study, we proceeded to determine the Cronbach's α-Cronbach's test, which in the words of Tuapanta Dacto et al. (2017) is an index that measures the internal consistency of a scale that serves to evaluate the extent to which the indices of an instrument are correlated, i.e., the internal relationship between 2 or more items with each other, thus allowing to corroborate the absence of errors in the selection and collection of data.

Table 5 shows the reliability of the set of variables involved in the study, broken down according to each of the samples participating in the study.

Table 5

Cronbach α-Cronbach's test on the variables participating in the study

Sample	α-Cronbach	Participating elements
Teachers in Galicia	0,840	373
4th ESO	0,899	91

Based on the results obtained, it is determined that, in the case of the sample of teachers from Galicia, the result obtained is 0.840, which falls within the interval [0.8-1.0], which corroborates that the study on the sample analyzed has a reliability that can be classified as high. In the case of the sample obtained for the fourth year of ESO students, its value is 0.899, which, as in the previous case, is within the interval [0.8-1.0], so that, as in the previous case, the reliability is rated as high, as can be seen in Table 6.

Table 6

Cronbach's α-Reliability Intervals

α-Cronbach				
Very Low	Under	Moderate	Good	High
[0-0,2)	[0,2-0,4)	[0,4-0,6)	[0,6-0,8)	[0,8-1)

Results

The results that will be shown below are determined by the study carried out through the samples analyzed on the previously stated objectives.

Objective 1: Value the introduction of mobile devices in the classroom as real-time assessment tools. It consists of analyzing the convenience of implementing mobile devices

with real-time evaluation tools in the classroom and their consideration as educational tools.

This objective is analyzed taking into consideration the study variable derived v_1'obtained from the arithmetic operation of the sum of the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by the equation:

$$v_1' = competencias_i + percepción_{docente} + percepción_{familia} + percepción_{alumnado} \quad (3)$$

The results obtained show that the school community as a whole considered the introduction and use of mobile devices to be convenient. At the same time, they consider that the software tools that can be distributed integrated in them, favor the real time evaluation of students and teachers, having an impact on the improvement of the degree of acquisition of educational competences.

Objective 2: To observe how mobile devices facilitate the acquisition of skills in ESO students where this technology has been implemented.

To the question of whether: Mobile devices are not perceived as necessary tools in the classroom to improve the degree of acquisition of competencies of students in Compulsory Secondary Education.

This objective is analyzed by taking into consideration the study variable derived from v_2'obtained as the product of the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by equation 4:

$$v_2' = (competencias_i * valoración - \text{uso}_{\text{alumno}_i}) \quad (4)$$

Objective 3: Perceive pedagogical improvements in the use of mobile devices in the transmission of PPEA at the classroom and home level.

To the question of whether: Mobile devices are not perceived as necessary tools in the classroom to improve the degree of acquisition of competencies among students in Compulsory Secondary Education.

This objective is analyzed by taking into consideration the study variable derived by aggregating the following variables v_3'obtained by aggregating the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by equation 5:

$$v_3' = (uso_i + manejo_i) * (evaluación_i - exámen_i) \quad (5)$$

Objective 4: To determine how these ICT tools influence the degree of acquisition of the competencies set by the academic curriculum.

This objective is analyzed by taking into consideration the study variable derived from v_4'obtained as an aggregation of the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by equation 6:

$$v_4' = (exámen_i + evaluación_i) * competencias_i \quad (6)$$

Objective 5: Analyze the functionality of these tools in situations of absence of presence, as occurred during the COVID pandemic.

This objective is analyzed by taking into consideration the study variable derived by aggregating the following variables v_5'obtained by aggregating the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by equation 7:

$$v_5' = uso_{movil\_i} * (percepción_{docente_i} + percepción_{familia_i}) \quad (7)$$

Objective 6: To verify the existence of a gap associated with ICT components that will prevent all families from accessing the tools to be introduced.

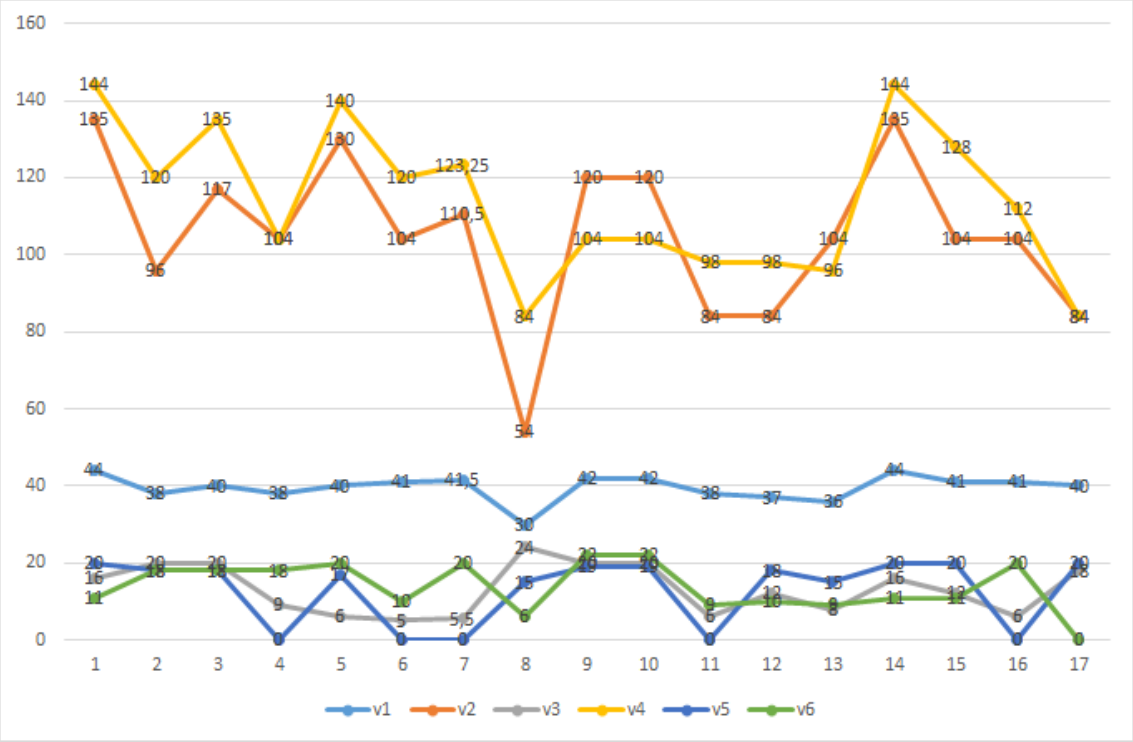
This objective is analyzed by taking into consideration the study variable derived by aggregating the following variables v_6'obtained by aggregating the variables variation of the degree of acquisition in the student body, teacher perception and parental perception as defined by equation 8:

$$v_6' = (grado\ adquisición_{alumnado_i} + percepción_{docente_i} + percepción\_familia_i) \quad (8)$$

Figure 5 shows the application of the derived variables $v_1' a v_6'$ obtained from the different starting variables involved in the study. This result is the result of applying the definition of each one of them to the different samples in which they participate.

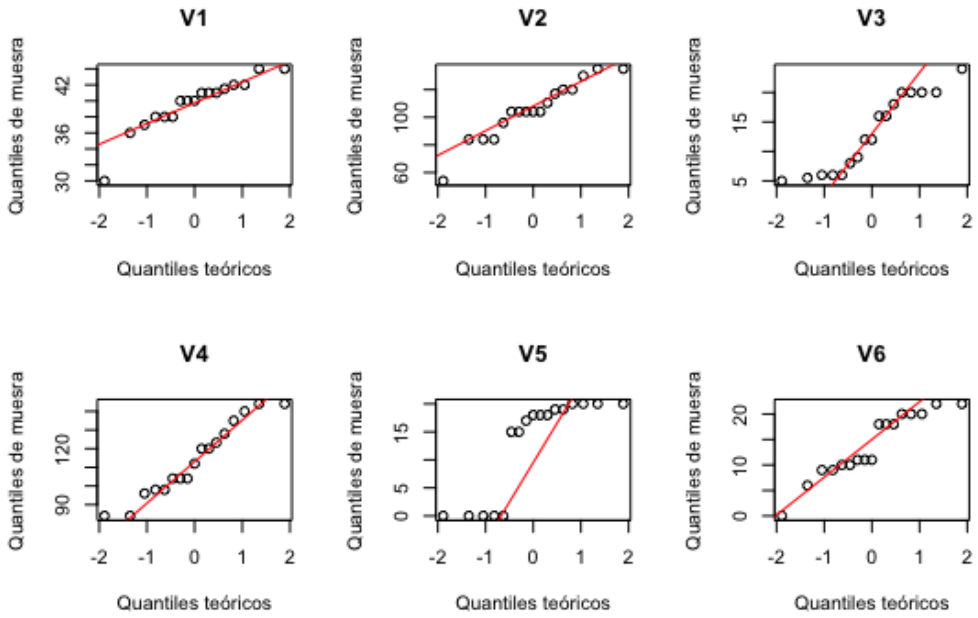
Figure 5

Results of the application on the variables under study v_1 to v_6



As for the determination of whether the data studied have the normality required in studies of this nature, it can be seen in Figure 6 that the normality of the data is reaffirmed, thus guaranteeing the results and conclusions obtained from the samples analyzed and the participating variables.

Figure 6
QQ (Quantil-Quantil) plots of the variables v_1 to v_6 involved in the study



Note. Own elaboration (2022) based on R-Pubs-Various graphs in one (Ortiz, 2016).

Discussion and conclusions

The analysis of the proposed objectives leads to the fact that for the:

Objective 1. In the statistical analysis of the hypothesis testing of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.03846. Since this value is less than 0.05, hypothesis H_1 = Teachers consider it convenient to implement mobile devices in the classroom to use them as real-time assessment tools, to the detriment of hypothesis H_0 = Teachers do not consider it convenient to implement mobile devices in the classroom to use them as real-time assessment tools.

Objective 2. In the statistical analysis of the hypothesis testing of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.2869. Since this value is greater than 0.05, the hypothesis H_0 = Mobile devices do not facilitate the acquisition of skills among ESO students is adopted as valid, instead of the alternative hypothesis H_1 = Mobile devices facilitate the acquisition of skills among ESO students.

Objective 3. In the statistical analysis of the hypothesis testing of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.04632. Since this value is less than 0.05, hypothesis H_1 = Teachers perceive pedagogical improvements due to the use of mobile devices in the PPEAs is adopted as valid, to the detriment of hypothesis H_0 = Teachers do not perceive pedagogical improvements due to the use of mobile devices in the PPEAs.

Objective 4. In the statistical analysis of the hypothesis contrast of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.3216. Since this value is greater than 0.05, the hypothesis$_{H0}$ = Mobile devices are not perceived as necessary tools in the classroom to improve the degree of acquisition of skills among students in Compulsory Secondary Education is adopted as valid, instead of the alternative hypothesis H_1 = Mobile devices are perceived as necessary tools in the classroom to improve the degree of acquisition of skills among students in Compulsory Secondary Education.

Objective 5. In the statistical analysis of the hypothesis contrast of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.0001157. Since this value is less than 0.05], the hypothesis H_1 = Mobile devices do not report functional improvements in situations of absence from school, as occurred during the COVID pandemic, is adopted as valid instead of H_0 = Mobile devices do not report functional improvements in situations of absence from school, as occurred during the COVID pandemic.

Objective 6. In the statistical analysis of the hypothesis contrast of the variable associated with this objective, the corresponding variable yields a p-value equal to 0.08702. Since this value is greater than 0.05, the hypothesis H_0 = There is no perception of a gap associated with ICT components that will prevent all families from having access to the tools to be introduced in the classroom is adopted as valid, instead of H_1 = There is a perception of a gap associated with ICT components that will prevent all families from having access to the tools to be introduced in the classroom.

As a result of the discussion following the analysis carried out on the objectives set out, it can be determined that: initially, teachers and parents were opposed to the use of mobile devices in the classroom, considering them more as an amusement than as a methodological-educational tool.

The students have a diametrically opposed view, since, although it is true that the use they have been making of cell phones coincides with that expressed by parents and teachers, they consider that an alternative use can be contemplated at the educational level, thus allowing a methodological change, which would require specific training of all the actors involved in the PPEAs (teachers, students and families).

Teachers and parents have changed the way they view and consider mobile devices after their implementation in the classroom, in fact, they have determined new approaches and methodologies that can be integrated and coexist alongside the new models introduced by the use of mobile devices as stated by Carrasco (2023).

The development and implementation of specific software can facilitate the teaching work, complementing the educational exercise in the evaluation process of the actions carried out, shortening the time of action-evaluation, which will have a positive impact on the training and degree of acquisition of competencies by the students.

The use of these assessment tools will introduce a new way of acting for the teacher, moving to a higher level, that of manager and guide in the PPEA, focusing on the students, thus transforming learning and relegating its memoristic nature.

The confinement by COVID has only revealed a certain deterioration in education, largely due to the interpretative and legislative differences between the different administrations involved in the drafting of school curricula and the divergent views between autonomous communities, not only at the political-ideological level but also at the north-south geographical level.

The need for a change in education, hand in hand with universal access to mobile devices, raises the question of whether these devices will be available to everyone, since it has been observed that, despite promoting access to mobile devices in the classroom, this change may upset the expectations created, largely due to the new technological crisis that has arisen associated with the lack of silicon-derived components.

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