



Factors Influencing Teachers' Uses of New Technologies: Mindsets and Professional Identities as Crucial Variables

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The improvement of the use of digital technologies (DTs) by teachers still needs to delve deeper into how some difficulties are related to a more general view that teachers have of the teaching profession and themselves as teachers. The goal of this article is to go further in this knowledge identifying different types of DTs use and relating them with conceptions and beliefs of teachers about teaching and themselves as teachers. A literature review and a mixed methods empirical research study were conducted. The research study combined interviews and a questionnaire, the former aiming to produce biographical narratives of participant teachers, and the latter revealing how participant teachers are currently using digital technologies. Findings indicate that teachers want to use new technologies to improve teaching, but they still feel a lack of knowledge regarding its pedagogical potential and its rules of use in the classroom. Two main types of use were identified - a restrictive and an expansive type. These types of use relate to a number of teachers' beliefs and conceptions - about innovation in their professional work, students, colleagues, leaderships, school projects, educational policies and job satisfaction - allowing to argue that different types of use correspond to different mindsets and professional identities. Being an issue of identity, promoting teacher adherence to digital technologies, requires a kind of training able to transform the individual teacher as a professional and therefore needs to be accompanied by means of close incitement and support.

Keywords: digital technologies, teacher professional identity, teacher digital mindsets, innovation in teaching, uses of technology

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INTRODUCTION

The claims to improve the use of digital technologies (DTs) – term that will be used to refer to new technologies implying digital devices, such as mobile technology – are increasingly stronger (Lencastre et al., 2021; Wirjawan et al., 2020). Due to the advantages they bring to individuals' self-fulfilment and social cohesion, to increase the use of digital technologies (notably digital) is one of Europe's (and the world's) main goals, with clear repercussions on the fields of education and training.

The factors influencing how people use these new technologies are diverse. It is known today that “generation” is not a safe variable to understand different types of technological usage (Orlando 2014), and that digital competence is not to be confused with the amount of time one spends using those technologies (Monteiro et al., 2021).

The concept of “digital literacy” allows one to understand the use of new technologies integrated into people's ways of life. Digital literacy is a way of being comfortable with the choices, activities and relationships DTs entail, and a means of being active and intervenient in different life contexts (Cementina, 2019; Gee, 2012; List, 2019). It therefore requires more than competences specific to the digital world; it also demands new values, relations, and self-transformation. (List, 2019).

To change established procedures in schools has been proved to be a difficult but important objective towards transformative education. Under this light, DTs are not a panacea, as school adhesion to digitalized ways of working deals with the same problems that school change faced before. Even if in some cases change is now easier, in others it is more challenging. One of the fundamental obstacles to schools' (teachers') adhesion to DTs may be the conception of (traditional) knowledge transference still prevailing. It seems that teachers' adhesion to, or rejection of, DTs stems essentially from this point of view. In many cases, rejection (or weak adherence) may be a common aspect regarding any kind of innovation, in others it will be due to a lack of instrumental competence in the use of DT's (Almerich et al. 2016; Zimmer et al., 2021), or due to an ideological stance nurtured by the fear that (traditional) knowledge will lose importance in school education (Lopes, 2021). Sometimes the transmissive and banking conception of knowledge (Freire, 1968; Lesne, 1984) is clearly present and sometimes the refusal of the DTs is sustained around a nostalgia for earlier times, for the age of books (Lopes, 2021).

The goal of disseminating DTs to day-to-day life as means of accessing and producing knowledge, culture and art, requires research on the reasons why people adhere to them or not, so we can better understand their nuances and intervene in them. In educational contexts, teachers' current ways of working, beliefs and conceptions of teaching and learning may assume great importance. In spite of the existence of important research studies on personal factors affecting teachers uses of new technologies (Salleh et al., 2022), there is still little reflection on how the view teachers have about teaching profession and themselves as teachers impact on their adherence to new technologies.

This article intends to deepen the reflection on factors influencing the way teachers adhere to new technologies in their pedagogical work, focusing on their perspectives of the teaching profession and themselves as professionals.

To do so, a literature review centred on schools' and teachers' perspectives regarding DTs, identifying relevant variables, concepts, and typologies was conducted. In addition, data emerging from a mixed research study of exploratory nature is analysed and discussed. This research study combined semi-structured interviews and a questionnaire. The research questions were as follows: how do teachers use DTs in teaching and in school? What are teachers' beliefs and conceptions regarding teaching and themselves as teachers? What relationships can be established between teachers' conceptions about teaching and teachers and the way they use digital technologies?

Data collection was carried out in Portugal, before and during the pandemic, and involved teachers participating in an annual teacher training activity carried out within the scope of the Rekindle Project (Mouraz et al., 2021).

First, the theoretical framework of the research study will be presented, followed by a description of the means of data collection and analysis and of the participants' characteristics. Subsequently, findings and their discussion will be presented, after which the article closes with the conclusion.

Context and Review of Literature

While it is clear the world will continue to transform itself extraordinarily, given the evolution and the availability of DTs (namely relating to automation; Bridglall, 2018; Peredrienko et al., 2020), a relatively deep gap between this new situation and the relational and educational processes in schools persists (Domeny, 2017). In fact, the use of DTs in education, notably in school education, is still a divisive issue in many professional contexts (Cementina, 2019), and gives rise to passionate adhesions or rejections. Some consider that DTs can distract students and become a learning barrier (Hills & Thomas, 2020), that they restrict communication skills (William, 2021); or that DTs, instead of facilitating, make the teacher's job more difficult (Alves et al., 2020).

Addressing difficulties related to access to DTs is the first step on the path to their widespread and daily use (Miranda & Russell, 2011) in schools. Therefore, their availability is an important condition for their use (Area-Moreira et al., 2016). There are several educational and social challenges regarding this, some of them evidenced during the pandemic, such as social inequalities (Kelly, 2021) and the imbalance between the type and level of DTs' use within families (strong) and in schools (weak) (Buchholz et al., 2020; König et al., 2020). In addition to these basic conditions, there are others that are less reported or discussed, but that are, according to Fong (2013), of great importance: teachers' current way of working (Salavati, 2016), and their views of the world and perspectives on DTs and education (Cementina, 2019). These are the variables to be addressed in this article by contributing to deepen the reflection on how teachers' perspectives about the teaching profession and about themselves as teachers impact on their adherence to new technologies

Beliefs concerning the relationship between technologies and pedagogy influence teachers' adherence to the integration of DTs in daily schoolwork and the way in which this integration is carried out (Ertmer et al., 2012). In fact, the value teachers attribute to DTs as forms of learning and knowledge seems to be at the core of this issue, as sometimes teachers personally adhere to DTs but do not acknowledge its use in education for learning purposes. Cementina (2019) calls these general perspectives on DTs and professional work "teachers' digital mindsets". In a convergent perspective, van den Beemt and Dienstraten (2012, 162) distinguished between "ICT mindedness and non-ICT mindedness", stating that "it is possible to infer that ICT minded teachers show higher levels of open mindedness, self-efficacy, beliefs and attitudes compared to non-ICT minded teachers".

The teachers' systems of thought assume relevance in this analysis (Salavati, 2016); as the pedagogical use of DTs is connected to the adherence to new forms of knowledge, to a new literacy, to demanding new skills (digital and multimodal), new social relations and ethical stances, and not only to new means of communication (Coiro et al., 2014).

Lankshear and Knobel (2006) mention two types of mindsets: one in which it is assumed that the world has not changed, but has merely digitalized – we call it "restrictive"; and another in which DTs are considered part of deep social changes, implying new forms of learning and coexistence – we call it "expansive".

This perspective is of fundamental importance as it opens a new field of reflection associated with the relationship between approaches towards DTs (weak or strong adherence) and professional identities, a relevant issue when it comes to promoting teachers' professional development. The process of identity formation implies the interaction between the identity the individual intends for himself/herself and the identity that the context requires from him/her; when there are disagreements between the desired identity and the required identity, the teacher develops assimilation strategies - trying to remain who he/she is - or accommodation strategies - changing his/her practice towards the required identity (Lopes, 2002, 2008, 2009). Following this perspective, one concludes there is a strong relationship between the effectiveness of professional change and how the desired identity by the teacher and the required identity (by the context) meets each other (Beijaard et al., 2004; Dubar, 2001; Lopes, 2001, 2002; Pereira et al., 2022). As Salavati (2016) and Backfisch et al. (2021) also conclude, teachers adhere to changes in accordance with how close those changes are to their personal thinking and beliefs. Zimmer et al. (2021) speak of a "teacher's digital learning identity" – a way of learning to live with DTs dependent on the teacher's current identity and his/her perceived competence to deal with them.

Some authors propose typologies of teachers' ways of using DTs. Area-Moreira et al. (2016), after an exhausting review of diverse previously proposed typologies, distinguish between "weak" and "intensive" use of DTs. In the first case, the technologies are used to pass on knowledge, in the second they are frequently used for team or individual work in which teachers and students produce new content and create new digital and communication resources. Puentedura (2013) distinguishes between four types of DTs use. Two of them are transformative: Redefinition, allowing the

accomplishment of what was inconceivable before, and Modification, which implies a significant redesign of a task; the other two are ways to improve teaching and learning, not to transform them: Augmentation, in which the tool allows a functional increase of the task; and Substitution, where the tool replaces previous ways of completing the task, but with no functional alterations.

Benavente (1990) developed a typology of teacher identity that might be useful in this regard as well, as it includes the issue of social equity and the critical dimension of teacher identity. Teacher identity is approached considering the “pedagogical universe” and the “social universe” of teaching. Her typology includes three types of identity: Type A that corresponds to a teacher that invests in the improvement of his/her pedagogical activity in the classroom from a didactic point of view, but without social concerns, namely regarding inclusion and equal opportunities; type B in which identity corresponds to teachers not investing in their pedagogical improvement as they consider that students’ academic failure is due to their own social origin and not to their (teachers’) pedagogical practice; families and their social class are to blame for students’ failure; type C has an inclusive and critical perspective on teaching and education, associating learning with democratic social change – in this case, teachers’ “pedagogical universe” communicates with and transforms in accordance to their “social universe”. Considering this social dimension of teachers’ professional identity and its translation in the adherence to DTs as reconversion, Rodrigues (2020, 24) defends that the use of DTs in teaching will demand not only tools, but the “adoption by the teacher of new roles and forms of work”.

METHOD

This research study was conducted with the objective of deepening the reflection on factors influencing the ways teachers adhere to new technologies in their pedagogical work, notably their current ways of working, conceptions and beliefs. The research questions were the following: how do teachers use DTs in teaching and school? What are teachers’ beliefs and conceptions regarding teaching and themselves as teachers? What relationships can be established between teachers’ conceptions about teaching and teachers and the way they use digital technologies?

Research design

To answer these questions, a concomitant mixed research study (Creswell, 2014) of an exploratory nature was conducted, with data being collected through an online questionnaire and semistructured interviews of biographical-narrative nature. The intention was to respond to the research questions, even if with exploratory objectives, with different kinds of data, both providing information to the research questions. As the type of mixed approach is concomitant, data collection with one method is not dependent on the other method - Data from both methods can be triangulated allowing to better identify some patterns in the results.

Participants

Participants in the questionnaire

Fifty-eight teachers, teaching from 6th to 12th grade, filled out the questionnaire. When accessing it online, the teachers agreed with the contents of the terms of free and informed consent, in which anonymity and conditions of data preservation were assured. Teachers answered this questionnaire before the beginning of the pandemic.

In Table 1, the respondents are distributed by sex, age, time of service and held positions. Most of the surveyed subjects are female (79%), aged between 50 and 55 years old (55%), with a time of service between 20 and 30 years (60%) and holding positions as teachers and pedagogical or institutional managers (60%).

Table 1

Distribution of respondents by sex, age, time of service and held positions

		<i>n</i>	%
Sex	Female	46	79,31%
	Male	12	20,69%
	Total	58	100,00%
Age	50 to 55 years of age	32	55,17%
	56 years of age or higher	26	44,83%
	Total	58	100,00%
Time of Service	20 to 30 years	35	60,34%
	31 years or more	23	39,66%
	Total	58	100,00%
Held positions	Teacher	23	39,66%
	Teacher and leadership position	35	60,34%
	Total	58	100,00%

Participants in the interviews

Nine (female) teachers were interviewed. They were selected due to - in the training activity they were attending – seemingly having opposite behaviours and approaches towards DTs (in this case, Mobile Technologies - MTs). The goal was to characterize these differences and to explore the biographical and other personal reasons underlying them. In Table 2, participant teachers are characterized. The names are fictitious, and any information that could allow for personal or institutional identification found in the data analysis was suppressed or replaced.

Table 2
Identification and characterization of the interviewed teachers

Name	Age	Teaching sector	Years of service	Training Level
Alice	53	7th to 12th grade	25	PhD
Carla	52	5th and 6th grade	29	Bach
Ema	55	7th to 12th grade	32	MA
Marta	53	7th to 12th grade	29	PhD
Matilda	58	5th and 6th grade	30	Bach
Olivia	53	7th to 12th grade	33	Bach
Sofia	53	7th to 12th grade	24	Bach
Eva	53	7th to 12th grade	23	Bach
Luciana	52	7th to 12th grade	23	Bach

Data collection and instruments

The questionnaire

The online questionnaire focuses on the use of mobile technologies (MTs) in teaching. It was developed with the objective of obtaining information on two dimensions: the professional profile of the teacher (gender, age, time of service and held positions); and the teachers' level of use and beliefs regarding MTs in teaching (10 items Likert-type scale; Table 3).

Table 3
Items of the questionnaire

Items	Description
Item 1	Sometimes I use my mobile phone to communicate with my colleagues (calls, SMS, MMS) about school subjects.
Item 2	I usually employ certain functions of my phone (ex: daily planner, reminders) to manage my professional tasks
Item 3	I frequently record professional documents on my mobile phone
Item 4	I believe my cell phone is a personal object and that it shouldn't be mixed in with schoolwork
Item 5	Mobile gadgets can be employed in school activities
Item 6	I regard mobile gadgets as pedagogical resources to be explored
Item 7	Using a mobile phone in classroom activities distracts students and disturbs school activities
Item 8	I already make use of MTs in my classes
Item 9	I believe a broader use of mobile gadgets as a resource that supports school activities should be put into place
Item 10	I know the laws that regulate the use of mobile gadgets in school environments in my country

The interviews

The conduction of the interviews was informed by the biographical-narrative approach. Focusing on lived experiences and on the meanings that individuals attribute to these experiences, the biographical-narrative approach allows one to grasp the complexities of the interactions between the individual and their contexts (Thomas Dotta et al., 2020). According to van den Beemt and Diepstraten (2016), data provided by the biographical interviews, consisting of reports of life trajectories, articulates past experiences and future expectations. The interview guidelines included two parts: the personal history up to the choice of the teaching profession; periods of professional career development and

professional practice and how and when technologies are present in these moments. In biographical-narrative research, epistemological and ethical issues are intertwined (Molina, 2011); when the researcher enters the contexts of the participants, even for a short period, he/she becomes part of their relational configuration, thoughts, and words, and this requires strict ethical surveillance by the researcher. Therefore, the collection process involved what Bolívar Botía (2008, 18) calls a “narrative contract”, in which the ethical rules of the research are clarified, and a term of informed consent, specifying guarantees regarding anonymity, is signed.

The interviews were conducted during the pandemic period in a virtual environment. No constraints were identified regarding the use of this environment, and its specificities were considered during the interactions (Thomas Dotta et al., 2019).

FINDINGS

The questionnaire

Data collected by the questionnaire were statistically analysed with the support of the SPSS version 26 (IBM corp., Armonk, NY, USA) software. To verify the existence of statistically significant differences when it came to the variables that compose the teachers' profiles – sex, ages, time of service, levels of education taught and held positions, the Mann-Whitney U nonparametric test was used. Whenever there was a need to verify the normality of the distributions the Kolmogorov-Smirnov nonparametric test was used when the sample group was over 50 elements, and the Shapiro-Wilk test when it was not. In all conducted hypothesis tests, a type I error equal to 5% (or significance level $\alpha = 0.05$) was considered (Marôco, 2021).

Uses and beliefs regarding DTs

In Figure 1, it is possible to observe that teachers consider that MTs can be used for pedagogical activities ($M = 4,4$) and that this resource should be explored at a pedagogical level and its use increased ($M = 4,4$).

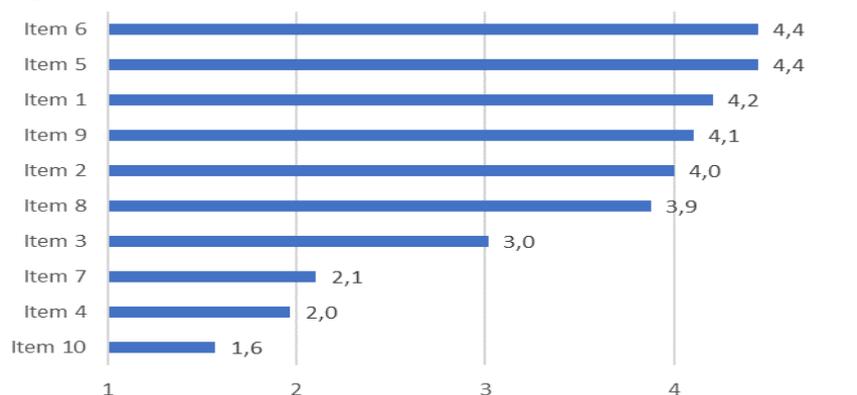


Figure 1
Items ordered descending according to mean value (n=58)

Teachers say they use MTs when communicating with colleagues about professional tasks ($M = 4,2$), when managing professional activities ($M = 4,0$) and, to a lesser extent, in classes ($M = 3,9$). Items 4 ($M = 2,0$) and 7 ($M = 2,1$), related to rejection or suspicion of the use of MTs, score a low average. The overwhelming majority of the teachers inquired did not know the laws that regulate the use of MTs in school environments ($M = 1,6$).

These results show a lack of awareness regarding the laws that regulate the use of the mobile phone in the classroom, but also that teachers strongly believe in the pedagogical potential of using it. However, teachers seem to use MTs predominantly for professional tasks that do not involve teaching directly.

Relations between uses and beliefs

Table 4 presents the mean differences among the items of teachers' level of use and beliefs regarding MTs in teaching depending on the "time of service". As the table illustrates, significant differences were found only for Item 2, "I usually employ certain functions of my phone (ex: daily planner, reminders) to manage my professional tasks". Teachers with more time of service present values significantly higher ($M = 4.43$, $n = 23$) than teachers with less time of service ($M = 3.71$, $n = 35$), $U = 259.0$, $z = -2.5$, $p = 0.013$.

Table 4

Mean (\pm SD) of teachers' level of use and beliefs regarding MTs in teaching in relation to time of service ($n = 58$)

	Time of Service		Mann-Whitney (p-value)
	20 to 30 years (n = 35)	31 years or more (n = 23)	
	M (\pm SD)	M (\pm SD)	
Item 1	4,14 ($\pm 0,91$)	4,30 ($\pm 0,56$)	n.s.
Item 2	3,71 ($\pm 1,23$)	4,43 ($\pm 0,73$)	s
Item 3	3,09 ($\pm 1,27$)	2,91 ($\pm 1,16$)	n.s.
Item 4	2,09 ($\pm 1,07$)	1,78 ($\pm 0,95$)	n.s.
Item 5	4,37 ($\pm 0,69$)	4,57 ($\pm 0,66$)	n.s.
Item 6	4,4 ($\pm 0,65$)	4,52 ($\pm 0,59$)	n.s.
Item 7	2,23 ($\pm 0,94$)	1,91 ($\pm 0,79$)	n.s.
Item 8	3,74 ($\pm 1,01$)	4,09 ($\pm 0,67$)	n.s.
Item 9	4,03 ($\pm 0,71$)	4,22 ($\pm 0,67$)	n.s.
Item 10	1,51 ($\pm 0,51$)	1,65 ($\pm 0,49$)	n.s.

Results according to Mann-Whitney tests (s: $p < 0.05$; n. s.: $p > 0.05$)

M, mean; SD, standard deviation

Table 5 presents the mean differences among the items of teachers' level of use and beliefs regarding MTs in teaching depending on the "teachers' age". As the table shows, only Item 6 (I regard mobile gadgets as pedagogical resources to be explored) revealed significant differences. Younger teachers present significantly higher values ($M = 4.59$, $n = 32$) than older teachers ($M = 4.27$, $n = 26$), $U = 302,0$, $z = -2,0$, $p = 0,043$.

Table 5

Mean (\pm SD) of teachers' level of use and beliefs regarding MTs in teaching in relation to age ($n = 58$)

	Age		Mann-Whitney (p-value)
	50 to 55 y/o (n = 35)	56 y/o or more (n = 23)	
	M (\pm SD)	M (\pm SD)	
Item 1	4,28 ($\pm 0,89$)	4,12 ($\pm 0,65$)	n.s.
Item 2	3,88 ($\pm 1,16$)	4,15 ($\pm 1,05$)	n.s.
Item 3	3,09 ($\pm 1,30$)	2,92 ($\pm 1,13$)	n.s.
Item 4	1,91 ($\pm 0,96$)	2,04 ($\pm 1,11$)	n.s.
Item 5	4,56 ($\pm 0,62$)	4,31 ($\pm 0,64$)	n.s.
Item 6	4,59 ($\pm 0,56$)	4,27 ($\pm 0,67$)	s.
Item 7	2,03 ($\pm 0,86$)	2,19 ($\pm 0,94$)	n.s.
Item 8	3,66 ($\pm 1,10$)	4,15 ($\pm 0,46$)	n.s.
Item 9	4,16 ($\pm 0,68$)	4,04 ($\pm 0,72$)	n.s.
Item 10	1,56 ($\pm 0,50$)	1,58 ($\pm 0,50$)	n.s.

Results according to Mann-Whitney tests (s: $p < 0.05$; n. s.: $p > 0.05$)

M, mean; SD, standard deviation

Table 6 presents the mean differences among the items of teachers' level of use and beliefs regarding MTs in teaching depending on "held positions". As the table illustrates, significant differences (p -values < 0.05) were found in item 4 (I believe my cell phone is a personal object and that it shouldn't be mixed in with schoolwork), item 5 (Mobile gadgets can be employed in school activities), item 6 (I regard mobile gadgets as pedagogical resources to be explored), item 7 (Using a mobile phone in classroom activities distracts students and disturbs school activities) and item 8 (I already make use of MTs in my classes). Teachers holding more school coordination positions present significantly higher values in item 5 ($M = 4.66$, $n = 35$; $M = 4,13$, $n = 23$); item 6 ($M = 4.60$, $n = 35$; $M = 4,22$) and item 8 ($M = 4.06$, $n = 35$; $M = 4,06$, $n = 23$), while teachers holding less school positions present higher values in item 4 ($M = 2,30$, $n = 23$; $M = 1,74$, $n = 35$) and item 7 ($M = 2,39$, $n = 23$; $M = 2,39$, $n = 23$).

Table 6
Mean (\pm SD) of teachers' level of use and beliefs regarding MTs in teaching in relation to their "held positions" (n = 58)

	Held Positions		Mann-Whitney (p-value)
	Teacher (n = 35) M (\pm SD)	Teacher and leadership role (n = 23) M (\pm SD)	
Item 1	4,00 (\pm 0,95)	4,34 (\pm 0,64)	n.s.
Item 2	3,83 (\pm 1,34)	4,11 (\pm 0,93)	n.s.
Item 3	2,87 (\pm 1,29)	3,11 (\pm 1,18)	n.s.
Item 4	2,3 (\pm 1,15)	1,74 (\pm 0,89)	s.
Item 5	4,13 (\pm 0,81)	4,66 (\pm 0,48)	s.
Item 6	4,22 (\pm 0,74)	4,6 (\pm 0,50)	s.
Item 7	2,39 (\pm 0,84)	1,91 (\pm 0,89)	s.
Item 8	3,61 (\pm 0,94)	4,06 (\pm 0,84)	s.
Item 9	3,91 (\pm 0,67)	4,23 (\pm 0,69)	n.s.
Item 10	1,48 (\pm 0,51)	1,63 (\pm 0,49)	n.s.

Results according to Mann-Whitney tests (s: $p < 0.05$; n. s.: $p > 0.05$)

M, mean; SD, standard deviation

Synthesis of the main tendencies of these results

The variable that seems to differ the most between participant teachers is "held positions", referring to leadership responsibilities they have or to other pedagogical activities they perform beyond classroom teaching. Teachers who, in addition to teaching, have held different management positions are the ones who consider the positive potential of using MTs in the classroom and believe their use should be increased (items 5, 6 and 8) the most. Teachers with no other positions besides teaching fear or reject the use of MTs in the classroom (items 4 and 7) the most.

Apparently, performing additional activities beyond teaching is associated with an innovative teacher professional identity.

These results seem to indicate that the variable "held positions" makes a difference regarding the uses and beliefs of the teachers participating in the research study. Teachers who occupy leadership positions in addition to teaching seem to believe more firmly in the potential of the use of MTs and are the ones who are more likely to claim to already benefit from them in the classroom.

The interviews

Regarding the objectives of this research study, the interviews were analysed according to paradigmatic (Polkinghorne, 1995), and thematic content analysis (Vaismoradi et al., 2013). Through reading and rereading the interviews (verbatim transcribed) different sets of data with specific characteristics were identified. Analysis was conducted in two steps. First the relevant corpus and themes were identified. This phase gave rise to a system of categories allowing to characterize teachers' perspectives regarding the place of educational innovation in their work; students; collaboration with colleagues; leaderships; involvement in school; educational policies; their own job satisfaction (Table 7).

Table 7

Themes emerging from paradigmatic and thematic analysis of the interviews, and respective description

Themes	Description
Innovation and professional identity	Innovation's place in professional definition
Students and teacher's work	Students' role in the teacher's work practice and organization
Collaboration with colleagues and networks	Colleagues and the place of collective sense of belonging in professional definition
School management style and support	Teachers' view on the way school management supports and encourages them to use DTs
School Involvement	How the teacher characterizes his/her work in school, restricted to the classroom or open to the challenges of school
Education Policies	Teacher perspectives on educational policies in connection with DTs
Teacher Professional Satisfaction	Satisfaction of teachers with and in their work

A second moment of analysis consisted in identifying typologies from these categories. From this second type of analysis two types of mindset emerged, that we named the "restrictive digital mindset" (RDM), particularly represented by three of these teachers, and the "expansive digital mindset" (EDM), represented particularly by six of these teachers (Table 8).

Table 8
Interviewed teachers by type of mindset and their characteristics

Name	Age	Teaching sector	Years of service	Training Level	Mindset
Alice	53	7th to 12th grade	25	PhD	Expansive
Carla	52	5th and 6th grade	29	Bach	Expansive
Ema	55	7th to 12th grade	32	MA	Expansive
Marta	53	7th to 12th grade	29	PhD	Expansive
Matilda	58	5th and 6th grade	30	Bach	Expansive
Olivia	53	7th to 12th grade	33	Bach	Expansive
Sofia	53	7th to 12th grade	24	Bach	Restrictive
Eva	53	7th to 12th grade	23	Bach	Restrictive
Luciana	52	7th to 12th grade	23	Bach	Restrictive

In each of these types, the aforementioned categories acquire different meanings and dynamics, as we will try to show in the following sections.

Expansive digital mindset

For teachers included in the EDM, innovation is part of their identity. Throughout their professional path these teachers always “grasped” the “new” resources and are usually pioneers in their use. The different technologies, namely the digital ones nowadays, are used with the objective of improving student learning and making them active in their own learning process. As stated by Benavente (1990) when proposing a “social universe” associated to the “pedagogical universe”, these teachers assume that social changes must be considered when organizing ways of teaching.

My connection to media and to other ways of teaching comes from way back; therefore, I don't see, at all, at this point, a way of teaching that doesn't imply renovation and a total revolution of what we are teaching. (Olivia)

I believe the evolution of teaching itself created the need to dedicate more time to DTs. (...) Not only in a very simple way, like using PowerPoint or small videos... but having the students building knowledge themselves with resources I gave them. (Carla)

Instead of me explaining to them how to use the app, I had one, two, three girls screen sharing and explaining how to do it. (Ema)

To these teachers, students are the central axis of the work teachers do; they believe in their capacities and differentiated potentials. They are committed to students' global development and not only with content acquisition.

Students are the inspiration to their professional development. Regarding the use of DTs, they assume the responsibility of teaching students, but they also learn from them; they are committed both to student learning and to their own professional learning.

I like teaching a lot. (...) I usually say that I have never found anyone who doesn't like to learn (...). Everyone will get there some way and be successful (...) I can safely say: “if you didn't learn this, you'll learn something else that will make you a

fully grown adult"; "you didn't learn this, but you learned that". I believe I can always find a different path. (Alice)

I love the way I see them grow (...) that is the main motivational factor for me, to see the children develop (...) The students like to be confronted with challenges and new things. (Ema)

Our real nourishment (is innovation), because now, when I prepare something different, I'm anxious to share it with them [students], to see how they react. It's that thing about working with students, involving them so that they are collaborators and not merely the receptors of the message. (Marta)

These teachers are integrated in teams with colleagues to improve the learning process:

There was a little group there that spoke the "same language"; we teach in classes taking place at night and we discuss everything and share DTs (Marta)

I'm a part of several teacher groups where things are commented on, discussed, suggested. What is asked of us is not compatible with each one staying in his/her own bubble. (Carla)

They also present a positive vision of school and have the support of school management:

If I go to the director and say: "Look, I'd like to do this or that..." I have no obstacles. It's a very positive environment. (Ema)

Our school is very innovative, it was even one of the first schools to have those "future classrooms", it is a pioneer school in that sense. (Matilda)

While they refer that the centre of their work is in the classroom and with students, they are involved in other activities, participate in projects, and have other roles in the school.

I don't feel good without being involved in other projects in school that go beyond the classroom; the classroom is too small for what I like to do in the school. (Ema)

They acknowledge the limitations of their work stemming from policies and the school system, but they find ways to subvert these limitations and always find other possibilities to achieve the objectives.

[I was] in a school that wouldn't let me be me. I decided to apply to another one. (Marta)

I've realized I'm not going to do all I wish as I wish...that's it! I'm not going to change the world, but I'll do it my way; discreetly. (Alice)

They feel professionally fulfilled and appreciated. The feeling of satisfaction and fulfilment grows with the increase of professional experience.

We are sick of some bureaucratic processes, but that's not being sick of being a teacher. (Alice)

I feel very happy with my job. I still go to school with the same excitement as I did on the first day. (Carla)

I am more and more thrilled with the profession. (Marta)

Restrictive digital mindset

For the teachers whose discourses were inscribed in an RDM, DTs take too much time to be used and are not considered adequate for all subject disciplines:

I like to improve. But all that implies time, implies energy consumption. (Sofia)

In art subjects, DTs are not very useful. (Luciana)

I think certain tools are fantastic for primary teaching, but not for middle or high schools teaching. (Eva)

DTs are seen more as a technical resource for the teacher's work and to get the students' attention, but participants don't believe they assure students' learning.

I started to prepare my classes in the computer until I had all my lesson plans organized. The materials as well, all sorted by folders. The tests, the worksheets, I have it all very organized, every year I improve, I never give out the same test twice. (Sofia)

I come to realize that, even with all this novelty, by the end, most of the times, I've had to literally repeat everything. Because they don't listen. (Luciana)

Students are the main source of satisfaction for these teachers as well, but they believe that the generic student does not match what they think a "good student" is. The activities they undertake using DTs is fundamentally using PowerPoint, videos and ready to use activities, with no interaction or production on the students' part. They are suspicious of the use that students can make of DTs and how they can be dangerous to them.

My satisfaction is being with the kids. However, even if I show the video to the classroom, put the PowerPoints in there, the links, most of them don't read them - in a classroom of 25 only 2 or 3 watched the video. (Luciana)

But the problem with all of this is that students don't have the maturity to know how to use things. I have a bunch of apps that I can use, but then I'm afraid to use them. (Eva)

A banking conception of learning (Freire 1968) in which the teacher is the centre of the whole discourse, predominates.

I think I can transmit knowledge to those who really want to learn. (...) I really want to teach, and the students must want to learn. (Sofia)

Where did we fail? I didn't fail in anything; students are just different. (Eva)

The idea that there is a negative outlook about the teaching profession and that little appreciation is given to teachers by others (school, students, community) is predominant in these teachers:

Above all we don't feel the profession is [appreciated]. Our own students don't appreciate us. (Luciana)

It doesn't satisfy me because the school demands too much of us and don't show appreciation? And when I say the school, I don't just mean the board, I mean the students, the parents and then the community in general. (Eva)

DISCUSSION

The findings coming from the survey resonate with Area-Moreira et al. (2016) indicating that most teachers use DTs more to organize professional tasks than for teaching and learning tasks, even though most of them (theoretically) agree with their use and recognize their educational potentialities. These results also converge with the idea that school is farther away from DTs than society in general, and that teachers use DTs more frequently for activities outside the profession or for professional activities not directly connected to teaching and learning (Buchholz et al., 2020; König et al., 2020).

The absence of information and experience (digital competence) brings up fears related to the way students can use technology, namely their mobile phone, to harm the teacher (i.e., by filming less adequate classroom situations).

Apparently, and according to the conducted statistical tests, teachers with greater involvement in school activities (project and department coordination...), beyond teaching classes, have a more favourable view of the use of DTs in teaching tasks and more firmly believe in the need to increase the use of DTs.

The analysis of the interviews shows, as stated by Salavati (2016), Cementina (2019) and Lankshear and Knobel (2006), that teachers' use of DTs relates to a more general view they have of the profession, something that Fong (2013) calls attention to, stating that these kinds of factors have been less considered in research. In fact, to the two types of using DTs corresponds two mindsets: The Expansive Digital Mindset (EDM) and the Restrictive Digital Mindset (RDM). In the EDM (in opposition to the RDM) is central the idea that the use of DTs is part of a major social transformation requiring transforming the ways of being a teacher and being a student, and, therefore, implying a revolution in the schools. DTs are not just another technology to be included in teaching because it is fashionable or because educators or governments insist that they need to be used; in fact, they are part of being a (new) teacher in contemporary societies, not because teacher uses DTs, but because DTs help him/her to turn into practice a transformative way of teaching. In fact, the two mindsets identified correspond to different ways of living the profession and living in the schools, which include different perspectives on school innovation; students; peers; school boards, education policies, and job satisfaction.

Teachers' statements illustrate that what makes the difference is the value teachers place on DTs as forms of learning and knowledge, forms that demand a new literacy, a "revolution" in concepts, practices and learning environments (Coiro et al., 2014), new skills, social relations, and ethical stances. Within the statements of EDM teachers we

identify perspectives that directly relate to the two types of transformation of Puentedura (2013), Redefinition and Modification, which open pedagogical action up to invention or reinvention. Differently, in the statements of RDM teachers are explicit the Augmentation, and Substitution types giving rise to the rejection of DTs by teachers, considering it is a lot of work for little gain in students learning.

As such, even if competences are important variables regarding teachers' uses of DTs, what differentiates these groups of teachers is not related with this; what differentiates them is a way of being, or trying to be, a teacher these days - in short, what differentiates these groups of teachers is their respective current professional identities: they can be called Expansive Digital Professional Identity (EDPI) and Restrictive Digital Professional Identity (RDPI).

The differences found in EDM or RDM mindsets also can be related to the types of identity proposed by Benavente (1990) – Type C corresponding to EDPI (articulating social universe and pedagogical universe) and Type B corresponding to RDPI. The adherence to DTs underlying the EDPI is not restricted to a reconfiguration of the pedagogical action; it includes the awareness of its relations with current social changes, DTs, and the school's and the teacher's role in this new context. The differences between EDPI and RDPI become especially important when it comes to the meaning given to innovation, students, peers, school leaders, and school involvement.

It is because of this relationship between the uses of DTs by teachers and their current professional identities that effective teachers' adherence to DTs for learning and teaching processes requires deep changes in the more general conceptions about education and social life.

Finally, still highlighting the main findings and their contribution to the knowledge base it is important to stress that, in accordance with Fullan (2007) and Domeny (2017), the perspectives teachers have about how school board support (or not) their use of DTs is an important factor differentiating EDPI and RDPI teachers, the first showing a positive perspective and the others a negative one. It is in this respect that the main findings of the questionnaires and the interviews meet each other, both stressing that the ways teachers use DTs relate with the support they have from the school leaders. However, as we are dealing with perspectives it is impossible to know what is the cause and what is the effect.

The distinction between EDPI and RDPI directly informs the general objective of this article, but it is lacking to address how can the EDPI be created or developed, that is, how the number of EDPI can be increased. Though this is a biographical-narrative study, it was not possible to capture biographical aspects that could inform the differences that were found, something that should be expanded upon in future studies in order to identify, beyond school and management support, events, contexts and relationships that may have an epiphany effect.

Meanwhile the relationship that was possible to establish between mindsets and professional identities in this research study has the potential of informing about processes of CPD (including pre-service and in-service education) supporting the

development of EDPI. In fact, being the expansive use of DTs a matter of identity, its development requires nurturing interactions between those who educate and those who are educated (Lopes, 2001, 2002). These nurturing interactions require cognitive (or technical) challenges and affective-support and the involvement of all levels of the relevant ecological system – micro (small group), meso (school), exo (educational policies) and macro (culture and society) level (Lopes, 2007; 2008; 2009; Lopes & Thomas Dotta, 2015).

Further studies, that can clarify other intervening variables, are necessary, as well as studies with teachers from other teaching sectors, with other time of experience and/or age. With a larger diversity of teacher characteristics, it is likely that other types of adherences are found. These might make this reality clearer and help to think on the conversion from one type to another as well.

CONCLUSION

The special contribution of this article is to go further deepening the relationship between the use teachers do of DTs and a more general view they have of teaching profession, their current way of working, beliefs and conceptions (about social change, change in education, students, colleagues, educational policies, school leaders...). Doing so, it makes it possible to relate the way teachers use DTs with their mindsets and respective professional identities.

The importance of establishing the relationship between uses and identities concerns the way of thinking about training and education for expansive digital professional identities. To train or to educate teachers to the expansive use of DTs is to change professional identities, and as such an exigent task implying personal growth and professional conversion.

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