ICT IN THE DIGITAL TRANSFORMATION OF EDUCATION IN SCHOOLS IN SOUTHERN SPAIN IN THE CONTEXT OF POST-PANDEMIC LEARNING

ABSTRACT

The aim of this study is to analyse the perception of digital transformation in post-pandemic education in schools in Southern Spain. To do this, the study will focus on the issues related to the implementation of a digital transformation school programme (#TDE). The study will focus on pupils, teachers, school management teams, families and other stakeholders in 12 schools ranging from nursery to primary and secondary level.

The study has three key objectives: (1) to carry out an initial diagnosis of the perception of digital transformation and information and communications technology (ICT) skills of the school community, (2) to evaluate the possible existence of significant differences between the participating schools according to their level of digitalisation, and (3) to identify the factors that enable and limit digital transformation and ICT in schools.

This project is timely as the COVID-19 pandemic led to the closure of schools for a significant period of time, thus accelerating the process of digital transformation and increasing the need for ICT and generalised distance learning. Identifying the strengths and weaknesses of school programmes aimed at supporting ICT and facilitating digital transformation in schools is crucial for future post-pandemic digital and educational challenges.

Keywords: Digital transformation in schools, ICT, school programme, #TDE, post-pandemic learning, perception

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TOPIC OF RESEARCH

This study analyses the impact of digital transformation in the context of post-pandemic education through an analysis of the implementation of a digital transformation school programme (#TDE). To do so, the study focuses on the use of ICT and the access to and use of other digital technologies, the perception of stakeholders towards such changes and the development of the digital policies of schools.

Digital transformation has been a major development in education since the beginning of the COVID-19 pandemic. Unprecedented challenges have forced schools to use a combination of blended scenarios in their teaching (West, 2012). The development of digital transformation school programmes has been necessary to equip teachers and pupils alike with the required skills in the new Digital Age (European Commission, 2021). The Digital Education Action Plan is a priority area of the European Commission (European Commission, 2020). In the context of Spain, the Spanish National Plan for Digital Skills includes key measures such as the digitalisation of education and the development of digital competences for learning (Spanish Ministry of Economic Affairs and Digital Transformation, 2021).

Different regional governments are responsible for carrying out this plan, including the development and implementation of a series of measures such as the endowment of digital devices to schools and pupils, the provision of digital school resources and the development of teacher competence. Among the regional initiatives to integrate ICT into Spanish schools is the School Digital Transformation Programme (#TDE), which has its origins in the Alhambra Plan (1986) to boost the use of computers in schools. In 2018, this plan was piloted for two years as #PRODIG. In 2019, #TDE was officially implemented in all public schools in Andalusia, Southern Spain to the benefit of over 4 000 schools, 100 000 teachers and 1.5 million pupils. #TDE is based on the European Framework for Digitally Competent Educational Organisations (DigCompOrg) as a reference framework for digitally competent organisations and includes the use of the JRC Check-In self-assessment tool[1] that is completed by all teachers at the start of the academic year. This self-assessment tool also requires the management team in each school to produce a digital rubric that details their school's level of digital competence. Throughout the year, the programme is led by a school coordinator who helps design the digital strategy in each school. The programme is monitored by the University of Seville, which completed an end of year assessment of the digital competence of teachers with the involvement of 88 749 teachers and 4 166 schools. The conclusion stated that A2 (36.28%) was the average level of teacher digital competence in Southern Spain (Junta de Andalucía, 2021). #TDE was implemented throughout the 2021/22 school year with renewed guidelines and the support of a team of 50 teacher advisors acting as digital mentors funded by the Recovery and Resilience Mechanism.

[1] The CheckIn testing tool has been discontinued as of 31 January 2022 and replaced with the SELFIEforTEACHERS self-reflection tool.

RESEARCH RATIONALE

The study is extremely timely as the research was conducted during the first year of the implementation of the #TDE programme in schools in Southern Spain. This coincided with the amendment of the Spanish national curriculum law (LOMLOE) in 2021. The new curriculum seeks to improve educational performance following the European Commission guidelines, with the OECD 2030 Agenda and Sustainable Development Goal 4 ensuring inclusive and equitable quality education and lifelong learning opportunities for all (United Nations, 2021). Two of its main pillars are the cross-disciplinary improvement of schools through the personalisation of the learning process and the adaptation of the educational system to current digital advances and the development of student digital competence (Eurydice, 2021). Ultimately, the study addresses the specific problem of pinpointing what makes school digital programmes particularly effective at a time when many countries are implementing such programmes in response to the COVID-19 pandemic to support pupils and their learning.

OBJECTIVES

There are three objectives as part of this research:

1. to carry out an initial diagnosis of the perception of digital transformation and ICT skills in the school community.
2. to evaluate the possible existence of significant differences between the participating schools according to their level of digitalisation.
3. to identify the factors that enable and limit digital transformation and ICT in schools.

LITERATURE REVIEW

The study is extremely timely as the research was conducted during the first year of the implementation of the #TDE programme in schools in Southern Spain. This coincided This study analyses digital transformation as the joint actions aimed at improving teaching and learning processes in schools through the integration of educational technologies (Petterson, 2021). Research on digital transformation in schools has increased exponentially in recent years (OECD, 2019). Before 2015, less than 30 papers on digital transformation were published per year, compared to more than 200 publications in 2019. Most studies pinpointed the need for a more equitable and inclusive digital transformation (Zhao, Liao & Sun, 2020), as well as a focus on the impact of European frameworks on the use of digital technologies in schools (Kampylis, Bocconi & Punie, 2012).

The theoretical framework includes complementary conceptual frameworks, such as DigCompOrg. This is a 10 year mixed-method research which analyses several frameworks in-depth, recognises schools as digitally competent educational organisations and promotes the integration of digital technologies in teaching, learning and organisational practices (Kampylis, Punie & Devine, 2015). One of the main conclusions of this research is that schools need to revise their organisational strategies to integrate digital technologies. DigCompOrg is comprised of 7 key elements: leadership and governance practices, teaching and learning practices, professional development, assessment practices, content and curricula, collaboration and networking, and infrastructure. These elements are also divided into 15 interrelated sub-elements and 74 descriptors which are currently being revised. All of these elements imply changes in

pedagogical, technological and organisational dimensions. DigComOrg enables educational bodies at all levels to design and implement digital school programmes. In relation to ICT, the framework points out the need for schools to have an operational plan for a core ICT backbone.

Integrating ICT for effective teaching and learning is also dealt with by the Technological Pedagogical Content Knowledge (TPACK) model. TPACK combines technological (TK), pedagogical (PK) and content knowledge (CK) for the successful integration of digital technologies (Mishra & Koehler, 2006). TPACK extends Shulman's Pedagogical Content Knowledge model (1986) and draws intersections between the three forms of knowledge detailed above. According to TPACK, it is crucial for teachers to have a deeper understanding of how to integrate educational technologies into teaching and pupil learning is only enhanced when the connections are made between technological, subject content and pedagogical knowledge. The first element, CK, is knowledge about the subject to be taught including concepts, theories and ideas. The second element, PK, refers to a teacher's individual knowledge about teaching practices. The third element, TK, points to knowledge regarding how to use ICT productively in class (Koehler & Mishra, 2009). Applying the TPACK model helps teachers to implement digital pedagogies based on the collaborative learning of pupils. This framework has even been taken a step further with the Technology, Pedagogy, Content and Space (TPeCS) model (Kali et al., 2019), which includes learning spaces as an additional dimension.

The above-mentioned models offer a framework for the understanding of the elements involved in digital transformation in schools in Southern Spain. However, not all schools share the same starting point. For this reason, the use of reference frameworks enables a systematic approach towards identifying the areas in which schools are competent and those that need to be targeted for improvement (Kampylis, Punie & Devine, 2015). Previous research carried out in Spanish schools led to the development of a four-stage matrix of digital transformation – initiation, implementation, integration and transformation, as well as eight dimensions of pedagogical and organisational integration of ICT (Area et al., 2010). Such a matrix is evidence-based (Balankat, Blamire & Kefala, 2006; Hew & Bush, 2007; Pelgrum, 2001). It identifies the stage of each school in relation to ICT, as seen in Figure 1 below:

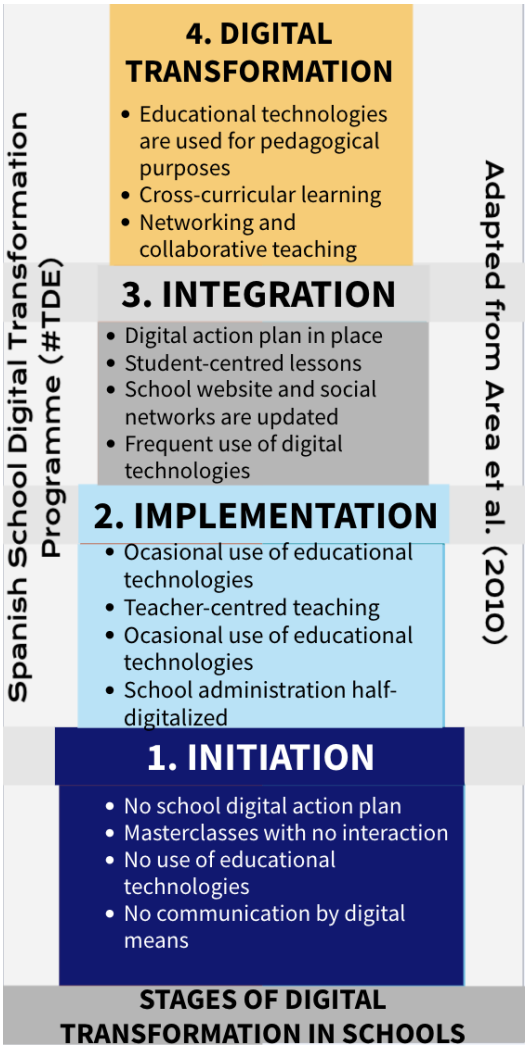

Figure 1. Stages of digital transformation in schools (Area et al., 2010)

The first two stages involve digital transformations without further changes. However, in the last two stages, digital technologies are used to transform and improve teaching and learning.

- Initiation stage: This first stage includes schools with no digital strategy in place or schools developing digital projects. In relation to ICT, lessons are teacher-centred and pupils have limited access to ICT. Teachers don't use digital tools for communication or coordination purposes.

- Implementation stage: This stage includes schools that have a digital plan or strategy but are not currently developing their own projects involving educational technologies. Some teachers may network or use digital resources in textbooks. ICT is only used occasionally but pupils have regular access to digital devices. Schools have websites and subsequent communication, coordination and administrative issues start to be carried out digitally, although not all teachers know how to use them.

- Integration stage: Schools have a digital plan and develop ICT projects. Digital technologies are used across subjects as a resource to develop the digital competence of pupils. Schools take part in digital projects and networking. Most

teachers know how to use digital technologies and encourage the collaborative work of pupils including the design of their own resources. The school website is updated. Digital technologies are used for communication and exchange of information with pupils and families. Administrative issues are also digitalised.

- Digital transformation stage: It is the highest level of digital maturity for a school. Stakeholders integrate digital technologies with significant pedagogical and social transformation potential. Valuable knowledge is shared and critical thinking is developed among pupils. Schools apply a whole-school approach with a shared vision on the use of digital technologies in developing projects. Schools have an updated website and social media profile. Digital technologies are used for administrative and management purposes.

RESEARCH METHODOLOGY

When developing the research proposal, we identified 'digital transformation in schools' as our area of study, choosing 'an analysis of the perception of digital transformation in a school programme by stakeholders' as the topic around which to formulate a research plan and methodology. It should be noted that the study had to overcome unexpected difficulties related to its original design. As face-to-face visits in schools were not allowed due to COVID-19 school protocols, participant observation was not possible. However, the use of digital technologies, namely videoconferences, ensured the viability of the study.

A significant aspect of our research was the role of ethics in researcher development and identity (Head, 2020). All participants gave their permission to be part of the study through a written consent form. As the study involved underage pupils, parents also signed a written consent form which respected the right of the child to refuse to participate.

Due to the pandemic and its resulting limitations, a cross-sectional study was used to collect data from many different stakeholders in each school at a given point in time (from January to May 2021).

For our qualitative study, we chose a purposive sampling approach with subjects selected on the basis of their involvement in the school and with the school programme (N=82). In each school, the ICT coordinator, principal, parents (most of them belonging to the parents' association or the Board of Governors), and pupil representatives were interviewed or took part in discussion groups. The sample was also complemented by interviews with a regional educational policymaker, two school inspectors, a school counsellor, an expert on digital addictions, one of the #TDE regional coordinators and a teacher trainer. Overall, 26 interviews and 15 discussion groups were carried out. Within the adult group, we must highlight that most participants were female, with an average age of between 41-50 years old. Most students were also female and between the ages of 10-12.

We also used a mixed-methods approach as this can produce enriching results which provide a better understanding of a complex phenomenon such as digital transformation and ICT in education (Creswell & Plano Clark, 2017).

We specifically used a three-phase mixed-method exploratory sequential design. This approach is more qualitatively-oriented and is set up in four major steps: (1) the design and implementation of the qualitative strand: stating the qualitative research questions, obtaining permissions, identifying the qualitative sample, and collecting open-ended data

and analysing it; (2) The use of strategies to build on the qualitative results: we designed and piloted an *ad hoc* questionnaire, and we determined the quantitative sample selection; (3) The design and implementation of the quantitative strand: stating the research questions, obtaining permissions, selecting the sample, collecting the data and analysing them using descriptive statistics; (4) and the interpretation of the connected results: on the one hand, summarising and interpreting the qualitative results, and on the other hand, the quantitative results, before finally discussing to what extent the quantitative results generalise or test the qualitative results.

In the qualitative study, individual interviews were semi-structured and usually lasted one hour. Discussion groups were made up of four to five members. All participants were encouraged to participate in an open discussion. Audio-visual support material was used with pupils. Both interviews and discussion groups were held online due to pandemic restrictions and were then transcribed using the online tool Sonix. Each transcription was read at least twice before being analysed. Qualitative analysis was carried out using a thematic analysis (Braun & Clarke, 2006) to identify key themes. For data processing, the software Atlas.ti and Voyant Tools were used, producing 255 quotations filtered into 46 codes after analysing 16 hours of recordings with an average of 8 000 words each. Deductive coding allowed us to identify codes, integrated into themes, while also including wider key ideas.

With regards to the quantitative study, a random sampling was followed with subjects randomly chosen from 12 schools (Gall, Borg & Gall, 1996). Two of the schools were nurseries, six were primary schools and four were secondary schools. All of the schools were public and five of them were located in a rural area. All schools were in the process of implementing #TDE. Whereas two of the schools had no previous experience of digitalisation, three of them had previously taken part in pilot digitalisation projects. A multi-scale questionnaire was created *ad hoc* to measure the nine dimensions included in the theoretical framework due to the impossibility of finding a unique validated scale which included all the dimensions to answer our research questions. Participants were students from 10-17 years old, teachers, and principals of primary and secondary schools in Southern Spain (N=739). Within the adult group, most respondents were female between 40-50 years old. The questionnaire was completed voluntarily by stakeholders from the eight different regions in Southern Spain based on 38 items divided into 9 dimensions using Likert questions with answer options ranging from 1= very negative to 5= very positive. The analysis of the data was conducted through descriptive statistics using the SPSS software package. We also determined that the data did not follow a normal distribution in line with the Kolmogorov-Smirnov Test. Thus, we used non-parametric tests to determine if there were significant differences between the schools.

RESULTS AND DISCUSSION

QUALITATIVE RESULTS

The first key result answers our research question about the perception of digital transformation and ICT skills in the school community. Most stakeholders identified digital transformation as a necessary process to adapt to a progressively digital society since the pandemic affected organisational aspects of schools, the professional development of teachers, the increase in ICT skills of pupils and improved communication with families. A parent in one of the schools stated:

> '*To me **digital transformation** has two big challenges: schools changing their organisation, management and teaching and learning processes; and equipping pupils with the necessary ICT skills*'.

Another aspect continuously mentioned in the interviews and discussion groups was the difficulty of integrating digital technologies. Many teachers acknowledged that their knowledge of digital tools also required the necessary pedagogical knowledge to integrate them into their own subjects. In relation to this aspect, a school inspector confirmed that:

> '*There are teachers who have adapted better and who are motivated to **integrate digital technologies** in the classroom, but many of them have difficulties. The intended innovative teacher training is still resulting in a focus on digital tools*'.

There is a large disparity in the digital competence of teachers. In schools at the initiation level, teachers admit to not having a basic level of digital skills, whereas in schools at a transformation level, teacher perception of their digital skills is higher. There seems to be an accepted generational and gender gap. A school principal explained:

> *'Teachers' digital competence is really important, crucial and must be developed by school digital programmes implemented in the school to support and train the whole school community'.*

Applicable to the issue of teachers and digital skills was **professional development** and specific teacher training. Almost everyone mentioned the remarkable effort that many teachers made during lockdown to be able to continue with the previously established teaching and learning processes. As one ICT Coordinator pointed out:

> '*For digital transformation in schools to be successful it should be considered as a long-term process. First, with no infrastructure there is no possible transformation. Secondly, teachers need to find the motivation to integrate digital technologies. Enforcing them doesn't work. And third, it requires a continuous professional development*'.

Assessment practices are pointed to as an area that requires improvement in all schools. Only some schools at a transformation stage started to integrate digital assessment. As one family commented:

> *'All teachers use digital technology in a cross-curricular way while pupils learn anything. In fact, last exams were even completed in a digital format'.*

Leadership is also considered a key element for successful digital transformation. In schools at the initiation level, a lack of guidance is reported. In schools at an

implementation and integration level, educational technologies are enhanced by IT coordinators. In schools at a transformation level, the process is usually led by school principals. As one participant stated:

> *'School management must assume an engaging role with digital technologies. We must be trained and lead by example'.*

A successful element of the programme is the network of digital mentors (#TDE Team). According to teachers, digital mentors offered support implementing the programme (using the Check-In tool, designing the digital plan, organising training) and encouraged collaboration and networking among schools. A member of the #TDE team commented:

> *'My role is to help not only teachers, but the school as a whole with the use of digital technologies. Initially, they expect you to fix computers. It is hard to make teachers understand that you are there to help them integrate digital technologies in the curriculum as well*'.

ICT skills were also repeatedly mentioned as an essential skill to develop in schools to reduce the digital gap and battle social exclusion. A school counsellor pointed out:

> *'Digital technologies are a basic and fundamental tool nowadays, just as important for communication and social purposes as speaking or any other activity to deal with everyday life. It is really important in pupils, so-called "digital natives", for their personal development. A pupil with no digital literacy has struggled since the pandemic and is at a high risk of being excluded from society*'.

Differences in the **stages of digital transformation** in schools are highlighted in terms of **infrastructure.** Most teachers reported having an interactive whiteboard and a computer in their classroom. Maintenance was highlighted as one of the weaknesses of the programme by almost all teachers. Pupils from schools at an initiation stage complain about the lack of access to and use of digital devices. In relation to this aspect, a primary school pupil described her situation:

> '*I preferred to work on the computer, to be honest. In my class, we only use the interactive whiteboard for copying and watching videos. We hardly ever use tablets*'.

In terms of **content and curricula**, schools at a transformation stage use innovative pedagogies, as one primary school pupil illustrates:

> *'I love something we do in class with our teacher. It's like making a digital presentation about what you like the most. You have to explain it to the class, and you enjoy it a lot and then they ask you questions. At the end, my schoolmates give me points which count towards the final mark'.*

A summary of the links between the key themes above can be found in Figure 2. This Collocation Graph presents keywords and terms that appear close to each other and are directed by the network graph. The colour-coded categories were generated and turned into themes (blue) and sub-themes (orange) as shown below:

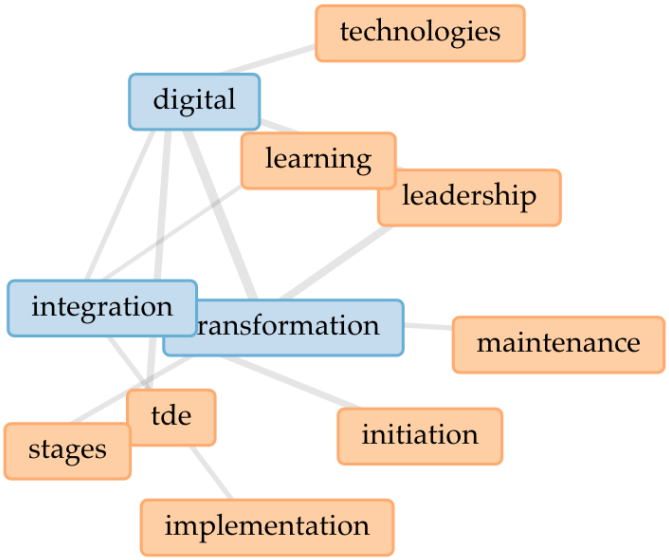

Figure 2. Links between key themes (using Voyant Tools)

QUANTITATIVE RESULTS

First, we completed a reliability test to measure internal consistency and see if the multiple-question Likert scale used was reliable. A general accepted rule was then used for interpreting results. Thus, a Cronbach's Alpha of 0.9 is considered excellent, between 0.9 and 0.8 good; and between 0.8 and 0.7 acceptable. The reliability test had a Cronbach's Alpha of 0.757 which indicates an acceptable internal consistency. However, as the scale had different dimensions, it has been broken into parts, each measuring a different dimension: Dimension 1: 0.835, Dimension 2: 0.839, Dimension 3: 0.795, Dimension 4: 0.771, Dimension 5: 0.784, Dimension 6: 0.832, Dimension 7: 0.971, Dimension 8: 0.911, Dimension 9: 0.865. We then carried out statistical descriptive analysis to record the Mean (M) and Standard Deviation (SD) of all dimensions as shown on Table 1 below. Descriptive statistics summarise the basic characteristics of our data set such as mean and standard deviation. The first column, the Mean, represents the average of the data and it is used to describe the sample involved with a single value that represents the centre of the distribution of the data in each dimension. The standard deviation indicates how far individual responses to a question vary from the mean.

Table 1. Mean and Standard deviation per item of the questionnaire

Item	M	SD
Dimension 1. Teaching and Learning	**3.43**	**1.18**
1. Digital competence	3.39	1.21
2. Use of online resources	3.68	1.15
3. LMS	3.39	1.21
4. Contextualised digital resources	3.88	1.26
Dimension 2. ICT Skills	**3.57**	**1.40**
5. Digital activities	3.38	1.34
6. Social networks	3.56	1.40
7. Email	3.94	1.18
8. Videoconferences	3.41	1.37
9. Online lessons	2.79	1.48

Item	M	SD
10. Online exams	2.40	1.46
Dimension 3. Professional development	**3.94**	**1.18**
11. Lesson Plans	3.62	1.16
12. Blended Learning	3.72	1.14
13. Learning scenario	3.59	1.21
14. Active methodologies	3.74	1.11
Dimension 4. Collaboration and networking	**3.59**	**1.21**
15. Time management	3.70	1.15
16. Working cooperatively and collaboratively	3.75	1.16
17. Content creation	3.85	1.09
18. Leisure	3.99	1.10
Dimension 5. Infrastructure	**3.99**	**1.11**
19. Camera	3.64	1.21
20. Maker material	3.11	1.34
21. Scans	3.39	1.25
22. Digital audio	3.05	1.31
Dimension 6. Content and curricula	**4.06**	**0.97**
23. Adaptation to new curricular changes	3.11	1.06
24. No difficulties integrating content and digital tools	3.41	1.20
25. Engagement to learn	4.22	0.92
26. Problem solving	4.11	0.95
Dimension 7. Assessment practices	**3.41**	**1.20**
27. Academic follow up	3.79	1.23
28. Information exchange	3.86	1.14
29. Improved communication	3.88	1.19
30. Family involvement	4.00	1.14
Dimension 8. Leadership and governance	**3.88**	**1.19**
31. ICT Coordinator	2.80	1.47
32. Decision-making involvement	2.96	1.41
33. Agreeing formats	3.20	1.47
34. Peer support	4.07	1.11
Dimension 9. Attitudes towards digital technologies	**3.20**	**1.47**
35. Videogames	3.51	1.33
36. Networking	3.17	1.25
37. Online safety	3.48	1.17
38. Digital disconnection	3.81	1.09

We compared the participating schools by educational level using the full questionnaire and nonparametric statistical methods for testing differences between groups. The Mann Whitney U test examines the difference between two groups and the Kruskal Wallis among three groups or more.

First, among the two nurseries, we completed a Mann-Whitney U test without finding statistically significant differences between school S11 and S12.

We then carried out a Kruskal-Wallis test among the primary schools (S5, S6, S7, S8, S9 and S10), finding statistically significant differences ($p < 0.05$) on each of the following dimensions: 4 ($p=0.01$), 8 and 9 ($p<0,001$) The school with the highest average score participated in the pilot programme. Schools with the lowest score were in rural areas.

In relation to the secondary schools (S1, S2, S3 and S4), we also completed a Kruskal-Wallis test showing statistically significant differences on dimensions 2, 6 and 9. The school

with the lowest score was not applying any of the programme measures at the time. The school with the highest score had participated in the pilot programme.

CONCLUSION – IMPLICATIONS FOR PRACTICE

The interpretation of the results of the quantitative and qualitative data revealed how digital transformation impacted education during the pandemic. Our first research question concerned the initial diagnosis of the perception of digital transformation and ICT skills in the school community. The qualitative analysis of the data helps us to identify and analyse the profile of each school in accordance with their stage of digital transformation (Area et al., 2010). From our research we can conclude that for the schools involved, such digital transformation impacted all elements of teaching and learning. Qualitative results brought to light the impact of digital transformation in 8 different elements linked to #TDE. Most significantly, in relation to leadership and governance, schools relied on ICT Coordinators and school principals to lead the changes. Those schools with no clear guidance lacked a whole-school vision to implement their digital strategy as reported by the different stakeholders. In this sense, #TDE requires ICT Coordinators or school leaders to complete the application for the school programme, ensuring its sustainability.

Another key finding is that teachers are integral to the process of digital transformation in schools. If we want digitally competent pupils, teachers must first become digitally competent. A wide diversity of digital competences exists in schools, ranging from teachers unable to perform basic digital tasks to teachers who develop digital projects in wider networks. The average range of digital competence, according to teachers' own perception, is A2. While the use of educational technologies by teachers increased during the pandemic, this did not have a direct effect on the integration of the technological, pedagogical, and content knowledge necessary for effective teaching and learning processes using such digital technologies. Therefore, a strong emphasis has been placed on necessary professional development and teacher training. #TDE requires schools to plan annual staff training with the follow up of local advisors.

Assessment practices are also a required area of improvement. Teachers reported the need for further training and families reported the need for further exchange of information in relation to this aspect.

Regarding content and curricula, Spain is still undertaking a process of reform of its education law. The new law includes the development of the digital competence of pupils across curricula.

In terms of collaboration and networking, the role of digital mentors provided by #TDE at local and regional level encourages collaboration between schools.

Lastly, regarding infrastructure, schools are generally well-equipped. However, a socio-economic gap has been reported between rural and city schools.

Ultimately, #TDE seems to be perceived as an effective digital transformation programme for schools which engage with the programme at each level. It is also an evidence-based route for schools in Southern Spain to become digitally competent and equitable organisations.

The quantitative analysis helped us to develop a tool to measure the perception of the elements detailed above. The results from stakeholders answered our second research

question about the significant differences between participating schools in line with their level of digitalisation.

We can confirm that schools at an initial level had no digital strategy in place or strong leadership to lead its design. ICT lessons are described as traditional and teacher-centred. Pupils report having limited access to digital devices and teachers use digital technologies occasionally.

Schools at an implementation level have a digital plan but they don't develop digital projects as of yet. Teachers' use of digital technologies is reduced to textbook digital resources mainly. Pupils have regular access to digital devices but these are mostly used for leisure and not for academic purposes. Schools have official websites and communication is beginning to be digitalised.

Schools at an integration level are implementing a digital plan and developing ICT projects. Digital technologies are integrated across subjects in order to develop the digital competence of pupils. Collaborative work using digital tools is encouraged. The school website is updated and communication is digitalised, improving families involvement with the school.

Finally, schools at a transformation stage are at their highest level of digital competence. They apply whole-school strategies with pedagogical and social impact in the school community. The exchange of knowledge among pupils using digital technologies increases their motivation. The school has an updated website and social networks connecting with other schools. International programmes and projects are developed, and all training and administrative procedures are digitalised.

These differences above help us to identify the determining factor in digital transformation in schools. This provides the answer to our third research question. First, as enablers of digital transformation, participating schools have a shared vision and a digital strategy in place led by strong horizontal leadership. Teachers need to be supported with appropriate training to develop their digital competence to integrate technological, pedagogical, and content knowledge including assessment practices, and adapting them to the new curricular law. To this purpose, infrastructure needs to be established and reviewed regularly. Digitally advanced schools should be mentoring less advanced schools. All schools should cater to disadvantaged pupils and families to guarantee equitable and quality digital education.

Secondly, the factors which limit digital transformation in schools remain a lack of infrastructure or bad quality devices and/or Internet connection, which is a notable issue in rural areas.

Based on the above-mentioned enabling and limiting factors, the recommendations for educators, researchers and policy makers are: Every school should design and implement a contextualised school digital plan. For this purpose, the guidance, resources, and support provided by school programmes could be an effective help. Equity in access and connectivity must be guaranteed to all pupils at school age, notably those in vulnerable situations or at risk of digital exclusion. Teachers should develop their digital competences to enable them to teach pupils and help families develop these necessary skills for the digital age. Time and resources used in effective practices during the pandemic should be maintained. Evidence-based models based on the integration of digital technologies, as well as those based on pedagogical and content knowledge, should lead the way forward.

Moreover, continual assessment and feedback are essential to monitoring improvement. Self-assessment tools for schools and teachers are highly recommended. Schools should follow a cyclical strategy, becoming resilient and emerging prepared for any upcoming and unexpected circumstance.

Notwithstanding its limitations, this study and its results could be used by researchers to further the study of digital transformation in schools and to expand on some of the key findings on the issues related to digital transformation in schools.

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