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Analysing the digital capacity of Spanish schools using SELFIE

An early diagnosis for a better response to COVID and beyond

2021

Castaño Muñoz, J., Weikert García, L., Herrero Rámila, C.



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Contact information

Name: Y. Punie

Address: Calle Inca Garcilaso 3, 41092 España

Email: Yves.PUNIE@ec.europa.eu / JRC-EAC-SELFIE-TOOL@ec.europa.eu

Tel.: +349544-8822

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Contents

- Abstract.....1
- Foreword.....2
- Acknowledgements.....3
- Executive summary4
- 1 Introduction.....6
- 2 Usefulness of the study.....8
- 3 Methods and participation.....9
- 4 Results by area.....10
 - 4.1 Leadership.....12
 - 4.2 Collaboration and networking.....13
 - 4.3 Infrastructure and equipment.....14
 - 4.4 Continuous professional development.....15
 - 4.5 Pedagogy: supports and resources.....16
 - 4.6 Pedagogy: implementation in the classroom.....17
 - 4.7 Assessment practices.....19
 - 4.8 Student digital competence.....20
- 5 Additional information.....22
 - 5.1 Usefulness of CPD activities.....22
 - 5.2 Teachers’ confidence in using technology.....23
 - 5.3 Students’ use of digital technologies in and outside the school.....24
 - 5.4 Barriers.....25
- 6 Conclusion.....29
- References.....30
- List of figures.....31
- List of tables.....32
- Annexes.....33
 - Annex 1. Contextualisation of the school report using the sample report(s).....33
 - Annex 2. Lessons learned for similar studies.....34

Abstract

The digitalisation of education systems is a political and social priority at European level. This report summarises the results of an inter-institutional study (European Commission JRC and Spanish Ministry of Education and VET) on the digital capacity of Spanish schools using the questionnaires of the European SELFIE tool in a representative sample of 6040 school leaders, teachers and students from 492 primary and secondary schools. The data show that, in general, the first steps of the digitalisation process have already been completed, therefore areas such as supportive uses of internet for preparation of lessons and existence of basic infrastructure obtain high scores. On the other hand, data also show areas where there is more room for improvement such as collaborative uses of digital technologies, or its application in innovative assessment procedures. The results are useful to Spanish schools that have participated in SELFIE to contextualise and interpret better their own school-report results in the light of results of similar schools. They are also useful to obtain a pre-COVID baseline situation on the digitalisation of schools that can guide policies in a pandemic situation where digital technologies play a more important role. Finally, the experience and results presented here can be useful to governments, organisations and stakeholders considering to conduct a similar exercise using the SELFIE tool.

Foreword

The past year has been a challenging year for schools with many of them closing their premises on various occasions due to COVID-19. Many schools in Europe were not prepared to transition to online and remote education and found the transition hard due to infrastructure challenges, lack of digital devices and appropriate educational content programmes as well as little previous experience and low levels of digital competence of educational staff but also of students. Back in October 2018, as part of the Digital Education Action Plan, the JRC developed in collaboration with DG EAC the SELFIE tool to help schools reflect on their digital capacity that leads to actions for improvement through the development of a digital action plan. The tool consists of a set of questions for school leaders, teachers and students that cover all the necessary areas for a school to develop their digital capacity: leadership, collaboration and networking, infrastructure and equipment, continuing professional development, support and resources for pedagogy and student's digital competence.

SELFIE has been found useful for schools: Up to April 2021, more than 9,000 schools and 1,000,000 users from more than 70 countries have participated in SELFIE since its launch in October 2018. Analysing aggregated and anonymised data from the data set could additionally provide useful information to understand where schools stand in their efforts to shift to digital and online learning. However, since participation in SELFIE is voluntary, self-selection of schools can lead to significant bias in the SELFIE results. The current report presents data from a random and representative sample of schools and individuals in Spain, thus eliminating the self-selection bias and providing accurate and reliable information about the views that students, teachers and school leaders have about the digital capacity of the schools. It was the result of a successful collaboration between JRC and the Spanish Ministry of Education and Vocational Training, through the National Institute of Educational Technologies and Teacher Training (INTEF), the National Institute of Educational Evaluation (INEE) and the regional education authorities. The results of the study were published in Spanish in a series of three reports (ISCED-2011 1, 2 and 3). This report presents a summary of the conclusions of the 3 reports in English.

The SELFIE tool, as well as the study presented in this report, are part of the research lines of the JRC on digital education and digital skills. Since 2005, more than 30 major studies have been conducted in this area, resulting in more than 140 publications. Information about all our studies can be found on the JRC website. The Human Capital and Employment Unit (JRC-B4) has developed, in addition to competence frameworks for educational organizations (DigCompOrg) and educators (DigCompEdu), a series of competence frameworks for individuals that aim to address key competences, such as the Digital Competence Framework for Citizens (DigComp), the Entrepreneurship Competence Framework (EntreComp), or the European Framework for Personal, Social and Learning to Learn Competence (LifeComp). Aim of all these frameworks, tools and studies are to support European and MS policies to deal with the challenges to modernize and innovate our education and training practices and to deliver the key competences needed for all to participate in our changing economy and society.

Yves Punie

Deputy Head of Human Capital and Employment Unit (JRC B4)

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Authors

Jonatan Castaño Muñoz (JRC-B4)

Lilian Weikert García (JRC-B4)

César Herrero Rámila (JRC-B4)

Executive summary

Policy context

Recently, the European Commission has launched three communications to respond to the challenges that European education systems are facing. These communications are part of a general strategy that aims to achieve the recovery and future growth of the EU, as well as to accelerate the transition towards climate neutrality and digital leadership. The communications aim to promote the creation of an European Education Area, an European Research Area and promote the new digital education action plan (2020-2027) that promotes a more efficient and inclusive use of digital technologies in education as well as the acquisition of digital competence.

The digitalization of education systems is a political and social priority at European level. In the last year, this relevance has been reinforced by the need for using digital technologies to face the disruption in education caused by the COVID 19 pandemic. Furthermore, the current situation has highlighted the need to have digitally capable schools that are prepared to benefit from digital technologies and thus become more resilient.

Related JRC work

In order to help schools with their digitalization processes and plans, the Joint Research Centre has developed the European Framework for Digitally-Competent Educational Organizations DigCompOrg framework (Kampylis, Punie, & Devine, 2015) and the SELFIE tool. This complements broader efforts done to promote digital competence of teachers and citizens. In this sense, JRC has developed the DigComp and the DigCompEdu frameworks. In autumn 2021 it is foreseen the launch of the SELFIE4teachers tool as part of the Digital Education Action Plan 2020-2027.

This report

The European Commission Joint Research Center (JRC) in Seville in collaboration with the Spanish Ministry of Education and Vocational Training, through the National Institute of Educational Technologies and Teacher Training (INTEF) and the National Institute of Educational Evaluation (INEE), has carried out a study on the digital capacity of Spanish schools using the questionnaires of the European SELFIE tool.

This report summarizes the results for 3 ISCED levels (1, 2 and 3) that were presented in different reports in Spanish (see Castaño Muñoz, Weikert Garcia, & Ministerio De Educación y Formación Profesional 2021a, 2021b and 2021c).

Usefulness

The results of these reports are mainly useful to a) Spanish schools that have participated in SELFIE to contextualize and interpret better their own school-report results (see [annex 1](#) for a detailed explanation on how to do this), b) Spanish policymakers, as they can have a precise overview of the digital capacity of the schools that inform decisions, c) other schools in Spain and beyond that have not used SELFIE as to get an insight on the type of data and results SELFIE generates, d) other educational stakeholders involved in supporting schools with the digital transformation.

Moreover, the results can be also relevant for e) other Member States, as they can learn from the experience and assess possibility of conducting similar research (see [annex 2](#) for a summary of process and lessons learnt for this study in view of a potential repetition of a similar exercise) and f) the JRC as the results provide information about the type of schools that adopt SELFIE and check the adequacy of the SELFIE tool for its application in a representative sample of schools.

Main findings

The study shows some strengths of the Spanish education system. Spanish schools from the 3 education levels analyzed, have good results in the areas “Pedagogy: Supports and resources” and “Infrastructure and equipment”. Moreover, regarding students’ digital competence, the study also reveals positive aspects: the development of responsible and safe use of technology is present at all education levels and, in ISCED 2 and 3, schools also focus their efforts on communication skills and content creation.

The areas related to leadership of the schools to promote digitalization and opportunities for continuous professional development in the use of digital technologies by teachers also show good results. This leads to optimism regarding the future use of digital technologies in Spanish schools.

Overall, the above results show that, in Spain, the first steps of the digitalization process have already been completed. Therefore, future actions or decisions to be taken should progress and focus on the advanced use of digital technologies. In this sense, it is important that teachers move towards advanced uses of digital technologies to develop learning activities, both inside and outside the classroom. A clear example would be the use of technologies for collaboration between students

and teachers in the development of cross-curricular projects and exchange of experiences, where the study detects room for improvement.

The study also identifies some concrete improvement opportunities that can guide the way towards advanced digitalization of the education system. With regard to assessment practices, the results of the study indicate that it is necessary to deepen the usefulness of digital technologies to facilitate a personalized and formative assessment that includes relevant and timely feedback. Similarly, the use of technology for peer assessment, that implies interaction between students, has been detected as an element of improvement. With this objective in mind, actions that promote the use and design of digital technologies can be initiated or continued to offer rapid and personalized feedback, self-reflection and peer evaluation exercises, and the design and use of technologies to evaluate transversal competences.

The study also shows that, before the COVID-19 crisis, the use of virtual learning environments was not a fully widespread practice. Making the use of virtual learning environments more generalised and promoting knowledge of their functionalities is useful in exceptional situations such as the COVID19 disruption but can also contribute to a better organization of learning and communication activities under normal circumstances.

Finally, although the study shows that in general the development of digital skills is implemented in Spanish classrooms, it should be said that those aspects in which less emphasis is placed are those referring to the critical analysis of information and its sources. This aspect is essential to combat misinformation and fake news and can be further developed.

See [Figure 1](#) for a graphic summary of the results.

1 Introduction

Digital technologies are more and more embedded in all the spheres of our lives, including education. However, there is still a lot of debate on how to use digital technologies more effectively to promote better pedagogies and learning. Research on the effects of digital technologies in teaching and learning, clearly indicates that the effects largely depend on the specific use and on the context where it is carried out. The incorporation of digital technologies in schools is more effective when is done in an organized and strategic way (Vanderlinde, van Braak & Dexter, 2012, Voogt, Knezek, Cox, Knezek, & Brummelhuis, 2011) and in a favorable context where all actors understand well the possibilities, limitations and implications of digital technologies and incorporate them following clear and defined pedagogical objectives (Voogt, Knezek, Cox, Knezek, & Brummelhuis, 2011; Tondeur, Valcke & van Braak, 2012). Therefore, it is important that schools are digitally capable. But what does it mean? According to JRC previous work, school digital capacity is "the extent to which the culture, policies, infrastructure, and digital competence of students and staff in schools promote the effective integration of digital technologies into teaching and learning practices" (Costa, Castaño-Muñoz, & Kampylis, 2021). Therefore, it is a multidimensional concept that takes into consideration different groups and needs (Tondeur, Valcke & van Braak, 2012) and looks for a collective response within the schools. The definition of the concept also refers to the strategy, vision and sustainability of measures focused on the use of digital technology at the school.

The importance of the schools' digital capacity has increased in the last year due to the COVID 19 pandemic. During this crisis the need for using digital technologies in education has increased as a response to the schools close-downs. This has revealed differences in the existing digital capacity level among schools as well as the importance of being a digitally capable school to be also a resilient school.

European Commission acknowledges the important role of digital technologies in education and training. This is reflected in several documents, but especially in the Digital Education Action plan 2018 -2020 and the new action plan 2020-2027. In these documents the importance of digital capacity of schools, is also acknowledged. The documents state that the integration of digital technologies in education requires a holistic approach and thus, the one of the key actions is to promote digital capacity planning and development in schools, including up-to-date organizational capabilities.

In this direction, the European Commission has developed SELFIE as a tool for supporting planning and development of schools digital capacity.

What is SELFIE?

SELFIE is a tool designed by the European Commission to help schools develop their digital capacity and effectively incorporate digital technologies into their teaching and learning practices. The tool is based on questionnaires to school leaders, teachers and students and aims to provide an initial diagnosis for schools to develop self-evaluation exercises that lead to plans and actions for digital capacity improvement. SELFIE has been found useful for schools: more than 9,000 schools and 1,000,000 users from more than 70 countries have participated in SELFIE since its launch in October 2018.

Although SELFIE's ultimate purpose is to help schools, school managers and policy-makers, have repeatedly requested access to aggregated data in order to be able to contextualize their results and have an overview of the digital capacity of schools in a specific country or region. This request was particularly evident during the first SELFIE forum held in Madrid in 2019¹ and the lack of aggregated data by region or country has been detected as a bottleneck for upscaling SELFIE use (JRC and ETF, Bocconi, & Lightfoot, 2021). The study presented here explores a response to this request in a specific context.

Why use SELFIE in a representative sample?

To respond to the above demand, it would not be appropriate to use aggregated raw data from all the schools participating in SELFIE in a region/country to obtain accurate values about the situation for all schools. The reason is straightforward: self-selection of SELFIE participating schools and of individuals responding within each school can lead to significant result biases. Therefore, to respond to obtain precise information about an education system, SELFIE needs to be used to collect data from a random and representative sample of schools and individuals. Only in this way the tool can provide aggregated (and anonymized), accurate and reliable information about the views that students, teachers and school leaders have about the digital capacity of the schools at the regional or national level.

In the study presented in this JRC Science for Policy Report, we moved in this direction. The Joint Research Centre of the European Commission, through Unit B4 - Human Capital and Employment, and the [Ministry of Education and Vocational Educational and Training](#) of the Government of Spain, through the National Institute of Educational Technologies and Teacher Training (INTEF) and the National Institute of Educational Evaluation (INEE), implemented an inter-institutional collaboration to obtain accurate information on the digital capacity of Spanish primary and secondary schools. This study has also been supported by Spanish regional authorities of Education.

¹ See: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC117482/selfie_forum_report.pdf

In this framework, we used the SELFIE questionnaires² in a representative sample of Spanish schools to collect accurate data on the situation of eight different areas of digital capacity. The detailed results of the study have been already presented in 3 reports in Spanish corresponding to the education levels ISCED 1, 2 and 3³. The results are analyzed aggregating the two strata set in the design of the sample (public ownership and private ownership). In the three reports two annexes are included with the results by strata. These reports were presented in an [online event](#) co-organized by JRC and INTEF, with the participation of the Spanish Minister of Education Isabel Celáa and Commissioner Mariya Gabriel. In this report, we present a summary of the main results found in the study.

Why was this study conducted in Spain?

Spain was selected for this project because it is the country with the highest participation in SELFIE, both in number of schools (2,380) and of individuals (176,839)⁴. Therefore, a criterion⁵ of maximizing utility in terms of the number of schools that can benefit from the results obtained to contextualize their own results is met⁶.

² The questionnaires were previously validated in psychometric studies, where the robustness of the questionnaire has been shown to measure the different dimensions of the digital capacity of schools. See: Costa, Castaño-Muñoz, & Kamylyis, 2021

³ In the Spanish education system, the correspondence is ISCED 1=Primaria; ISCED 2= 1st, 2nd and 3rd of ESO; and ISCED 3= 4th ESO, 1st and 2nd Bachillerato.

⁴ Participation rates when the reports were written by the end of 2020.

⁵ In SELFIE a school is defined as education level within an educational institution.

⁶ This high participation is due to high involvement of Spanish public authorities in SELFIE development and promotion. For example, the Ministry of Education and VET has launched [three editions of a MOOC](#) specific about DigCompOrg and SELFIE, has co-organised the [SELFIE Forum](#) 2019, and has developed numerous SELFIE briefings (e.g.: [SIMO 2019](#)).

2 Usefulness of the study

The results of the study come at the right time given the relevance of remote and blended education scenarios due to the closure of classes/schools and the measures taken to combat the COVID-19 pandemic. Therefore, they can have a high social impact. The results are useful for:

- **Spanish schools that participate (or have participated) in SELFIE:** since the results presented here allow schools to contextualize their own values (included in the SELFIE school report), taking as reference values of similar schools in Spain (included in the Spanish report of the same education level and school ownership). [Annex 1](#) explains in detail how schools can use the report to contextualize their own results.
- **Other schools:** as the report can provide examples of the type of data and results that the SELFIE tool offers after its use.
- **Policy-makers in Spain:** as results provide valuable evidence to design policies aiming at schools digital capacity development. A summary of the aggregated results is presented in [section 4](#)
- **Other educational stakeholders** involved in support schools with the digital transformation can also benefit of the information presented here.
- **Other member states:** potentially, the study also can work as a pilot project that allow to draw lessons to assess better the possibility of conducting similar studies in other countries or regions. Some of these lessons are listed in [Annex 2](#).
- **The Joint Research Centre:** as the results provide information about the type of schools that adopt SELFIE compared to “average” schools. In addition, data can also be a point of comparison for returning to them in the future and analyses how the digital capacity of schools has evolved after the COVID-19 pandemic. Finally, the reports can help spread the knowledge about the tool and, eventually, increase participation in SELFIE.

3 Methods and participation

The properties of the SELFIE questionnaires have been previously validated as an adequate tool for capturing the digital capacity of the schools (Costa et al. 2021). They give a comprehensive vision of the digital capacity. SELFIE questionnaires collect views of school leaders, teachers and students on 8 different key areas of digital capacity: leadership, collaboration and networking, infrastructure and equipment, continuing professional development, pedagogy: supports and resources, pedagogy: implementation in the classroom, assessment practices, and student digital competence.

For the study, three independent samples, one per each ISCED level, were drawn following a two-stage design. In a first stage, schools were selected following a probability proportional to (students) size sampling taking into consideration the region. Moreover we defined school ownership (public-private, including in this second category private and charter schools) as an explicit strata. In a second step, a random selection of students and teachers in each selected school was performed. In ISCED 1 schools, we selected one classroom and 15 teachers whereas in ISCED 2 and 3 schools we selected randomly 30 students from different classrooms and 20 teachers. School leaders⁷ were always selected.

We had high participation rates: 94% of selected schools participated and the participation by level and ownership was always higher than 90%. The obtained responses were weighted following standard procedures so as to guarantee country (but not region) representativeness. For the weighting procedures we used the last data available about the population: course 2018-2019.

In total data have been collected from a representative sample of 492 Spanish primary and secondary schools, involving a total of 1,721 school leaders, 7,934 teachers, and 16,648 students (see table 1). The design of the sample and its size allowed to obtain representative data by education level and by the type of school ownership (public or private). Data collection through SELFIE finalized just before the schools closures in Spain due to the COVID-19 pandemic (first quarter 2020) so they show the weaknesses and strengths of the system just before entering a phase in which digital technologies are playing a key role for instructional continuity.

Table 1. Participation in the study by ISCED level and type of school.

	All				Public			Private		
	SCH	SL	T	ST	SL	T	ST	SL	T	ST
ISCED 1	190	604	2671	5460	131	1882	3505	57	789	1955
ISCED 2	152	552	2660	6478	99	1758	3972	53	902	2506
ISCED 3	150	565	2603	4710	102	1864	3185	48	739	1525
TOTAL	492	1721	7934	16648	332	5504	10662	158	2430	6040

Source: JRC, 2021. Note: ISCED refers to International Standard Classification of Education. In the Spanish education system, the correspondence is ISCED 1=Primaria; ISCED 2= 1st, 2nd and 3rd of ESO; and ISCED 3= 4th ESO, 1st and 2nd Bachillerato

SELFIE questionnaire uses subjective Likert scales (1-totally disagree to 5 totally agree). However, as they are subjective data, SELFIE should not be used for country comparisons. The data were analyzed mainly estimating the average per question/area and estimating the confidence intervals using standard errors robust to intra-class correlation following Taylor linearisation. In the next section we present a summary of the main results.

⁷ For these study as school leaders participated the school principal, the school secretary, the head of studies and the ICT coordinator. Defined as people with decision-making capacity in the use of technology in the school.

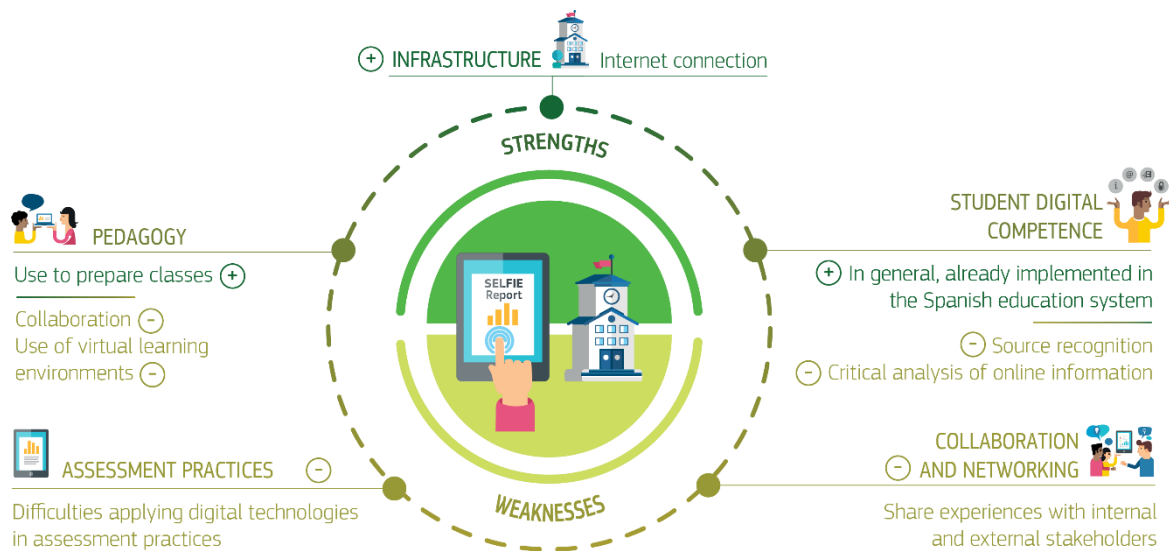
4 Results by area

The results of the study provide an overview of the areas and items within each area that are considered to be the more and the less developed ones by school leaders, teachers and students. Thus, the results identify strengths and weaknesses of the Spanish education system's digital capacity at different ISCED levels and can be useful to plan actions for the development of specific aspects of it.

It is important to highlight that the results of this study are in no way prescriptive and it is the role of policymakers, school leaders and schools to use and discuss them in the most appropriate way to reach the goals strategically established by them.

Data show that, in general, the best-valued areas in the three education levels, by school leaders and teachers, are "Pedagogy: Supports and Resources" and "Infrastructure and Equipment". On the other hand, results show that "Assessment Practices" and "Collaboration and Networking" are the areas with lower averages, and therefore with more room for improvement. (see Figure 1).

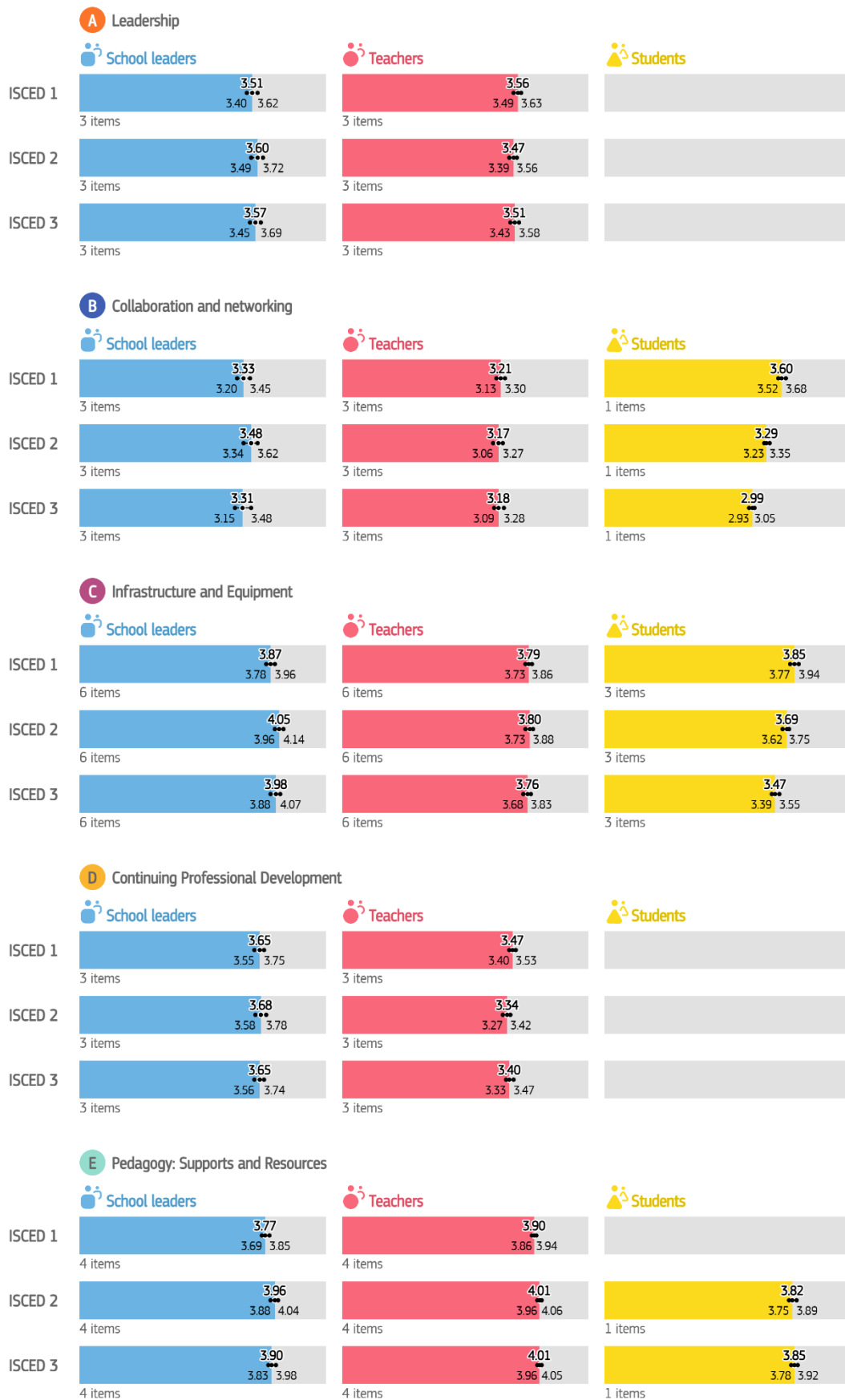
Figure 1. Overview of results

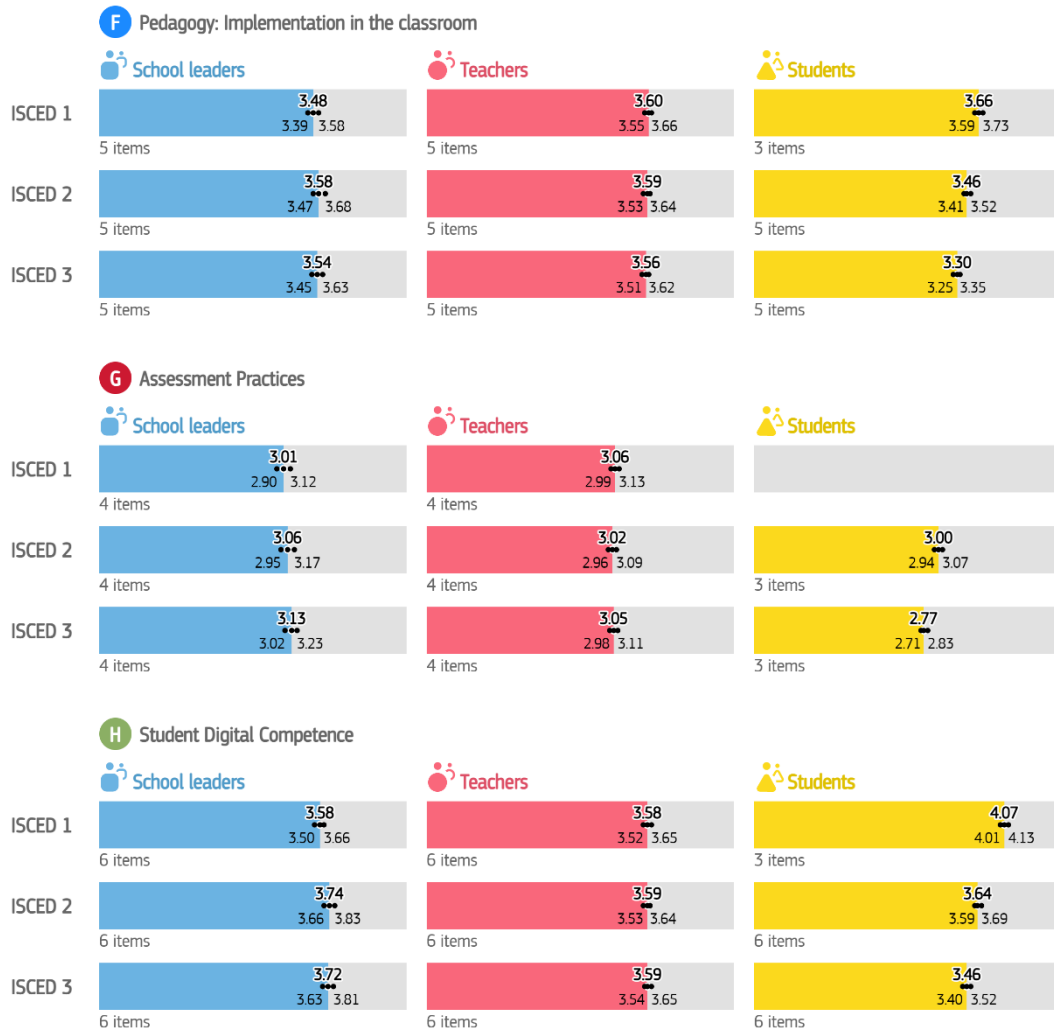


Source: JRC, 2021.

Figure 2 shows the average values and/or percentages of the items in each area for each profile (school leaders, teachers and students) along with their corresponding 95% confidence intervals. These intervals consider the estimation error and the error associated to sample design.

Figure 2. Overview of results by area





Source: JRC, 2021.

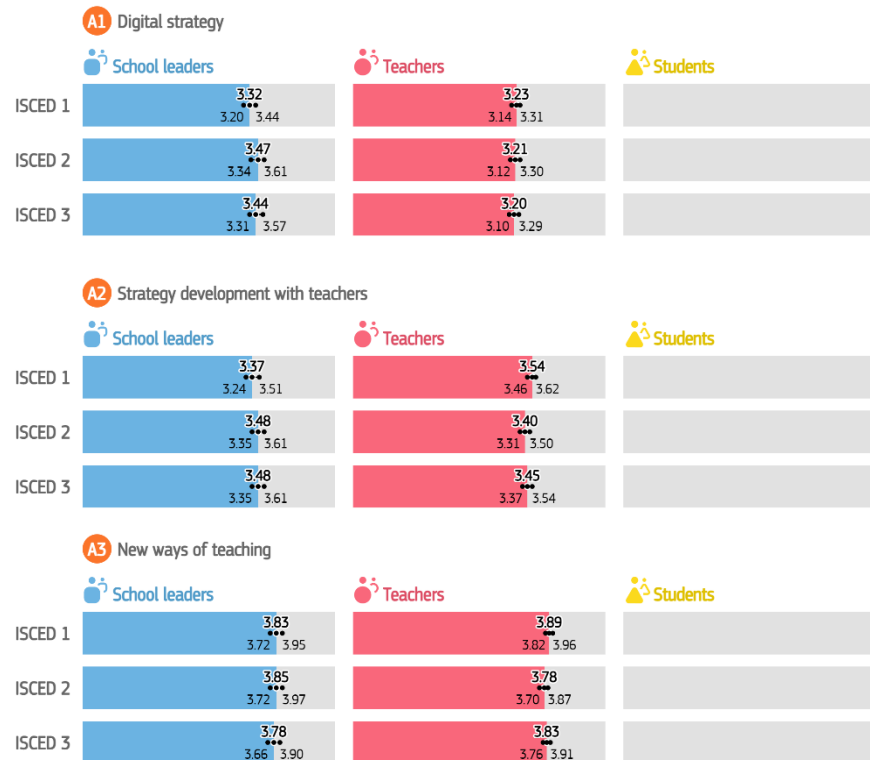
Results also show that teachers in the three education levels give lower punctuations than school leaders to most of the items, and that students become more critical in their perceptions as they progress in the education level. Another trend is that, in general, school leaders and teachers from private and charter schools, tend to give higher scores to the items covered by the questionnaire. This is transversal in the three ISCED levels analyzed. There are some exceptions that will be commented in the corresponding areas. In the following sections we present the results in detail by each of the areas.

4.1 Leadership

This area relates to the role of leadership in the school-wide integration of digital technologies and their effective use for the school's core work: teaching and learning.

Leadership is an area with intermediate scores. Within this area, the item with higher scores is the one referred to the support provided to teachers to try out new ways of teaching with digital technologies. Regarding the existence of a school digital strategy, it is interesting to see how teachers are more critical than school leaders.

Figure 3. Area A: Leadership – Representative means by item and profile



Source: JRC, 2021.

4.2 Collaboration and networking

This area is referred to the measures taken by the school to be up to date with what is being done regarding the use of technology in education in the external (e.g. other schools, organizations, etc.) and internal (e.g. teachers and students) environment. This area also refers to measures to communicate, collaborate and share experiences. It is one of the areas with lower scores and therefore with highest room for improvement. An exchange of experiences of schools with their community and environment can allow them to obtain more and better information on how to use technology, what indirectly can inform the school digital plan.

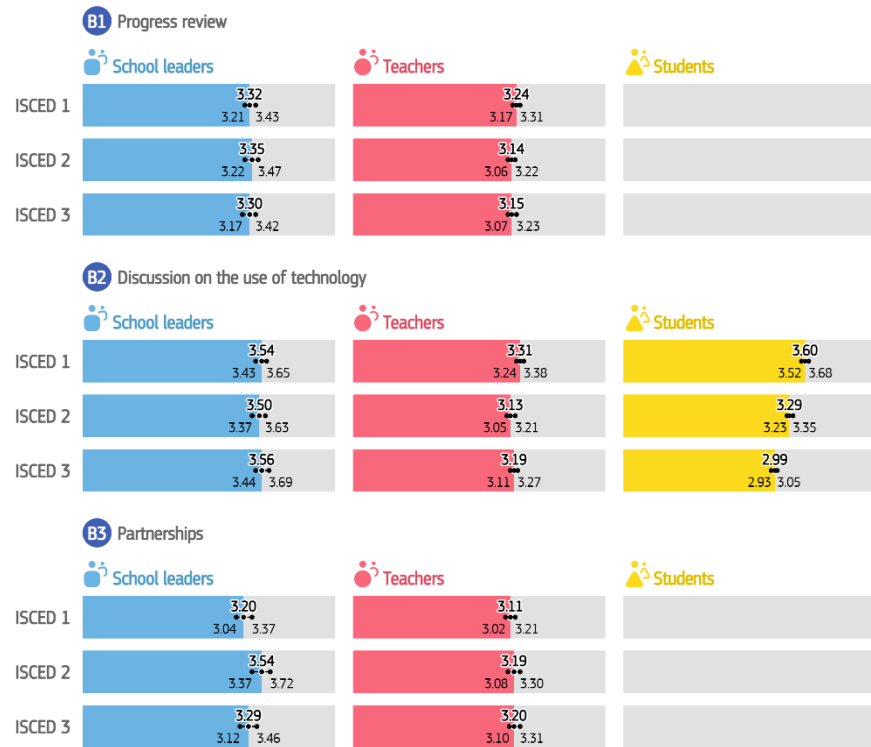
Analyzing the area in detail, one can observe that the internal debate on the advantages and disadvantages of the use of technology with teachers and students is implemented to greater extent than a systematic review of what is being done and what is working in the classroom. Similarly, the schools are more attentive to their internal situation than to what external agents (other schools, institutions, families ...) are doing. Finally, following a common trend, teachers have a more critical view than school leaders in this area too.

The relative low scores on this area reflect a low involvement of other stakeholders (beyond the school leaders and from inside and outside the school) in discussing, agreeing, and, especially, regularly monitoring, the use of digital technologies. If the context changes, and remote or blended education is needed, internal (teachers and students) and external actors (families, social organizations or other schools) should be involved in discussions and knowledge-exchange on the use of digital technologies because they have first-hand information on the problems associated to the use of technologies inside and outside the school. Social and community aspects are considered key to education success. In this regard, digital capacity of schools can benefit from the promotion of networks, communities, and participatory actions oriented to develop and monitor the digitalization plans of schools. It is also important to be inclusive and tackle socio-cultural barriers to participation.

In ISCED 3 there are no differences in school leaders' punctuations from public and private schools⁸.

⁸ These punctuations are only significantly different accepting the 90% confidence level.

Figure 4. Area B: Collaboration and networking - Representative means by item and profile



Source: JRC, 2021.

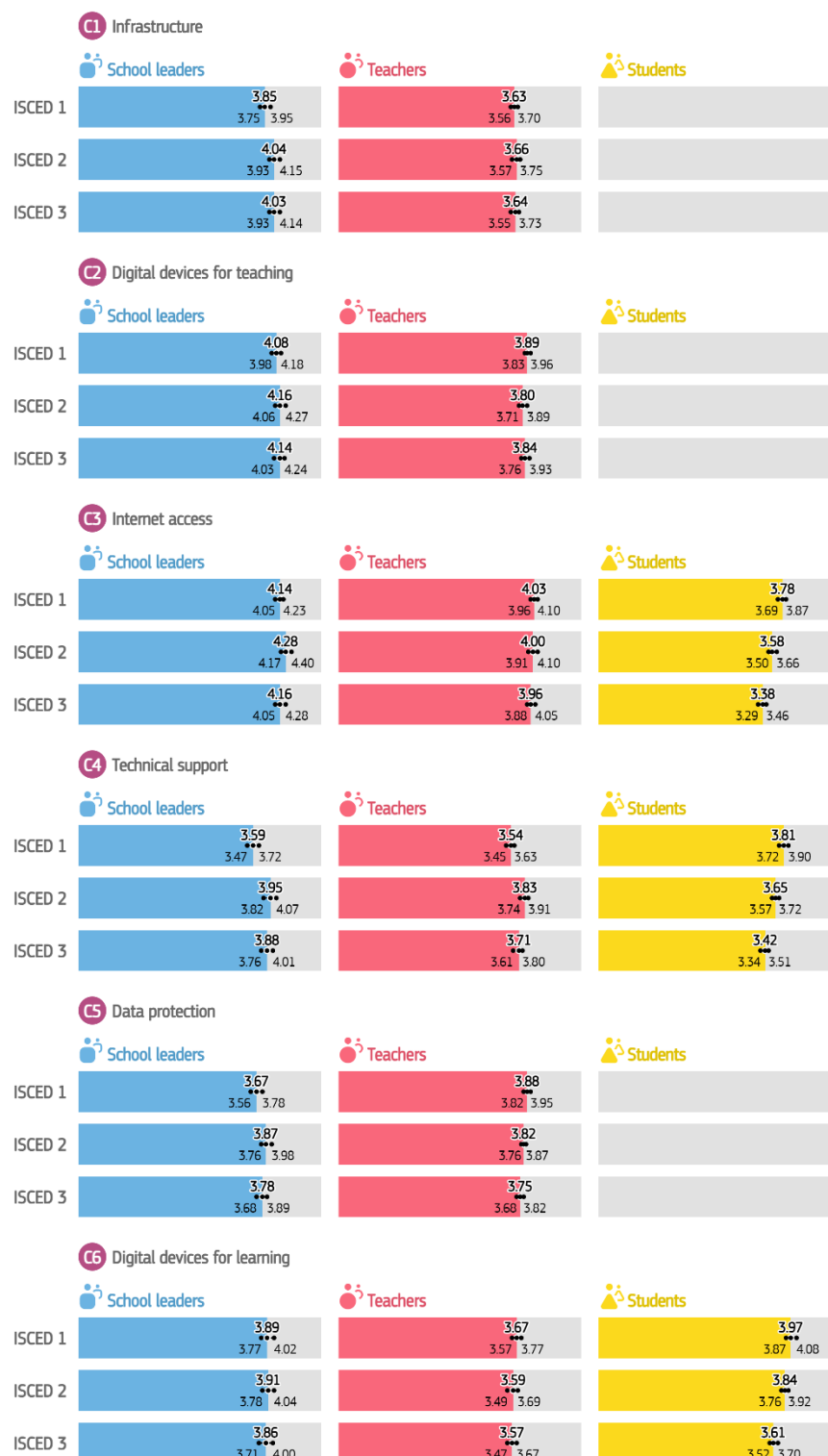
4.3 Infrastructure and equipment

This area refers to the existence of an adequate infrastructure and equipment that allows the application of digital technologies in teaching-learning processes in the school.

This is one of the areas with better scores, but teachers have more critical views than school leaders. In general, the good scores in the area show that basic infrastructure is not an issue in Spain. Thus, policies should promote more advanced infrastructure, and innovative uses of digital technologies for teaching and learning.

Analyzing one by one the items of the area, the existence of adequate infrastructure to be used for innovative teaching and learning in the school and the existence of internet connection are the items with higher scores. However, it is interesting that internet access is the item best valued by teachers and school leaders, but it is the worst valued by students, perhaps showing a different perception of what is considered adequate internet access or the different internet access that collectives have in the schools. This last alternative is reinforced by the fact that the existence of devices for teaching has higher scores than the existence of school-owned/managed digital devices for students to use when they need. Finally, it is interesting to see that in primary schools teachers and school leaders consider that they have a worse technical assistance than secondary schools.

Figure 5. Area C: Infrastructure and equipment – Representative means by item and profile



Source: JRC, 2021.

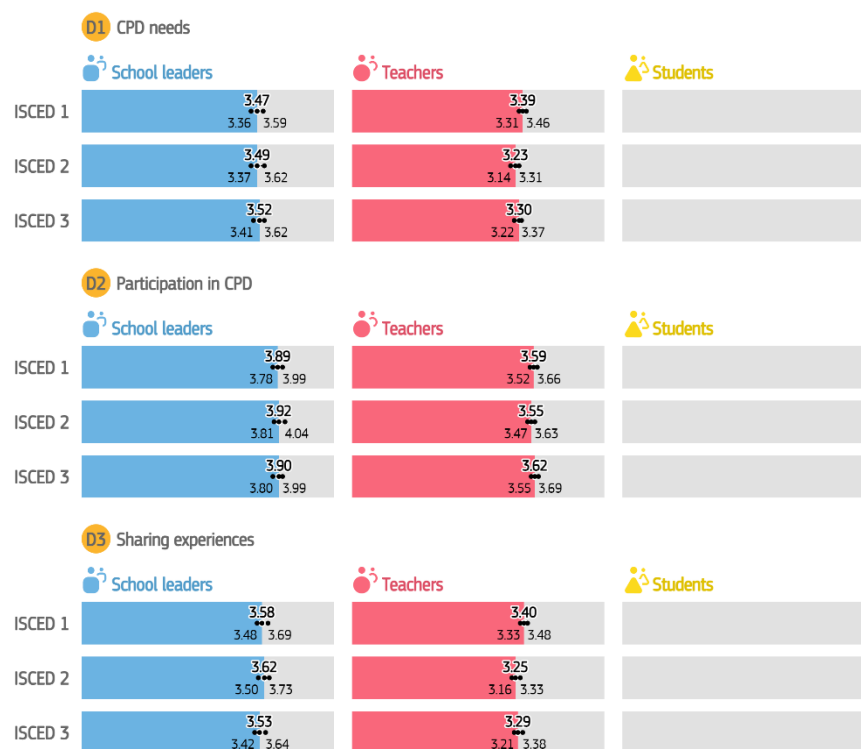
4.4 Continuous professional development

Teachers play a key role in education and it is essential that they have access to the training and competences that are needed to use technologies in an appropriate way. This area looks at whether or not the school facilitates and invests in the continuing professional development (CPD) of its staff at all levels. CPD can support the development and integration of new modes of teaching and learning that harness digital technologies to achieve better learning outcomes.

This is an area with intermediate scores, but teachers have a worse perception than school leaders about the support received from the school to participate in CPD. Among the 3 items of the area, the one referred to teachers' opportunities to participate in CPD for teaching and learning with digital technologies stands out due to its high values. However, the items referred to the perceived support to internal discussion about CPD needs and activities to exchange experiences with other teachers have lower scores. It is important that teachers feel supported on this as sharing experiences has been detected as a key approach for effective integration of digital technologies and students digital competence development.

In ISCED 1, there are no significant differences in this area between public and private schools.

Figure 6. Area D: Continuous professional development – Representative means by item and profile



Source: JRC, 2021.

School leaders in ISCED 3 public and private schools give no significantly different punctuations to the items of this area.⁹

4.5 Pedagogy: supports and resources

This area refers to teachers' use of digital technologies as support for the preparation of classes and activities. Together with infrastructure, this is one of the areas with highest scores. Spanish teachers frequently use technology to prepare their classes and do so to a greater extent than to carry out pedagogical innovations in the classroom. This confirms that early stages of digitalization have already been covered in Spain. Thus, policies should go further and focus on advanced uses of digital technologies. In this sense, it is important to overcome the mere use of the internet by teachers to prepare face-to-face classes, and move towards the use of digital technologies to implement innovative learning activities (in school or outside).

At all levels, there is an agreement between the profiles that the highest uses of digital technologies are linked to searching online for digital resources and to communicating with the school community (for example via email, webs, blogs).

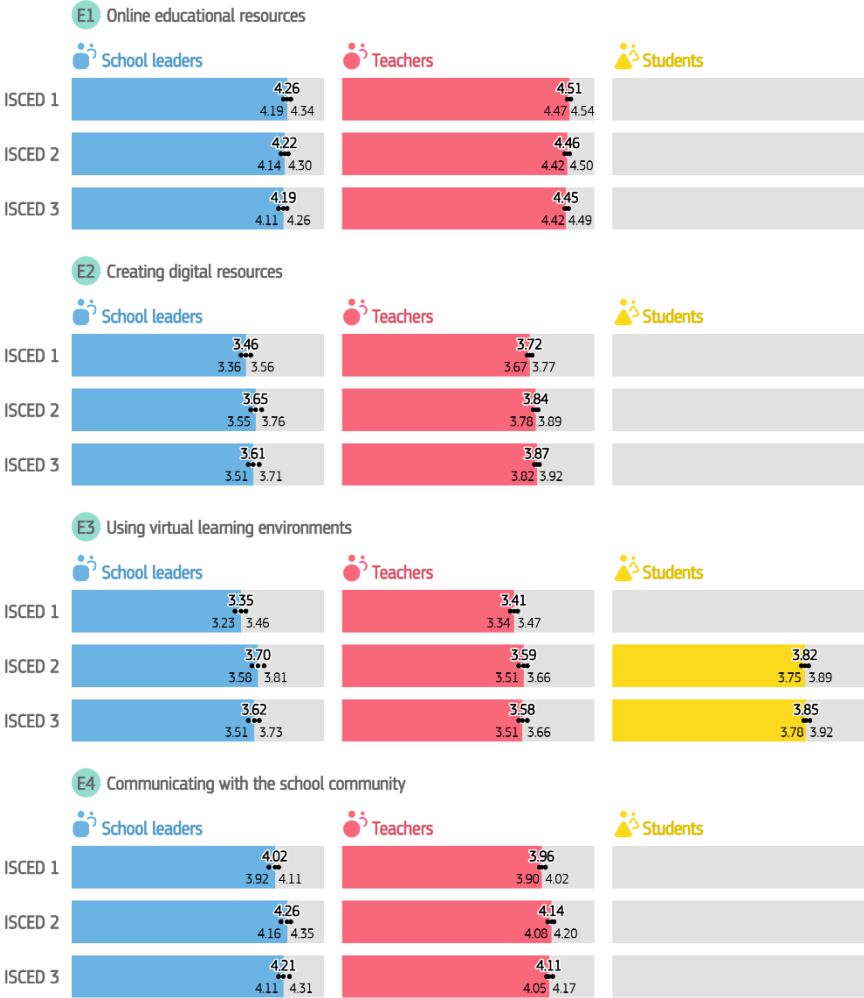
However, in other items the scores are lower. First, data show that the creation of digital resources is less frequent than the search for them. Therefore high-quality repositories where teachers can find and adapt resources can be especially beneficial. Secondly, we see that the use of virtual learning environments is the lowest scoring item in this area. During the closure of schools due to COVID-19, research detected the use of improvised digital solutions by teachers and schools (Vuorikari, Velicu, Chaudron, Cachia, Di Gioia, 2020), which may require a learning curve for harnessing their functionalities. The promotion of the use of up-to-date virtual learning environments and knowledge about their functionalities by teachers, also in face-to-face

⁹ These punctuations are only significantly different accepting the 90% confidence level.

education, may enable a better organization of the learning activities and enhance the communication during these. Thus, it is an important element to promote if the goal is to have digitally capable and resilient schools.

Analyzing differences by type of school, the data show that in primary education there is more room for improvement in almost all the items of the area than in secondary education. The only exception is the search for online educational resources. Therefore, specific actions tailored to this education level could be especially useful. Finally it is interesting to highlight that in ISCED 3, the trend that private schools use more technologies than public ones is broken when it comes to the use of technologies for preparing classes and activities: there are no differences between public and private schools in this area.

Figure 7. Area E: Pedagogy: supports and resources – Representative means by item and profile



Source: JRC, 2021.

4.6 Pedagogy: implementation in the classroom

This area refers to the use of digital technologies to update and innovate the teaching and learning practices.

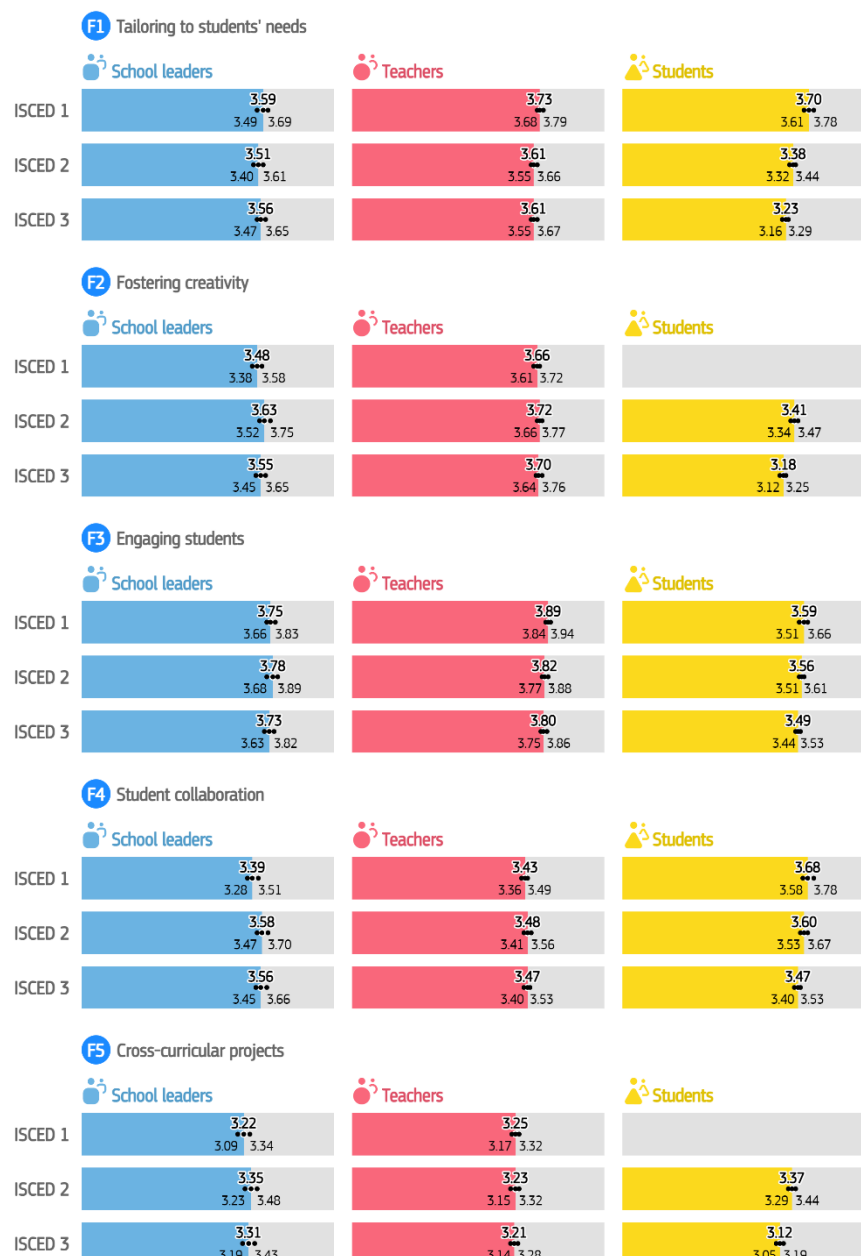
Our data show that the implementation of teaching and learning practices using digital technologies is an area with intermediate scores. Teachers already apply digital technologies by adapting the teaching process to students, promoting their creativity and engaging them in the development of the class.

On the other hand, there are items with lower scores. The use of digital technology for students' collaboration obtains a low average score by teachers and school leaders. This low use may indicate that it is not promoted by teachers and therefore it could be limiting collaboration and interaction channels among students, especially outside the school. In addition, low experience in such activities can have a direct effect on remote learning situations when the use of technologies is very relevant for collaboration and the maintenance (or creation) of a sense of belonging to the group. The promotion of this type of activities can develop teamwork and self-regulation, skills that are very important in remote education. Interestingly, this

item is the best perceived in this area by ISCED 1 and 2 students. While, this discrepancy may indicate the existence of uses initiated by the students themselves for collaboration, they would not be guided and consequently may be less effective than if it were structured by teachers.

Another item with a low score on the use of technology to implement learning activities is the use of technology for the development of cross-curricular projects. Such projects can make learning closer to real situations and more meaningful for students. In addition, it is an important element in fostering collaboration between teachers, which has demonstrated an effective way to integrate technologies in education, as well as in integrating curricula content into common activities reducing the burden of hours in potential contexts of remote education where compliance with the schedule and its division by subject cannot be guaranteed.

Figure 8. Area F: Pedagogy: implementation in the classroom – Representative means by item and profile



Source: JRC, 2021.

In this area there are no significant differences for education level ISCED 2 in the students' punctuations of public and private schools. There are also no differences in teacher punctuations in this area in ISCED 3 public and private schools.

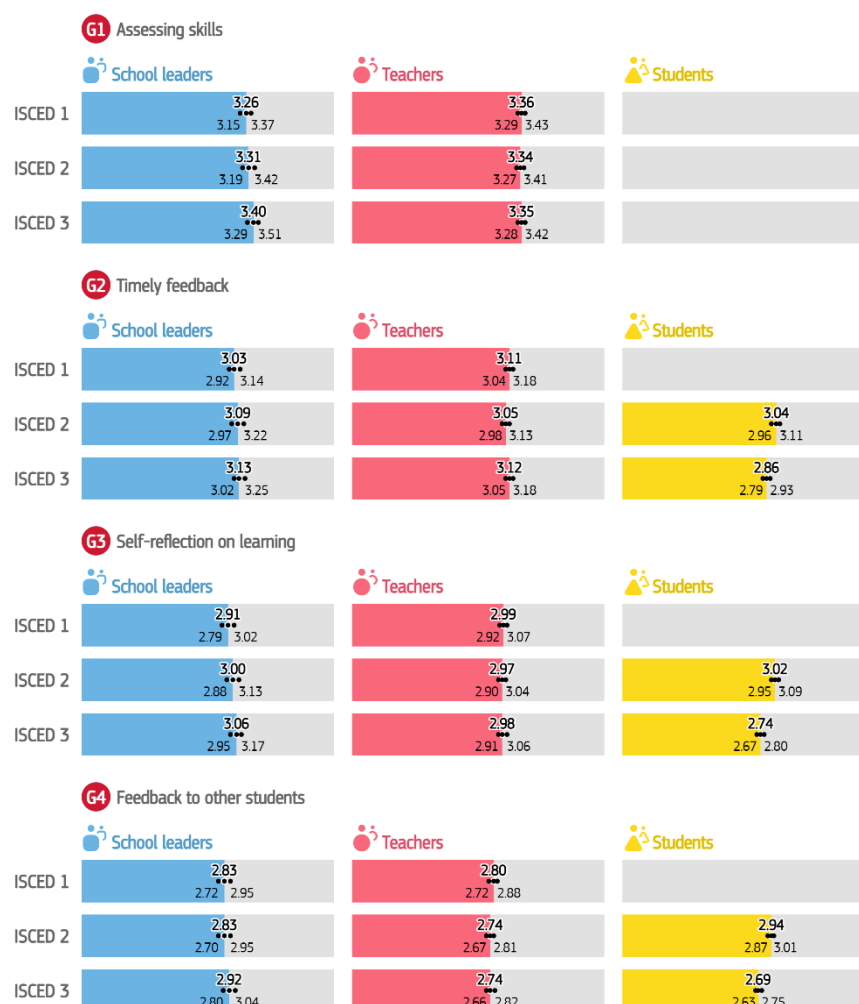
4.7 Assessment practices

This area relates to measures that schools may consider in order to gradually shift the balance from traditional assessment towards a more comprehensive repertoire of practices. This repertoire could include technology-enabled assessment practices that are student-centred, personalized and authentic. Digital technologies offer new possibilities for evaluation, more accurate feedback and evaluation of digital skills.

Our data show that this is the area with lowest scores. This indicates that schools should reflect on the usefulness of digital technologies to facilitate personalized and formative assessment that includes relevant and timely feedback. Such practices are especially useful for remote or blended education scenarios where it can be more difficult to give feedback to students and, specially, evaluate learning using traditional formats.

The most common practice is to use digital technologies to assess students' skills. On the other hand, the use of technology for peer evaluation, a type of assessment that involves interaction between students, is shown as a particularly weak aspect in the three analyzed education levels. Digital technologies can enable the replication of summative assessment mechanisms, via online tests that, in the best case scenario, include identity control. However, to really make evaluation systems more resilient and efficient, formative evaluation should be also promoted. In this direction, policies can help by promoting the use and design of digital technologies for personalized feedback (algorithms and adaptive systems can support teachers on it, but are not enough), self-reflection and peer-evaluation exercises, and the design and use of technologies to assess transversal skills.

Figure 9. Area G: Assessment practices – Representative means by item and profile



Source: JRC, 2021.

The students' results in ISCED 2 have no significant differences in public and private schools. The results for teachers in ISCED 3 public and private schools are also not significantly different.

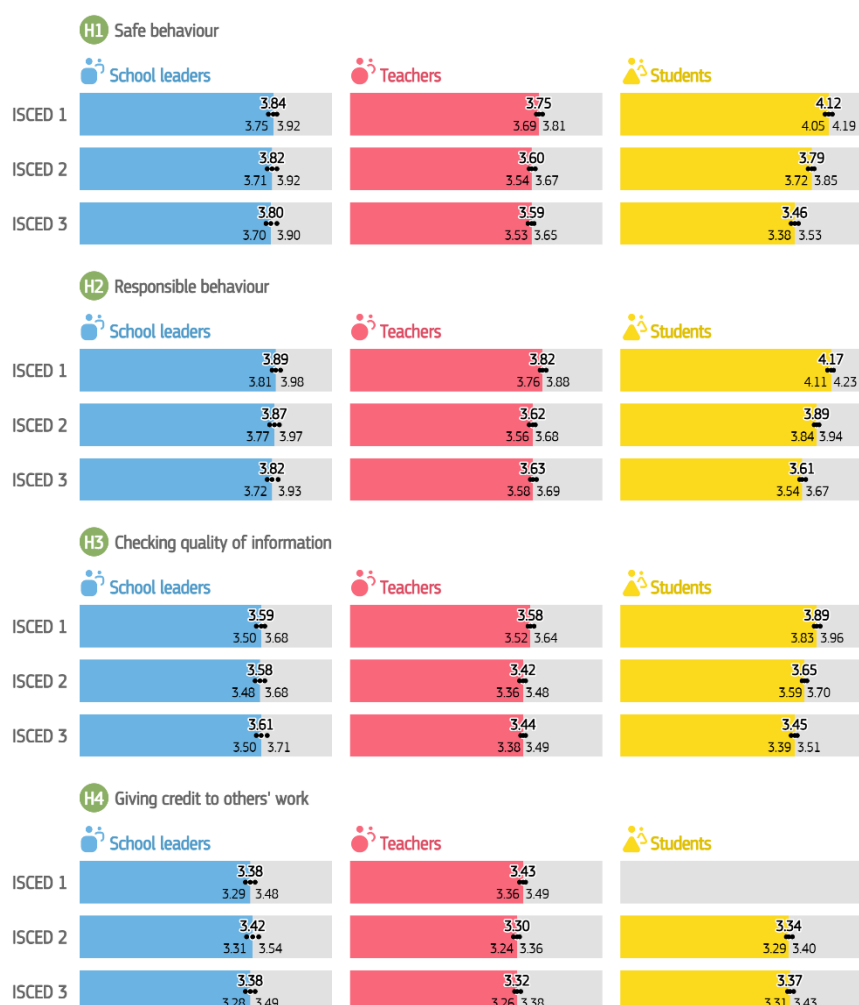
4.8 Student digital competence

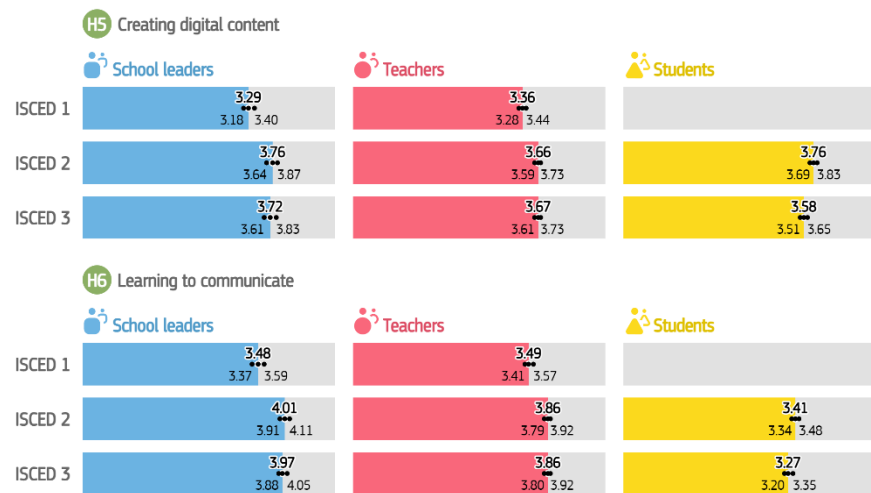
This area relates to the set of skills, knowledge and attitudes that enable the confident, creative and critical use of digital technologies by students. In general the items in the area have intermediate scores and show that the development of digital skills is implemented in Spanish classrooms, but there are some aspects with room for improvement.

Analyzing the items in detail it can be observed that the development of the safe and responsible use of technology by students is emphasized in all education levels, including primary that shows an early development of these skills. In addition, in ISCED 2 and 3, schools also focus on communication skills and content creation. Teachers and school leaders believe that communication skills are promoted to a greater extent than students do. This may indicate different perceptions of what is considered online communication by these groups, but also the use of different tools.

On the other hand, in general, the two aspects that are less developed are the recognition of sources and the ability to judge the quality of information found online. Therefore, a higher emphasis in the early development of these two interrelated skills is needed to fight against misinformation and fake news.

Figure 10. Area H: Student digital competence – Representative means by item and profile





Source: JRC, 2021.

Like in the previous areas, students of ISCED 2 public and private schools have no significant different perceptions on this area.

5 Additional information

In order to contextualize the situation of the different areas covered in the previous section, the SELFIE questionnaire includes a series of additional questions that can provide valuable information. This is for instance information on the usefulness perceived by the teachers of the continuous professional development activities, their confidence in using technology and the barriers that inhibit the use of digital technologies in the school.

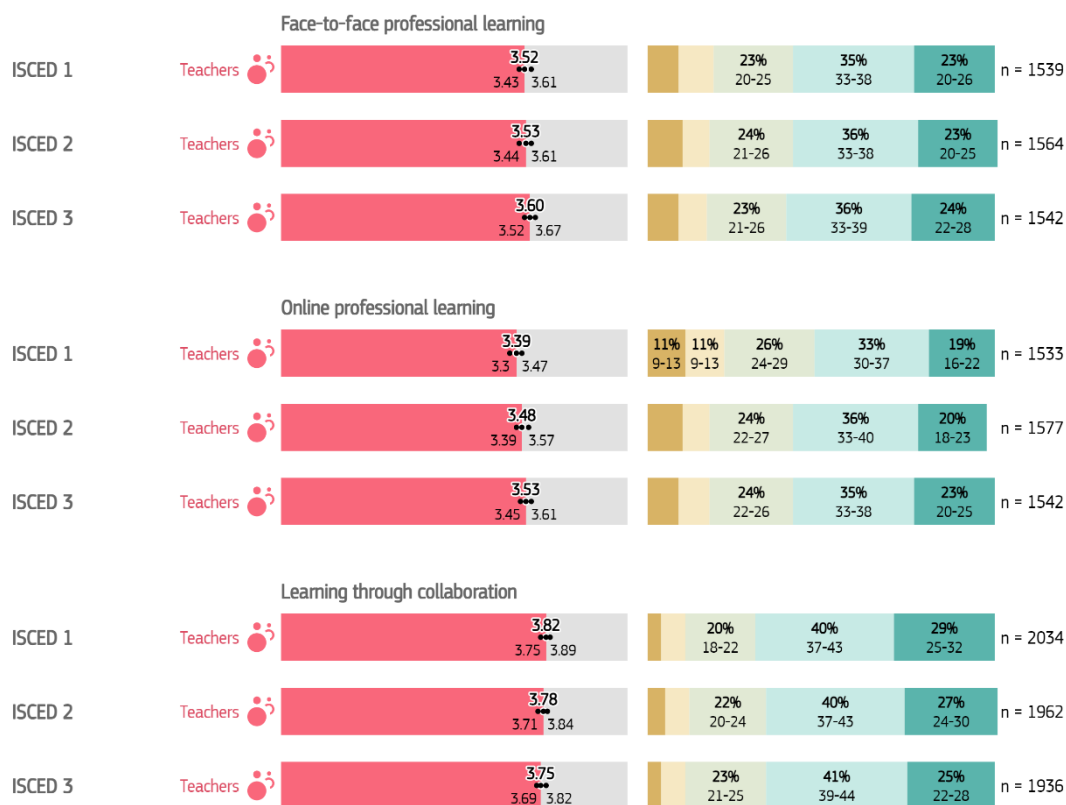
5.1 Usefulness of CPD activities

Teachers of the three analyzed education levels, perceive that the CPD activities that are most useful on the use of digital technologies in education are those that are carried out within the same school. Learn from the other teachers within the school through online or offline collaboration and other in-house training sessions organized by the school (for instance workshops by the ICT Coordinator or observing colleagues teaching) are the activities perceived as most useful. Thus, the most-valued activities are these organized in a flexible way and that better suit the specific training needs of schools and teachers. Again, these results also reinforce the importance of creating a culture of collaboration in the school.

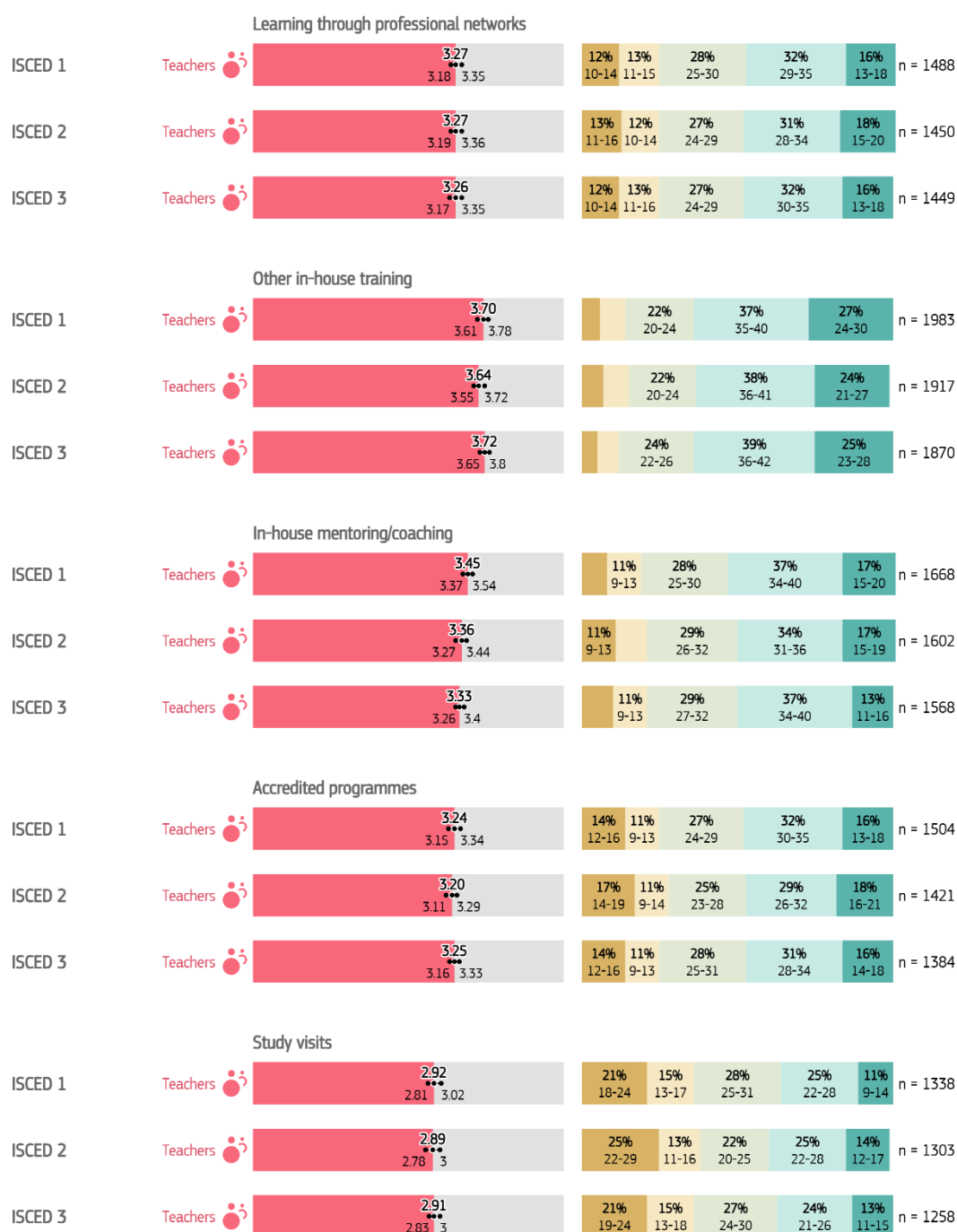
Faced with these activities, there are some that are perceived as less useful: the more formal activities, such as accredited programmes or study visits to other schools, companies or organizations.

Finally, the teachers of the three education levels perceive that both face-to-face and online training have a similar utility.

Figure 11. Usefulness of CPD activities – Representative means and frequency of answers¹⁰



¹⁰ Answer options: Not at all useful; Not useful; A little bit useful; Useful; Very useful; Did not participate.



Source: JRC, 2021

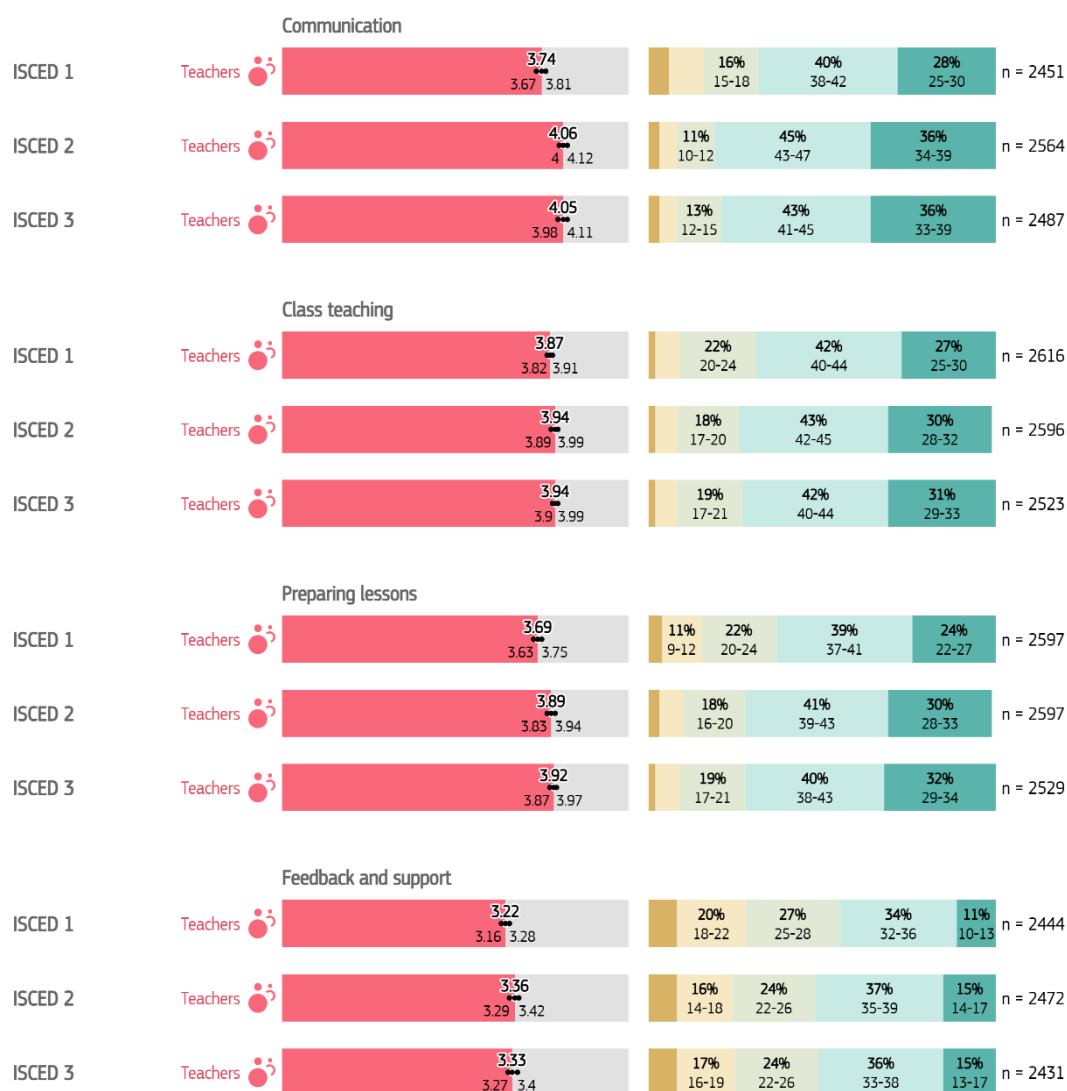
There are no significant differences in the perception of the teachers in schools of both types of ownership, public and private.

5.2 Teachers' confidence in using technology

Teachers' confidence in the use of technology has been detected as one of the factors that promote and facilitate the use and effectiveness of digital technologies in education (Ertmer, P. & Ottenbreit-Leftwich, A, 2010). For this reason, the questionnaire includes a question about how confident teachers feel in the application of digital technologies for different activities.

Communicating with students and their families is when teachers feel more confident, especially in ISCED 2 and ISCED 3 schools. For ISCED 1 they feel more confident in class teaching with digital devices and resources. On the other hand, teachers from the three education levels feel significantly less confident regarding using technology for providing feedback to students. This last point reinforces the idea that assessment practices is an area with room for improvement.

Figure 12 Teachers' confidence in using technology - Representative means and frequency of answers¹¹



Source: JRC, 2021

There are no significant differences between the three levels, but teachers in private schools feel more confident in all aspects, following the general trend.

5.3 Students' use of digital technologies in and outside the school

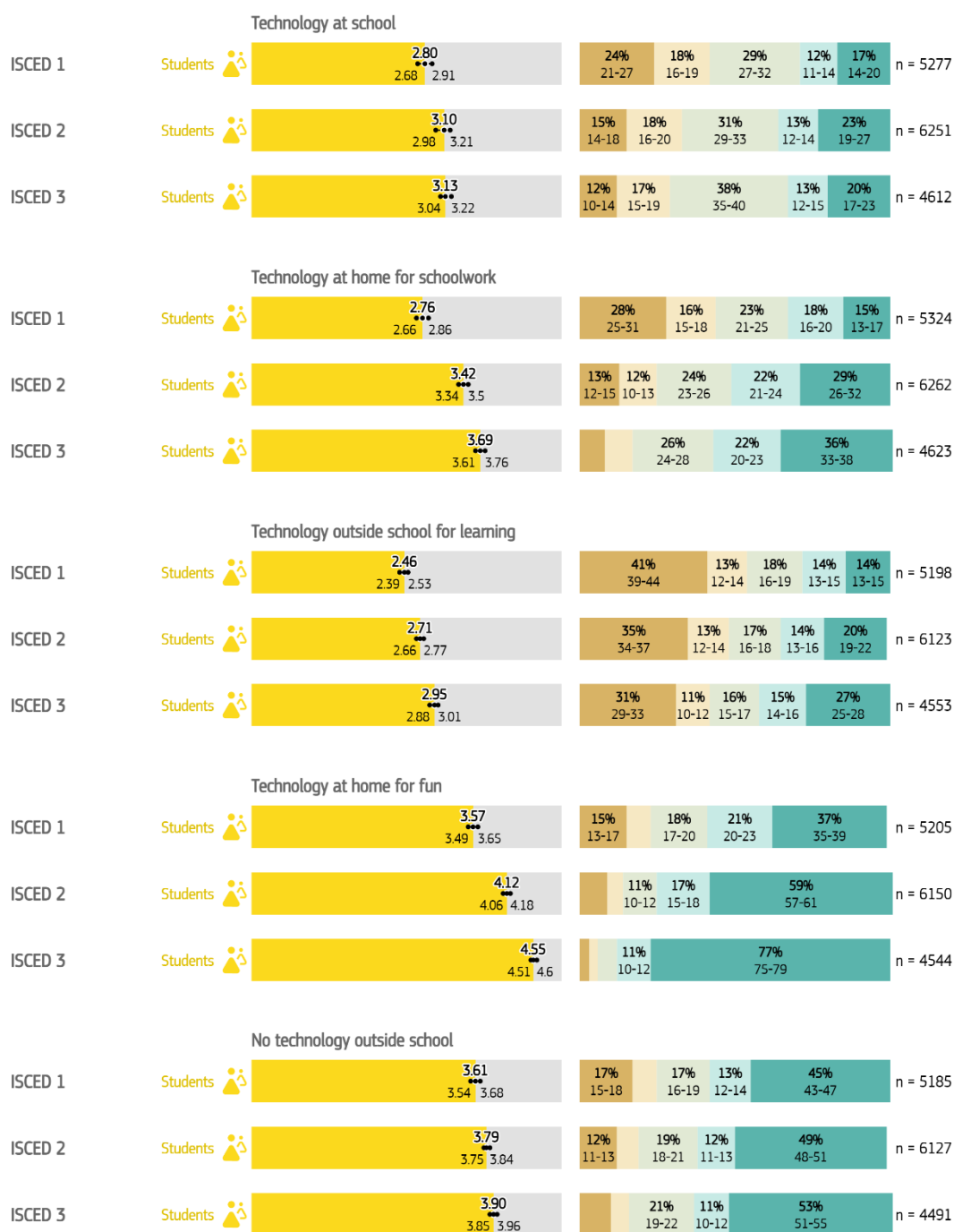
ISCED 2 and ISCED 3 students declare to use more often technology at home to carry out homework than at school. In general, the use of technology for school related tasks is more frequent in the case of private school students than public school students.

However, the frequency of use for leisure activities at home is similar. More than 80% of ISCED 3 students report using digital technology at home for more than one hour a day for fun activities. This percentage decreases for younger students.

Around 40% of the students state that they do not take part every day in activities outside school in which no technology is used (like sports, music, reading or being with friends). Here, again there are no significant differences between students from public and private schools.

¹¹ Answer options: Not at all confident; Not confident; A little bit confident; Confident; Very confident; Prefer not to say

Figure 13. Students' use of digital technology - Representative means and frequency of answers¹²



Source: JRC, 2021

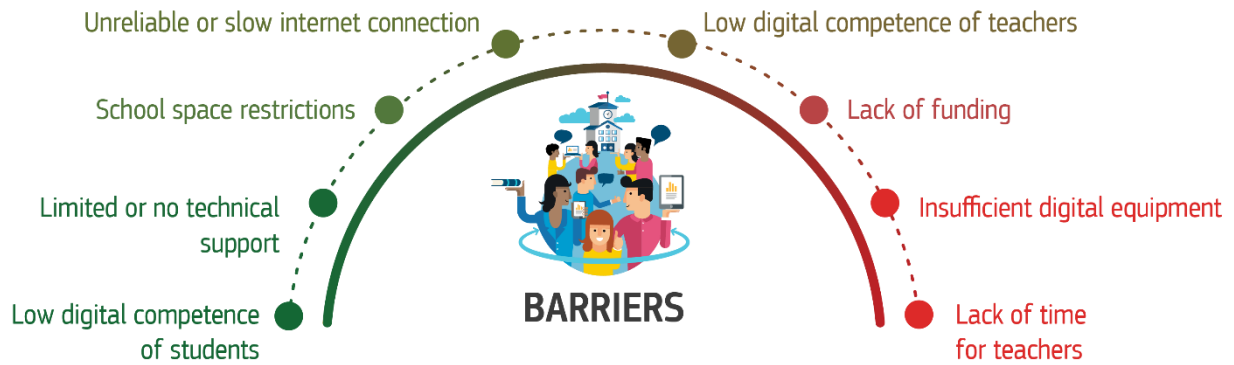
5.4 Barriers

Finally, school leaders and teachers are asked on the barriers that limit the use of technologies in school. There is consensus in all education levels that teachers' lack of time is the most important barrier. It is followed by the lack of funding and the bad adequacy of the equipment in the school (but internet connection is not considered a problem). In addition, by focusing on digital competences, school leaders identify teachers' lack of digital competence as one of the biggest barriers. However, the

¹² Answer options: Never or hardly ever; At least once a month but not every week; At least once a week but not every day; Up to one hour every day; More than one hour every day; Prefer not to say

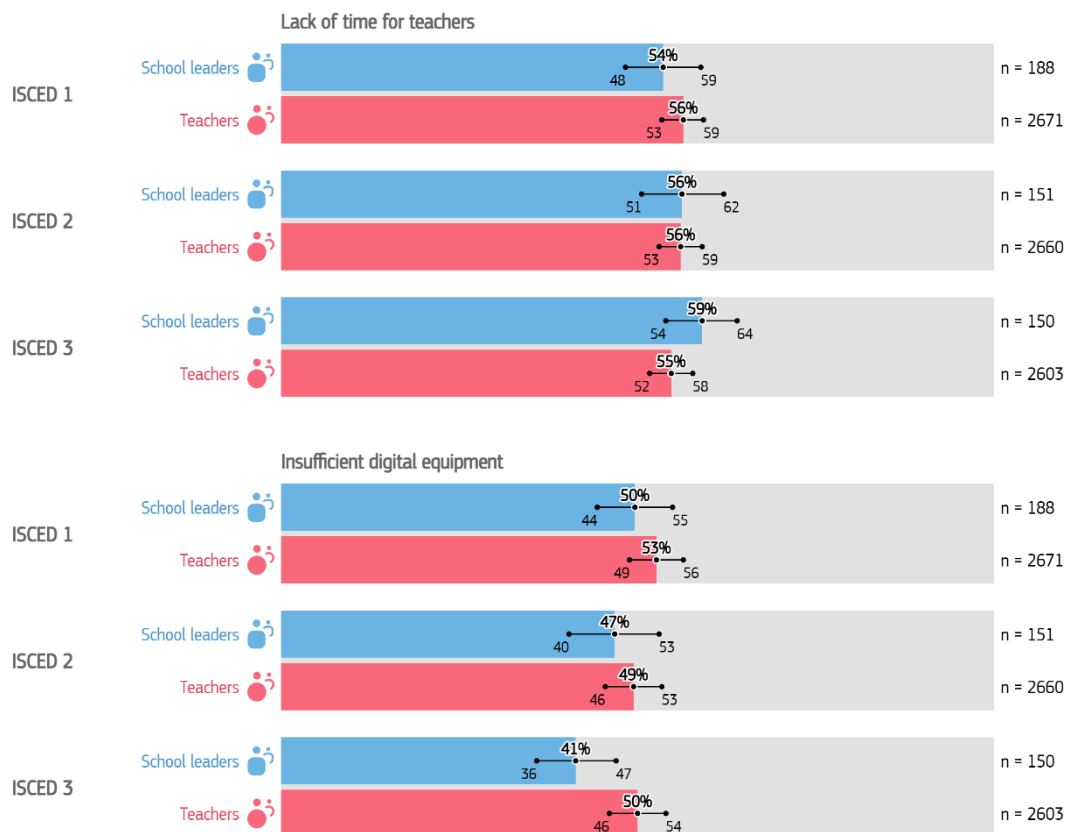
lack of digital competence of students is not seen as a remarkable barrier in no education level. Lack of technical support is seen as also a significant barrier, but mostly in primary schools.

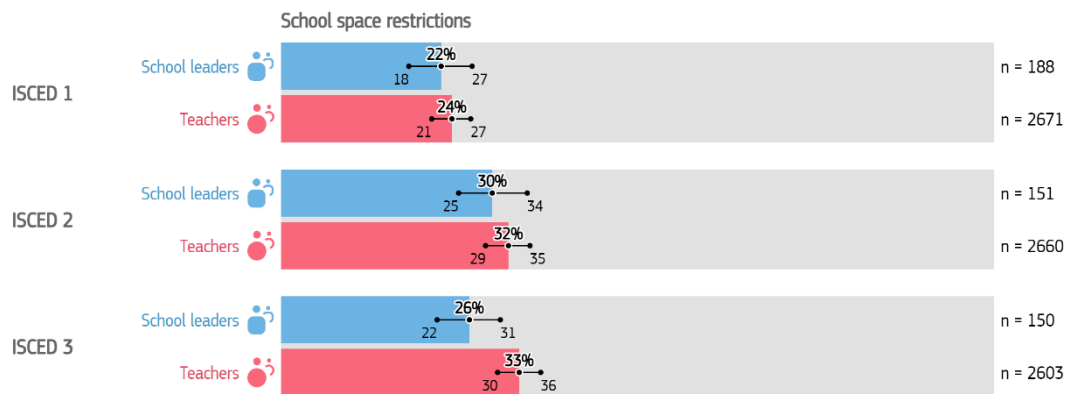
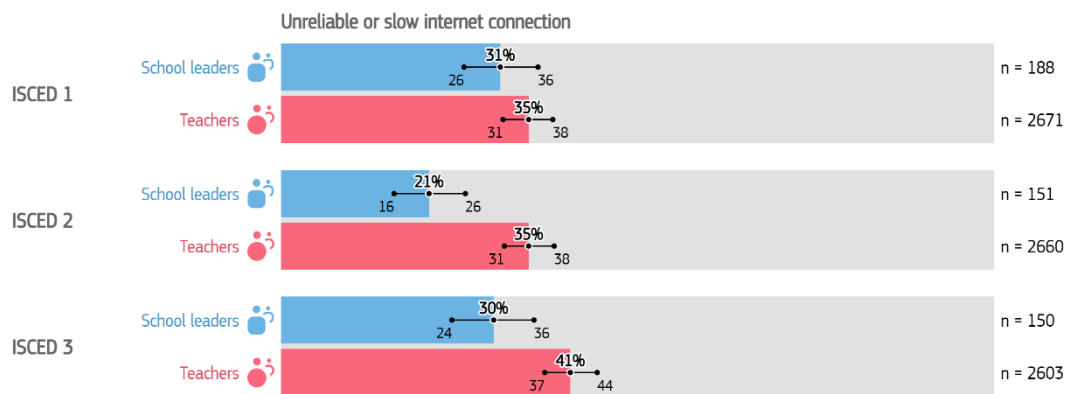
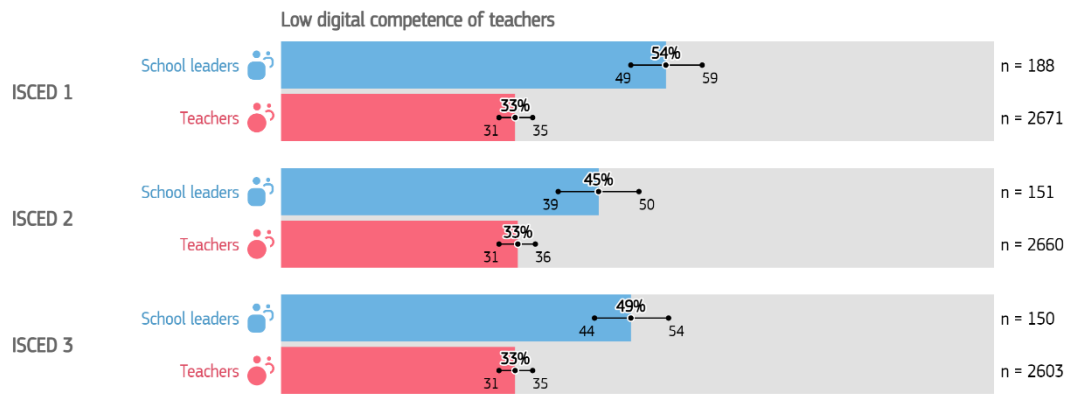
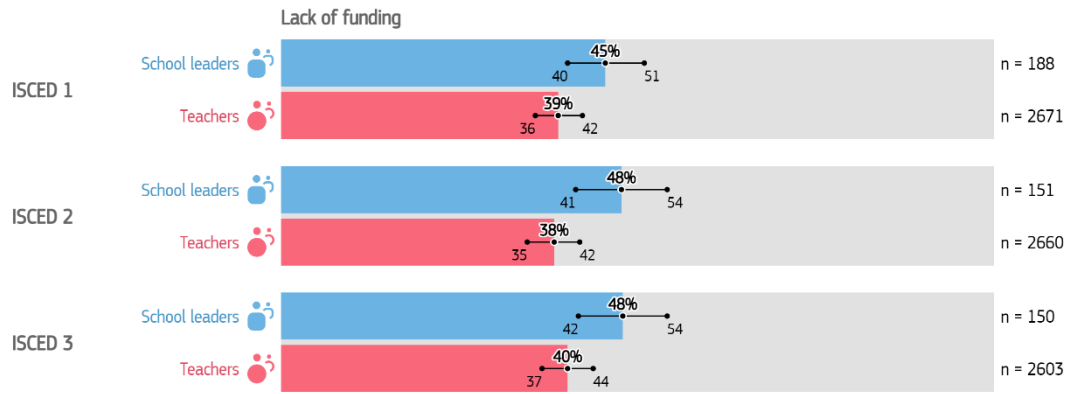
Figure 14. Overview of barriers for the use of digital technology

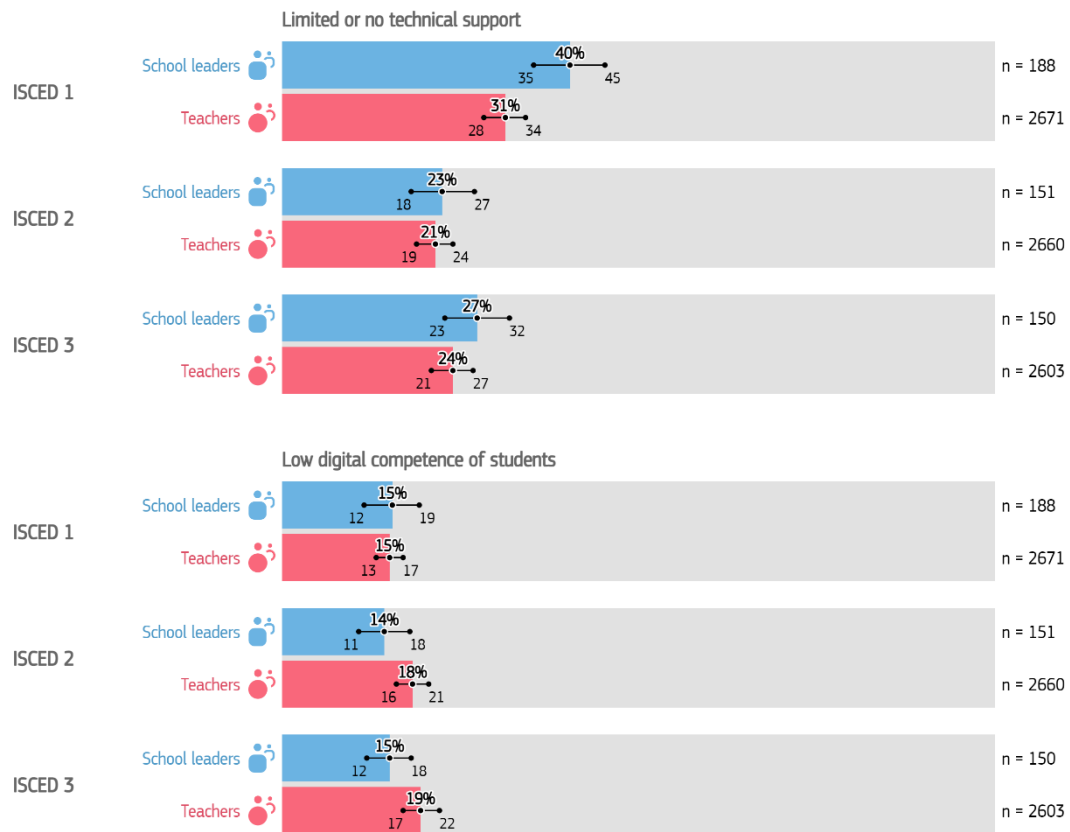


Source: JRC, 2021.

Figure 15. Factors that inhibit the use of digital technology







Source: JRC, 2021

6 Conclusion

The digitalization of education systems is a key issue in Europe and beyond. Educational leaders, schools and families are taking more and more steps in this direction. In this context, SELFIE is a tool developed by the European Commission that invites collective reflection within schools on the application of digital technologies in teaching and learning processes. This reflection is based on the information obtained through personalized questionnaires for school leaders, teachers and students. In previous psychometric studies, the robustness of the questionnaire has been demonstrated to measure the different dimensions of the digital capacity of schools and therefore to provide a good basis for debate and reflection on how to integrate digital technologies in the specific context of each school.

The research results presented in this report went a step beyond by using the SELFIE questionnaire for data collection from a representative sample of Spanish schools in three educational levels. This makes it possible to offer a global and precise overview of the vision that the different profiles (school leaders, teachers and students) have on the digital capacity of Spanish primary and secondary schools. We have already presented before (see Castaño Muñoz, Weikert Garcia, & Ministerio De Educación Y Formación Profesional 2021a, 2021b and 2021c) the detailed results by level in three reports in Spanish that target schools in Spain that want to contextualize better their own results after using the SELFIE tool.

However, although the research was conducted in a specific country, the target of this Science for Policy report is international. The report aimed to share this experience to an international audience that may be interested in the results, methods, or even in conducting similar exercises. However, it is important to highlight that this data is not intended to be used for country comparisons because, conversely to international large scale assessments, its data reflect the opinions from school leaders, teachers and students and, consequently, subjective and cultural factors can play an important role.

The data collection ended at a very specific point in time: the first quarter of 2020, just before the closure of the Spanish education system due to the COVID19 pandemic. It is therefore important to bear in mind that these data may have varied due to the needs and rapid transformations derived from the new situation. However, the data can give an idea of the initial situation and can inform actions in a context, where, predictably, the use of digital technologies in education will be more important than previously. The data can also work as a baseline to explore changes produced in the use of technologies due to the pandemic.

As a future research avenue, the data collected here could be compared with self-selected data of schools participating in SELFIE on a voluntary basis to explore self-selection trends and what schools are more likely to use SELFIE. Moreover, the role of other important variables related to the digital capacity level of schools can be further explored. In this study, we have presented data for Spain and have analyzed it by educational level and school ownership (explicit strata), but other contextual variables may play a role. An example is the location of the school in terms of rural and urban areas. A digital divide may exist related to this variable and, therefore, it has to be taken into account when interpreting and using the results presented here. In the future, it would be also interesting to explore this aspect and include it as an explicit strata in the design of the sample. Countries considering to perform similar exercises in their own context should assess the adequacy of adding this (or other) variables as explicit strata.

Finally, it is important to highlight that this report is an important building block of the JRC B4 Unit research line promoting the effective incorporation of digital technologies in education, but in the future new research and developments are foreseen. First, regarding SELFIE, the tool is in constant evolution and new developments are implemented. Recently, a new set of questions on blended learning were added to respond to COVID 19 crisis, moreover an adaptation of the tool for Work Based Learning will be launched autumn 2021. Finally, the JRC is launching a series of studies to understand the Impact of SELFIE on the digital empowerment of schools. Specifically, a qualitative study started in March 2021, aiming to identify key elements of SELFIE impact and measures to support integration of SELFIE in the school practice. Another study will be starting in April 2021, on the feasibility of a randomised control trial on the impact of SELFIE. Next steps will be determined on the impact assessment of SELFIE, based on the results of these two studies.

Beyond SELFIE, other efforts are being made in this direction. The digital competence of teachers have been identified as a key enabler for effective use of digital technologies in education. Thus, as part of the DEAP 20-27, a new specific self-reflection tool on this topic will be launched: SELFIE4Teachers.

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List of figures

Figure 1. Overview of results 10

Figure 2. Overview of results by area..... 11

Figure 3. Area A: Leadership - Representative means by item and profile 13

Figure 4. Area B: Collaboration and networking - Representative means by item and profile..... 14

Figure 5. Area C: Infrastructure and equipment – Representative means by item and profile 15

Figure 6. Area D: Continuous professional development – Representative means by item and profile..... 16

Figure 7. Area E: Pedagogy: supports and resources – Representative means by item and profile 17

Figure 8. Area F: Pedagogy: implementation in the classroom – Representative means by item and profile 18

Figure 9. Area G: Assessment practices – Representative means by item and profile 19

Figure 10. Area H: Student digital competence – Representative means by item and profile..... 20

Figure 11. Usefulness of CPD activities – Representative means and frequency of answers 22

Figure 12 Teachers’ confidence in using technology - Representative means and frequency of answers ... 24

Figure 13. Students’ use of digital technology - Representative means and frequency of answers..... 25

Figure 14. Overview of barriers for the use of digital technology 26

Figure 15. Factors that inhibit the use of digital technology 26

List of tables

Table 1. Participation in the study by ISCED level and type of school 9

Annexes

Annex 1. Contextualisation of the school report using the sample report(s)

To contextualise the SELFIE school report using the values from the study the procedure is as follows. First, contrast the values of the school (presented in the own school report), with those of the Spanish sample of the same level and/or ownership (presented in the sample report).

Here are the links to the Spanish reports:

- [ISCED 1](#)
- [ISCED 2](#)
- [ISCED 3](#)

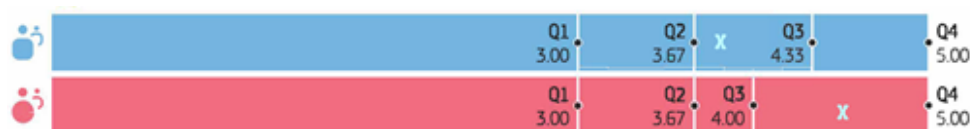
The data disaggregated by ownership are presented in Annexes A – public ownership – and B – private ownership, of the sample reports.

If the average value in the school report for an item (or area) of interest...

1. **... is greater than the higher value of the sample report confidence interval**, the school has a higher level of digital capacity in that item (or area) than the average for Spanish schools in the same education level and ownership.
2. **... is between the lower value and the higher value of the sample report confidence interval**, the school has the same level of digital capacity in that item (or area) as the average for Spanish schools in the same education level and ownership.
3. **... is less than the lower value of the sample report confidence interval**, the school has a lower level of digital capacity in that item (or area) than the average of Spanish schools in the same education level and ownership.

Another useful tool for contextualizing the results of a school report is the use of quartiles. The first page of the detailed description of each of the 8 digital capacity areas presents the values of the quartiles of the distribution of the area. Quartiles allow schools to estimate the relative position in the distribution compared to schools of similar characteristics. Broadly speaking, if the average value of the school in a given area...

1. **... is less than the value of the first quartile of the sample (<Q1)**, the school is among the 25% of Spanish schools with the lowest level of digital capacity in the corresponding area.
2. **... between the values of 1st and 2nd quartile of the sample (Q1-Q2)**, the school is above the 25% of the Spanish schools with the lowest level of digital capacity in the corresponding area, but below the 50% of schools with the highest level.
3. **... between the values of the 2nd and 3rd quartile of the sample (Q2-Q3)** the school is above the 50% of Spanish schools with the lowest level of digital capacity in the corresponding area, but below the 25% with the highest level.
4. **... is above the value of the 3rd quartile of the sample (>Q3)**, the school is located among the top 25% of the Spanish schools in terms of digital capacity in the corresponding area.



For example, in the graph above, if the management teams of the school have rated the area (on average) 3.75 points and the faculty with 4.5 points, the school would be:

- Between 2nd and 3rd quartile regarding school leaders opinion. That is, among the 50% of schools with best punctuation,
- Above 3er quartile with respect to teachers. That is, among the top 25% of schools with best punctuation in this area.

Annex 2. Lessons learned for similar studies

After the study, we are in a good position to think about lessons learnt from it. In this annex, we list a series of recommendations for repeating the study in other contexts.

A.2.1. Recommendations on the steps to be taken

a) Expression of interest on the part of the country/government.

b) Appointment of a national coordination team. The national coordination team is usually part of the Ministry of Education (in the case of Spain, it was composed by INTEF and INEE) and is the main contact point for the study.

c) Collaboration with the national coordination team.

To carry out the study, close collaboration between JRC and the national coordination team is required to:

- a. Define technical aspects of sampling and sample size:
 - i. Define the strata of interest for which representative data will be obtained (e.g. ISCED levels, public/private)
 - ii. Define the variance to use (based on previous studies) for calculating the sample size
- b. Agree on the contents to be included in the report presenting the results (prior to obtaining the results)
- c. Agree on the project calendar. A key point is to decide the adequate moment to carry out the data collection considering the school calendar.
- d. Obtain the sample framework (i.e. list of schools in the country with information of interest for sampling: number of students, teachers, region, and information on the strata of interest.). It is necessary to decide whether any existing sample framework from other studies can be reused and updated.
- e. Select the sample of schools and their substitutes. And provide the information related to them with an identification code.
- f. Develop official and effective communication that ensures the collaboration and participation of selected schools (and/or responsible regional governments).
- g. Calculate the weights to be used in the analysis to ensure the representativeness of the results. This can only be done once data collection is over.
- h. Collaboration and review of reports prepared by the JRC.
- i. Disseminate project results.

JRC, for its part, takes care of:

- j. Using the online SELFIE tool to collect data and monitor participation
- k. Data analysis
- l. Preparation of the report (reports) of results in English.

A.2.2. Data and results

JRC is responsible for collecting data on its servers. This ensures the anonymity of schools and individuals. Therefore, the data cannot be used by the authorities to evaluate schools.

The final product is a report (or several) with the aggregated results (averages, distributions, etc.). The report offers an overview of the schools' digital capacity in the country/region. The aggregated data presented is useful for policymakers and schools participating in SELFIE to contextualise their own results (see point 1.4).

Microdata are not shared with the national coordination team.

A.2.3 Calendar and resources

The study requires resources from the JRC and the national coordination team. There is a need for 12 person/month per year per institution. It is necessary to include personnel with advanced statistical knowledge on studies following similar statistical

procedures (such as PISA, PIRLS, TIMMS...), and staff for monitoring and perform data collection. The estimated duration of the exercise (from the first contact to having the publications with results) is estimated to be around 16 months.

A.2.4. Aspects to improve in the SELFIE tool in order to be useful for similar exercises

There are a number of elements of the SELFIE tool that have hindered the study presented here. In order to repeat the study, it is highly recommended to develop a specific SELFIE data collection system, differentiated from the standard use of SELFIE, that..

- Includes clear, sampling-specific instructions that cannot be confused with SELFIE general instructions. They should clarify who should answer as a teacher and who as a school leader. It is highly recommended to prevent the same individual from having to fill out 2 questionnaires.
- Standardise and automate the collection of information about students, teachers and managers within the schools.
 - Standardise and automate random selection of individuals within the schools.
 - Automate the (number of) responses tracking so that automated and/or individualised reminders to schools that do not progress in data collection can be easily implemented.
 - Include a system that ensures that only selected individuals within the school fill out the SELFIE questionnaires. We recommend an implementation of a double control systems that includes: a) the use of one-time links, and b) One password to access to the link that is shared only with the selected person.
 - Make data collection more flexible. Since the response of the selected individuals is key for the success of the study, it is recommended to include the possibility of extending the data collection beyond the date indicated in the exercise configuration and beyond the maximum of 3 weeks set by the tool. It is also recommended that if a school needs to extend the data collection over multiple SELFIE sessions, the system automatically joins the information for all sessions in the database.

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