Digitally Disengaged and Digitally Unconfident Children in Europe

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Introduction

A public debate has been raging since the 1970s (Tichenor et al., 1970) regarding digital transformations as well as the digital divides caused by them. Concerns have been raised about the consequences of the digital divide which can lead to new forms of social disadvantage and/or inequality (Wong et al., 2015; Datta et al., 2019; Goggin, 2019). The COVID-19 pandemic and the unprecedented worldwide health emergency associated with it acted as an accelerator leading to a paradigm shift and a series of digital transformations around the world.

Generally, the lack of access to ICT has been seen as a major cause of social exclusion—especially nowadays, when there are increased expectations of ICT being used in education. Factors that explain digital divides

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are linked to geography, gender, disability, age, and socio-economic status (Ayllón et al., 2023; Kuc-Czarnecka, 2020; Livingstone et al., 2005; Livingstone & Helsper 2007; Ragnedda & Muschert, 2019; Senkbeil et al., 2019). There is growing public concern that children, particularly those with fewer technological resources or unreliable Internet access, could fall behind in their educational development (Lai & Widmar, 2021; Cullinane & Montacute, 2020; Frenette et al., 2020; Lourenco & Tasimi, 2020; Ayllón et al., 2023). This body of research has been referred to in the literature as the 'first-level' digital divide.

Moving beyond access, and despite the high levels of Internet diffusion across countries (van Deursen et al., 2011), students of today are still not equally equipped for their technology-rich future: various kinds of digital divides persist in society and affect the young generation and their digital futures (Ivari et al., 2020; van Deursen & van Dijk, 2019). Hargittai (2002) considers such differences to be 'second-level' digital divides. In this respect, ICT interest and confidence both play an essential role in the acquisition of digital skills, which are, in turn, fundamental in terms of eradicating digital inequalities (Areepattamannil & Santos, 2019; Hu et al., 2018). New measures to prevent a widening of the digital gap are therefore crucial in alleviating the significant existing differences in digital competence and knowledge of ICT and in preventing further marginalisation.

Drawing on data from the Programme for International Student Assessment (PISA) from 2015 and 2018, this chapter provides evidence-based insights that seek to explain some aspects of digital skills polarisation and existing differences in terms of both interest in ICT and confidence in using it among school-aged children in Europe. It is important to stress here that analysing data for these years can provide valuable information into the impact of the COVID-19 pandemic on children and a historical perspective for the post-pandemic era, assisting us in understanding the challenges that children face in the digital world. Data from 2018 can be used for baseline comparisons to help us understand the extent of the shift in children's online behaviour and digital habits. The data can reveal existing disparities in children's access to ICT and how the pandemic exacerbated them. This information can provide

valuable knowledge about children that were disproportionately negatively impacted by the pandemic and how to help them in the future.

The next section introduces the data and the methodology used, as well as our definition of digital disengagement and lack of digital confidence. Section "Results" shows our main results. Finally, section "Conclusions" summarises our main findings, proposes some policy recommendations, and discusses avenues for future research.

Data and Methodology

We use data from the 2015 and 2018 waves of the OECD's PISA survey, which is designed to measure 15-year-old students' ability to use their reading, mathematics, and science knowledge and skills to meet real-life challenges.[1] In particular, we use the 2018 ICT familiarity questionnaire, which asks children about digital media and devices and students' attitudes towards them. We only consider children who have access to a desktop computer, portable laptop (or notebook), or tablet (e.g., iPad, BlackBerry, PlayBook) with an Internet connection, or to a smartphone (with Internet access) either at home or at school.[2] Table 2 in the Appendix shows the total number of observations by country.

We measure students' interest in ICT using their answers to the following six questions: (1) 'I forget about time when I'm using digital devices'; (2) 'The Internet is a great resource for obtaining information I am interested in (e.g., news, sports, dictionary)'; (3) 'It is very useful to have social networks on the Internet; (4) 'I am really excited discovering new digital devices or applications'; (5) 'I really feel bad if no Internet connection is possible'; and (6) 'I like using digital devices'. All the questions have four possible answers—'strongly disagree', 'disagree', 'agree', and 'strongly agree'—which we grade from 1 to 4. From the six questions and the four possible answers, we proxy each student's interest in ICT

[1] The data from PISA is freely available on the OECD website (http://www.oecd.org/pisa/data/).

[2] Note the impossibility for children to be interested in or confident about using technological devices when they do not even have access to them (Ayllón et al., 2023). Data regarding digital access is not provided for Germany; however, as the percentage of digital deprivation is low there, we include it anyway in the analysis (Ayllón et al., 2023).

using a Likert-type scale to total up the values of the defining items. We classify a child as 'digitally disengaged' if he or she has a score of 12 points or below. Such a score means that the children have mostly responded that they 'strongly disagree' or 'disagree' on all six questions.

We measure students' confidence in ICT in a similar fashion, using their responses to the following group of questions: (1) 'I feel comfortable using digital devices that I am less familiar with'; (2) 'If my friends and relatives want to buy new digital devices or applications, I can give them advice'; (3) 'I feel comfortable using my digital devices at home'; (4) 'When I come across problems with digital devices, I think I can solve them'; (5) 'If my friends and relatives have a problem with digital devices, I can help them'. Again, answers range from complete disagreement to total agreement; we coded these as explained above and similarly computed a Likert scale. We classify a child as 'digitally unconfident' if he/she has a score of 10 points or below.[3]

A significant psychometric property of attitude measurement is reliability. By definition, such measurement is reliable if it is constant over time, provided the repeated measurements are conducted under consistent conditions and there has been no definite change in attitude. To assess reliability, Cronbach's alpha reliability coefficients for the overall scale are calculated (Fabrigar et al., 1999). According to Nunnally and Bernstein (1994) and Revelle and Zinbarg (2009), a scale or subscale is reliable if Cronbach's alpha coefficients are at least 0.70. The reliability analysis performed on the data does not indicate the need to exclude any questions, since Cronbach's alpha reliability coefficients for the overall scale are greater than 0.70 for the whole of Europe and for each country, for both the ICT interest measure and the ICT confidence measure—being 0.91 for the former and 0.93 for the latter. See further details by country in Table 2 in the Appendix.

Table 1 shows the summary statistics of our sample. About 49.4% of the students were girls; 13.8% were of immigrant origin; and 10.1% reported having parents with a low level of education. As for a low level

[3] Note that some children did not answer all the questions considered in both indexes. However, for each student, if there is only one question missing, we impute such missing information using the mean value of the answers for the other questions in the same index. Children with two or more unanswered questions in each index are not considered.

Table 1 Summary statistics, Europe, 2018

Variable	Mean	Std. Dev.	Min.	Max.
Female	0.494	0.500	0	1
Age	15.08	0.290	15.08	16.33
Immigrant origin	0.138	0.345	0	1
Low-educated parents	0.101	0.302	0	1
Low level of family wealth	0.162	0.368	0	1
Low level of home possessions	0.173	0.378	0	1
Repeating a school year	0.126	0.332	0	1
Being bullied	0.105	0.306	0	1
No sense of belonging at school	0.041	0.198	0	1

Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Results are weighted

Source: Authors' computation, using data from PISA, 2018

of family wealth and a low level of home possessions, 16.2% and 17.3%, respectively, of the children reported being in those situations. Moreover, 12.6% of the children were repeating a course. Finally, 10.5% of students had been bullied and 4.1% had no sense of belonging at school. See the exact definition of each variable in Table 3 in the Appendix.

Results

The main results indicate that, at the European level, the ICT interest score is 17.9 on average. In addition, Fig. 1 presents the scores by country. The choropleth map shows two country clusters, displaying a certain West-East divide. On the one hand, in Southern, Western, and Northern Europe, the ICT interest scores are high: for example, in Spain, France, and Sweden, the figures are 18.3, 18.7, and 18.3, respectively. On the other hand, in Eastern Europe, the ICT interest scores are as low as 16.3 in Albania and Bulgaria.

Furthermore, Fig. 2 shows the percentages of digitally disengaged children in Europe—which naturally is a mirror image of Fig. 1: where the ICT interest score is high, the percentage of digitally disengaged children is low, and vice versa. In Europe as a whole, 5.7% of children are digitally disengaged. However, the figures differ considerably for individual

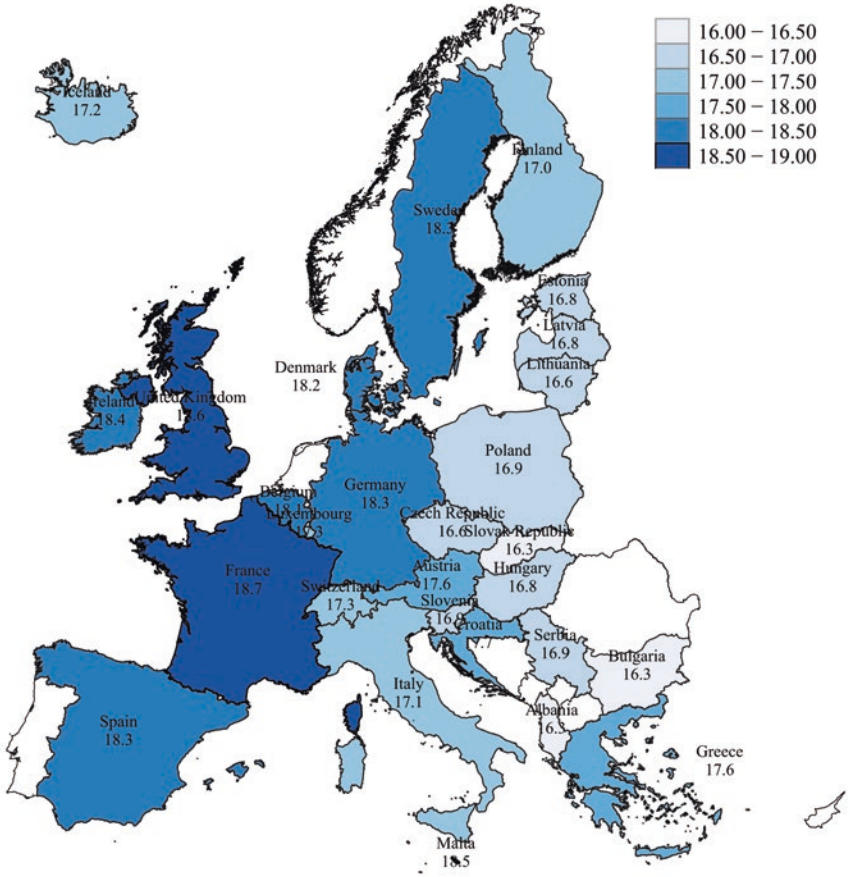


Fig. 1 ICT interest scores among 15-year-old children, Europe, 2018. Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Results are weighted. Source: Authors' computation using data from PISA, 2018

countries: whereas in Belgium (3.5%), France (4.8%), Germany (3.9%), and Spain (5.2%) the percentages of digitally disengaged children are low, in Eastern Europe digital disengagement is relatively high, with 17.3% in Bulgaria and 15.2% in Albania.

As for children's confidence in using ICT, Fig. 3 shows the ICT confidence scores by country (the European average is 14.9). In the

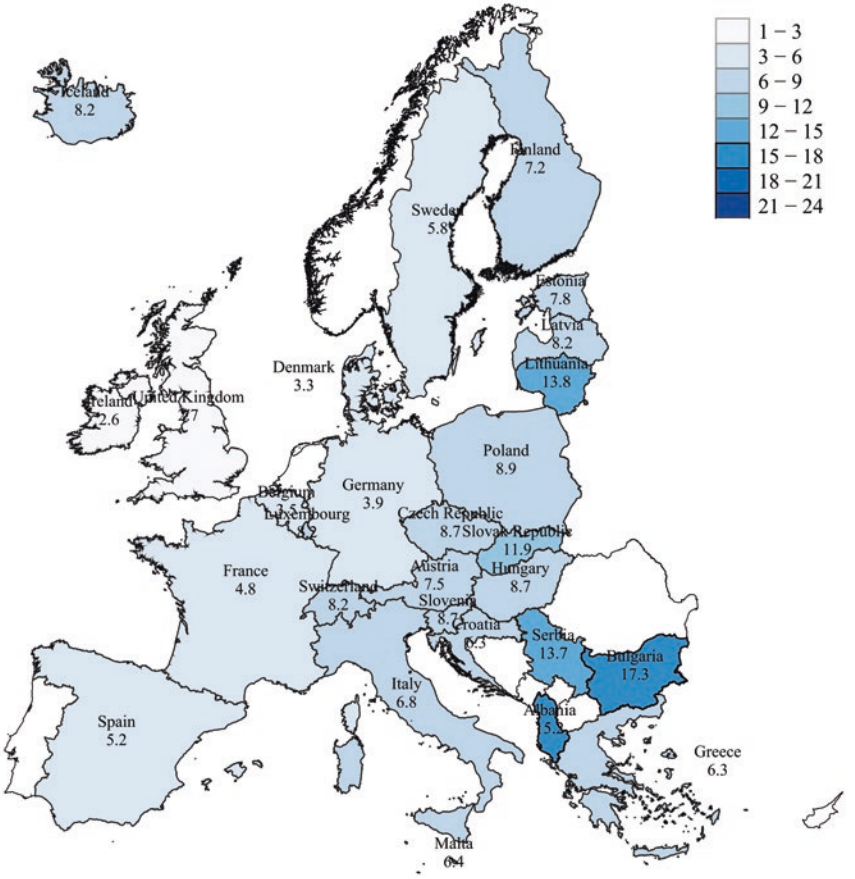


Fig. 2 Percentages of digitally disengaged children, Europe, 2018. Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Results are weighted. Source: Authors' computation using data from PISA, 2018

Mediterranean and Eastern Europe, ICT confidence is low: for example, in Italy, Bulgaria, and Albania, the ICT confidence scores are 14.5, 13.9, and 13.9. Meanwhile, in Northern and Anglophone Europe, the scores are relatively high: 15.4 in Sweden and 15.6 in the United Kingdom.

In Fig. 4, we display the percentages of digitally unconfident children by country (at the European level, 8% of children are digitally

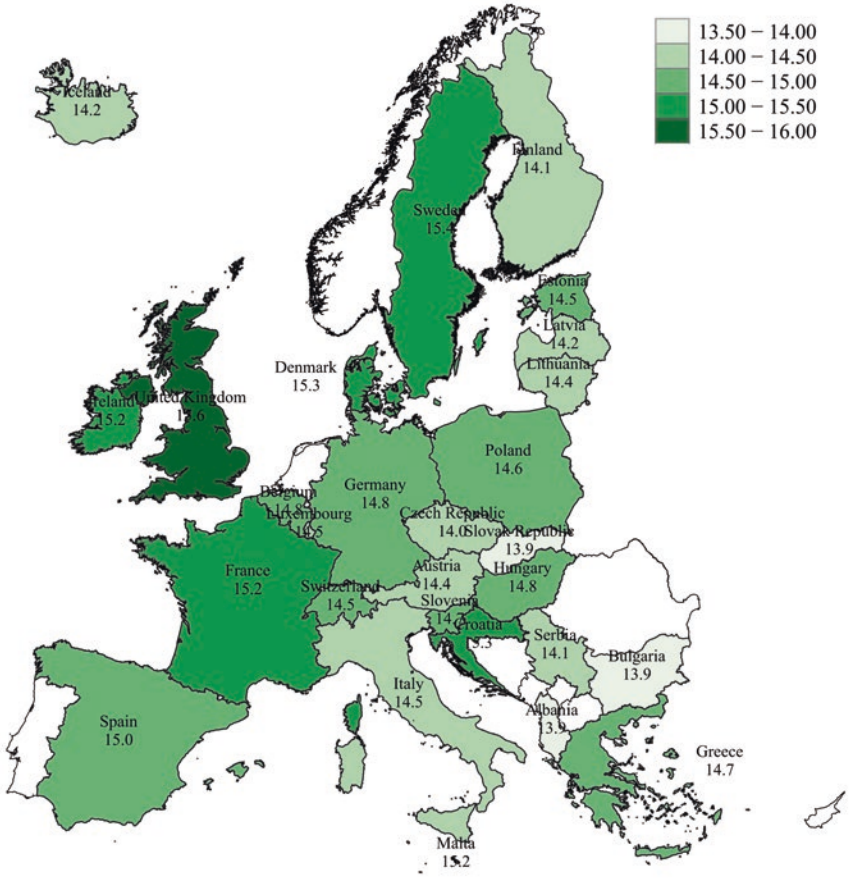


Fig. 3 ICT confidence scores among 15-year-old children, Europe, 2018. Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Results are weighted. Source: Authors' computation using data from PISA, 2018

unconfident). As with the ICT confidence scores, again a certain West-East divide is to be seen. In Bulgaria, 16.8% of children said they did not feel comfortable using digital devices. It is the same story in Albania, where 14% of children are digitally unconfident. This phenomenon is to be found across much of Eastern Europe, whereas in Continental and Northern Europe—with the exceptions of Finland (11.1%), Austria

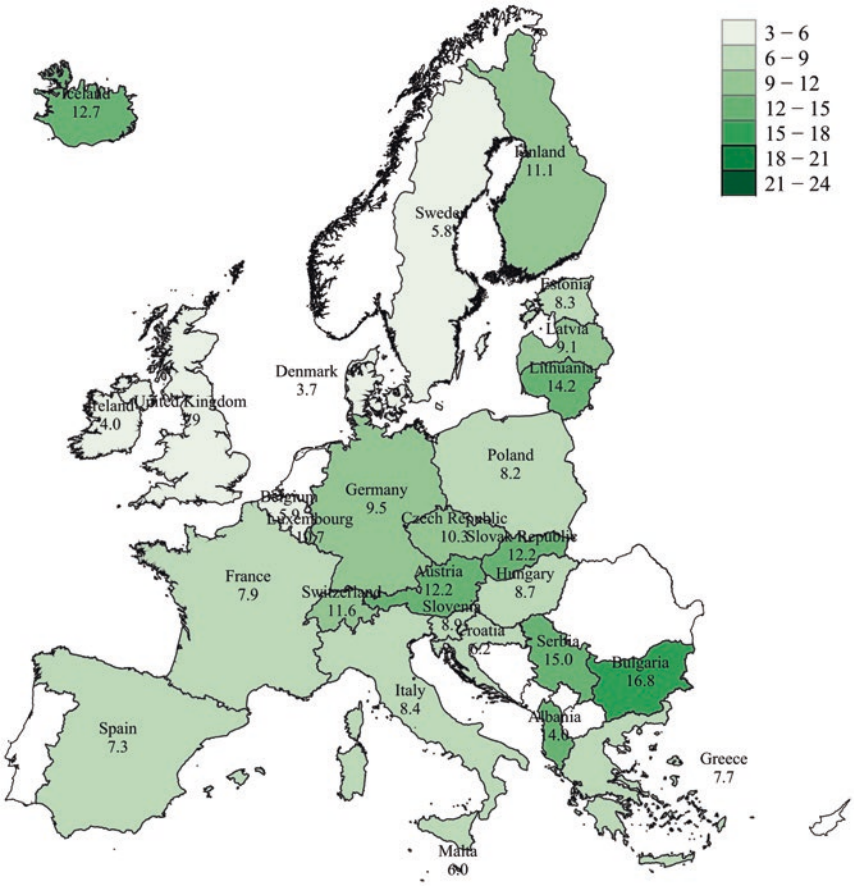


Fig. 4 Percentages of digitally unconfident children, Europe, 2018. Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Results are weighted. Source: Authors' computation using data from PISA, 2018

(12.2%), and Iceland (12.7%)—the percentages of digitally unconfident children are relatively low.

Next, we want to analyse changes in the percentage of digitally disengaged children and those who lack digital confidence across European countries over time. For this exercise, we draw on PISA 2015 and calculate the percentages of digitally disengaged and unconfident children, as

in Figs. 2 and 4. This trend analysis shows that, while some countries have moved towards increased levels of digital engagement and confidence, in others the situation has deteriorated, so that there are higher numbers of children who lack interest and confidence in the digital world.

Figure 5 shows the percentages of digitally disengaged children in 2015 and 2018. Countries that already had low percentages in 2015 generally maintained this level in 2018. However, a slight increase can be found in, for example, Estonia, Greece, Spain, Finland, and where the figures for digitally disengaged children increased by between 1 and 2 percentage points. In Poland, Slovenia Iceland, and the Slovak Republic, the figures increased by between 2 and 3 percentage points. Bulgaria, with an increase of 6 percentage points, stands out as the country where

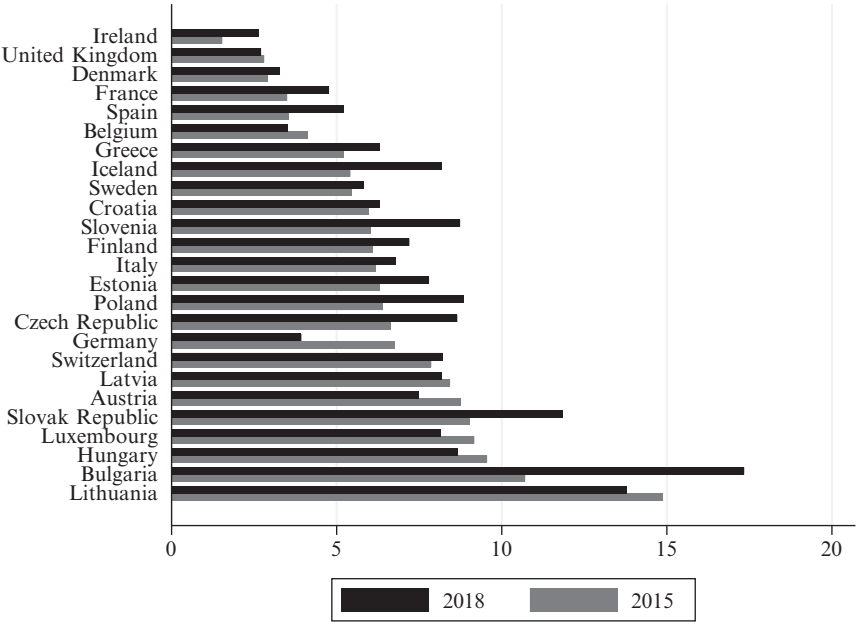


Fig. 5 Percentages of digitally disengaged children, Europe, 2015–2018. Note: Data for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania is not available for 2018. Data for Albania, Malta, and Serbia is not available for 2015. Results are weighted. Source: Authors' computation using data from PISA, 2015 and 2018

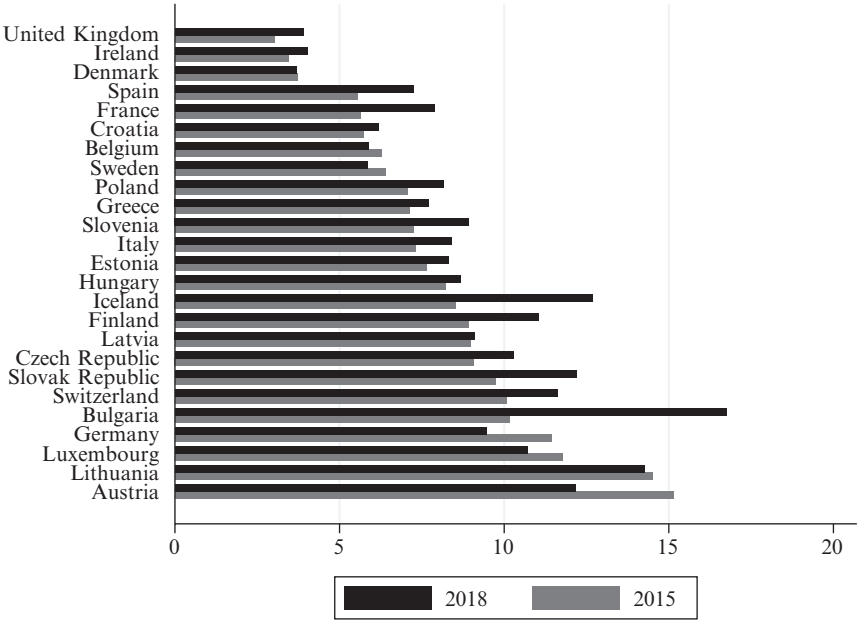


Fig. 6 Percentages of digitally unconfident children, Europe, 2015–2018. Note: Data for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania is not available for 2018. Data for Albania, Malta, and Serbia is not available for 2015. Results are weighted. Source: Authors' computation using data from PISA, 2015–2018

the number of digitally disengaged children increased the most. By contrast, in Austria, Belgium, and Luxembourg, the percentages dropped. Finally, Germany managed to reduce its digital disengagement by 2.8 percentage points.[4]

Similarly, Fig. 6 displays the percentages of digitally unconfident children in 2015 and 2018. We see a decrease in their number in Austria, Germany, and Luxembourg. Again, Bulgaria is the country where the number of digitally unconfident children increased the most, by about 6.6 percentage points. Iceland, too, saw an important increase of 4.1 percentage points.

[4] All differences reported in the text are statistically significant.

Now that we know where digitally disengaged and unconfident children live and how the phenomenon has evolved, we can try to find out which socio-economic and demographic characteristics define a digitally disengaged and digitally unconfident child. With that in mind, we run a series of logistic regressions, in which we consider seven vulnerable groups: (i) children of immigrant origin; (ii) those who cohabit with low-educated parents; (iii) those whose families have a low level of wealth; (iv) those whose families have a low level of home possessions; (v) those who need to repeat a year; (vi) those who have been bullied; and (vii) those who do not feel a sense of belonging at their school. As for ICT interest, our dependent variable takes the value 1 if the child is digitally disengaged and 0 otherwise. In the case of ICT confidence, again our dependent variable takes the value 1 if the child is digitally unconfident and 0 otherwise. Control variables include gender and the child's age.[5] We also use country-fixed effects (to control for time-invariant country characteristics). Standard errors are robust and clustered at the country level and the results are weighted.

As shown in Fig. 7 and in Table 4 in the Appendix, at the European level one characteristic stands out as being very closely linked to children's lack of interest in ICT: having to repeat a school year. On average across Europe, that increases the risk of suffering ICT disengagement by a factor of 1.7. Also, being bullied and having a low level of home possessions multiply the risk of digital disengagement by a factor of 1.7 and 1.4, respectively. A lack of sense of belonging at the school they attend is positively associated with digital disengagement: it increases the risk of suffering such problems by a factor of 1.4. The same is true for having low-educated parents: that multiplies the risk by a factor of 1.2. As for immigrant origin and level of wealth, we find that neither of those variables is statistically significant; meanwhile, being a girl and being older reduces the likelihood of being digitally disengaged.[6]

[5] Even though PISA only interviews 15-year-old children, the database contains concrete data about the age in years and months of each individual. See Table 1 for summary statistics.

[6] Figures 11 and 12 in the Appendix show the results of the regressions on lack of interest and lack of confidence, using all the variables that define our indicators (e.g., being bullied and having no sense of belonging at school).

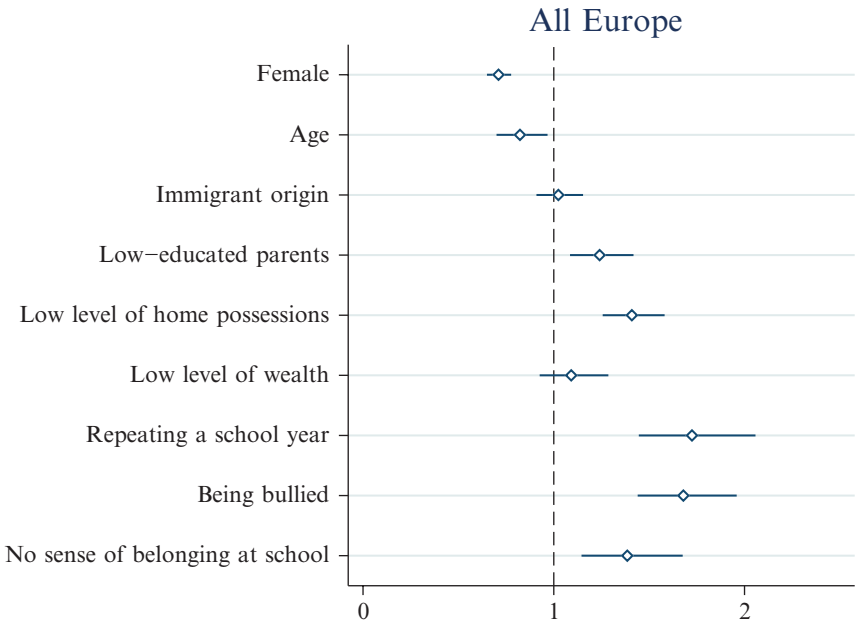


Fig. 7 Probability of being digitally disengaged, by socio-economic, demographic, and subjective characteristics, Europe, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

The same analysis is performed by country cluster (see Fig. 8 and Table 4 in the Appendix).[7] We find that most of the risk factors considered are positively linked to digital disengagement. However, the relevance of the associations varies by country cluster, and, in general, such associations are weak, preventing us from reaching any very strong conclusions at the country-cluster level. In all country groups, the characteristics most associated with digital disengagement are the repetition of a

[7] We consider six country clusters: Northern Europe (Finland, Iceland, and Sweden), Southern Europe (Greece, Italy, Malta, and Spain), Eastern Europe (Albania, Bulgaria, Croatia, Hungary, Poland, Serbia, and the Slovak Republic), Continental Europe (Austria, Belgium, the Czech Republic, Denmark, France, Germany, Luxembourg, Slovenia, and Switzerland), the Anglophone countries (the United Kingdom and Ireland) and the Baltic area (Estonia, Latvia, and Lithuania).

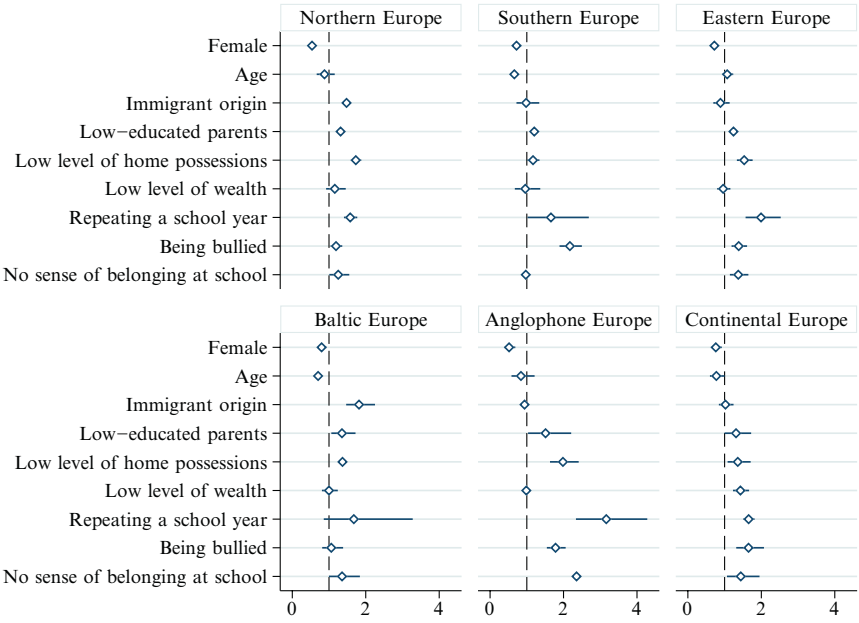


Fig. 8 Probability of being digitally disengaged, by socio-economic, demographic, and subjective characteristics, European country clusters, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

school year and a low level of home possessions. In Northern Europe, having to repeat a year and having fewer family possessions increase the risk of being digitally disengaged by factors of 1.6 and 1.7, respectively, while in Anglophone Europe the figures are 3.2 and 2.0. No sense of belonging at school is also positively related to digital disengagement—except in Southern Europe, where the relationship is not statistically significant. The coefficient for low-educated parents is statistically significant and positively related to digital disengagement, as is being bullied, which increases the probability of being digitally disengaged in all contexts—except in Baltic Europe. As for immigrant origin, in Northern and Baltic Europe, the probability of being digitally disengaged increases with this



Fig. 9 Probability of being digitally unconfident, by socio-economic, demographic, and subjective characteristics, Europe, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

characteristic, whereas in Anglophone Europe it decreases. Family wealth is not statistically significant in most country clusters.

As for children's ICT confidence, Fig. 9 shows that, again, having to repeat a year and having a small number of home possessions are the factors most linked to the phenomenon: these increase the risk of being digitally unconfident by a factor of 1.5 and 1.4, respectively. Also, the subjective feelings of not belonging at school and of being bullied, and having a low level of wealth all increase the probability of a lack of digital confidence—by a risk factor of 1.8, 1.5, and 1.2, respectively. As for poorly educated parents, we find no statistically significant relationship. Immigrant origin and age again reduce the likelihood of being digitally unconfident, while being a girl increases it.

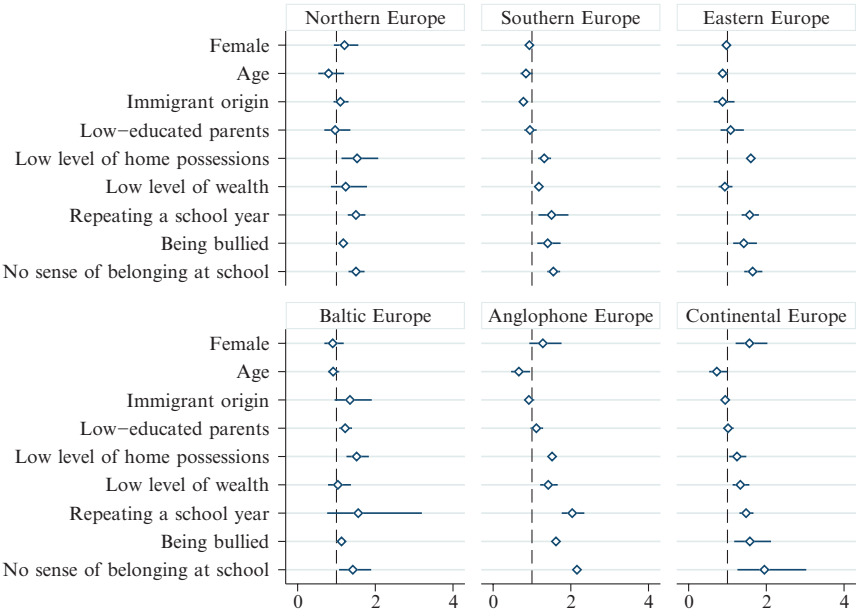


Fig. 10 Probability of being digitally unconfident, by socio-economic, demographic, and subjective characteristics, European country clusters, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

Finally, we move to the results by country cluster (see Fig. 10 and Table 5 in the Appendix). With very few exceptions, we find that most of the risk factors considered are positively linked to a lack of digital confidence. Again, having to repeat a year (with a risk factor ranging from 1.5 in Northern Europe to 2.0 in Anglophone Europe), a below-average number of home possessions (ranging from 1.2 in Continental Europe to 1.6 in Eastern Europe), and little sense of belonging at school (ranging from 1.4 in Baltic Europe to 2.1 in Anglophone Europe) are the strongest factors associated with lack of digital confidence. Baltic Europe is the only context in which having to repeat a year is not linked to ICT confidence. As for being bullied, the results are similar: that increases the probability of being digitally unconfident in all contexts. Low-educated

parents and immigrant origin are not statistically significant in most clusters—except in Southern Europe, where those factors reduce the likelihood of being digitally unconfident. As for gender, in most countries being a girl increases the probability of lack of digital confidence. Finally, age reduces the probability in all the country clusters considered.

Conclusions

This chapter provides a detailed account of the number of digitally disengaged and digitally unconfident children in Europe. We use data from PISA from 2015 and 2018. Our indices capture students' subjective opinions on both ICT interest and confidence, answering questions such as 'I like using digital devices' for ICT interest and 'I feel comfortable using my digital devices at home' for ICT confidence. Students had four possible answers, ranging from 'strongly disagree' to 'strongly agree', and based on these responses we define whether or not a child lacks digital interest and confidence.

Following our classification exercise for lack of digital interest and lack of digital confidence, we find that approximately 5.7% of 15-year-olds in Europe are digitally disengaged and 8% are unconfident about their ICT usage. However, across the countries of Europe, the figures vary in ways similar to the findings of Ayllón et al. (2023) regarding digital deprivation. For example, in Ireland, only 2.6% of children are digitally disengaged and 4% show no confidence, whereas in Bulgaria the figures are 17.3% and 16.8%. Despite the disparities between country clusters in terms of children's socio-economic characteristics linked to ICT interest and confidence, we find that having to repeat a year and below-average home possessions (i.e., material deprivation) are the main determinants of digital disengagement and lack of confidence.

According to the Digital Education Action Plan 2021–2027 (action 11) a key policy aspect is the collection of cross-national data on students' digital skills. In this direction, the results of this study reveal existing disparities amongst European countries concerning children's interest and confidence towards ICT, disparities that should be addressed to provide

support to children who were also disproportionately impacted by the pandemic. Relevant strategic goals address the need for *quality education* and *reduced inequalities*, to ensure that everyone has the opportunity to participate in the digital world and reap its benefits. Closing the digital gap is imperative as it has the potential to perpetuate and worsen existing social and economic inequalities. Efforts should be made to ensure that all children and young people, regardless of their background, can have access to and develop the skills necessary to effectively use digital technologies and respective tools. Policy initiatives should enhance children's digital skills, which are now an essential pillar of the educational system. If we are to ensure equal opportunities in education, we need to address the digital divide not only in terms of access but also in terms of skills. Knowing who the digitally disengaged and unconfident children in Europe are, and identifying what socio-economic characteristics they share, it is crucial to design effective policies that address digital inclusion. Current and future political efforts should be made in this direction.

Finally, some limitations of our analysis should be noted. First, the unavailability of data regarding both computer and Internet access in some countries prevented us from analysing all the European countries. Second, our analysis by risk factors was restricted to the socio-economic variables contained in the PISA database, which prevented us from taking account of all possible dimensions of vulnerability.

Appendix

Table 2 Number of observations and Cronbach's alpha coefficients per country

Country	*N*	Cronbach's alpha coefficients. ICT interest measure	Cronbach's alpha coefficients. ICT confidence measure
Albania	6108	0.940	0.941
Austria	6442	0.894	0.922
Belgium	7655	0.895	0.922
Bulgaria	4625	0.942	0.944
Croatia	6461	0.926	0.952
Czech Republic	6643	0.894	0.929
Denmark	6797	0.883	0.924
Estonia	5057	0.905	0.933
Finland	5307	0.911	0.934
France	5996	0.925	0.939
Germany	5451	0.878	0.926
Greece	6119	0.904	0.922
Hungary	5054	0.896	0.944
Iceland	3079	0.927	0.943
Ireland	5510	0.899	0.927
Italy	10,953	0.894	0.919
Latvia	4873	0.906	0.923
Lithuania	6571	0.916	0.944
Luxembourg	5053	0.906	0.928
Malta	3085	0.934	0.938
Poland	5436	0.903	0.936
Serbia	5812	0.943	0.952
Slovak Republic	5566	0.913	0.931
Slovenia	6023	0.925	0.948
Spain	32,947	0.910	0.928
Sweden	5114	0.916	0.940
Switzerland	5565	0.893	0.930
United Kingdom	7668	0.905	0.938
Total	190,970	0.913	0.934

Note: We only consider children who have access to a desktop computer, portable laptop (or notebook), or tablet (e.g., iPad, BlackBerry, PlayBook) with an Internet connection, or to a smartphone (with Internet access)

Source: Authors' computation, using data from PISA, 2018

Table 3 Description of the variables

Variable	Description
Female	Takes the value 1 if the respondent is a girl and 0 otherwise.
Age	Age of the child.
Immigrant origin	Takes the value 1 if the parents of the respondent are immigrants and 0 otherwise.
Low-educated parents	Takes the value 1 if the parents of the respondent have a low level of education (ISCED Level=0, 1, 2) and 0 otherwise.
Repeating a year	Takes the value 1 if the student is repeating a year and 0 otherwise.
Low level of family wealth	Takes the value 1 if the student has a low level of wealth and 0 otherwise. We consider a child to have a low level of wealth if s/he has less or equal to -0.75 in the weighted likelihood estimates (WLEs) scores for family wealth. These scores are calculated as a combination of the questions: 'Which of the following are in your home: a room of your own, a link to the Internet, country-specific wealth item 1, country-specific wealth item 2, country-specific wealth item 3'; 'How many of these are there at your home: televisions, cars, rooms with a bath or shower, cell phones with Internet access (e.g., smartphones), computers (desktop computer, portable laptop or notebook), tablet computers (e.g., iPad®, BlackBerry®, PlayBook™), E-book readers (e.g., Kindle™, Kobo, Bookeen)', which are normalised to have an average of 0 and a standard deviation of 1 across countries. Positive values in this index mean that the student reported more family wealth than the average student, and negative values mean the opposite.

Low level of home possessions	Takes the value 1 if the student has a low level of home possessions and 0 otherwise. We consider a child to have a low level of home possessions if s/he has less or equal to -0.75 in the weighted likelihood estimates (WLEs) scores for home possessions. These scores are calculated as a combination of the questions: 'Which of the following are in your home: a desk to study at, a room of your own, a quiet place to study, a computer you can use for school work, educational software, a link to the Internet, classic literature (e.g., Shakespeare), books of poetry, works of art (e.g., paintings), books to help with your school work, technical reference books, a dictionary, books on art, music, or design, country-specific wealth item 1, country-specific wealth item 2, country-specific wealth item 3'; How many of these are there at your home: televisions, cars, rooms with a bath or shower, cell phones with Internet access (e.g., smartphones), computers (desktop computer, portable laptop or notebook), tablet computers (e.g., iPad®, BlackBerry®, PlayBook™), E-book readers (e.g., Kindle™, Kobo, Bookeen, musical instruments (e.g., guitar, piano)'; 'How many books are there in your home? 0–10 books, 11–25 books, 26–100 books, 101–200 books, 201–500 books, more than 500 books', which are normalised to have an average of 0 and a standard deviation of 1 across countries. Positive values in this index mean that the student reported more home possessions than the average student, and negative values mean the opposite.
Being bullied	Takes the value 1 if the student has been bullied and 0 otherwise. We define this using the responses to the statements: (1) 'Other students left me out of things on purpose'; (2) 'Other students made fun of me'; (3) 'I was threatened by other students'; (4) 'Other students took away or destroyed things that belonged to me'; (5) 'I got hit or pushed around by other students'; and (6) 'Other students spread nasty rumours about me'. Answers go from 'never' or 'almost never' to 'once a week or more', which we code from 1 to 4. Then, for each child, we define a Likert-type scale to total the respective values of the defining items. We consider children with more than 12 points to have been bullied.

(*continued*)

Table 3 (continued)

Variable	Description
No sense of belonging at school	Takes the value 1 if the student expressed no sense of belonging at school and 0 otherwise. We define this using the responses to the statements: (1) 'I feel like an outsider (or left out of things) at school'; (2) 'I make friends easily at school'; (3) 'I feel like I belong at school'; (4) 'I feel awkward and out of place in my school'; (5) 'Other students seem to like me'; and (6) 'I feel lonely at school'. Answers go from 'strongly agree' to 'strongly disagree', which we code from 1 to 4. Because they are positive, statements (2) and (5) elicit responses that run in the opposite direction. To resolve this, we rotate the responses, so that statements (2) and (5) effectively become 'I do not make friends easily at school' and 'Other students do not seem to like me'. Then, for each child, we define a Likert-type scale to total the respective values of the defining items. We consider children with fewer than 12 points to have no sense of belonging at school.

Table 4 Logistic regressions (odds-ratios) for the probability of being digitally disengaged at the European level and by country cluster

Variables	All Europe	Northern Europe	Southern Europe	Eastern Europe	Baltic Europe	Anglophone Europe	Continental Europe
Female	0.7102***	0.5379***	0.7201***	0.7216***	0.7988***	0.5179***	0.7608***
	(0.0323)	(0.0120)	(0.0602)	(0.0365)	(0.0627)	(0.0750)	(0.0751)
Age	0.8227**	0.8765	0.6604***	1.0707	0.7031***	0.8411	0.7753*
	(0.0679)	(0.1236)	(0.0438)	(0.0782)	(0.0417)	(0.1568)	(0.1010)
Immigrant origin	1.0241	1.4776***	0.9815	0.8876	1.8178***	0.9390	1.0240
	(0.0622)	(0.0513)	(0.1558)	(0.1122)	(0.1987)	(0.0523)	(0.1013)
Low-educated parents	1.2404***	1.3156***	1.2038***	1.2419***	1.3531**	1.5109**	1.3117*
	(0.0847)	(0.0552)	(0.0445)	(0.0462)	(0.1663)	(0.2925)	(0.1824)
Low level of home possessions	1.4094***	1.7302***	1.1696**	1.5337***	1.3671***	1.9839***	1.3592***
	(0.0826)	(0.0722)	(0.0829)	(0.1090)	(0.0498)	(0.1981)	(0.1589)
Low level of family wealth	1.0914	1.1578	0.9592	0.9612	1.0002	0.9873	1.4311***
	(0.0914)	(0.1349)	(0.1730)	(0.0912)	(0.1092)	(0.0537)	(0.1112)
Repeating a school year	1.7246***	1.5777***	1.6575**	1.9927***	1.6762	3.1637***	1.6546***
	(0.1553)	(0.0921)	(0.4088)	(0.2418)	(0.5740)	(0.4879)	(0.0781)
Being bullied	1.6793***	1.1906**	2.1733***	1.3844***	1.0618	1.7831***	1.6516***
	(0.1319)	(0.0809)	(0.1547)	(0.1074)	(0.1437)	(0.1300)	(0.1909)
No sense of belonging at school	1.3855***	1.2511**	0.9728	1.3728***	1.3552*	2.3543***	1.4412**
	(0.1345)	(0.1375)	(0.0495)	(0.1278)	(0.2116)	(0.0083)	(0.2226)
Observations	139,278	10,497	36,663	29,809	13,311	9814	39,184
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Standard errors are in parentheses. ***, **, and * represent statistical significance at 1%, 5%, and 10%. Results are weighted and clustered at the country level

Source: Authors' computation, using data from PISA, 2018

Table 5 Logistic regressions (odds-ratios) for the probability of being digitally unconfident at the European level and by country cluster

Variables	All Europe	Northern Europe	Southern Europe	Eastern Europe	Baltic Europe	Anglophone Europe	Continental Europe
Female	1.2085**	1.2071	0.9340*	0.9730	0.9041	1.2804	1.5660***
	(0.1095)	(0.1590)	(0.0385)	(0.0517)	(0.1254)	(0.2078)	(0.2063)
Age	0.7852***	0.7982	0.8454*	0.8751***	0.9148	0.6634**	0.7255**
	(0.0594)	(0.1646)	(0.0783)	(0.0257)	(0.0736)	(0.1218)	(0.1170)
Immigrant origin	0.9052**	1.1012	0.7795***	0.8741	1.3480*	0.9204	0.9418
	(0.0417)	(0.0977)	(0.0346)	(0.1343)	(0.2389)	(0.0655)	(0.0528)
Low-educated parents	1.0046	0.9662	0.9481	1.0811	1.2245***	1.1126	1.0152
	(0.0535)	(0.1678)	(0.0805)	(0.1509)	(0.0836)	(0.0825)	(0.0689)
Low level of home possessions	1.3737***	1.5313***	1.3156***	1.6011***	1.5192***	1.5180***	1.2449**
	(0.0636)	(0.2375)	(0.0842)	(0.0550)	(0.1460)	(0.0377)	(0.1117)
Low level of family wealth	1.1658**	1.2379	1.1784***	0.9329	1.0367	1.4190***	1.3304***
	(0.0701)	(0.2315)	(0.0468)	(0.0905)	(0.1480)	(0.1147)	(0.1093)
Repeating a school year	1.4969***	1.5015***	1.5044***	1.5714***	1.5604	2.0361***	1.4782***
	(0.0748)	(0.1153)	(0.1947)	(0.1130)	(0.5714)	(0.1478)	(0.0917)
Being bullied	1.5009***	1.1761***	1.4052***	1.4196***	1.1306***	1.6181***	1.5768***
	(0.0997)	(0.0155)	(0.1515)	(0.1546)	(0.0099)	(0.0038)	(0.2382)
No sense of belonging at school	1.7740***	1.5026***	1.5506***	1.6479***	1.4218**	2.1585***	1.9506***
	(0.1580)	(0.1050)	(0.0842)	(0.1184)	(0.2080)	(0.0155)	(0.4376)
Observations	138,231	10,412	36,228	29,733	13,282	9725	38,851
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Data is not available for Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Montenegro, the Netherlands, Norway, Portugal, and Romania. Standard errors are in parentheses. ***, **, and * represent statistical significance at 1%, 5%, and 10%. Results are weighted and clustered at the country level

Source: Authors' computation, using data from PISA, 2018

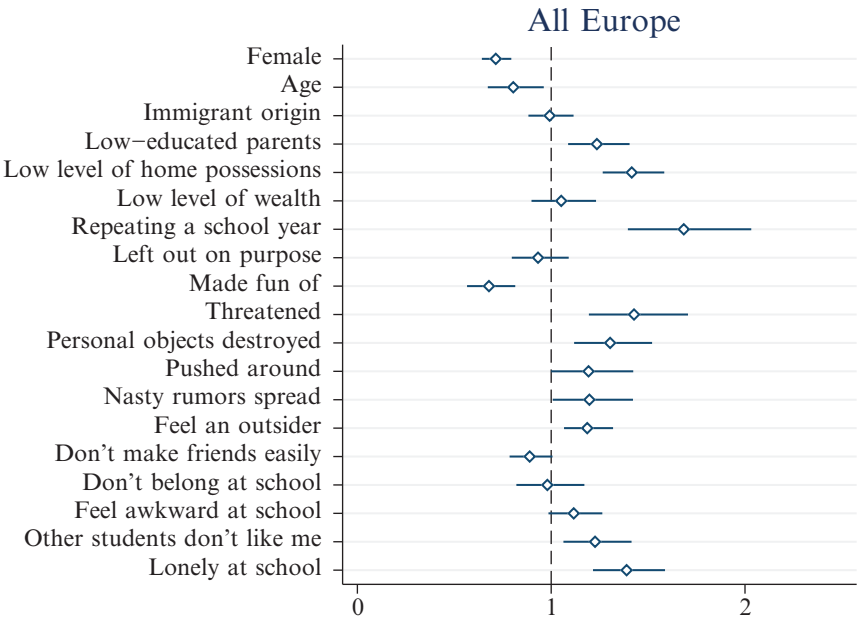


Fig. 11 Probability of being digitally disengaged, by socio-economic, demographic, and subjective characteristics (disaggregated), Europe, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

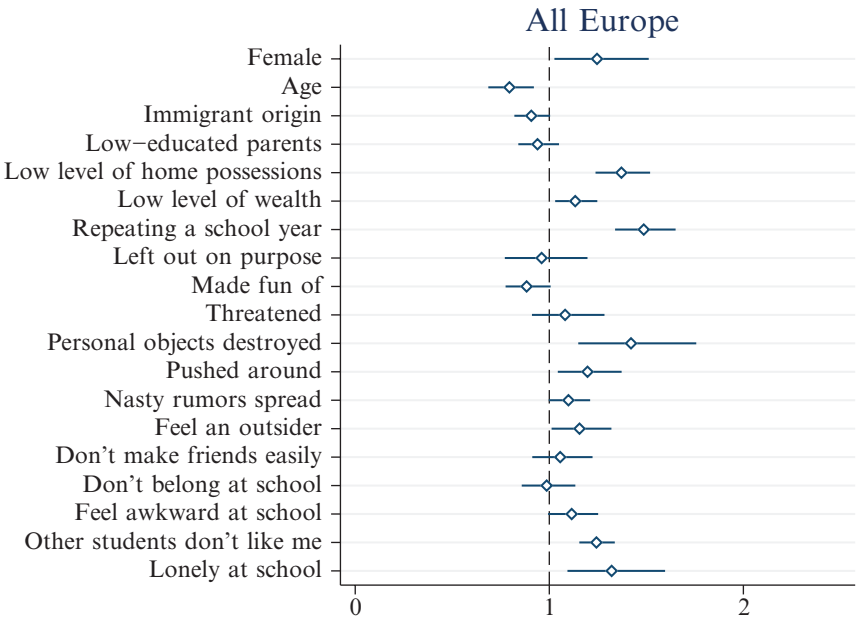


Fig. 12 Probability of being digitally unconfident, by socio-economic, demographic, and subjective characteristics (disaggregated), Europe, 2018. Note: Data is not available for Albania, Bosnia and Herzegovina, Cyprus, Kosovo, Macedonia, Malta, Montenegro, the Netherlands, Norway, Portugal, Romania, and Serbia. The horizontal line indicates confidence intervals at 95%. Results are weighted. Source: Authors' computation using data from PISA, 2018

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