The Digital Divide: The Role of Socioeconomic Status across Countries

Plamen Mirazchiyski

Skills in using modern technologies are especially important for the future of individuals, and attention paid on student abilities in using ICT resources for their personal empowerment is needed. These kind of skills in youth are especially important because today's youth will compete for technological jobs globally (Ritzhaupt, Liu, Dawson, & Barron, 2013). The social effects of ICT on production are totalizing, altering or eliminating not just the existing work practices and conditions, but creating new sectors of capital. Post-industrial society moves towards the less traditional physical production of commodities to the provision of services and adoption of a "global, mobile and networked e-capital" (Stevenson, 2009, p. 3). The information industry had become the driving force of the new economy more than 15 years ago through producing, processing, distributing and using information. Moreover, it even permeates the traditional sectors of economy, such as agriculture and manufacturing (M.-C. Kim & Kim, 2001). The emerging information capital is related with lowering the labour needs and the work is reorganized in terms of employment in forms as "contingent workers" (Stevenson, 2009). However, to succeed in these new conditions, a new set of skills is required. This means that the digital skills of todays' youth are crucial for their success in the future, which is why this study takes students as its target group. Fifteen years ago Kim and Kim (2001) predicted that:

> ...information exchanges will shape most of human activities. Communication will become not so much an instrument for conveying messages but a critical factor in enhancing the quality of life. So it is necessary to implement measures to not only increase the media availability but also improve communicative competencies at home and work. (p. 88)

However, as with many other skills, the possession of skills in the digital domain differs across students, depending on, among other things, basic student individual and socio-demographic characteristics. These differences in the digital domain depending on individual and socio-demographic characteristics are known as the "digital divide".

van Dijk (2006) points out that digital divide should be explored as rooted in multifaceted processes of social, mental and technological aspects, going further away from the simple possession of the technology. Three levels of digital divide are recognized (Hohlfeld, Ritzhaupt, Barron, & Kemker, 2008):

- Equitable access to hardware (lowest);
- Frequency of use of technology by teachers and students in class (medium);
- Student's ability to use ICT for own empowerment (highest).

This study focuses namely on the third level of the digital divide, gaps in students' abilities for an effective participation in different domains. The focus is on a specific aspect of the entire spectrum of the broad ICT abilities, namely the Computer and Information Literacy (CIL), following its definition given by Fraillon, Schulz & Ainley (2013): "individual's ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in society" (Fraillon et al., 2013, p. 17). The purpose of this study is to explore the digital divide (CIL gaps) across 14-year-old students based on their socio-economic status (SES) using data from 20 countries[1], participating in the IEA's International Computer and Information Literacy Study (ICILS) 2013. The study also tests how different ICT-related factors explain the aforementioned gaps across the participating countries. The research questions related with SES gaps are:

1. Which ICT-related student personal and ICT characteristics explain the student SES CIL gaps?
2. Which school ICT-related characteristics explain the student SES CIL gaps?

Background

The term "digital divide" originated in mid-1990s, used for the first time by an unknown American source. In general, it suffers from lack of theoretical foundation, mainly due to the following reasons (van Dijk, 2006):

1 The term "country" is used provisionally throughout the paper to designate educational systems or a benchmarking participants, such as Buenos Aires (Argentina), Newfoundland and Labrador (Canada) and Ontario (Canada).

- Very recent concept, mainly at descriptive level;
- Lack of conceptual elaboration and definition;
- Not being discussed against the general theory of social inequalities;
- Only a minor role of the "diffusion of innovations" theory;
- Lack of interdisciplinary research and preponderance of sociological and economic studies, mostly ignoring the attitudes towards technology and its use;
- Static (possession of technology) vs. dynamic (developing technology) approach;
- No serious elaboration of the consequences of the digital divide.

Traditionally seen as a gap in possession, the digital divide was perceived to be bridged with the rapid increase of computer and network access after 2000 (Hargittai & Hinnant, 2008). But even then the studies on the digital divide had their focus on accessibility, ignoring the information inequality. In addition, possessing financial resources is not automatically related to willingness to access and use information. As the access to media becomes easier for everyone, regardless of the economic power, the focus shifts to how information is used, what one does with the information (M.-C. Kim & Kim, 2001). The digital divide is a much more complex phenomenon than just the possession of means to obtain information (M.-C. Kim & Kim, 2001). In addition, "As informatization progresses in society, the cause and structural nature of social inequality changes as well" (M.-C. Kim & Kim, 2001, p. 79). This is why the issue of access to technology (the first level of digital divide) started to lose its importance and more recently the "beyond access" aspects or "second level of the digital divide" (Hargittai & Hinnant, 2008, p. 605) became issues and attracted further attention. These beyond access issues include (van Dijk, 2006; van Dijk & Hacker, 2003):

- Inequalities in social, cultural and informational capital and resources amplified by the use of digital media;
- Inequality of positions and power in social networks;
- Differences in social, psychological and cultural backgrounds.

Further, the concepts of skills, competencies, and technology use and applications were added, shifting the focus from inequalities in possession to inequalities in social, cultural and informational capital and resources. Some researchers have focused on inequalities in terms of positions of power in social networks which could result in unequal participation opportunities in different social areas, thus reflecting all common social and cultural differences. These traditional inequalities in resources and capital

are boosted by the use of technology due to the control positions in a society with increasing complexity where the skills to acquire and sustain positions are unequal (van Dijk, 2006). In this way, the information turns into a positional good and some social positions create better prospects to obtain, process and use important information, which empowers those having the appropriate skills and their networks. Individuals and networks that are not well-positioned are subject to social exclusion. Those who are very included due to their dominant position (an "information elite") become even more empowered and gain even more capital and resources, increasing the traditional social inequalities (van Dijk, 2006). Additionally, the higher-SES individuals and families could afford the equipment earlier than lower-SES ones and, as early adopters, have the advantage by having continuously more experience than the later adopters (Hohlfeld et al., 2008; M.-C. Kim & Kim, 2001). The divide between the early and late adopters tends to increase further in future because the information technology also progresses with time, but also because the amount of information increases along with the complexity of its utilization (M.-C. Kim & Kim, 2001). However, even if the homes were equipped equally, children from higher SES families gain more (Hargittai & Hinnant, 2008). This reflects a form of "capital" which is different than the social and cultural ones and is unequally distributed in society. The resources, in turn, are material (equipment and software), social (networks possessing and using technology, plus the social support in using it) and cognitive (constituting literacy, numeracy and informacy [i.e. "informational literacy", digital skills for reading and searching textual information which is complex and multifaceted]) (van Dijk & Hacker, 2003). Thus, CIL can contribute to raising the cultural capital of those who have access to technology and acquire the skills to use it, serving the interests of the dominant class and reproducing the existing social structure and ideological framework in power (Kucukaydin & Tisdell, 2008), although most authors at the beginning of the 21st century agree that "inequality in the information society is fundamentally different from that of industrial society" (M.-C. Kim & Kim, 2001, p. 79).

The expansion of the concept and the issues beyond possession and access to ICT allows three levels of the digital divide in society and education to be distinguished: 1) infrastructure and support; 2) frequency of using ICT by students and teachers; 3) student ICT preparedness. These three levels are assumed to be hierarchical (Epstein, Nisbet, & Gillespie, 2011; Hohlfeld et al., 2008). The first level preoccupies the public opinion and policy (van Dijk & Hacker, 2003), the third is hardest to address (Hohlfeld, Ritzhaupt, & Barron, 2013), mainly due to the complexity of

the digital divide on the number of demographic and personal characteristics, such as computer possession and access, family and school socio-economic status, gender, ethnicity, experience with ICT, self-efficacy, attractiveness of and interest in technology, rural location and educational level (Henderson, 2011; Hohlfeld et al., 2008; M.-C. Kim & Kim, 2001; Ritzhaupt et al., 2013; van Dijk, 2006). The focus of this paper is namely the third level, as it is the important pre-requisite for the students' success in future. Broadly defined, digital skills are not limited to the abilities to operate technology, but the abilities to search, process and apply information are the more important ones. Said another way, digital skills have different aspects: instrumental, operational, structural, strategic and informational. The last one, viewed as increasingly important has two distinctive components: formal (the ability to work with the formal characteristics of the technology, e.g. files and hyperlinks) and substantial (the ability to find, select, process and evaluate information in sources regarding specific questions). Research so far has been focused on the operational skills, related to the command of hardware and software, while the informational component has been largely neglected (van Dijk, 2006; van Dijk & Hacker, 2003).

The digital divide is multifaceted, resulting from the differences between home and school, along the range of family SES, rural location and gender. The ones who possess low CIL are likely to be from minorities, with low income, with lower educational attainment and children from single-parent families. The especially endangered are those who reside in rural or central city areas, who are less-likely to have access to the internet, thus being "information-poor" (Henderson, 2011). The suburban schools are richer in ICT resources (hardware, software and network access), but also in teacher preparation for using ICT in instruction. On the other hand, poorer urban and rural schools have outdated ICT resources and unreliable network access. These inequalities are actually a small and specific part of the greater inequality picture (Kucukaydin & Tisdell, 2008). Kim & Kim (2001) and van Dijk & Hacker (2003) add education and age to the different digital divides. The digital divide needs to be framed as any divide based on race, gender, class and nation around the world because they reflect these divides in the same way (Kucukaydin & Tisdell, 2008).

Greater gaps still appear to exist between homes, based on SES. Public schools are perceived as bridging the gaps in possession of technological means, and it is expected that schools' ICT resources could decrease the gaps based on student characteristics. But leaving possession and access aside, there is still one substantial difference between students in schools

with differing levels of SES: those from lower SES schools tend to use computers more often for "drill and practice" activities, solving problems and analysing data, while the students studying at higher SES schools use computers for written expression, they tend to use computers and the internet at home more often and in general use the technology in higher-order thinking activities (Hohlfeld et al., 2008). The differences at the school level can be explained with the school-level SES, which is related to different other student characteristics. Lower-SES schools differ in both the methods and technologies used for instruction (Hohlfeld et al., 2013).

Method

As stated earlier, this study tests the differences in CIL of 8th grade students based on their SES. The analysis uses stepwise multiple linear regression models, adding control variables to the regression models in order to partial out their effect from the relationship. This way the characteristics bridging the digital divide in CIL are identified.

Data

The data stem from IEA's International Computer and Information Literacy Study (ICILS) 2013, which evaluates CIL achievement and collects background information from students at grade 8 and their schools and teachers across 21 countries. The target population of the students was defined as those enrolled in the grade representing eight years of schooling or its equivalent within the country. In most countries this definition matched students in grade 8. The only exception is Norway, where students in grade 9 and their teachers were sampled. The minimum requirement of the number of sampled schools is 150 within each country. The sample of schools was drawn using Probability Proportional to Size (PPS). That is, the more students in the target grade a school has, the more likely it is to be sampled. Within each school 20 students were sampled across all its target-grade classes, disregarding the number of classes within the school. At least 15 teachers within schools were sampled regardless of the subject they teach in the target grade (Meinck, 2015). However, the sampled teachers are not necessarily the teachers of the sampled students which means that link between students cannot be linked to their teachers. Therefore teacher characteristics cannot be used as the explanatory variables of student achievement or as the control variables of the relationship between student achievement and their SES. The list of 21 countries participating in ICILS 2013, their sample sizes and population estimates are presented in Table 1. As the table shows, four countries did not meet the sampling requirements of sampling at least 150 schools within the

country (Denmark, Hong Kong, Netherlands and Switzerland). These countries were included in this study due to their importance in terms of cross-country comparison. Their results, however, need to be taken with caution because the estimates may be biased due to the sample coverage. Buenos Aires (Argentina) and Newfoundland and Labrador (Canada) and Ontario (Canada) are benchmarking participants.

Table 1. Sample sizes and their population estimates

Countries	Sample Size	Population Estimate
Buenos Aires (Argentina)*	1,076	41,200
Australia	5,326	264,948
Canada (Newfoundland and Labrador)*	1,556	5,068
Canada (Ontario)*	3,377	139,615
Chile	3,180	222,720
Croatia	2,850	44,193
Czech Republic	3,066	83,193
Denmark†	1,767	58,249
Germany	2,225	841,762
Hong Kong†	2,089	59,611
Korea	2,888	562,234
Lithuania	2,756	30,842
Netherlands†	2,197	183,212
Norway‡	2,436	56,894
Poland	2,870	365,863
Russian Federation	3,626	1,124,977
Slovak Republic	2,994	49,186
Slovenia	3,740	16,870
Switzerland†	3,225	85,888
Thailand	3,646	694,162
Turkey	2,540	1,196,184

**Benchmarking participant*
†Not meeting the sampling requirements
‡Grade 9 population

Data about students' CIL achievement and SES, ICT infrastructure and use, as well as other basic individual and demographic characteristics from 20 countries is used in the analyses: the Netherlands had to be excluded from the study due to lack of data on the SES measure.

Measures

Assessment items in ICILS 2013 are tasks distributed in four modules and each student takes only two modules, assigned to him or her at random.

That is, not each student faces every single task (Fraillon, 2015). In turn, the CIL scores could not be computed using the well-known methods from the Classical Test Theory (CTT) or Item Response Theory (IRT). Instead, the CIL scores in ICILS 2013 were obtained by the study center as five "plausible values" (PVs). In brief, the item parameters were estimated using different IRT models, depending on the scoring of the items (dichotomous or partial credit). The item parameters were used along with student responses on achievement items and the principal components of the background items to form conditional distribution where the information of the items the students did not face was imputed using the information of the background variables. The final scores for each student were drawn at random five times (PVs) from the distribution of the scores of students with similar background characteristics (Gebhardt & Schulz, 2015).

The SES measure used in this study is the National index of students' socioeconomic background (S_NISB). The index was derived from the students' parental highest occupational status, students' parental highest educational attainment and the number of books in the students' home. The index was created using Partial Credit Model (PCM), part of the broad IRT framework (Schulz & Friedman, 2011).

Individual student, student home and school variables were used as well in the regression models (see Analytical methods). The groups of different variables are as follows:

- Individual characteristics related to CIL: expected further education; basic skills ICT self-efficacy; advanced skills ICT self-efficacy; attitudes towards ICT.
- ICT use at home and school: frequency of computer use at home, school and other locations; use of ICT for different purposes, including study purposes.
- Home and school ICT resources, emphasis and use of ICT in teaching and learning: availability of computers and network connection at home; principal's views on the importance of using ICT; ICT use for teaching and learning activities at school; monitoring of teacher use of ICT in pursuing learning outcomes; ICT management and resources; teacher professional variables (school principal responses).

The full list of all used variables with their description and measurement characteristics can be found in the Appendix.

Analytical Methods

In the first step, the differences in CIL across individual and school SES are tested using bivariate linear regression models. School SES is aggregated individual SES at the school level as a measure of the contextual effect. Prior to analysis the index was linearly transformed to have a mean of 50 and a standard deviation of 10 points to be in line with the rest of the scale variables used in the study. In the second step, variables on different individual student, home and school characteristics are added to the regression models to account for their influence on the relationship between CIL and SES.

Results

The results from the first step of the regression analysis are presented in Table 2.

Table 2. Regression coefficients for the digital divide based on student gender, school location and individual and school-level SES

Educational Systems	Individual SES		(SE)	School SES		(SE)
Australia	2.96	*	(0.15)	5.70	*	(0.38)
Buenos Aires (Argentina)	4.06	*	(0.52)	6.72	*	(0.80)
Canada (Newfoundland and Labrador)	2.16	*	(0.28)	3.94	*	(0.46)
Canada (Ontario)	1.92	*	(0.22)	3.87	*	(0.63)
Chile	3.47	*	(0.20)	5.85	*	(0.32)
Croatia	2.33	*	(0.19)	3.12	*	(0.54)
Czech Republic	1.99	*	(0.10)	4.37	*	(0.34)
Denmark†	1.93	*	(0.19)	3.59	*	(0.65)
Germany	2.57	*	(0.21)	6.60	*	(0.45)
Hong Kong†	1.20	*	(0.32)	5.56	*	(1.19)
Korea	1.85	*	(0.18)	3.38	*	(0.60)
Lithuania	2.63	*	(0.19)	5.13	*	(0.57)
Norway	2.03	*	(0.16)	3.50	*	(0.54)
Poland	2.84	*	(0.18)	4.59	*	(0.40)
Russian Federation	2.24	*	(0.21)	5.12	*	(0.63)
Slovak Republic	3.07	*	(0.26)	5.79	*	(0.97)
Slovenia	1.82	*	(0.16)	2.14	*	(0.71)
Switzerland†	1.66	*	(0.29)	4.65	*	(0.73)

Educational Systems	Individual SES		(SE)	School SES		(SE)
Thailand	4.08	*	(0.32)	7.56	*	(0.59)
Turkey	3.21	*	(0.31)	5.96	*	(0.73)
International Average	2.50	*	(0.06)	4.86	*	(0.14)

**Significant at p<.05 level*
†Not meeting the sampling requirements

As the table shows, statistically significant CIL gaps between students in regard to their individual SES is found in all 20 countries in this study. The gap is lowest in Hong Kong and highest in Thailand, 1.20 and 4.08 score points per unit increase in SES respectively. This is similar for the school-level aggregated SES where in all countries the effect is positive and significant, from 2.14 (Slovenia) to 7.56 score points (Thailand).

The control variables were added to the model to test the mitigation effect of the individual and school characteristics (see the Method section). The results show that the individual and school-level SES gaps are not mitigated when any of the variables in the Appendix are controlled for, the effect of SES remains strong and significant (the results are not published here due to the vast amount of outputs). These results (strong relationship between individual SES and CIL and even stronger between CIL and school SES) suggest that there are compositional and interaction effects due to the individual and school-level SES. Additional Hierarchical Linear Models were built to test these effects.

First, a null model is built to obtain the Intra-Class Correlation Coefficients (ICCs). The model is presented in the equation below.

$$Y_{ij} = \beta_{0j} + r_{ij} \qquad \text{(L1)} \qquad (1)$$
$$\beta_{0j} = \gamma_{00} + u_{0j} \qquad \text{(L2)},$$

where

Y_{ij} – 1st to 5th PV of CIL
β_{0j} – intercept, expected achievement of student i within cluster j
r_{ij} – error at individual level
γ_{00} – CIL grand mean
u_{0j} – deviation of clusters around the grand mean

The ICCs of the CIL scores are presented in Table 3.

Table 3. Intra-Class Correlations for the CIL scores

Countries	ICC
Australia	0.27
Buenos Aires (Argentina)	0.37
Canada (Newfoundland and Labrador)	0.15
Canada (Ontario)	0.17
Chile	0.40
Croatia	0.14
Czech Republic	0.25
Denmark†	0.14
Germany	0.55
Hong Kong†	0.49
Korea	0.16
Lithuania	0.39
Norway	0.13
Poland	0.19
Russian Federation	0.35
Slovak Republic	0.39
Slovenia	0.11
Switzerland†	0.23
Thailand	0.40
Turkey	0.48

†Not meeting the sampling requirements

As the table shows, the largest variance between schools is in Germany (0.55), the lowest is in Slovenia (0.11). Next, Model 1 includes individual SES at Level 1, and Model 2 incorporates school-level SES at Level 2. Both models use random intercepts and fixed slopes. Level 1 SES is centered around the group mean and Level 2 aggregated SES is centered around the grand mean in Model 2. The equations for these two models are presented in Equations 2 and 3.

$$Y_{ij} = \beta_{0j} + \beta_{1j}SES_{1ij} + r_{ij} \text{ (L1, group-mean centering)} \quad (2)$$
$$\beta_{0j} = \gamma_{00} + u_{0j} \text{ (L2)}$$
$$\beta_{1j} = \gamma_{10} \text{ (L2)}$$
$$Y_{ij} = \beta_{0j} + \beta_{1j}SES_{1ij} + r_{ij} \text{ (L1, group-mean centering)} \quad (3)$$
$$\beta_{0j} = \gamma_{00} + \gamma_{01}\overline{SES_j} + u_{0j} \text{ (L2, grand-mean centering)}$$
$$\beta_{1j} = \gamma_{10} \text{ (L2)}$$

where

β_{1j} – regression slope
γ_{10} – average regression slope across all clusters (fixed effect)

The standardized coefficients from Model 1 and Model 2 are presented in Table 4.

Table 4. Model 1 and Model 2 standardized results

Countries	SES (L1)	p	$\overline{\text{SES}}$ (L2)	p
Australia	0.22	<0.001	0.72	<0.001
Buenos Aires (Argentina)	0.17	<0.001	0.63	<0.001
Canada (Newfoundland and Labrador)	0.22	<0.001	0.64	<0.001
Canada (Ontario)	0.19	<0.001	0.58	<0.001
Chile	0.16	<0.001	0.82	<0.001
Croatia	0.26	<0.001	0.54	<0.001
Czech Republic	0.18	<0.001	0.71	<0.001
Denmark†	0.22	<0.001	0.79	<0.001
Germany	0.05	0.295	0.74	<0.001
Hong Kong†	-0.05	0.124	0.42	<0.001
Korea	0.18	<0.001	0.31	0.019
Lithuania	0.24	<0.001	0.70	<0.001
Norway	0.24	<0.001	0.58	<0.001
Poland	0.27	<0.001	0.86	<0.001
Russian Federation	0.16	<0.001	0.43	<0.001
Slovak Republic	0.26	<0.001	0.60	<0.001
Slovenia	0.25	<0.001	0.37	0.003
Switzerland†	0.10	0.062	0.69	<0.001
Thailand	0.10	0.002	0.65	<0.001
Turkey	0.17	<0.001	0.56	<0.001

†Not meeting the sampling requirements

For the effect of the individual SES, the results in the table are quite similar to the ones from the single-level regression. A strong and significant association between CIL and SES was found in most countries, but in Germany, Hong-Kong, Switzerland and Thailand the effects are very small and insignificant. The lowest coefficients among the countries where the effect of the individual SES is significant are Chile (0.16), Russian Federation (0.16), Buenos Aires (Argentina) (0.17), Turkey (0.17), Czech Re-

public (0.18) and Korea (0.18). The ones with the highest effects are Slovenia (0.25), Croatia (0.26), Slovak Republic (0.26) and Poland (0.27). However, the school SES on Level 2 has strong and significant effect in all countries in ICILS 2013 and the coefficients are greater. The smallest school-level SES effects are found in Korea (0.31) and Slovenia (0.37), the largest are in Chile (0.82) and Poland (0.86).

To test for the compositional effect of school SES (difference between the school level effect and the person-level effect of SES), Model 2 was further modified by centering SES around the grand mean on both Levels 1 and 2 (Model 3):

$$Y_{ij} = \beta_{0j} + \beta_{1j}SES_{1ij} + r_{ij} \text{ (L1, grand-mean centering)} \quad (4)$$
$$\beta_{0j} = \gamma_{00} + \gamma_{01}\overline{SES_j} + u_{0j} \text{ (L2, grand-mean centering)}$$
$$\beta_{1j} = \gamma_{10} \text{ (L2),}$$

The results from these models are presented in Table 5. Statistically significant compositional effects were found in 13 out of 20 countries: Australia, Buenos Aires, Chile, Czech Republic, Denmark, Germany, Hong Kong, Lithuania, Poland, Slovak Republic, Switzerland, Thailand and Turkey. In all these countries the effect is strong and statistically significant, ranging from 0.43 (Turkey) to 0.73 (Chile). In the remaining seven countries (Canada [Newfoundland and Labrador], Canada [Ontario], Croatia, Korea, Norway, Russian Federation and Slovenia) non-significant compositional effects was found.

Table 5. Model 3 standardized results for the compositional effect

Countries	SES (L1)	p	$\overline{SES}$ (compositional effect, L2)	p
Australia	0.25	<0.001	0.57	<0.001
Buenos Aires (Argentina)	0.23	<0.001	0.48	0.005
Canada (Newfoundland and Labrador)	0.26	<0.001	0.29	0.079
Canada (Ontario)	0.22	<0.001	0.32	0.039
Chile	0.22	<0.001	0.73	<0.001
Croatia	0.30	<0.001	0.20	0.099
Czech Republic	0.21	<0.001	0.60	<0.001
Denmark†	0.25	<0.001	0.60	<0.001
Germany	0.07	0.295	0.72	<0.001
Hong Kong†	-0.05	0.124	0.45	<0.001

Countries	SES (L1)	p	$\overline{\text{SES}}$ (compositional effect, L2)	p
Korea	0.20	<0.001	0.11	0.476
Lithuania	0.28	<0.001	0.53	<0.001
Norway	0.26	<0.001	0.33	0.009
Poland	0.32	<0.001	0.65	<0.001
Russian Federation	0.19	<0.001	0.29	0.023
Slovak Republic	0.30	<0.001	0.43	<0.001
Slovenia	0.28	<0.001	0.06	0.735
Switzerland†	0.11	0.061	0.63	<0.001
Thailand	0.13	0.002	0.59	<0.001
Turkey	0.22	<0.001	0.43	<0.001

†Not meeting the sampling requirements

To test if the effect of student SES on CIL varies as a function of school-level SES, a cross-level interaction term was added to the model (Model 4):

$$Y_{ij} = \beta_{0j} + \beta_{1j}SES_{1ij} + r_{ij} \text{ (L1, grand-mean centering)} \quad (5)$$
$$\beta_{0j} = \gamma_{00} + \gamma_{01}\overline{SES}_j + u_{0j} \text{ (L2, grand-mean centering)}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11}\overline{SES}_j + u_{1j} \text{ (L2),}$$

where

γ_{11} – cross-level interaction effect
u_{1j} – random effect, varying correlation of individual characteristic and dependent variable between aggregate units

The results in Table 6 show that there are significant and negative SES cross-level interaction effects in Australia, Chile, Croatia and Slovak Republic with values varying from -0.08 (Croatia) to -0.16 (Slovak Republic). The negative sign of these cross-level interaction coefficients in these countries means that in schools where the SES tends to be higher, students coming from higher SES families tend to be less advantaged than the ones coming from lower SES families. In other words, the differences in CIL between lower and higher SES students tend to be lower in schools where the composition of students tends to be from higher SES families. In the 16 remaining countries the interactions are statistically insignificant, regardless of the direction of the relationship.

Table 6. Model 3 standardized results for the interaction effect

Countries	SES (L1 × L2)	p
Australia	-0.10	0.001
Buenos Aires (Argentina)	0.04	0.641
Canada (Newfoundland and Labrador)	0.02	0.680
Canada (Ontario)	-0.08	0.055
Chile	-0.09	0.004
Croatia	-0.08	0.009
Czech Republic	-0.02	0.391
Denmark†	0.01	0.747
Germany	-0.11	0.112
Hong Kong†	0.05	0.287
Korea	0.06	0.292
Lithuania	-0.05	0.315
Norway	0.09	0.147
Poland	-0.04	0.220
Russian Federation	0.04	0.275
Slovak Republic	-0.16	<0.001
Slovenia	-0.05	0.245
Switzerland†	0.04	0.531
Thailand	-0.02	0.777
Turkey	0.01	0.674

†Not meeting the sampling requirements

Conclusions and Discussion

In all countries the effect of individual SES is sizeable and statistically significant. The same applies to the SES context of schools, the aggregate SES of students at school levels is related significantly to student CIL, and this relationship is much stronger than for the individual student SES. The models were controlled for individual (educational attainment, attitudes towards technology and self-efficacy in using ICT), ICT use (frequency at home, school or other locations, use for different purposes) did not mitigate the digital divide based on SES. Moreover, none of the numerous school ICT variables in different aspects (resources, emphasis, views on the importance, use in instruction, management, teacher professional variables, etc.) did mitigate this gap.

The multilevel models revealed that the individual SES is not related to student CIL in only four countries, but the school SES is related to CIL in all countries. In addition, in two thirds of all countries there is a compositional effect: the influence of the overall SES of the students in school has on the individual CIL achievement. Somewhat soothing is that in most countries there was no interaction effect between SES on individual and school level (i.e. the effect of student SES on achievement does not vary as a function of the aggregated SES on school level), and where such effect was found, it was negative (the higher SES students are not advantaged compared to low SES students in the same schools).

All these are alarming finding for all countries included in this study: the school with its resources, personnel, purposeful use of ICT in instruction and emphasis on ICT does not help on bridging the digital divide gap between students coming from low and high SES families. Along these lines, some authors say that the digital divide is actually a "home-school divide", and this divide between the real world and the classroom in terms of technology use is the real concern: rich literate practices at home versus the narrow and restricted practices used at school and in the classroom (Henderson, 2011). Moreover, school may often neglect the learning outside its walls and ignore what students bring to schools as a multi-literate experience (Henderson, 2011). The aforementioned issues on the differences between the home and school divide are related to the educational ecology perspective, where the adoption of ICT in education is viewed as a whole and the broader social and cultural contexts, where family and home factors belong, have a stronger influence than the school ones. Schools should rely more on the dynamic relationship with families in planning the use of technology in instruction, which could increase the social capital and empower individuals and their families which, in turn, would improve the learning outcomes (Yu, Yuen, & Park, 2012). From the point of view of the "third space" theories, the knowledge acquired at home and school come together. "In such 'third spaces', meaningful connections are made between different funds of knowledge, mutually informing and reshaping one another" (Grant, 2011, p. 293). The intersection of these different knowledge funds gives the students the opportunity to use different cultural resources in their learning, including other domains. If these knowledge funds are different and do not intersect, the good learning experience at home does not facilitate learning at school, discontinuing the transfer between the two different cultures and children would have to put more efforts in creating their third space (Grant, 2011).

The findings show that the widespread expectation at the end of last century opinion that the massive computerization of the population will

bridge the digital divide (see the Background section) was overly optimistic and the issue of the digital divide has much deeper roots than simply possessing technological means. And just as with any other kind of means, the possession does not guarantee their successful use or use by its purpose. As Yu et al. (2012) note, the presence of a computer at home does not mean it is used academically: it could be used for gaming, shopping or communicating. ICT underuse or use for different purposes at home, in turn, has consequences for education (Yu et al., 2012). Additional analyses of ICILS data (not published here) show, for example, that 66% of the students in the group of analyzed countries use digital devices less than once a month or never for school-related purposes at any location (preparing reports/essays, presentations, working with other students from your own or other schools, completing exercises, organizing own time and work, writing about their own learning, and completing tests). Moreover, when it comes to the use of digital devices for study purposes outside of school (creating or editing documents [e.g. to write stories or assignments], use a spreadsheet to do calculations, store data or plot graphs, use education software designed to help with school study, searching for information for study or school work, and accessing wikis or online encyclopaedia for study or school work), 51% answer they never do it or do it less than once a month. But even if used for academic purposes, what matters for some of the gaps is how digital technology is used: as stated in the beginning of the paper, low and high SES students differ in the way they use the computer – drill and practice versus higher-order thinking activities (Hohlfeld et al., 2008).

References

Epstein, D., Nisbet, E. C., and Gillespie, T. (2011) Who's Responsible for the Digital Divide? Public Perceptions and Policy Implications. *Information Society 27* (2), pp. 92–104. http://doi.org/10.1080/01972243.2011.548695

Fraillon, J. (2015) ICILS Test Development. In Fraillon, J., Schulz, W., Friedman, T., Ainley, J., and Gebhardt, E. (ed.). *ICILS 2013 Technical Report*. Amsterdam: International Association for the Evaluation of Educational Achievement.

Fraillon, J., Schulz, W., and Ainley, J. (2013) *International Computer and Information Literacy Study: Assessment Framework*. Amsterdam: International Association for the Evaluation of Educational Achievement.

Gebhardt, E., and Schulz, W. (2015) Scaling Procedures for ICILS Test Items. In Fraillon, J., Schulz, W., Friedman, T., Ainley, J., and Geb-

hardt, E. (ed.). *ICILS 2013 Technical Report*. Amsterdam, the Netherlands: International Association for the Evaluation of Educational Achievement.

Grant, L. (2011) "I'm a completely different person at home": using digital technologies to connect learning between home and school: Connecting home and school learning. *Journal of Computer Assisted Learning 27* (4), pp. 292–302.

Hargittai, E., and Hinnant, A. (2008) Digital Inequality: Differences in Young Adults' Use of the Internet. *Communication Research 35* (5), pp. 602–621.

Henderson, R. (2011) Classroom pedagogies, digital literacies and the home-school digital divide. *International Journal of Pedagogies & Learning 6* (2), pp. 152–161.

Hohlfeld, T., Ritzhaupt, A., and Barron, A. (2013) Are gender differences in perceived and demonstrated technology literacy significant? It depends on the model. *Educational Technology Research & Development 61* (4), pp. 639–663. http://doi.org/10.1007/s11423-013-9304-7

Hohlfeld, T., Ritzhaupt, A., Barron, A., and Kemker, K. (2008). Examining the digital divide in K-12 public schools: Four-year trends for supporting ICT literacy in Florida. *Computers & Education 51* (4), pp. 1648–1663. http://doi.org/10.1016/j.compedu.2008.04.002

Kim, M.-C., and Kim, J.-K. (2001) Digital Divide: Conceptual Discussions and Prospect. In Kim, W., Ling, T.-W., Lee, Y.-J., and Park S.-S. (ed.). *The Human Society and the Internet Internet-Related Socio-Economic Issues*, pp. 78–91. Berlin: Springer-Verlag.

Kucukaydin, I., and Tisdell, E. J. (2008) The Discourse on the Digital Divide: Are We Being Co-opted? *InterActions: UCLA Journal of Education & Information Studies 4* (1), pp. 1–19.

Meinck, S. (2015) Sampling Design and Implementation. In Fraillon, J., Schulz, W., Friedman, T., Ainley, J., and Gebhardt, E. (ed.). *ICILS 2013 Technical Report*. Amsterdam: International Association for the Evaluation of Educational Achievement.

Ritzhaupt, A. D., Liu, F., Dawson, K., and Barron, A. E. (2013) Differences in Student Information and Communication Technology Literacy Based on Socio-Economic Status, Ethnicity, and Gender: Evidence of a Digital Divide in Florida Schools. *Journal of Research on Technology in Education 45* (4), pp. 291–307.

Schulz, W., and Friedman, T. (2011) Scaling Procedures for ICCS Questionnaire Items. In Fraillon, J., Schulz, W., Friedman, T., Ainley, J., and Gebhardt, E. (ed.). *International Civic and Citizenship Educa-*

tion Study: Technical Report, pp. 157–259. Amsterdam: International Association for the Evaluation of Educational Achievement.

Stevenson, S. (2009) Digital Divide: A Discursive Move Away from the Real Inequities. *The Information Society 25* (1), pp. 1–22.

van Dijk, J. (2006) Digital divide research, achievements and shortcomings. *Poetics 34* (4–5), pp. 221–235.

van Dijk, J., and Hacker, K. (2003) The Digital Divide as a Complex and Dynamic Phenomenon. *Information Society 19* (4), p. 315.

Yu, M., Yuen, A. H. K., and Park, J. (2012). Students' Computer Use at Home: A Study on Family Environment and Parental Influence. *Research & Practice in Technology Enhanced Learning 7* (1), pp. 3–23.

Appendix

Control variables used in the regression models

Table 1. Student variables.

Variable name	Variable description	Type	Categories/Properties
S_SEX	Sex of student	Dichotomous	0 – Boy, 1 - Girl
IS1G13A	How many computers are currently used in your home? (desktop)	Continuous	Open ended
IS1G13B	How many computers are currently used in your home? (portable devices)	Continuous	Open ended
IS1G17A	How often do you use a computer in these places? (home)	Categorical	1-5 (Never-Everyday)
IS1G17B	How often do you use a computer in these places? (school)	Categorical	1-5 (Never-Everyday)
IS1G17C	How often do you use a computer in these places? (other place)	Categorical	1-5 (Never-Everyday)
S_INTRST	Interest and enjoyment in using ICT scale	Continuous	M=50, SD=10
S_USEAPP	Use of specific ICT applications scale	Continuous	M=50, SD=10
S_USECOM	Use of ICT for social communication scale	Continuous	M=50, SD=10
S_USEINF	Use of ICT for exchanging information scale	Continuous	M=50, SD=10
S_USELRN	Use of ICT during lessons at school scale	Continuous	M=50, SD=10
S_USEREC	Use of ICT for recreation scale	Continuous	M=50, SD=10
S_USESTD	Use of ICT for study purposes scale	Continuous	M=50, SD=10
S_ISCED	Expected education by student	Categorical	0-4 (ISCED levels)
S_BASEFF	ICT self-efficacy basic skills scale	Continuous	M=50, SD=10

Variable name	Variable description	Type	Categories/Properties
S_ADVEFF	ICT self-efficacy advanced skills scale	Continuous	M=50, SD=10
S_NISB	National index of students' socio-oeconomic background	Continuous	M=50, SD=10 (altered metrics)

Table 2. School variables.

Variable name	Variable description	Type	Categories/Properties
IP1G09A	ICT and Teaching/Importance of ICT use/Developing students' computer skills	Categorical	1-3 (Very important--Not important)
IP1G09B	ICT and Teaching/Importance of ICT use/Using ICT for facilitating students' responsibility for their own learning	Categorical	1-3 (Very important--Not important)
IP1G09C	ICT and Teaching/Importance of ICT use/Using ICT to augment and improve students' learning	Categorical	1-3 (Very important--Not important)
IP1G09D	ICT and Teaching/Importance of ICT use/Developing students' understanding and skills	Categorical	1-3 (Very important--Not important)
IP1G09E	ICT and Teaching/Importance of ICT use/Developing students' proficiency in accessing and using information with ICT	Categorical	1-3 (Very important--Not important)
IP1G09F	ICT and Teaching/Importance of ICT use/Developing collaborative and organisational skills	Categorical	1-3 (Very important--Not important)
IP1G10	Is ICT used in any teaching and learning activities in your school?	Categorical	1 – Yes, 2 – No
IP1G11AA	ICT and Teaching/Monitor teachers use ICT/Developing students' computer skills/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No
IP1G11AB	ICT and Teaching/Monitor teachers use ICT/Developing students' computer skills/Teacher self-evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11AC	ICT and Teaching/Monitor teachers use ICT/Developing students' computer skills/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11AD	ICT and Teaching/Monitor teachers use ICT/Developing students' computer skills/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11AE	ICT and Teaching/Monitor teachers use ICT/Developing students' computer skills/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G11BA	ICT and Teaching/Monitor teachers use ICT/Facilitating students' responsibility/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No

Variable name	Variable description	Type	Categories/Properties
IP1G11BB	ICT and Teaching/Monitor teachers use ICT/Facilitating students' responsibility/Teacher self-evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11BC	ICT and Teaching/Monitor teachers use ICT/Facilitating students' responsibility/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11BD	ICT and Teaching/Monitor teachers use ICT/Facilitating students' responsibility/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11BE	ICT and Teaching/Monitor teachers use ICT/Facilitating students' responsibility/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G11CA	ICT and Teaching/Monitor teachers use ICT/Augment and improve students' learning/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No
IP1G11CB	ICT and Teaching/Monitor teachers use ICT/Augment and improve students' learning/Teacher self--evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11CC	ICT and Teaching/Monitor teachers use ICT/Augment and improve students' learning/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11CD	ICT and Teaching/Monitor teachers use ICT/Augment and improve students' learning/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11CE	ICT and Teaching/Monitor teachers use ICT/Augment and improve students' learning/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G11DA	ICT and Teaching/Monitor teachers use ICT/Developing students' understanding/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No
IP1G11DB	ICT and Teaching/Monitor teachers use ICT/Developing students' understanding/Teacher self-evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11DC	ICT and Teaching/Monitor teachers use ICT/Developing students' understanding/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11DD	ICT and Teaching/Monitor teachers use ICT/Developing students' understanding/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11DE	ICT and Teaching/Monitor teachers use ICT/Developing students' understanding/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G11EA	ICT and Teaching/Monitor teachers use ICT/Developing students' proficiency/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No

Variable name	Variable description	Type	Categories/Properties
IP1G11EB	ICT and Teaching/Monitor teachers use ICT/Developing students' proficiency/Teacher self-evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11EC	ICT and Teaching/Monitor teachers use ICT/Developing students' proficiency/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11ED	ICT and Teaching/Monitor teachers use ICT/Developing students' proficiency/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11EE	ICT and Teaching/Monitor teachers use ICT/Developing students' proficiency/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G11FA	ICT and Teaching/Monitor teachers use ICT/Developing skills/Reviewing lesson plans	Dichotomous	1 – Yes, 2 – No
IP1G11FB	ICT and Teaching/Monitor teachers use ICT/Developing skills/Teacher self-evaluation	Dichotomous	1 – Yes, 2 – No
IP1G11FC	ICT and Teaching/Monitor teachers use ICT/Developing skills/Observing classrooms	Dichotomous	1 – Yes, 2 – No
IP1G11FD	ICT and Teaching/Monitor teachers use ICT/Developing skills/By other means	Dichotomous	1 – Yes, 2 – No
IP1G11FE	ICT and Teaching/Monitor teachers use ICT/Developing skills/Not monitored	Dichotomous	1 – Yes, 2 – No
IP1G12A	ICT and Teaching/Teachers acquire skills/Integrating Web-based learning in their instructional practice	Categorical	1-3 (Expected and required-Not expected)
IP1G12B	ICT and Teaching/Teachers acquire skills/Using ICT-based forms of student assessment	Categorical	1-3 (Expected and required-Not expected)
IP1G12C	ICT and Teaching/Teachers acquire skills/Using ICT for monitoring student progress	Categorical	1-3 (Expected and required-Not expected)
IP1G12D	ICT and Teaching/Teachers acquire skills/Communicating with other staff via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12E	ICT and Teaching/Teachers acquire skills/Collaborating with other teachers via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12F	ICT and Teaching/Teachers acquire skills/Communicating with parents via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12G	ICT and Teaching/Teachers acquire skills/Integrating ICT into teaching and learning	Categorical	1-3 (Expected and required-Not expected)

Variable name	Variable description	Type	Categories/Properties
IP1G12H	ICT and Teaching/Teachers acquire skills/Using subject-specific learning software (e.g. tutorials, simulation)	Categorical	1-3 (Expected and required-Not expected)
IP1G12I	ICT and Teaching/Teachers acquire skills/Using e-portfolios for assessment	Categorical	1-3 (Expected and required-Not expected)
IP1G12J	ICT and Teaching/Teachers acquire skills/Using ICT to develop authentic (real-life) assignments for students	Categorical	1-3 (Expected and required-Not expected)
IP1G12A	ICT and Teaching/Teachers acquire skills/Integrating Web-based learning in their instructional practice	Categorical	1-3 (Expected and required-Not expected)
IP1G12B	ICT and Teaching/Teachers acquire skills/Using ICT-based forms of student assessment	Categorical	1-3 (Expected and required-Not expected)
IP1G12C	ICT and Teaching/Teachers acquire skills/Using ICT for monitoring student progress	Categorical	1-3 (Expected and required-Not expected)
IP1G12D	ICT and Teaching/Teachers acquire skills/Communicating with other staff via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12E	ICT and Teaching/Teachers acquire skills/Collaborating with other teachers via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12F	ICT and Teaching/Teachers acquire skills/Communicating with parents via ICT	Categorical	1-3 (Expected and required-Not expected)
IP1G12G	ICT and Teaching/Teachers acquire skills/Integrating ICT into teaching and learning	Categorical	1-3 (Expected and required-Not expected)
IP1G12H	ICT and Teaching/Teachers acquire skills/Using subject-specific learning software (e.g. tutorials, simulation)	Categorical	1-3 (Expected and required-Not expected)
IP1G12I	ICT and Teaching/Teachers acquire skills/Using e-portfolios for assessment	Categorical	1-3 (Expected and required-Not expected)
IP1G12J	ICT and Teaching/Teachers acquire skills/Using ICT to develop authentic (real-life) assignments for students	Categorical	1-3 (Expected and required-Not expected)
IP1G13AA	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13AB	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked

Variable name	Variable description	Type	Categories/Properties
IP1G13AC	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13AD	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13AE	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13AF	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13AG	Management of ICT/responsibility for ICT/Purchasing and supplying ICT equipment/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BA	Management of ICT/responsibility for ICT/Selecting software to be used/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BB	Management of ICT/responsibility for ICT/Selecting software to be used/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BC	Management of ICT/responsibility for ICT/Selecting software to be used/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BD	Management of ICT/responsibility for ICT/Selecting software to be used/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BE	Management of ICT/responsibility for ICT/Selecting software to be used/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BF	Management of ICT/responsibility for ICT/Selecting software to be used/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13BG	Management of ICT/responsibility for ICT/Selecting software to be used/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CA	Management of ICT/responsibility for ICT/Maintaining ICT equipment/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CB	Management of ICT/responsibility for ICT/Maintaining ICT equipment/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked

Variable name	Variable description	Type	Categories/Properties
IP1G13CC	Management of ICT/responsibility for ICT/Maintaining ICT equipment/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CD	Management of ICT/responsibility for ICT/Maintaining ICT equipment/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CE	Management of ICT/responsibility for ICT/Maintaining ICT equipment/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CF	Management of ICT/responsibility for ICT/Maintaining ICT equipment/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13CG	Management of ICT/responsibility for ICT/Maintaining ICT equipment/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DA	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DB	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DC	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DD	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DE	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DF	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13DG	Management of ICT/responsibility for ICT/Choosing whether ICT is used in teaching/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13EA	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13EB	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked

Variable name	Variable description	Type	Categories/Properties
IP1G13EC	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13ED	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13EE	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13EF	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13EG	Management of ICT/responsibility for ICT/Implementing ICT approaches in teaching/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FA	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FB	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FC	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FD	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FE	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FF	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13FG	Management of ICT/responsibility for ICT/Implementing ICT approaches in administration/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GA	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked

Variable name	Variable description	Type	Categories/Properties
IP1G13GB	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GC	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GD	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GE	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GF	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13GG	Management of ICT/responsibility for ICT/Using ICT-based approaches to assessment/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HA	Management of ICT/responsibility for ICT/Students learn information search strategies/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HB	Management of ICT/responsibility for ICT/Students learn information search strategies/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HC	Management of ICT/responsibility for ICT/Students learn information search strategies/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HD	Management of ICT/responsibility for ICT/Students learn information search strategies/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HE	Management of ICT/responsibility for ICT/Students learn information search strategies/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HF	Management of ICT/responsibility for ICT/Students learn information search strategies/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13HG	Management of ICT/responsibility for ICT/Students learn information search strategies/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G13IA	Management of ICT/responsibility for ICT/Students learn how to evaluate/[Ministry or local authority]	Dichotomous	1 – Marked, 2 – Not marked

Variable name	Variable description	Type	Categories/Properties
IP1G13IB	Management of ICT/responsibility for ICT/Students learn how to evaluate/School principal or deputy	Dichotomous	1 – Marked, 2 – Not marked
IP1G13IC	Management of ICT/responsibility for ICT/Students learn how to evaluate/Heads of department	Dichotomous	1 – Marked, 2 – Not marked
IP1G13ID	Management of ICT/responsibility for ICT/Students learn how to evaluate/ICT coordinator	Dichotomous	1 – Marked, 2 – Not marked
IP1G13IE	Management of ICT/responsibility for ICT/Students learn how to evaluate/Info specialist or librarian	Dichotomous	1 – Marked, 2 – Not marked
IP1G13IF	Management of ICT/responsibility for ICT/Students learn how to evaluate/Individual teachers	Dichotomous	1 – Marked, 2 – Not marked
IP1G13IG	Management of ICT/responsibility for ICT/Students learn how to evaluate/No one	Dichotomous	1 – Marked, 2 – Not marked
IP1G14B	Management of ICT/Procedures ICT use/Restricting the number of hours students are allowed to sit at a computer	Dichotomous	1 – Yes, 2 – No
IP1G14C	Management of ICT/Procedures ICT use/Student access to school computers outside class hours (but during school hours)	Dichotomous	1 – Yes, 2 – No
IP1G14D	Management of ICT/Procedures ICT use/Student access to school computers outside school hours	Dichotomous	1 – Yes, 2 – No
IP1G14E	Management of ICT/Procedures ICT use/Honouring of intellectual property rights (e.g. software copyrights)	Dichotomous	1 – Yes, 2 – No
IP1G14G	Management of ICT/Procedures ICT use/Playing games on school computers	Dichotomous	1 – Yes, 2 – No
IP1G14H	Management of ICT/Procedures ICT use/Giving the local community (parents and/or others) access to school computers	Dichotomous	1 – Yes, 2 – No
IP1G14I	Management of ICT/Procedures ICT use/Providing students with their own laptop computers	Dichotomous	1 – Yes, 2 – No
IP1G15A	Management of ICT/Professional development/Participating in courses on the use of ICT in teaching	Categorical	1-3 (None or almost none-Many)

Variable name	Variable description	Type	Categories/Properties
IP1G15B	Management of ICT/Professional development/Working with another teacher who has attended a course	Categorical	1-3 (None or almost none-Many)
IP1G15C	Management of ICT/Professional development/Discussing the use of ICT in education	Categorical	1-3 (None or almost none-Many)
IP1G15D	Management of ICT/Professional development/Observing colleagues using ICT in their teaching	Categorical	1-3 (None or almost none-Many)
IP1G15E	Management of ICT/Professional development/Discussing within groups of teachers about using ICT in their teaching	Categorical	1-3 (None or almost none-Many)
IP1G15F	Management of ICT/Professional development/Participating in a [community of practice] concerned with ICT in teaching	Categorical	1-3 (None or almost none-Many)
IP1G15G	Management of ICT/Professional development/Participating in courses conducted by an external agency or expert	Categorical	1-3 (None or almost none-Many)
IP1G15H	Management of ICT/Professional development/Participating in professional learning programs delivered through ICT	Categorical	1-3 (None or almost none-Many)
IP1G16A	Management of ICT/Priority to facilitate ICT/Increasing the numbers of computers per student in the school	Categorical	1-4 (High priority-Not a priority)
IP1G16B	Management of ICT/Priority to facilitate ICT/Increasing the number of computers connected to the Internet	Categorical	1-4 (High priority-Not a priority)
IP1G16C	Management of ICT/Priority to facilitate ICT/Increasing the bandwidth of Internet access for the computers	Categorical	1-4 (High priority-Not a priority)
IP1G16D	Management of ICT/Priority to facilitate ICT/Increasing the range of digital learning resources	Categorical	1-4 (High priority-Not a priority)
IP1G16E	Management of ICT/Priority to facilitate ICT/Establishing or enhancing an online learning support platform	Categorical	1-4 (High priority-Not a priority)
IP1G16F	Management of ICT/Priority to facilitate ICT/Providing for participation in professional development	Categorical	1-4 (High priority-Not a priority)
IP1G16G	Management of ICT/Priority to facilitate ICT/Increasing the availability of qualified technical personnel	Categorical	1-4 (High priority-Not a priority)

Variable name	Variable description	Type	Categories/Properties
IP1G16H	Management of ICT/Priority to facilitate ICT/Providing teachers with incentives to integrate ICT	Categorical	1-4 (High priority-Not a priority)
IP1G16I	Management of ICT/Priority to facilitate ICT/Providing more time for teachers to prepare lessons	Categorical	1-4 (High priority-Not a priority)
IP1G16J	Management of ICT/Priority to facilitate ICT/Increasing the professional learning resources	Categorical	1-4 (High priority-Not a priority)
C_HINHW	ICT use hindered in teaching and learning - Lack of hardware	Continuous	M=50, SD=10
C_HINOTH	ICT use hindered in teaching and learning - Other obstacles	Continuous	M=50, SD=10
C_ICTRES	ICT resources at school	Continuous	M=50, SD=10