Technical Note 46

Young Lives

Digital Access, Use and Skills Across Four Countries:

Construction of Scales and Preliminary Results from the Young Lives Round 5 Survey

Santiago Cueto, Claudia Felipe and Juan León

www.younglives.org.uk

JUNE 2018

Digital Access, Use and Skills Across Four Countries: Construction of Scales and Preliminary Results from the Young Lives Round 5 Survey

Santiago Cueto, Claudia Felipe and Juan León

First published by Young Lives in June 2018

Printed on FSC-certified paper from traceable and sustainable sources.

About Young Lives

Young Lives is an international study of childhood poverty, following the lives of 12,000 children in four countries (Ethiopia, India, Peru and Vietnam) over 15 years. **www.younglives.org.uk**

Young Lives is core-funded by UK aid from the Department for International Development (DFID).

The views expressed are those of the author(s). They are not necessarily those of, or endorsed by, Young Lives, the University of Oxford, DFID or other funders.

Core-funded by

UKaid
from the British people

Young Lives, Oxford Department of International Development (ODID), University of Oxford, Queen Elizabeth House, 3 Mansfield Road, Oxford OX1 3TB, UK

Tel: +44 (0)1865 281751 • Email: younglives@younglives.org.uk

Contents

Summary

This technical note outlines the procedures used to develop a digital module, administered to both Young Lives cohorts in the four study countries during the Round 5 household survey in 2016. The modules were based on existing scales in this field. We carried out pilot tests of instruments and performed psychometric analysis to present evidence of the reliability and validity of the instruments. The items measure access, digital skills and use of digital devices, including computers, tablets, the internet and mobile phones. This note provides measures of computer (offline) and internet skills, estimated through factor analysis.

Descriptive results show a clear digital divide across countries, with respondents in Peru and Vietnam showing higher levels of access, more frequent use, and earlier age of engagement with digital devices than respondents in Ethiopia and India. However, in a multivariate analysis we found that within countries there are differences in access associated with socio-economic status; for example, the wealth index (collected in Round 1 of Young Lives in 2001) predicts access to computers 15 years later, as do maternal education and ethnicity. In some cases, gender (favouring males, particularly in India) is also predictive of access. We also found that starting to use computers and the internet earlier, and using them daily, was associated with higher levels of digital skills in both cohorts for most countries.

The authors

Santiago Cueto has a degree in Educational Psychology from the Pontifical Catholic University of Peru and a PhD in the same field from Indiana University, United States. He has been a Visiting Researcher at the University of California at Davis and the University of Oxford. Santiago is the Research Director and Senior Researcher at GRADE, where he coordinates the Peru component of the international study Young Lives/Niños del Milenio. He has worked as a consultant to international organisations such as the Inter-American Development Bank, the World Bank and UNESCO.

Claudia Felipe has a Bachelor's degree in Economics from the Pontifical Catholic University of Peru. Currently she supports Santiago Cueto as a Research Assistant at GRADE.

Juan León has a PhD in Educational Theory and Policy and Comparative and International Education from Pennsylvania State University, United States. He has a Bachelor's degree in Economics from the Pontifical Catholic University of Peru. Juan is a Senior Researcher at GRADE in Peru. He is also a Lecturer in the Department of Psychology at the Universidad Antonio Ruiz de Montoya in Lima.

Acknowledgements

The authors would like to acknowledge and thank María Cristina Vásquez from GRADE for her significant contribution to the preparation of the instrument on digital access and skills used in the Young Lives Round 5 survey. Marta Favara provided useful comments on an earlier version of this note.

1. Introduction

Access to computers and other digital devices and the internet has grown quickly in contemporary societies, and more so than other recent transformations, such as access to water, electricity, sanitation or education (World Bank 2016). Beyond access, it is often expected that citizens around the world should be able to demonstrate advanced digital skills, as these favour economic growth, help people find jobs and perform more efficiently, and allow governments to provide improved services. The World Bank (2016) refers to these benefits as 'digital dividends', which in general are development benefits resulting from using technologies. Access and skills in using digital devices also open up opportunities for individuals and groups in a variety of areas, such as education. Taking this into consideration, Young Lives decided to include a module on access to digital devices and the internet, as well as frequency of use and skills in using them, in our Round 5 household survey, administered in 2016. This module was administered to the Younger Cohort and Older Cohorts in Ethiopia, India (the states of Andhra Pradesh and Telangana only), Peru and Vietnam. This technical note provides background information on the development of the module, details on some psychometric characteristics of the scales, and reports on the initial findings.

2. Background: perspectives and research on digital access and skills

As in many aspects of contemporary life, inequality is key in understanding access to computer technologies and skills. In this regard, the 'digital divide' is a concept that has gained increasing attention over recent decades. The digital divide has been defined as 'the gap between people who do and do not have access to forms of information and communication technology' (van Dijk 2017: 1). These refer mostly to computers, other digital devices (such as smartphones and tablets), and the internet. The term has been used since the mid-1990s, mainly in reference to access. However, over the past few years the emphasis of the divide has shifted to also include skills, both in regard to digital devices and also the internet. The skills necessary to effectively use digital devices and the internet has been described by some authors as a 'second-level divide' (Hargittai 2002). However, as many authors have suggested, the concept of 'divide' may be misleading, as it suggests that there are two clearly separate groups: those who have access (frequently or even daily) those who do not (ever). In many cases though, we are talking about a continuum for access and skills, with no clear threshold.

Van Dijk (2017) has proposed a theoretical model he terms the 'resources and appropriation theory' to explain digital access and skills. His model emphasises the role of inequalities; those that have been most studied in this field are age, gender, race/ethnicity, intelligence, different categories of personality, health, and disability. Reviewing the results for all these variables is beyond the scope of this note, but some of these variables were available in our survey and are therefore included in the analyses below.

Some international organisations have suggested that mastering skills in technology is essential for citizens. For example, the Partnership for 21st Century Learning has proposed that individuals should develop information, communication and technology literacy, which includes applying technology effectively. Literacy in this field includes using 'technology as a tool to research, organise, evaluate and communicate information'; 'use digital technologies … to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy'; and 'apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies' (Partnership for 21st Century Learning 2015).

Along these lines, the European Commission has published a framework for digital competencies, called DigComp. DigComp is described as a 'tool to improve citizen's digital competence for work and employability, learning, leisure, consumption and participation in society' (EU Science Hub n.d.), and it includes a self-evaluation instrument. The framework includes abilities in information and data literacy, communication and collaboration, digital content creation, safety and problem solving, with eight levels of proficiency. This framework would be difficult to use in developing countries, given that access and use of digital devices is lower. For example, 96% of 15-year-old students in OECD countries reported that they had a computer at home (OECD 2015). In developing countries, such as the Young Lives countries, these figures are much lower, and limited access is often the first issue that students face.

The United Nations has established the Sustainable Development Goals (SDG), covering the period between 2015 and 2030. Among the 17 goals, Goal 4 relates to education: 'Ensure inclusive and quality education for all and promote lifelong learning' (United Nations n.d.). In the most recent Global Education Monitoring Report prepared to track achievements related to this goal (UNESCO 2017), a global indicator was included that relates to digital skills: 'Percentage of youth/adults with information and communications technology (ICT) skills, by type of skill' (171), plus two thematic indicators: 'Percentage of youth/adults who have achieved at least a minimum level of proficiency in digital literacy skills' and 'Youth/adult educational attainment rates by age group, economic activity status, levels of education and programme orientation' (171). The report shows wide disparities between countries in regard to mastery of digital skills. The results included in this technical note are relevant to the SDGs.

Testing a variety of students' and citizens' skills has become a part of several international programmes over the past few decades, including tests in basic education such as PISA, PIRLS and TIMSS, and, for adults, PIAAC.[1] Aligned with these efforts to measure skills has been an increasing interest in evaluating digital skills (Filippucci and Pacei 2007).

Most studies of computer and internet access and skills have been carried out in industrialised countries. Filippucci and Pacei (2007) found lower skills levels in Italy for females, people with lower levels of education, part-time workers, and people working in some areas that apparently did not require significant use of computers, such as health and social assistance. They found low levels of skills overall and suggested these should be emphasised in schools and companies.

1 PISA measures a variety of skills among 15-year-old students; see www.oecd.org/pisa. PIRLS measures reading skills, while TIMSS measures skills in mathematics and science; see https://timssandpirls.bc.edu. PIAAC is the Programme for the International Assessment of Adult Competencies developed by the OECD; see www.oecd.org/skills/piaac.

Age seems to be an important consideration, as each new generation is expected to have higher access and skills than previous generation. However, younger people do not always have higher skills than older people, as, for example, adults working in companies are often trained on how to use computers and the internet for tasks linked with production, and university students are often expected to heavily use digital devices for a variety of purposes, with specific software being constantly developed for many professions. Despite this, only a few studies have surveyed digital access and skills among children. In a UK study including children aged 9 to 19 years old, Livingstone and Helsper (2007) found inequalities by age (older children had more access), gender (favouring boys), and socio-economic status (favouring middle-class over working-class households).

In many industrialised countries, it would seem that young adults are among the more active users of computers and the internet. For example, Hargittai and Hinnant (2008) found that among 18 to 26-year-old men in the US, those who used computers at home and were frequent users had higher levels of knowledge of internet-related terms. The education level of the individual was not related to their knowledge. However, education level was related to the number of capital-enhancing online activities (i.e. political participation, career advancement, and consulting information about financial and health services). A variable included in both models that turned out to be non-significant was frequency of internet use.

In a descriptive study in the US testing people´s skills on finding information on the internet, Hargittai (2002) found that young adults had higher skills than older people. Experience with technology also predicted skills, but there were small differences between males and females.

3. Development of the Young Lives digital module

For the development of the digital module, the international Young Lives team decided to collect information on access to, use of, and skills on digital devices and the internet. While we found that in the literature there is little discussion about using self-report measures to measure access and use of digital devices, there is more debate on the measurement of skills. We considered several options. The first was a direct measure of skills, providing participants with exercises on the tablets that were used to collect data, and asking respondents to show their skills through solving a few items. This method was used in the US by Hargittai (2002), but with only a small sample of 54 subjects. We discounted this method for a variety of reasons, primarily because in the variety of contexts in which Young Lives collects data, the type of devices and software that children regularly use would also be very different, and thus testing them on tablets with a single piece of software could be an unfair method for some to demonstrate their skills. Similarly, the OECD (2015) has developed an applied test so that they can estimate two ‘navigation in digital reading’ scores, based on the achievement of the child using the computer. Again, this would require that participants know how to operate the tablet we used in the field, which would not be the case for many children, who may, for example, be able to use computers but not tablets, or use tablets but with different software. Finally, we wanted to test both computer and internet skills, and thus did not choose a direct method.

The second option we considered to measure children´s abilities was to present them with a variety of computer and digital skills tasks on paper, with multiple choice options for their

responses. This was discarded due to the difficulty in covering a valid range of items they would be familiar with, plus the fact that testing using a paper and pencil format would likely be unnatural for some children, as it is different from a real environment, and would therefore lessen their chances of performing to the best of their abilities.

A third method to measure skills is self-reporting on knowledge of internet-related terms (Hargittai and Hinnant 2008).[2] We did not use these option as we have four study countries and within these many specific contexts (e.g. urban and rural), and ages (15 years old for the Younger Cohort and 22 for the Older Cohort), and thus selecting a universal, relatively small, set of terms that was relevant for all seemed difficult.

The fourth option, which we selected, was to measure skills through self-reports of digital skills. This method has a number of advantages: first, it does not matter what hardware or software children use to perform the tasks; and second, several items can be administered in a short period of time, thus allowing a range of skills to be explored. There are, however, also disadvantages, and particularly that in self-reports the issue of social desirability always has to be considered. In other words, children may report that they have higher skills than they actually do, or compare themselves favourably in relation to their peers. Filippucci and Pacei (2007) administered a self-report scale with a test of skills in Italy, and included in their survey general computer knowledge, competence in managing files, word processing, spreadsheets, access database, basic web search tasks, and web page construction. They found that the correlation between the self-report and direct test of skills in any given scale ranged from 0.54 to 0.89. All correlations are positive, as would be expected; however, the authors found that many respondents overestimated their computer skills. Thus, our results should be interpreted with some caution, as they may over represent the actual skills of participants.

To develop the questions to be included in the Round 5 digital skills survey, we carried out a pilot test in all countries, so that we could test administration procedures as well as clarity of language in the items. In the pilot, we administered a large set of items (based on the instruments mentioned above) to children outside the Young Lives sample but of similar ages to our respondents from both cohorts in all four countries. Sample sizes ranged from 96 (pilot sample for the Older Cohort in Peru) to 463 participants (pilot sample for the Older Cohort in India). We entered all items for statistical analysis and noted questions raised by participants and comments from field workers. From this analysis we noted that the section on skills could only be reasonably responded to by participants that had frequent digital access; other participants seemed to feel uncomfortable acknowledging that they had no computer or internet skills. Given that access was very low for the Younger Cohort in Ethiopia and India, we decided not to include questions on skills in the final Round 5 survey, but it was administered in all countries for the Older Cohort. For the selected groups, questions on skills were only administered to those who answered ‘many times in my life’ to question 1. Using the pilot data, we ran analysis to estimate reliabilities of the scales and fact analysis to identify the items that could more efficiently form a single construct for each variable mentioned below. Finally, we adjusted the instructions and framing of some items to facilitate comprehension. The items included in the final version were revised based on these pilots and deliberations within the team.

2 This refers to words (frames, preference settings and newsgroups) and file extensions (jpg and pdf) that are common knowledge for people who use the internet frequently.

4. Digital module in the Young Lives Round 5 survey

4.1. Construction of the scales

Different questionnaires and surveys (Helsper, van Deursen and Eynon 2015a; Livingstone 2004; PISA 2009; World Bank 2015) collect information on access to digital devices. Appendix 1 lists the items we used and the original sources for them. In the pilot and final survey, the digital module was divided into three parts. First, we asked about digital access, in other words, if the respondent had ever used any digital device. Second, we inquired about the frequency of use and age of first use. Lastly, we included questions about computer skills (without internet) and online skills.

In the first section of the module, we included items on access and use of computers and other digital technology. The module began with an access question that acted as a filter for the remaining items. We asked about access to computers or laptops, tablets, internet, and mobile phones with internet access (e.g. smartphone; see item Q1 in Appendix 1). For the latter, we decided to ask only about mobile phones with internet access as this is a more accurate measure of having access to similar interfaces or operational systems of digital devices, such as tablets or laptops. These questions served as a filter. Only those who answered having used any of the options 'many times in their lives' continued answering the questions on uses and skills that followed.[3] The access question was not limited to a particular place (i.e. home, school or community) where the respondent reported using the device.

We then included a question on frequency of use: 'In the last 12 months, how often have you been using any of the following'. The options were the same as for first question: computer or laptop, tablet, internet, mobile phone with internet access (e.g. smartphone; see Q2 in Appendix 1). The third item was 'How old were you when you first used each of the following?' (see Q3 in Appendix 1). Finally, in this section we asked for usage of two popular tools: email and social networks (see Q4 in Appendix 1).

Including an assessment of digital skills is relevant because, as mentioned above, inequality in this field refers not only to access but also to differences in digital literacy (van Deursen, Helsper and Eynon 2015). Most recent studies, such as Helsper et al. (2015b) and Livingstone and Bulger (2014), measure only internet use and skills in industrialised countries. However, in developing countries, the difference between access and skills is quite relevant, in both computers and the internet. This is why we included questions specific to offline and online activities.

The first set of items/survey questions in the skills section measures computer offline skills (see Q5 in Appendix 1). It includes 10 Likert-type questions, which measure self-reported mastery of basic digital skills related to file management tasks, operations, text functions and tasks in office programmes. However, we did not include the complete survey developed by Duvel and Pate (2004) due to time limitations in the administration of the survey.

3 Appendix 2 shows the options for responses and frequencies per country and cohort for all questions.

The second set of items/survey questions in the skills section measures internet skills (see Q6 in Appendix 1). It is based on the questionnaire developed by Helsper et al. (2015b)[4] for the 'From Digital Skills to Tangible Outcomes Project';[5] however, after the pilot we adapted some of the items. Helsper et al. proposed five different types of skills, and our instrument includes some of the items proposed in three of their digital skills scales: Operational ('skills to operate the digital media and its special structures such as menus and hyperlinks'); Information navigation ('skills to search, select and evaluate information in digital media'); and Creative ('skills to create content of acceptable quality to be published on the internet'). We did not include all items for the subscales due to time limitations during administration.

In regard to psychometric properties, in Round 5 the reliability of these two scales was calculated using Cronbach´s Alpha. The coefficients are presented in Table 1. All indices are very high, and all items had high correlations among themselves and with the total score. In addition, as shown below, the items in each scale in each country formed a single factor, which was used for analysis. This was taken as evidence of construct validity, although again, the main limitation of the scale is that it is short and thus does not measure a wide range of skills.

Table 1. *Reliability (Cronbach's Alpha) of computer and internet skills scales per cohort and country*

Skills	Ethiopia	India	Peru	Vietnam
Computer skills – Younger Cohort	---	---	0.91	0.89
Internet skills – Younger Cohort	---	---	0.87	0.82
Computer skills – Older Cohort	0.93	0.91	0.95	0.95
Internet skills – Older Cohort	0.91	0.88	0.92	0.88

Note: The skills surveys were not administered for the Younger Cohort in Ethiopia and India.

Field workers administered the survey at home, filling in the responses in a tablet. The Ethics Committee of the Social Science Division, University of Oxford, approved all the procedures for survey administration, as did the Human Subjects Committee of the Instituto de Investigación Nutricional (IIN) in Lima. Below, we test the scales validity using an exploratory factor analysis, and present some descriptive results and preliminary findings from multivariate regressions, estimating the probability of having access to digital devices and the predictors of digital skills. For the latter we did some recoding, the procedures for which are explained below.

4.2. Factor analysis for computer and internet skills

For the computer scale (10 items) and internet scale (eight items), we tested the validity using an exploratory factor analysis. Given the low frequency of cases by category, we recoded the responses of participants (see Table A6 in Appendix 2). The categories 'Strongly disagree', 'Disagree', 'Neither agree or disagree', and 'I do not understand what this means' were coded with a value of 0; the category 'Agree' was coded with a value of 1, and the category 'Strongly agree' was coded with a value of 2. Once each item was recoded, the exploratory factor analysis was performed.

4 For this instrument, we did not use social and mobile skills from the questionnaire.

5 Licence provided: http://creativecommons.org/licenses/by-nc-sa/4.0/legalcode

Table 2 shows that for most scales, the items load in one factor as we expected. However, in Ethiopia and Vietnam, some items loaded in two factors. However, the variance explained by the first factor of each scale accounted for a high proportion of the common variance across items in all cases (from 44 per cent to 70 per cent). Finally, we tested the adequacy of the data for our analysis using the Keyser-Meyer-Olkin (KMO) test. The results show that for all analysis the data are adequate for the factor analysis performed, as the KMO index for all the scales is above 0.80.

Table 2. *Factor analysis and sampling adequacy*

	Computer skills Younger Cohort		Computer skills – Older Cohort				Internet skills Younger Cohort		Internet skills – Older Cohort			
	Peru	Vietnam	Ethiopia	India	Peru	Vietnam	Peru	Vietnam	Ethiopia	India	Peru	Vietnam
Percentage of variance explained by Factor 1	0.55	0.51	0.61	0.55	0.70	0.70	0.52	0.44	0.60	0.56	0.65	0.56
Percentage of variance explained by Factor 2		0.11	0.10					0.13				
Data adequacy – KMO	0.94	0.92	0.92	0.92	0.95	0.95	0.92	0.87	0.90	0.91	0.93	0.90

Finally, to build the composite scores for each scale, we used a confirmatory factor analysis; Table 3 presents the scoring coefficients used in the construction of the computer skills index and internet skills indices.

Table 3. *Scoring coefficients*

	Computer skills scoring coefficients Younger Cohort		Computer skills scoring coefficients Older Cohort			
	Peru	Vietnam	Ethiopia	India	Peru	Vietnam
I know how to create a folder on a digital device.	1.00	1.00	1.00	1.00	1.00	1.00
I know how to move a file from one folder to another	1.08	1.07	1.04	1.10	1.17	1.06
I know how to delete a file.	1.01	0.94	0.89	0.80	1.13	0.87
I know how to retrieve a deleted file from the recycle bin.	1.15	1.02	1.23	1.10	1.38	1.14
I know how to use the undo and redo functions, while working on a digital document.	1.04	0.98	1.15	1.33	1.27	1.13
I know how to change the margins (for example, using Word).	0.98	0.99	1.18	1.13	1.26	1.17
I know how to bold, italicise or underline text (for example, using Word).	0.95	0.97	1.22	1.05	1.12	1.03
I know how to insert a table in a document (for example, using Word).	1.04	0.93	1.04	1.18	1.26	1.13
I know how to use a spreadsheet to plot a graph (for example, using Excel).	0.86	0.70	1.08	1.17	1.29	1.06
I know how to create a presentation (for example, using PowerPoint).	1.01	0.66	1.20	1.32	1.23	1.03

	Internet skills scoring coefficients Younger Cohort		Internet skills scoring coefficients Older Cohort			
	Peru	Vietnam	Ethiopia	India	Peru	Vietnam
I know how to open downloaded files.	1.00	1.00	1.00	1.00	1.00	1.00
I know where to click to go to a different webpage.	0.92	1.07	1.03	1.05	0.90	1.07
I know how to complete online forms.	1.01	0.95	1.13	1.21	1.08	1.14
I know how to connect to a Wi-Fi network.	1.07	0.78	1.01	1.01	0.95	0.86
I find it easy to decide what the best keywords are to use for online searches.	0.84	0.99	1.21	1.07	0.85	0.97
I find it easy to find a website I visited before.	0.99	1.13	1.2	1.14	0.89	1.03
I know how to create something new from existing online images, music or video.	0.88	0.82	1.23	0.88	0.89	0.97
I know which apps or software are safe to download.	0.89	0.89	1.08	1.11	0.81	0.86

5. Results

5.1. Descriptive results

Table 4 presents the characteristics of the Younger and Older Cohorts for the four countries. The variables included here were included later in the multivariate analysis.

Table 4. *Sample characteristics*

Variable	Younger Cohort				Older Cohort			
	Ethiopia	India	Peru	Vietnam	Ethiopia	India	Peru	Vietnam
Male (%)	52.8	53.9	50.4	51.3	53.0	49.2	52.6	49.1
Age (in years)	15.1	15.0	15.0	15.2	22.0	22.0	21.9	22.3
Wealth index in Round 1 (score)[a]	0.2	0.4	0.4	0.4	0.2	0.4	0.5	0.5
Ethnic majority group (%)[b]	43.4	46.5	86.6	87.2	42.5	46.7	90.2	88.5
Maternal education								
Incomplete primary or less (%)	84.8	71.7	29.2	24.3	87.5	79.9	32.2	27.2
Complete primary or incomplete secondary (%)	9.8	22.4	33.3	62.3	7.9	16.1	35.0	59.5
Complete secondary or more (%)	5.4	5.9	37.5	13.4	4.6	4.0	32.9	13.3
Score in CDA in Round 2 of YL[c]	8.2	9.4	8.4	9.8	---	---	---	---
Score in mathematics in Round 2 of YL[d]	---	---	---	---	4.9	5.8	5.8	7.5
Score in mathematics in Round 3 of YL[e]	6.6	12.0	14.2	19.4	---	---	---	---
Number of participants in Module in Round 5	1802	1884	1841	1938	813	914	596	910
Number of participants in Round 1	1999	2011	2052	2000	1000	1008	714	1000

Notes: a. The wealth index in Round 1 is a composite score comprised of measures of housing quality, access to services, and consumer durables.

b. For Ethiopia, Peru and Vietnam the ethnic majority was defined based on the maternal tongue of the child in Round 2. For India, the ethnic majority was defined based on the caste of the child; in this table, Backward Classes is the majority group. In Peru, Spanish is compared with minority languages (Quechua and other indigenous languages). In Vietman, Vietnamese is compared with minority languages (Tay, H'mong, Nung, Dao and Giay). In Ethiopia, Amarigna is compared with Tigrigna, Oromifa, and others (Afarigna, Guraghigna, Hadiyigna, Sidamigna, Siltigna, Welayitegna). In India, Backward Classes are compared with Scheduled Castes, Scheduled Tribes, and other castes.

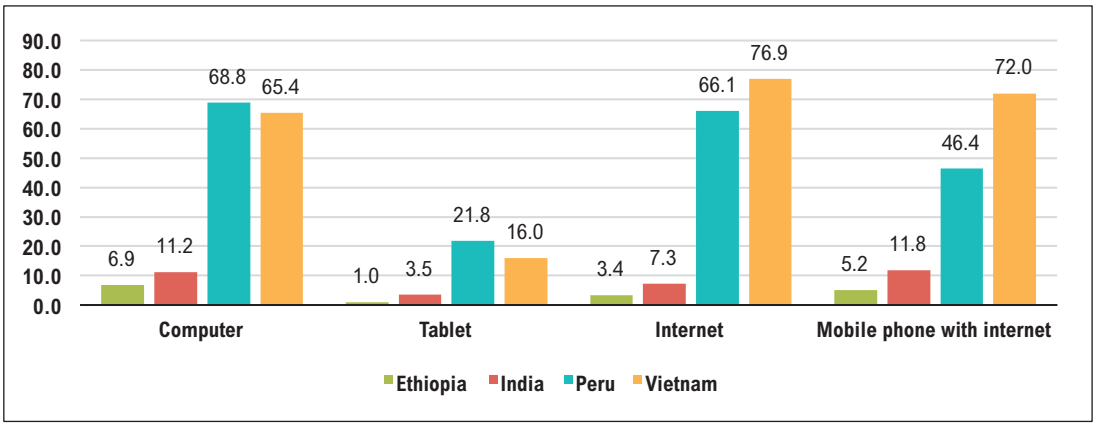
c. The CDA test is a test of quantitative notions administered to the Younger Cohort in Round 2 (age 5). For more information, see www.ninosdelmilenio.org/wp-content/uploads/2012/10/tn15.pdf.

d. The mathematics test administered to the Older Cohort in Round 2 included items on number and number sense. For more information, see www.ninosdelmilenio.org/wp-content/uploads/2012/10/tn15.pdf.

e. The mathematics test administered to the Younger Cohort in Round 3 included items on number and number sense. For more information, see www.ninosdelmilenio.org/wp-content/uploads/2013/03/tn25.pdf.

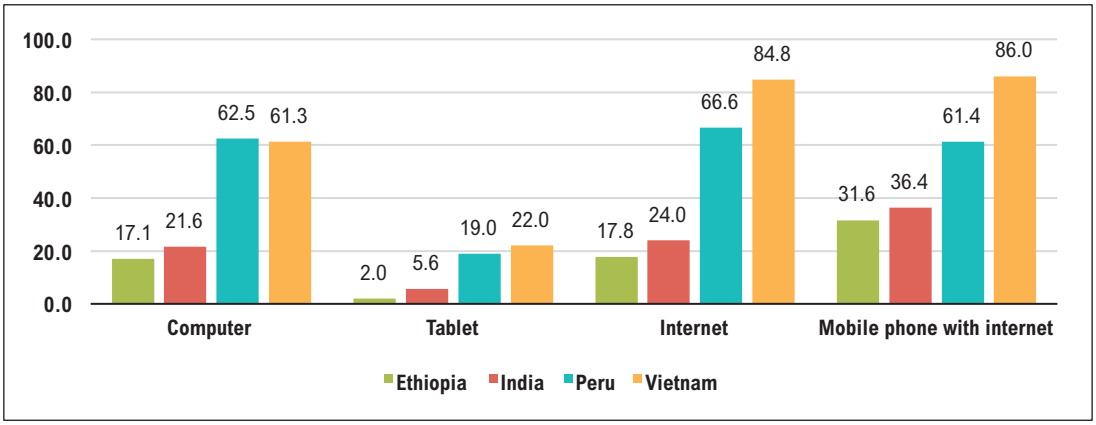
Figures 1 and 2 present the results on access to the four types of digital devices, showing the proportion of children who said they had used the device 'many times in their lives'.[6]

Figure 1. *Access to digital devices and internet by country – Younger Cohort (%)*



Note: Percentage saying they had used each of the devices 'many times in their lives'.

Figure 2. *Access to digital devices and internet by country – Older Cohort (%)*



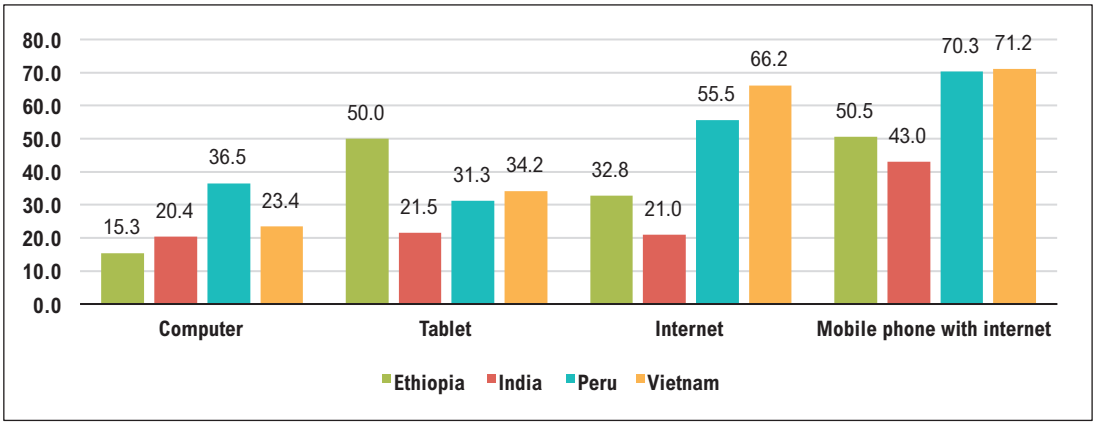
Note: Percentage saying they had used each of the devices 'many times in their lives'.

The results show a higher use of computers, mobile phones and internet, over tablets, in Peru and Vietnam, for both cohorts. Mobile phone use is reported to be particularly high in Vietnam, as well as access to the internet. In some OECD countries more access is reported to the internet than to computers among the adult population (OECD 2013). This is clearly happening in Vietnam. When the cohorts are compared, it is clear that in all countries there is more usage of mobile phones among the Older Cohort. There is also a pattern of higher internet use among the Older Cohort. However, for computers there is more access for the Younger Cohort, but only in Peru and Vietnam. The patterns are mixed in regard to use of tablets. In regard to frequency of use, Figures 3 and 4 present the percentage of children by cohort and country who reported they used each of the devices daily (only for those who reported using each device 'many times in their life' in the previous question; the same exclusion applies to all the questions that follow).[7]

6 See Appendix 2 for detailed results for all categories for this question and the questions that follow, by cohort and country.

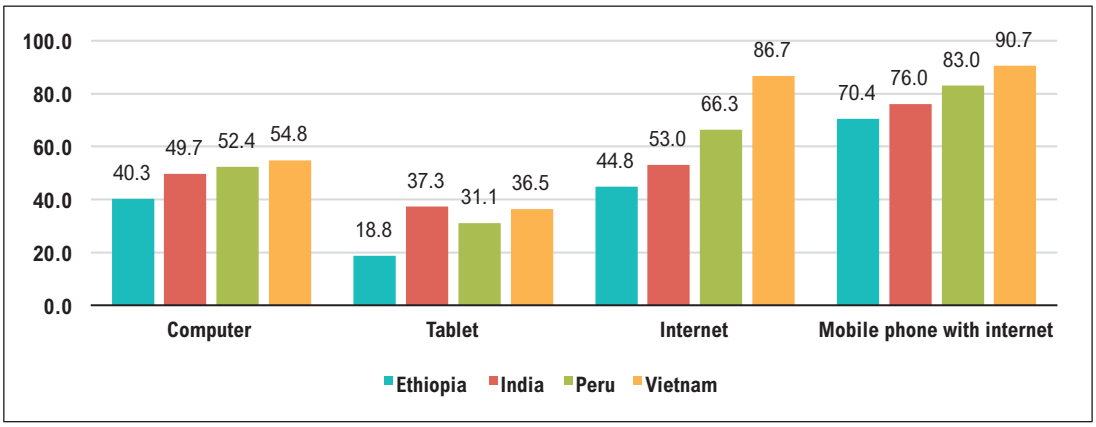
7 Detailed results by item are in Appendix 2.

Figure 3. *Percentage of Young Lives children using digital devices daily – Younger Cohort (%)*



Note: Data only for those who reported using the device 'many times in their life' in the previous question.

Figure 4. *Percentage of Young Lives children using digital devices daily – Older Cohort (%)*



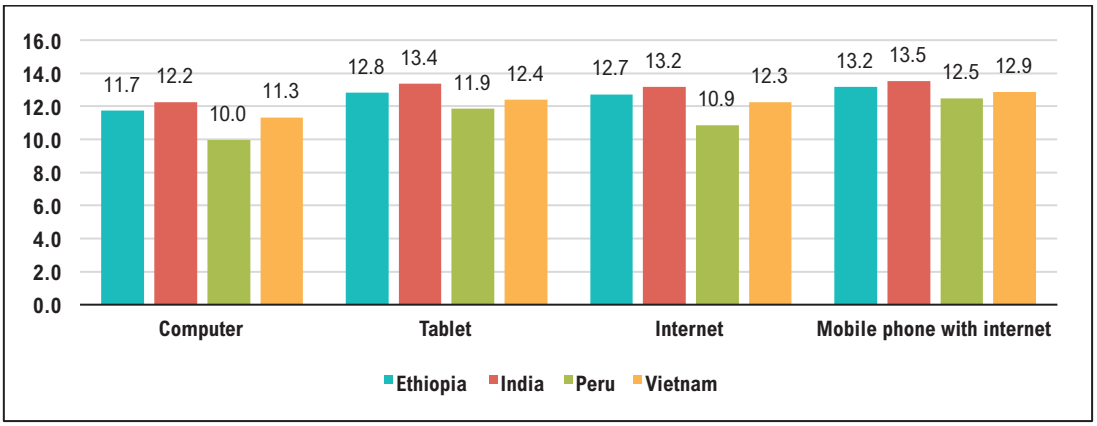
Note: Data only for those who reported using the device 'many times in their life' in the previous question.

Again, higher frequency of use is reported in Peru and Vietnam, over Ethiopia and India. Also, frequency of mobile phone and internet use seems particularly high for the Older Cohort in Vietnam. In most cases, usage is more frequent for the Older Cohort.

In regard to age of first use, Figures 5 and 6 present the reported average age by cohort and country for each device and the internet.[8]

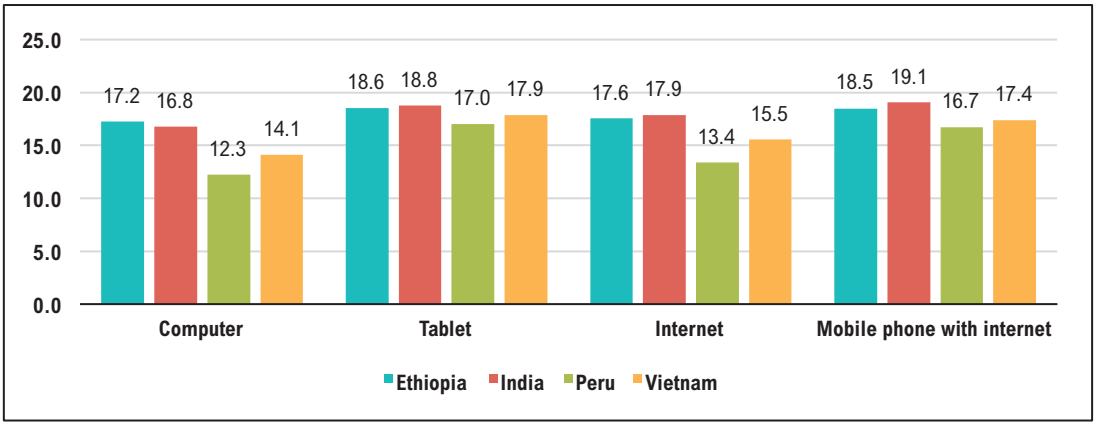
8 Appendix 4 includes a test of significance of the differences among countries for each variable.

Figure 5. *Age of first use (in years) of digital devices and internet by country – Younger Cohort*



Note: Data only for those who reported using the device 'many times in their life' in the first question.

Figure 6. *Age of first use (in years) of digital devices and internet by country – Older Cohort*

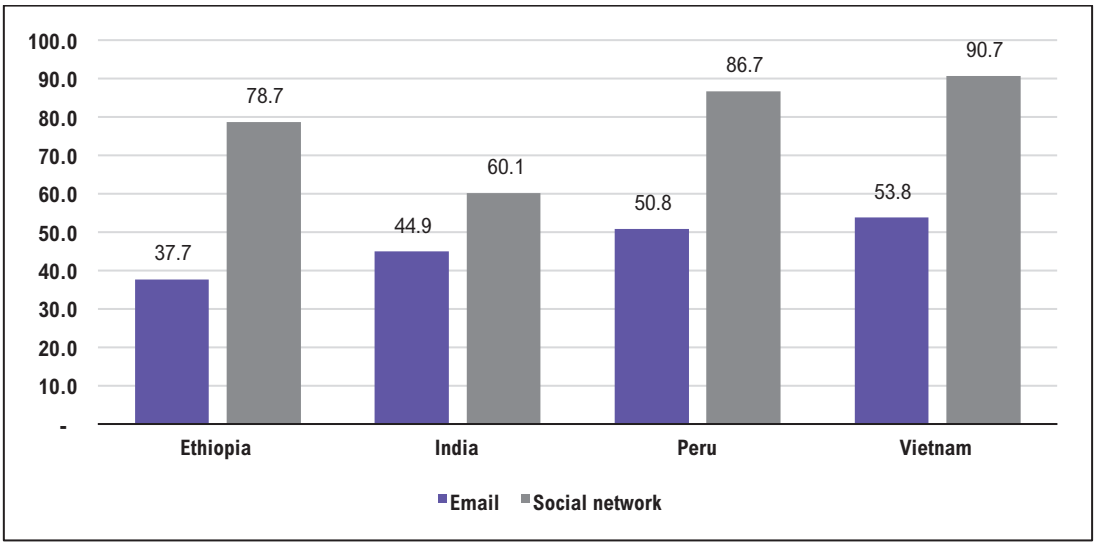


Note: Data only for those who reported using the device 'many times in their life' in the first question.

Age of first use is much lower for the Younger Cohort, compared to the Older Cohort; this is in line with trends found in other countries. As in previous figures, respondents from Peru and Vietnam show an advantage, in this case as they started using the devices earlier in life.

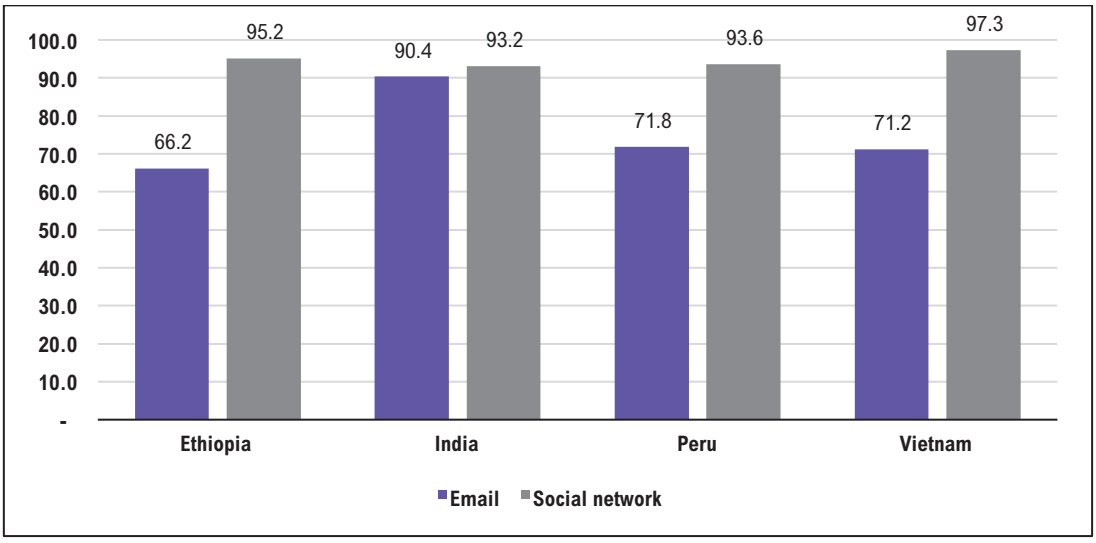
Figures 7 and 8 present the percentage of children who had an email or social network account (examples included Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.) Use of social networks is reported more frequently than having an email account in all countries. However, reported patterns are again higher in Peru and Vietnam, except for the Older Cohort in Ethiopia and India, with almost all respondents from the four countries reporting having a social network. Appendix 4 presents a test of the significance of these differences.

Figure 7. *Percentage of children who had used internet tools by country – Younger Cohort (%)*



Note: Data only for those who reported using the device 'many times in their life' in the first question.

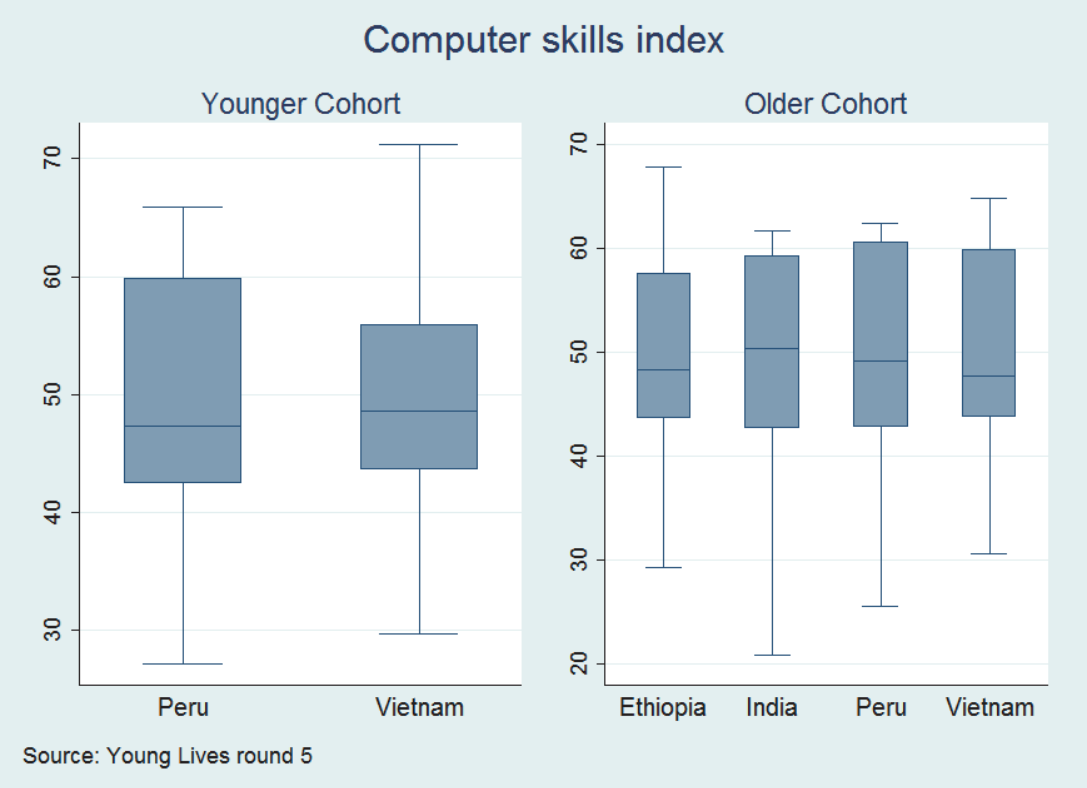
Figure 8. *Percentage of children who had used internet tools by country – Older Cohort (%)*



Note: Data only for those who reported using the device 'many times in their life' in the first question.

Figure 9 presents the factor scores in the computer skills scale for the Younger Cohort in Peru and Vietnam, and for the four countries for the Older Cohort (the skills scales were not included in Ethiopia and India´s Younger Cohort survey given the low frequency of use observed in the pilot). To facilitate interpretation, we transformed the scores into a scale with a mean of 50 and standard deviation of 10.

Figure 9. *Computer skills by country – Older and Younger Cohorts*



Note: Interpretation of a box chart in Appendix 3.

For Peru and Vietnam, for both cohorts, there is a relatively large group with higher skills than the other two countries.[9] In contrast, in India there is a large group with a low level of skills, compared to the international group. The means are very similar across countries, but as mentioned above, the group that was asked these questions in Ethiopia and India was much smaller than Peru and Vietnam, given the filter used from question 1.[10]

A similar procedure was followed for the items in the internet skills scale. The results are presented in Figure 2. The patterns seem to be very similar to those found for computer skills.

[9] All values were included in the figure and analyses, as the number of extreme values was very small.

[10] Sample sizes are reported in Appendix 2.

Figure 10. *Internet skills by country – Older and Younger Cohorts*

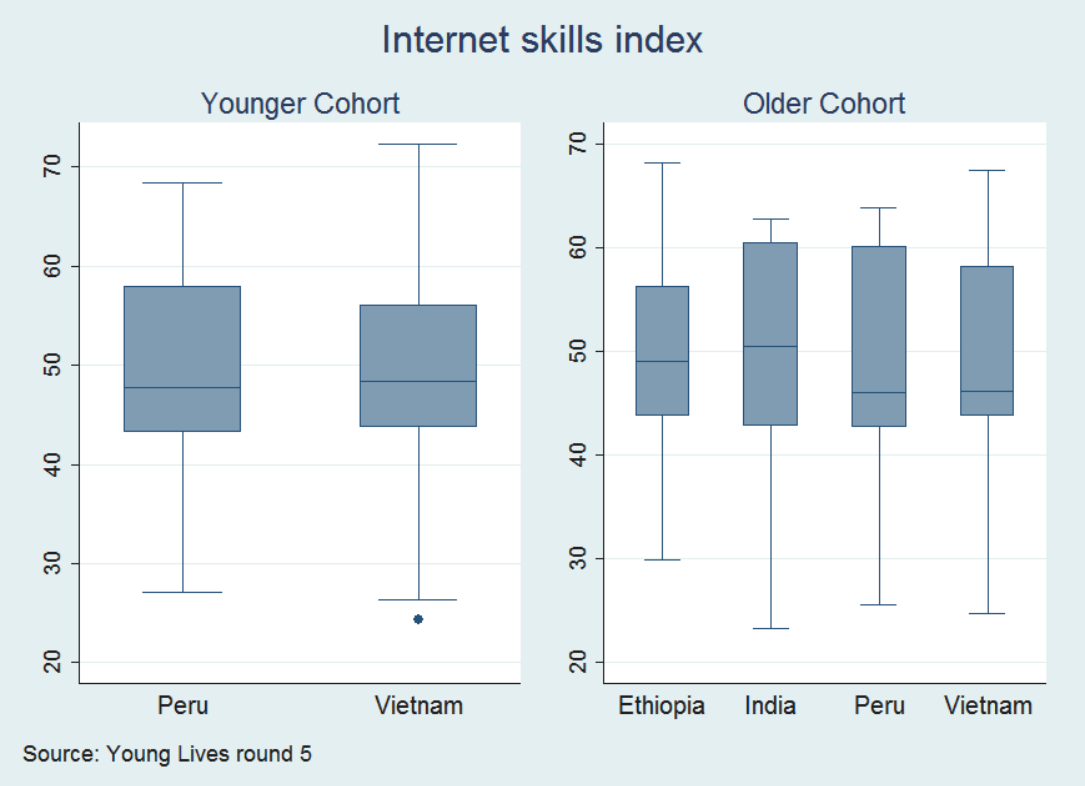


Table 5 presents the correlations between computer and internet skills for the four countries and two cohorts. The correlations are high and positive in both cohorts.

Table 5. *Pearson correlations between computer and internet skills scales by cohort and country*

Skills	Ethiopia	India	Peru	Vietnam
Younger Cohort	---	---	0.79	0.75
			(1158)	(1174)
Older Cohort	0.81	0.75	0.85	0.78
	(86)	(154)	(449)	(551)

Note: The digital skills scales were not administered to the Younger Cohort in Ethiopia and India. All correlations were statistically significant (p<=0.000). Number of observations is in parentheses.

Tables A6.1 to A6.12 in Appendix 2 include the results for both cohorts per country for all items. Table 6 presents some of these results, to provide a sense of what participants can do (the first three questions refer to the computer skills scale, the latter three to the internet skills scale). For Peru and Vietnam, the percentage who answered positively is always higher in the Older Cohort, compared to the Younger Cohort. There was no cut-off score to decide what level of skills would be acceptable, as is done in some international tests and DigComp. However, it would seem that even among this group, with frequent contact with computers or the internet, there are many respondents who do not feel confident about their mastery of specific tasks (for example, in only a few cases was the percentage saying that they strongly agreed that they could do the task above 50 per cent).

Table 6. *Responses to items per country and cohort*

Item	Cohort	Ethiopia	India	Peru	Vietnam
I know how to create a folder on a digital device.	Younger Cohort	--	--	38.0	24.2
	Older Cohort	35.3	59.9	45.4	35.7
I know how to bold, italicise or underline text (for example, using Word).	Younger Cohort	--	--	41.6	31.7
	Older Cohort	25.2	49.2	50.8	36.4
I know how to create a presentation (for example, using Power Point).	Younger Cohort	--	--	29.7	9.6
	Older Cohort	17.3	48.2	44.7	23.1
I know how to open downloaded files.	Younger Cohort	--	--	33.1	23.9
	Older Cohort	31.7	52.1	43.8	29.7
I know how to complete online forms.	Younger Cohort	--	--	21.3	11.5
	Older Cohort	24.8	44.7	36.5	21.1
I know how to connect to a Wi-Fi network.	Younger Cohort	--	--	32.2	43.1
	Older Cohort	31.0	54.3	40.9	47.3

Notes: The results correspond to the percentage of respondents saying that they 'strongly agree' with each statement. Responses correspond only to those who answered that they had used the device 'many times in their lives' to the question 'Have you ever used any of the following? Computer, tablet, internet or mobile phone with internet access'.

5.2. Multivariate analysis

Finally, we ran multivariate analysis to estimate the predictive value of several variables (included in Table 4) on computer and internet skills. We first used a probit model to estimate the association between predictive variables and the probability of having used a computer or the internet many times (binary dependent variable). The marginal effects of the model are presented in Tables 7 and 8 for the Younger and Older Cohort respectively. Then, we used an OLS model to study the determinants of computer and skills.[11] Table 9 presents the results for the Older and Younger Cohorts. The coefficients of the regressions should be interpreted as associations and not cause and effect relationships.

Regarding use, results in Table 7 for the Younger Cohort show that wealth index in Round 1 is a positive significant predictor in all cases for computer and internet use. This is an interesting result, given that this index was captured when children were 1 year old, and it has a significant association with access 14 years later. This speaks to high levels of inequality in all countries. Related to this, maternal education (i.e. secondary education completed or above) is also associated with use in almost all cases (except for internet use in Ethiopia). For example, in Ethiopia, children with a mother with more than secondary education are 10.5 percentage points more likely to use a computer (other coefficients should be interpreted in a similar way). The third variable that is significant for all countries is mathematics achievement in Round 3, when the children were 8 years old. However, this variable may be capturing an indirect way in which socio-economic status predicts performance, as this variable has been found to be associated with educational opportunities and outcomes (see, for example, Cueto et al. 2016). Mathematics achievement in Round 2, when children were age 5, is significant for computer and internet use, but only for Peru and Vietnam, and only for internet use in India. Ethnicity has a negative value in Vietnam, which means that Vietnamese speakers are more likely to use the internet and computers than those who speak a minority language. In India we found that Scheduled Castes are more

11 We calculated a bias sample correction in two steps: (i) with data from all respondents, a probit regression estimated the probability of being part of the sample as a function of demographic characteristics; and (ii) the predicted probability of each individual being in the analysis sample was used as a control variable for the analysis with the restricted sample.

likely to use a computer than Backward Classes. Also, in Ethiopia we found that those who speak Tigrigna are less likely to use the internet relative to those who speak Amarigna. Gender has a significant effect for some analyses, favouring boys in India and girls (in relation to computers only) in Ethiopia.

For the Older Cohort (Table 8), results on use are similar to the Younger Cohort. Use is associated with wealth level (also collected 14 years before the Round 5 data), achievement and maternal education (except in Ethiopia). There is also a gender gap, in favour of males: they more likely to use computers or the internet in Ethiopia, India and Vietnam. There were also differences by ethnic groups or castes in all countries, favouring the majority group in Ethiopia (Amarigna) and Vietnam (Vietnamese), and the minority group in Peru. Results were lower for Scheduled Tribes in India. It is surprising that indigenous children would have an advantage in Peru, a result we did not find for the Younger Cohort. In many other studies, indigenous children have been shown to be poorer and less educated. In fact, when we estimate the simple difference in Peru between indigenous and non-indigenous children and young people, the indigenous group have lower access. However, when we introduce the control variables in the regression (i.e. wealth and maternal education), the direction of the association is reversed. Given the age of this group (22 years old), we included being enrolled in tertiary education in Round 5, which increases the probability of using a computer and the internet in all cases. The interpretation of this result is of an association: it may be that people who have access to a computer and the internet are more likely to access tertiary education; it could also be that entering tertiary education gives these individuals access to computers and the internet. Finally, both of these explanations may be true.

In regard to the determinants of digital skills, the results are often quite different from those predicting use. This is likely explained because the analysis of determinants includes only those that used computers or the internet many times in their lives, hence making the group included in Table 9 much smaller (and selected), with less variance, than those considered in Tables 7 and 8. For example, maternal education is significant in Peru (for the Younger Cohort) and Vietnam (internet in the Younger Cohort, and computer and internet skills in the Older Cohort). This suggests that this variable may be particularly powerful in this country, perhaps through family processes that would require a complementary study. Mathematics achievement in Round 3 for the Younger Cohort was statistically significant in Peru (computer and internet skills) and Vietnam (internet skills only), suggesting a link between academic skills in general. A similar result was found in PISA (OECD 2015). Gender favours boys for the Younger Cohort in Peru, but favours girls for computer skills in the Older Cohort in Vietnam. Ethnicity is significant in Ethiopia, with lower results for the Oromifa group, and also in favour of the majority group in Peru and Vietnam. In India, Scheduled Tribes and other castes show lower results than Backward Classes. Being enrolled in tertiary education (Older Cohort only) results in marginally positive and significant coefficients for Ethiopia.

There are, however, two variables in Table 9 that could not be included in Tables 7 and 8: age of first use and frequency of use. Age of first use of computers was statistically significant in most cases (except India) in the expected direction: the earlier, the better. Age of first use of the internet also followed this pattern. Daily use of computers was also related to higher skills in most cases (except Ethiopia) in the expected direction: more practice is associated with higher skills. Finally, daily use of the internet was related to higher skills in all cases except Ethiopia and the Older Cohort in Vietnam. Some of the non-significant results in the samples for Ethiopia and India may be explained because the samples were quite small in these countries, and this has an effect on the statistical power of the analysis. Overall, these results suggest that more practice is linked with higher skills.

Table 7. *Marginal effects of the model on computer and internet usage many times in life – Younger Cohort*

Variable	Ethiopia		India		Peru		Vietnam	
	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects
Sex: male	-3.0**	1.3	3.1*	6.4***	0.5	1.5	-0.1	-0.7
Maths in Round 2 (CDA)	0.2	0.3	0.1	0.7*	1.6**	2.1***	1.4**	1.8***
Maths in Round 3	0.8***	0.4***	0.4***	0.4**	0.9***	0.9***	0.9***	0.6**
Maternal education: (base incomplete primary or less)								
Primary complete or secondary incomplete	1.4	-0.1	3.5+	1.7	1.9	3.0	8.9**	3.9
Secondary complete or more	10.5**	0.2	13.6**	8.7**	10.1**	10.7**	12.7**	7.2 +
Wealth index in Round 1	13.6**	15.1***	23.8***	16.1***	33.0***	48.7***	11.6 +	27.3***
Language minority groups					4.0	3.8	-19.1**	-11.0***
Language: base Amarigna								
Tigrigna	0.9	-3.5***						
Oromifa	-2.3	-						
Others	-3.4 +	-2.7 +						
Castes: Backward Classes								
Other Castes			0.0	0.0				
Scheduled Castes			4.9*	0.3				
Scheduled Tribes			2.1	0.0				
Observations	1,602	1,338	1,807	1,807	1,687	1,687	1,757	1,757

Notes: Marginal effects are shown as percentages. In one case being enrolled in school perfectly predicted not using the internet (-). No coefficient is indicated if not used in the model. ***p<0.001, ** p<0.01, * p<0.05, + p<0.10.

Table 8. *Marginal effects of the model on computer and internet usage many times in life – Older Cohort*

	Ethiopia		India		Peru		Vietnam	
	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects	Use computer Marginal effects	Use internet Marginal effects
Sex: male	0.4	8.9***	8.1***	18.6***	2.2	1.4	5.6*	-1.3
Maths in Round 2	2.5***	2.2***	4.4***	4.8***	3.6***	3.3***	6.0***	3.3***
Maternal education: (base incomplete primary or less)								
Primary complete or secondary incomplete	1.4	0.7	5.9 +	6.5 +	11.7**	15.9***	8.9*	6.9*
Secondary complete or more	9.3	8.5	20.8**	17.7*	11.5*	9.2 +	24.0***	12.4*
Wealth index in Round 1	25.7***	39.7***	40.0***	26.0***	43.3***	49.0***	27.4**	25.9***
Enrolled in school	-1.6	-2.0	-	-6.2	-	-	-22.8	-
Enrolled in tertiary education	18.0***	9.8***	8.5**	6.9*	23.7***	16.8***	30.4***	-
Language minority groups					14.3*	10.8*	-6.5	-12.1***
Language: base Amarigna								
Tigrigna	-9.7**	-11.8***						
Oromifa	1.1	-11.3**						
Others	-10.7**	-6.7 +						
Castes: Backward Classes								
Other Castes			9.9**	6.7+				
Scheduled Castes			-0.9	-5.2				
Scheduled Tribes			-13.5***	-13.4***				
Observations	691	691	853	860	535	535	871	740

Notes: Marginal effects in percentage are shown. No coefficient is indicated if not used in the model. In some cases (Peru and Vietnam) being enrolled in school perfectly predicted using internet or computer (-). In one case (India) being enrolled in school perfectly predicted not using the internet or computer (-). ***p<0.001, ** p<0.01, * p<0.05, + p<0.10.

Table 9. *Regression coefficients for computer and internet skills – Younger and Older Cohort*

Variables		Ethiopia		India		Peru				Vietnam			
		Older Cohort		Older Cohort		Younger Cohort		Older Cohort		Younger Cohort		Older Cohort	
		Model (i)	Model (ii)	Model (i)	Model (ii)	Model (i)	Model (ii)	Model (i)	Model (ii)	Model (i)	Model (ii)	Model (i)	Model (ii)
Sex: male		0.11	0.33+	0.16	0.33	0.04+	0.09***	-0.00	0.04	-0.04	-0.02	-0.10*	-0.03
		(0.07)	(0.16)	(0.13)	(0.25)	(0.02)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)	(0.04)	(0.03)
Maths in Round 2 (CDA)						0.02	0.02			-0.02	0.06		
						(0.01)	(0.01)			(0.03)	(0.01)		
Maths in Round 3						0.23***	0.15**			0.06	0.11*		
						(0.01)	(0.00)			(0.01)	(0.00)		
Maths in Round 2		0.33	0.29	0.20	0.32+			0.03	0.01			0.18*	0.27***
		(0.05)	(0.04)	(0.06)	(0.06)			(0.02)	(0.02)			(0.03)	(0.02)
Maternal education: (base incomplete primary or less)	Complete primary or incomplete secondary	0.07	0.11	0.09	0.05	0.02	0.05	-0.12	-0.15	-0.02	0.03	0.19**	0.24***
		(0.12)	(0.19)	(0.10)	(0.11)	(0.04)	(0.04)	(0.08)	(0.11)	(0.16)	(0.03)	(0.07)	(0.06)
	Complete secondary or more	0.06	0.23	0.28	0.19	0.13+	0.15*	-0.02	-0.00	0.04	0.10*	0.23*	0.33***
		(0.22)	(0.20)	(0.25)	(0.25)	(0.06)	(0.05)	(0.07)	(0.09)	(0.22)	(0.04)	(0.12)	(0.07)
Wealth index in Round 1		0.21	0.42	0.12	0.26	0.13	0.13	-0.07	-0.07	-0.01	-0.04	0.01	0.10
		(0.45)	(0.71)	(0.54)	(0.43)	(0.17)	(0.17)	(0.21)	(0.27)	(0.20)	(0.12)	(0.17)	(0.16)
Enrolled in school		-0.01	-0.19		-0.05							0.03**	
		(0.13)	(0.16)		(0.17)							(0.12)	
Enrolled in tertiary education		0.54+	0.39+	-0.02	0.15			-0.03	0.09			0.09	
		(0.29)	(0.17)	(0.13)	(0.11)			(0.08)	(0.08)			(0.10)	
Age in computer first use		-0.15*		0.09		-0.23***		-0.08+		-0.19***		-0.15***	
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Daily use of computer		0.23		0.19**		0.16***		0.21***		0.11***		0.27***	
		(0.08)		(0.06)		(0.03)		(0.04)		(0.03)		(0.04)	
Probability predicted of using a computer		-0.45		-0.16		-0.11		0.41*		0.22		-0.01	
		(0.87)		(0.88)		(0.51)		(0.38)		(1.66)		(0.42)	
Age at internet first use			-0.22*		-0.15+		-0.16***		-0.13**		-0.22***		-0.21***
			(0.02)		(0.02)		(0.01)		(0.01)		(0.01)		(0.01)
Daily use of internet			0.20		0.19*		0.15***		0.18***		0.20***		0.04
			(0.11)		(0.06)		(0.02)		(0.05)		(0.02)		(0.04)
Predicted probability of using internet			-0.56		-0.37		-0.06		0.31		-0.01		-0.31*
			(0.92)		(0.99)		(0.34)		(0.46)		(0.40)		(0.46)
Language minority groups						-0.05	-0.06+	-0.13*	-0.08	0.08	-0.06	-0.00	-0.19**
						(0.05)	(0.04)	(0.10)	(0.12)	(0.37)	(0.08)	(0.12)	(0.12)
Language: base Amarigna	Tigrigna	-0.13	-0.20										
		(0.17)	(0.33)										
	Oromifa	0.07	-0.28*										
		(0.12)	(0.18)										
	Others	-0.17	0.04										
		(0.23)	(0.19)										
Castes: Backward Classes	Other Castes			0.06	-0.21*								
				(0.13)	(0.09)								
	Scheduled Castes			-0.12	-0.07								
				(0.09)	(0.13)								
	Scheduled Tribes			-0.23+	-0.15								
				(0.28)	(0.26)								
Observations		115	72	191	163	1,184	1,151	380	397	1,164	1,375	536	564
R-squared		0.28	0.31	0.20	0.25	0.30	0.24	0.28	0.24	0.12	0.15	0.28	0.17
F-joint significance		3.663	6.070	4.668		57.23	37.65	15.98	15.67	16.13	23.11		15.55

Notes: ***p<0.001, ** p<0.01, * p<0.05, + p<0.1. Robust standard errors are in parentheses. (i) Digital skills in computing; (ii) Digital skills in internet use.

6. Discussion

This technical note has described the process leading to the construction of a scale to measure access, use and skills of digital devices and the internet in the Young Live Round 5 survey (administered in 2016). Based on items used in previous rounds of Young Lives and existing scales, we developed items to measure access, use and skills in computers or laptops, tablets, internet, and mobile phones for two cohorts in Ethiopia, India (the states of Andhra Pradesh and Telangana), Peru and Vietnam.

The samples included in Young Lives are not nationally representative, but are chosen to reflect a variety of contexts within each country. Their most significant value lies in the fact that there are five rounds of household surveys, so we have many variables that allow for a longitudinal analysis of the outcomes of interest. To our knowledge, this is the first comparative, longitudinal study on the access, use and skills of digital devices and the internet in developing countries.

There are clear differences in access across and within countries. Across countries, it is clear that access is higher in Peru and Vietnam, compared to Ethiopia and India. Furthermore, the difference extends to more frequent use at earlier ages, also in favour of Peru and Vietnam.

Within countries, access is explained by socio-economic status, specifically by two variables: a wealth index that was collected 14 years before our Round 5 survey, and maternal education. Other variables linked to access are gender, in favour of males (particularly in India), and ethnicity, with some indigenous groups or castes having lower access to computers and the internet. Mathematics skills also seem to be linked with access, although this may be an indirect effect of socio-economic status (as this variable explains access to higher quality schooling and outcomes in all countries). International patterns suggest that access to computers will expand over the next few years, but it would be good for governments to prioritise those groups within each country that have lower access.

In regard to skills, we adapted some international scales to produce short measures of computer and internet abilities. The reliability indices were very high, suggesting that the scores are stable. Furthermore, factor analysis resulted in a predominant factor that explained most of the variance, as expected. However, in the interpretation of results the issue of bias should be considered, as the skills were self-reported by participants from both cohorts. Measuring skills in computers and internet is still relevant, as it can explain the real opportunities for children and youth to use digital devices and the internet. In our study, skills were measured only among those who reported using computers or the internet many times in their lives. Thus, the patterns of inequality presented for use have an implication on the interpretation of the results regarding skills.

The descriptive results show that many children in all countries report that they do not feel confident performing what could be considered simple tasks. The regression results show that earlier and more frequent use are associated with higher skills, which is not surprising but at the same time suggests a path for policy. Some other variables were also predictive of skills for some countries or cohorts. For example, mathematics skills were statistically significant. This may be linked with socio-economic status, but perhaps in this case may also be linked with higher levels of analytical skills, which would seem relevant for both domains. Maternal education was also relevant in many cases, and ethnicity in some cases. This reinforces the idea of having some groups prioritised by governments to decrease inequality levels linked to the digital divide.

In terms of policy, at face value it would seem to be beneficial to provide access to digital devices and the internet. Where and how to provide access, however, are still issues for discussion. For example, just vastly increasing access to computers at school has not been found to have an impact on student achievement in Peru, although it did lead to increases in students' abilities to use the computers (Cristia et al. 2017). In a follow-up study in Peru, providing access to computers and the internet, with manuals and an option for workshops to promote pedagogical uses for students, also did not result in increases in achievement, although, again, it resulted in increased knowledge about computers (Beuermann et al. 2015). In a study in the US, Vigdor, Ladd and Martinez (2014) found that the introduction of home computer technology was associated with lower scores in reading and mathematics over time. Similarly, in Romania, Malamud and Pop-Eleches (2011) found that a government programme that provided home computers to poor children was associated with lower school grades, but in this case they found higher cognitive and computer skills. However, Muralidharan et al. (2017) recently found that providing a technology programme after school helped middle-school students in India in mathematics and reading. The programme was specifically targeted to the children's level of abilities.

It seems obvious from this and other studies that programmes for the provision of computers, other digital devices and the internet would benefit from having a previously designed theory of change regarding its expected uses and outcomes, particularly if educational outcomes (such as increases in achievement scores) are anticipated (Busso et al. 2017). The UNESCO Broadband Commission for Sustainable Development has recently published a document to promote the development of digital skills for life and work (2017). One of the topics they emphasise is to develop skills with equity considerations in mind, something highlighted throughout this technical note.

References

Broadband Commission for Sustainable Development (2017) 'Working Group on Education: Digital Skills for Life and Work', Paris: UNESCO. http://unesdoc.unesco.org/images/0025/002590/259013e.pdf (accessed 2 April 2018).

Busso, M., J. Cristia, D. Hincapié, J. Messina, and L. Ripani (eds.) (2017) 'Learning Better: Public Policy for Skills Development', Washington, DC: Inter-American Development Bank.

Beuermann, D.W., J. Cristia, S. Cueto, O. Malamud, and Y. Cruz-Aguayo (2015) 'One Laptop per Child at Home: Short-Term Impacts from a Randomized Experiment in Peru', *American Economic Journal: Applied Economics* 7.2: 53-80.

Cristia, J., P. Ibarrarán, S. Cueto, A. Santiago, and E. Severín (2017) 'Technology and Child Development: Evidence from the One Laptop per Child Program', *American Economic Journal: Applied Economics* 9.3: 295-320.

Cueto, S., R. Singh, T. Woldehanna, and L.T. Duc (2016) *Education Trajectories in Ethiopia, India, Peru and Vietnam: From Early Childhood to Early Adulthood*, Policy Brief 30, Oxford: Young Lives.

Duvel, C., and S. Pate (2004) 'Computer Knowledge: Report from a Student Self Evaluation', *Journal of Industrial Technology* 20.1: 2-16.

EU Science Hub (n.d.) 'DigComp: Digital Competence Framework for Citizens', https://ec.europa.eu/jrc/en/digcomp (accessed 2 April 2018).

Filippucci, C., and S. Pacei (2007) 'Measuring Competence in Computer Skills', *Statistica* Anno LXVII (1), 3-25.

Hargittai, E. (2002) 'Second-level Digital Divide: Differences in People´s Online Skills', *First Monday* 7.4. http://journals.uic.edu/ojs/index.php/fm/article/view/942 (accessed 2 April 2018).

Hargittai, E., and A. Hinnant (2008) 'Digital Inequality in Young Adults' Use of the Internet', *Communication Research* 35.5: 602-621.

Helsper, E.J., A.J.A.M. van Deursen, and R. Eynon (2015a) 'Tangible Outcomes of Internet Use: From Digital Skills to Tangible Outcomes Project Report', www.oii.ox.ac.uk/research/projects/?id=112 (accessed 2 April 2018).

Helsper, E.J., A.J.A.M. van Deursen, and R. Eynon (2015b) 'From Digital Skills to Tangible Outcomes: Full Questionnaire', www.oii.ox.ac.uk/research/projects/?id=112 (accessed 2 April 2018).

Livingstone, S. (2004) 'UKGO (UK Children Go Online) Children Questionnaire', London: LSE Research Online. http://eprints.lse.ac.uk/501/ (accessed 2 April 2018).

Livinstone, S., and E. Helsper (2007) 'Gradation in Digital Inclusion: Children, Young People and the Digital Divide', *New Media and Society* 9.4: 671-696.

Livingstone, S., and M. Bulger (2014) 'A Global Research Agenda for Children's Rights in The Digital Age', *Journal of Children and Media* 8.4: 317–335.

Malamud, O., and C. Pop-Eleches (2011) 'Home Computer Use and the Development of Human Capital', *Quarterly Journal of Economics* 126.2: 987–1027.

Muralidharan, K., A. Singh, and A. Ganimian (2017) *Distrupting Education? Experimental Evidence on Technology-aided Instruction in India*, CESifo Working Paper Series No. 6328,

Munich: CESifo. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2925751 (accessed 2 April 2018).

OECD (2011) 'PISA 2009 Results: Students on Line: Digital Technologies and Performance (Volume VI)', Paris: OECD Publishing.

OECD (2013) 'OECD Skills Outlook 2013: First Results from the Survey of Adult Skills', Paris: OECD Publishing.

OECD (2015) 'Students, Computers and Learning: Making the Connection', Paris: OECD Publishing.

Partnership for 21st Century Learning (2015) 'P21 Framework Definitions', www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf (accessed 2 April 2018).

UNESCO (2017) 'Global Education Monitoring Report 2017-18. Accountability in Education: Meeting our Commitments', Paris: UNESCO.

United Nations (n.d.) 'Sustainable Development Goals: Goal 4', www.un.org/sustainabledevelopment/education (accessed 2 April 2018).

van Deursen, A.J.A.M., E. Helsper, and R. Eynon (2015) 'Development and Validation of the Internet Skills Scale (ISS)', *Information, Communication and Society* 19.6: 804-823.

van Dijk, J.A.G.M. (2017) 'Digital Divide: Impact of Access', in P. Rossler (ed.) *The International Encyclopedia of Media Effects*, 1-11. Hoboken: John Wiley and Sons.

Vigdor, J.L., H.F. Ladd, and E. Martinez (2014) 'Scaling the Digital Divide: Home Computer Technology and Student Achievement', *Economic Inquiry* 52.3: 1103-1119.

World Bank (2016) 'World Development Report 2016: Digital Dividends', Washington, DC: World Bank.

Appendices

Appendix 1. Background of items included in the digital module of the Round 5 survey

Table A1. *Aim and source of questions included in Round 5 of the Young Lives survey*

		Adaptation source	Observations
Q.1	**Have you ever used any of the following?**	ICT Questionnaire – PISA (OECD 2011) and Young Lives Community Questionnaire (R1, R2, R3, R4)	These items are comparable to items used in previous Young Lives rounds, but there are also new items (e.g. mobile phone with internet access) due to the advances in digital technology. These items filter the respondents that are familiar with digital devices and therefore can answer questions on frequency of use and skills.
01	Computer or laptop		
02	Tablet		
03	Internet		
04	Mobile phone with internet access (e.g. smartphone)		

		Adaptation source	Observations
Q.2	**In the last 12 months**, how often have you been using any of the following?	ICT Questionnaire – PISA (OECD 2011)	This question registers the frequency of use for each type of device, regardless of the location of access.
01	Computer or laptop		
02	Tablet		
03	Internet		
04	Mobile phone with internet access (e.g. smartphone)		

		Adaptation source	Observations
Q.3	How old were you **when you first used** each of the following? Enter age in years	'From Digital Skills to Tangible Outcomes project' Questionnaire (Helsper et al. 2015b)	This question collects information on how early the children had access to digital devices. This information will be useful for portraying generational gaps between cohorts.
01	Computer/laptop		
02	Tablet		
03	Internet access (e.g. internet cabin, Wi-Fi connection)		
04	Mobile phone with internet access (e.g. smartphone)		

		Adaptation source	Observations
Q.4	**Which of the following do you currently have?**	'From Digital Skills to Tangible Outcomes project' Questionnaire (Helsper et al. 2015b)	This question measures access to and engagement with internet communication networks.
01	Email (e.g. john@hotmail.com or john@gmail.com)		
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)		

		Adaptation source	Observations
Q.5			
01	I know how to create a folder on a digital device.	ICT Questionnaire – PISA (OECD 2011) and Quantitative self-reported survey (Duvel and Pate 2004).	These items measure self-reported mastery of basic digital skills related to file management tasks.
02	I know how to move a file from one folder to another.		
03	I know how to delete a file.		
04	I know how to retrieve a deleted file from the recycle bin.		
05	I know how to use the undo and redo functions, while working on a digital document.		This item is related to operations.
06	I know how to change the margins (for example, using Word).		These items are related to text functions.
07	I know how to bold, italicise or underline text.		
08	I know how to insert a table in a document (for example, using Word).		
09	I know how to use a spreadsheet to plot a graph (e.g. in Excel).		These items are related to special operations in office programmes or applications.
10	I know how to create a presentation (e.g. using PowerPoint).		

		Adaptation source	Observations
Q.6			
01	I know how to open downloaded files.	'Measuring Digital skills. From Digital Skills to Tangible Outcomes project' Questionnaire (Van Deursen, Helsper and Eynon 2015)	These items collect self-reported information on digital skills for internet use. These items are related operational activities.
02	I know where to click to go to a different webpage.		
03	I know how to complete online forms.		
04	I know how to connect to a Wi-Fi network.		
05	I find it easy to decide what the best keywords are to use for online searches.		These items are related to information navigation activities.
06	I find it easy to find a website I visited before.		
07	I know how to create something new from existing online images, music or video.		These items are related to creative activities.
08	I know which apps/software are safe to download.		

Appendix 2. Descriptive results by country and cohort

The results for each item by country and cohort are presented below. For Peru only, sampling weights were used in all tables.

Table A2. *Descriptive results*

A2.1. Ethiopia – Younger Cohort (n=1802)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	67.1	20.4	6.9	5.6
02	Tablet	72.6	6.0	1.0	20.4
03	Internet	77.2	8.5	3.4	10.8
04	Mobile phone with internet access (e.g. smartphone)	77.1	13.3	5.2	4.4

A2.2. India – Younger Cohort (n=1884)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	56.5	31.6	11.2	0.7
02	Tablet	79.4	14.0	3.5	3.2
03	Internet	69.1	22.4	7.3	1.2
04	Mobile phone with internet access (e.g. smartphone)	59.2	28.5	11.8	0.5

A2.3. Peru – Younger Cohort (n=1841)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	4.3	26.8	68.8	0.1
02	Tablet	45.1	33.0	21.8	0.1
03	Internet	9.4	24.4	66.1	0.1
04	Mobile phone with internet access (e.g. smartphone)	30.6	22.8	46.4	0.1

A2.4. Vietnam – Younger Cohort (n=1938)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	11.8	22.8	65.4	0.1
02	Tablet	53.3	30.3	16.0	0.5
03	Internet	9.9	13.2	76.9	0.1
04	Mobile phone with internet access (e.g. smartphone)	11.2	16.6	72.0	0.1

A2.5. Ethiopia – Older Cohort (n=813)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	50.6	30.0	17.1	2.3
02	Tablet	71.2	9.1	2.0	17.7
03	Internet	57.8	19.2	17.8	5.2
04	Mobile phone with internet access (e.g. smartphone)	45.4	21.8	31.6	1.2

A2.6. India – Older Cohort (n=914)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	50.0	26.9	21.6	1.5
02	Tablet	69.8	17.6	5.6	7.0
03	Internet	48.4	23.7	24.0	3.9
04	Mobile phone with internet access (e.g. smartphone)	40.0	21.9	36.4	1.6

A2.7. Peru – Older Cohort (n=596)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	12.0	25.1	62.5	0.3
02	Tablet	50.0	30.7	19.0	0.3
03	Internet	8.6	24.2	66.6	0.6
04	Mobile phone with internet access (e.g. smartphone)	14.3	24.0	61.4	0.3

A2.8. Vietnam – Older Cohort (n=910)

Q.1	Have you ever used any of the following?	No, never (%)	Yes, a few times in my life (%)	Yes, many times in my life (%)	I do not know what this is (%)
01	Computer or laptop	14.3	24.4	61.3	0.0
02	Tablet	38.9	38.9	22.0	0.2
03	Internet	8.0	7.1	84.8	0.0
04	Mobile phone with internet access (e.g. smartphone)	6.4	7.6	86.0	0.0

Question 1 enabled other answers in the survey. Specifically, Q2.1 was only answered by those who responded ‘yes, many times in my life’ in Q1.1; Q2.2 was only answered by those who responded ‘yes, many times in my life’ in Q 1.2, and so on. Questions in the following sections were also enabled by the relevant response in Q1. Table A3 presents the results.

Table A3. *Frequency of use of digital devices and internet*

A3.1. Ethiopia – Younger Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=124)	0.8	10.5	21.8	51.6	15.3
02	Tablet (n=18)	5.6	22.2	11.1	11.1	50.0
03	Internet (n=61)	-	6.6	14.8	45.9	32.8
04	Mobile phone with internet access (e.g. smartphone) (n=93)	1.1	4.3	5.4	38.7	50.5

A3.2. India – Younger Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=211)	1.4	9.5	18.0	50.7	20.4
02	Tablet (n=65)	-	13.8	24.6	40.0	21.5
03	Internet (n=138)	-	12.3	23.9	42.8	21.0
04	Mobile phone with internet access (e.g. smartphone) (n=223)	-	8.5	8.5	39.9	43.0

A3.3. Peru – Younger Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=1290)	0.2	2.3	5.9	55.2	36.5
02	Tablet (n=436)	3.2	11.9	18.9	34.6	31.3
03	Internet (n=1257)	0.2	1.5	5.5	37.3	55.5
04	Mobile phone with internet access (e.g. smartphone) (n=909)	0.4	3.1	4.0	22.1	70.3

A3.4. Vietnam – Younger Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=1267)	0.9	5.3	16.0	54.4	23.4
02	Tablet (n=310)	2.6	13.9	18.7	30.6	34.2
03	Internet (n=1490)	0.3	1.5	6.3	25.7	66.2
04	Mobile phone with internet access (e.g. smartphone) (n=1396)	0.9	5.3	16.0	54.4	23.4

A3.5. Ethiopia – Older Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=139)	1.4	5.8	19.4	33.1	40.3
02	Tablet (n=16)	-	18.8	31.3	31.3	18.8
03	Internet (n=145)	1.4	5.5	10.3	37.9	44.8
04	Mobile phone with internet access (e.g. smartphone) (n=257)	1.2	2.7	4.3	21.4	70.4

A3.6. India – Older Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=197)	0.5	2.0	16.2	31.5	49.7
02	Tablet (n=51)	3.9	3.9	13.7	41.2	37.3
03	Internet (n=219)	1.4	-	11.0	34.7	53.0
04	Mobile phone with internet access (e.g. smartphone) (n=333)	0.6	0.6	4.2	18.6	76.0

A3.7. Peru – Older Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=425)	1.6	4.1	7.6	34.3	52.4
02	Tablet (n=148)	8.2	11.3	17.2	32.2	31.1
03	Internet (n=447)	0.6	2.5	4.5	26.2	66.3
04	Mobile phone with internet access (e.g. smartphone) (n=410)	1.0	1.3	4.5	10.2	83.0

A3.8. Vietnam – Older Cohort

Q.2	In the last 12 months, how often have you been using any of the following?	Never (%)	Less than once a month (%)	Monthly (%)	Weekly (%)	Daily (%)
01	Computer or laptop (n=558)	2.3	9.9	10.9	22.0	54.8
02	Tablet (n=200)	4.0	18.0	16.5	25.0	36.5
03	Internet (n=772)	0.6	0.5	2.6	9.6	86.7
04	Mobile phone with internet access (e.g. smartphone) (n=783)	0.4	0.6	2.6	5.7	90.7

Age of first use is a variable that has been reported to be relevant for the acquisition of skills and is included in Table 7. Table A4 reports the Young Lives results.

Table A4. *Age of first use of digital devices (years)*

Q.3	How old were you when you first used each of the following? Enter age in years	Ethiopia		India		Peru		Vietnam	
		YC	OC	YC	OC	YC	OC	YC	OC
01	Computer/laptop	11.7	17.9	12.2	16.8	10.0	12.3	11.3	14.1
02	Tablet	12.8	18.6	13.4	18.8	11.9	17.0	12.4	17.9
03	Internet access (e.g. internet cabin, Wi-Fi connection)	12.7	17.6	13.2	17.9	10.9	13.4	12.3	15.5
04	Mobile phone with internet access (e.g. smartphone)	13.2	18.5	13.5	19.1	12.5	16.7	12.9	17.4

Next, we asked about the usage of two common functions that would indicate internet access. Table A5 presents the results.

Table A5. *Use of email or social networks*

A5.1. Ethiopia – Younger Cohort (n=61)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	62.3%	37.7%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	21.3%	78.7%

A5.2. India – Younger Cohort (n=138)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	55.1%	44.9%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	39.9%	60.1%

A5.3. Peru – Younger Cohort (n=1257)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	49.2%	50.8%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	13.3%	86.7%

A5.4. Vietnam – Younger Cohort (n=1490)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	46.2%	53.8%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	9.3%	90.7%

A5.5. Ethiopia – Older Cohort (n=145)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	33.8%	66.2%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	4.8%	95.2%

A5.6. India – Older Cohort (n=219)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	9.6%	90.4%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	6.8%	93.2%

A5.7. Peru – Older Cohort (n =447)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	28.2%	71.8%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	6.4%	93.6%

A5.8. Vietnam – Older Cohort (n=772)

Q.4	Which of the following do you currently have?	No	Yes
01	Email (e.g. john@hotmail.com or john@gmail.com)	28.8%	71.2%
02	A social network account and/or instant messaging account (e.g. Facebook, LinkedIn, Twitter, WhatsApp, Skype, etc.)	2.7%	97.3%

The items on skills were administered only in Peru and Vietnam for the Younger Cohort, and in all countries to the Older Cohort. Table A6 presents the results for each category. The scale showed high levels of reliability, as shown in Table 1. The category 'I do not understand what this means' had very low frequency, suggesting that the items were clearly understood by respondents.

Table A6. *Computer and internet skills*

A6.1. Peru – Younger Cohort (n=1290)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	0.9	5.1	3.6	51.2	38.0	1.2
02	I know how to move a file from one folder to another.	0.5	7.8	3.3	45.9	41.6	0.9
03	I know how to delete a file.	0.3	5.1	1.9	48.1	43.9	0.7
04	I know how to retrieve a deleted file from the recycle bin.	1.8	19.1	7.1	37.5	33.1	1.4
05	I know how to use the undo and redo functions, while working on a digital document.	0.8	13.3	7.9	47.1	28.1	2.8
06	I know how to change the margins (for example, using Word).	0.7	11.4	5.9	51.4	28.7	1.9
07	I know how to bold, italicise or underline text (for example, using Word).	0.3	4.3	2.5	50.2	41.6	1.0
08	I know how to insert a table in a document (for example, using Word).	0.9	15.0	7.0	46.6	28.3	2.2
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	1.4	21.4	11.2	41.6	20.8	3.7
10	I know how to create a presentation (for example, using PowerPoint).	2.0	14.0	4.9	47.0	29.7	2.5

A6.2. Peru – Younger Cohort (n=1257)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	0.7	7.2	3.3	54.7	33.1	1.0
02	I know where to click to go to a different webpage.	0.2	4.0	2.6	55.6	36.8	0.7
03	I know how to complete online forms.	1.2	20.2	8.8	43.6	21.3	4.9
04	I know how to connect to a Wi-Fi network.	1.3	12.3	5.7	46.5	32.2	2.0
05	I find it easy to decide what the best keywords are to use for online searches.	0.8	7.5	7.2	60.1	23.7	0.7
06	I find it easy to find a website I visited before.	0.4	6.9	4.4	55.1	32.5	0.8
07	I know how to create something new from existing online images, music or video.	1.0	14.2	9.7	52.4	20.8	1.8
08	I know which apps or software are safe to download.	1.2	15.8	10.8	50.3	19.8	2.1

A6.3. Vietnam – Younger Cohort (n=1267)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	1.4	8.6	5.0	60.7	24.2	0.1
02	I know how to move a file from one folder to another.	1.7	11.8	5.6	56.9	23.9	-
03	I know how to delete a file.	0.9	6.9	4.0	60.7	27.3	0.1
04	I know how to retrieve a deleted file from the recycle bin.	2.5	26.8	10.4	42.7	17.6	-
05	I know how to use the undo and redo functions, while working on a digital document.	1.4	21.5	11.3	49.1	16.7	-
06	I know how to change the margins (for example, using Word).	0.9	14.4	8.1	56.4	20.2	0.1
07	I know how to bold, italicise or underline text (for example, using Word).	1.1	6.6	4.4	56.1	31.7	0.1
08	I know how to insert a table in a document (for example, using Word).	1.3	18.5	10.2	52.7	17.1	0.1
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	3.3	28.6	13.3	42.7	12.0	0.2
10	I know how to create a presentation (for example, using PowerPoint).	6.2	35.4	14.7	33.9	9.6	0.2

A6.4. Vietnam – Younger Cohort (n=1490)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	1.1	4.4	2.9	67.8	23.9	-
02	I know where to click to go to a different webpage.	0.9	4.8	3.0	60.9	30.2	0.1
03	I know how to complete online forms.	2.6	30.7	15.8	39.3	11.5	0.1
04	I know how to connect to a Wi-Fi network.	0.7	1.7	2.2	52.3	43.1	0.1
05	I find it easy to decide what the best keywords are to use for online searches.	1.1	5.1	5.4	57.7	30.6	0.1
06	I find it easy to find a website I visited before.	0.6	8.7	5.6	62.9	22.1	0.1
07	I know how to create something new from existing online images, music or video.	2.0	27.0	15.8	44.9	10.3	-
08	I know which apps or software are safe to download.	1.9	16.2	14.1	53.4	14.5	-

A6.5. Ethiopia – Older Cohort (n=139)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	-	3.6	4.3	56.8	35.3	-
02	I know how to move a file from one folder to another.	-	5.8	3.6	57.6	33.1	-
03	I know how to delete a file.	0.7	2.2	1.4	58.3	37.4	-
04	I know how to retrieve a deleted file from the recycle bin.	1.4	13.7	10.8	42.4	31.7	-
05	I know how to use the undo and redo functions, while working on a digital document.	3.6	10.8	7.2	55.4	23.0	-
06	I know how to change the margins (for example, using Word).	3.6	6.5	12.2	52.5	25.2	-
07	I know how to bold, italicise or underline text (for example, using Word).	2.2	8.6	15.8	48.2	25.2	-
08	I know how to insert a table in a document (for example, using Word).	3.6	7.9	10.1	56.8	21.6	-
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	3.6	10.8	15.8	48.9	20.9	-
10	I know how to create a presentation (for example, using PowerPoint).	5.8	25.2	14.4	37.4	17.3	-

A6.6. Ethiopia – Older Cohort (n=145)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	1.4	2.8	7.6	56.6	31.7	-
02	I know where to click to go to a different webpage.	0.7	4.8	6.9	59.3	28.3	-
03	I know how to complete online forms.	2.1	9.0	12.4	51.7	24.8	-
04	I know how to connect to a Wi-Fi network.	1.4	6.9	2.8	57.9	31.0	-
05	I find it easy to decide what the best keywords are to use for online searches.	3.4	9.0	11.7	51.0	24.8	-
06	I find it easy to find a website I visited before.	3.4	9.7	9.0	51.7	26.2	-
07	I know how to create something new from existing online images, music or video.	5.5	13.1	14.5	44.8	21.4	0.7
08	I know which apps or software are safe to download.	4.8	10.3	14.5	52.4	17.2	0.7

A6.7. India – Older Cohort (n=197)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	0.5	1.5	2.0	35.5	59.9	0.5
02	I know how to move a file from one folder to another.	0.5	2.5	3.0	29.4	64.5	-
03	I know how to delete a file.	0.5	2.0	0.0	29.9	67.5	-
04	I know how to retrieve a deleted file from the recycle bin.	1.5	5.6	3.0	36.5	52.8	0.5
05	I know how to use the undo and redo functions, while working on a digital document.	1.5	7.1	6.6	39.1	45.7	-
06	I know how to change the margins (for example, using Word).	0.5	3.0	5.6	42.6	47.7	0.5
07	I know how to bold, italicise or underline text (for example, using Word).	1.0	3.0	4.1	41.6	49.2	1.0
08	I know how to insert a table in a document (for example, using Word).	0.5	4.1	6.1	42.1	46.2	1.0
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	1.0	7.6	11.2	38.6	39.6	2.0
10	I know how to create a presentation (for example, using PowerPoint).	1.0	6.1	6.6	36.5	48.2	1.5

A6.8. India – Older Cohort (n=219)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	0.9	1.4	2.7	42.9	52.1	-
02	I know where to click to go to a different webpage.	0.9	1.4	4.6	42.5	50.7	-
03	I know how to complete online forms.	0.5	8.2	8.2	38.4	44.7	-
04	I know how to connect to a Wi-Fi network.	0.9	5.5	3.2	36.1	54.3	-
05	I find it easy to decide what the best keywords are to use for online searches.	-	3.7	8.2	45.7	42.5	-
06	I find it easy to find a website I visited before.	0.5	4.1	5.0	48.9	41.6	-
07	I know how to create something new from existing online images, music or video.	4.6	12.3	15.1	37.9	30.1	-
08	I know which apps or software are safe to download.	0.9	5.5	6.4	42.5	44.3	0.5

A6.9. Peru – Older Cohort (n=425)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	0.2	3.1	2.1	48.2	45.4	0.9
02	I know how to move a file from one folder to another.	0.5	3.1	2.6	44.0	49.6	0.2
03	I know how to delete a file.	-	3.1	0.7	45.2	50.8	0.2
04	I know how to retrieve a deleted file from the recycle bin.	0.2	11.1	3.8	37.4	47.3	0.2
05	I know how to use the undo and redo functions, while working on a digital document.	0.2	8.0	3.5	42.1	45.6	0.5
06	I know how to change the margins (for example, using Word).	-	7.3	3.1	48.0	41.2	0.5
07	I know how to bold, italicise or underline text (for example, using Word).	-	3.5	0.5	44.9	50.8	0.2
08	I know how to insert a table in a document (for example, using Word).	-	9.6	4.5	42.4	43.1	0.5
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	0.5	14.4	4.9	41.2	34.8	0.7
10	I know how to create a presentation (for example, using PowerPoint).	0.7	9.4	4.2	40.2	44.7	0.7

A6.10. Peru – Older Cohort (n=447)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	-	5.4	1.6	48.8	43.8	0.4
02	I know where to click to go to a different webpage.	-	3.1	0.9	50.3	45.4	0.2
03	I know how to complete online forms.	0.7	11.2	5.4	43.6	36.5	2.7
04	I know how to connect to a Wi-Fi network.	0.4	6.0	2.5	49.2	40.9	0.9
05	I find it easy to decide what the best keywords are to use for online searches.	0.2	4.7	7.6	56.2	30.4	0.9
06	I find it easy to find a website I visited before.	-	4.7	2.5	56.6	35.3	0.9
07	I know how to create something new from existing online images, music or video.	0.4	10.1	11.0	51.0	26.8	0.7
08	I know which apps or software are safe to download.	0.9	13.9	7.4	52.8	24.6	0.4

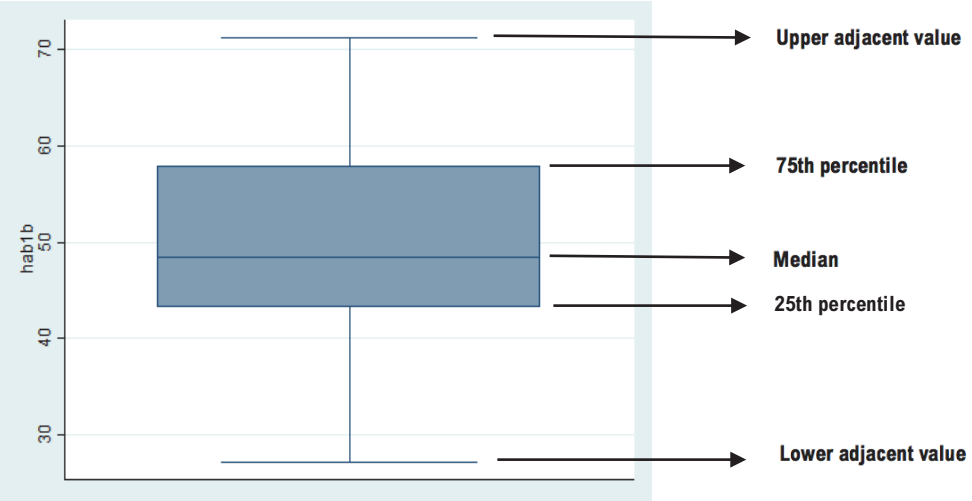
A6.11. Vietnam – Older Cohort (n=558)

Q.5	Computer (offline) skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to create a folder on a digital device.	2.3	6.6	4.3	51.1	35.7	-
02	I know how to move a file from one folder to another.	1.4	7.7	3.4	50.5	36.9	-
03	I know how to delete a file.	1.3	3.2	1.8	55.2	38.5	-
04	I know how to retrieve a deleted file from the recycle bin.	2.2	14.2	7.3	44.3	32.1	-
05	I know how to use the undo and redo functions, while working on a digital document.	2.5	14.0	6.1	46.8	30.5	0.2
06	I know how to change the margins (for example, using Word).	2.3	10.9	7.2	48.0	31.5	-
07	I know how to bold, italicise or underline text (for example, using Word).	2.0	6.6	3.8	51.3	36.4	-
08	I know how to insert a table in a document (for example, using Word).	2.7	13.4	5.0	49.5	29.2	0.2
09	I know how to use a spreadsheet to plot a graph (for example, using Excel).	3.4	25.3	9.1	40.3	21.9	-
10	I know how to create a presentation (for example, using PowerPoint).	4.3	23.1	9.7	39.6	23.1	0.2

A6.12. Vietnam – Older Cohort (n=772)

Q.6	Internet skills	Strongly disagree (%)	Disagree (%)	Neither agree or disagree (%)	Agree (%)	Strongly agree (%)	I do not understand what this means (%)
01	I know how to open downloaded files.	1.0	3.1	2.1	64.1	29.7	-
02	I know where to click to go to a different webpage.	0.6	6.0	2.2	55.8	35.2	0.1
03	I know how to complete online forms.	2.1	21.8	9.8	45.2	21.1	-
04	I know how to connect to a Wi-Fi network.	1.0	1.3	1.0	49.1	47.3	0.3
05	I find it easy to decide what the best keywords are to use for online searches.	0.8	3.9	2.5	54.4	38.3	0.1
06	I find it easy to find a website I visited before.	0.9	4.8	4.7	61.0	28.5	0.1
07	I know how to create something new from existing online images, music or video.	2.6	17.5	14.2	47.0	18.7	-
08	I know which apps or software are safe to download.	1.7	14.1	13.7	51.9	18.5	-

Appendix 3. Interpretation of a box chart



Appendix 4. Test of differences in descriptive tables

An analysis of variance was used to find the significance of the differences between pairs. If results were significant, we used a Scheffe test to establish which differences were significant, given that each one involved a comparison among four countries. Tables A7.1 and A7.2 show the results. The same letters indicates that the difference was not significant (e.g. a is equal to a, b is equal to b, and so on). Different letters indicate that the differences were statistically significant at the 1% level (e.g. a is different from b, b is different from c, and so on).

Table A7.1. *Significant differences for the Younger Cohort*

Younger Cohort	Age at computer first use (Figure 5)	Age at tablet first use (Figure 5)	Age at internet first use (Figure 5)	Age at mobile phone with internet first use (Figure 5)	Have an email (Figure 7)	Have a social network (Figure 7)
Peru	c	b	c	c	a	a
Vietnam	b	c	b	b	a	b
Ethiopia	ab	abc	ab	ab	a	ab
India	a	a	a	A	a	c

Table A7.2. *Significant differences for the Older Cohort*

Older Cohort	Age at computer first use (Figure 6)	Age at tablet first use (Figure 6)	Age at internet first use (Figure 6)	Age at mobile phone with internet first use (Figure 6)	Have an email (Figure 8)	Have a social network (Figure 8)
Peru	c	b	c	a	b	ad
Vietnam	b	cd	b	b	a	bd
Ethiopia	a	abc	a	c	a	abc
India	a	ad	a	d	b	c

Digital Access, Use and Skills Across Four Countries: Construction of Scales and Preliminary Results from the Young Lives Round 5 Survey

This technical note outlines the procedures used to develop a digital module, administered to both Young Lives cohorts in the four study countries during the Round 5 household survey in 2016. The modules were based on existing scales in this field. We carried out pilot tests of instruments and performed psychometric analysis to present evidence of the reliability and validity of the instruments. The items measure access, digital skills and use of digital devices, including computers, tablets, the internet and mobile phones. This note provides measures of computer (offline) and internet skills, estimated through factor analysis.

Descriptive results show a clear digital divide across countries, with respondents in Peru and Vietnam showing higher levels of access, more frequent use, and earlier age of engagement with digital devices than respondents in Ethiopia and India. However, in a multivariate analysis we found that within countries there are differences in access associated with socio-economic status; for example, the wealth index (collected in Round 1 of Young Lives in 2001) predicts access to computers 15 years later, as do maternal education and ethnicity. In some cases, gender (favouring males, particularly in India) is also predictive of access. We also found that starting to use computers and the internet earlier, and using them daily, was associated with higher levels of digital skills in both cohorts for most countries.

Young Lives

An International Study of Childhood Poverty

About Young Lives

Young Lives is an international study of childhood poverty, involving 12,000 children in four countries over 15 years. It is led by a team in the Department of International Development at the University of Oxford in association with research and policy partners in the four study countries: Ethiopia, India, Peru and Vietnam.

Through researching different aspects of children's lives, we seek to improve policies and programmes for children.

Young Lives Partners

Young Lives is coordinated by a small team based at the University of Oxford, led by Professor Jo Boyden.

- *Ethiopian Development Research Institute, Ethiopia*
- *Pankhurst Development Research and Consulting plc, Ethiopia*
- *Centre for Economic and Social Studies, Hyderabad, India*
- *Sri Padmavathi Mahila Visvavidyalayam (Women's University), Andhra Pradesh, India*
- *Grupo de Análisis para el Desarollo (GRADE), Peru*
- *Instituto de Investigación Nutricional (IIN), Peru*
- *Centre for Analysis and Forecasting, Vietnamese Academy of Social Sciences, Vietnam*
- *General Statistics Office, Vietnam*
- *Oxford Department of International Development, University of Oxford, UK*

Contact:
Young Lives
Oxford Department of International Development,
University of Oxford,
Mansfield Road,
Oxford OX1 3TB, UK
Tel: +44 (0)1865 281751
Email: younglives@younglives.org.uk
Website: www.younglives.org.uk

Young Lives