

Aggregating skills indicators (HH15)

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ITU EGH subgroup on ICT Skills (report prepared for the 2022 meeting of EGH by Riina Vuorikari, reviewed by Nathan Menton)

Summary of proposed recommendations

- Discontinue the grouping of indicators by levels (basic/intermediate/advanced)
- Create new groups that are aligned with the DigComp 2.0 areas (see Table 1)
- Include component indicators from HH9 to complement and rebalance the data underlying aggregates (Table 1, bracketed items; Figure 1 in Annex 1 shows the number of countries who collect these data).
- Compiling data for an aggregate indicator of ICT skills:
 - a. **Preference at the individual level** (not the case currently).
Implementation at a global level could be quite challenging and possibly requires assistance to countries for: (1) processing data in some cases, and/or (2) microdata provided to the ITU for processing.
 - b. **A workable alternative** is to use averages of component indicators within each area as shown in Table 1. In this case, writing a computer program should be its own category to avoid skewing averages (now part of *Digital content creation*).

Table 1. HH15 and HH9 component indicators allocated to DigComp areas

Information / data literacy	Communication / collaboration	Digital content creation	Safety	Problem solving
1. Verifying the reliability of information [2. Getting information about goods or services] [3. Reading or downloading newspapers, etc] [4. Seeking health-related information]	1. Sending messages (e.g. email, messaging service, SMS) with attached files [2. Making calls (Telephoning over the Internet)] [3. Participating in social networks] [4. Taking part in consultation or voting via Internet]	1. Using copy and paste tools 2. Creating electronic presentations 3. Using basic arithmetic formula in a spreadsheet 4. Writing a computer program [5. Editing online text, spreadsheets, presentations] [6. Uploading self/user-created content]	1. Changing privacy settings 2. Setting up effective security measures	1. Finding, downloading, installing and configuring software 2. Connecting and installing new devices 3. Transferring files or applications between devices [4. Electronic financial transactions] [5. Doing an online course] [6. Purchasing or ordering goods or services]

1. Background

In 2013, the Expert Group on ICT Household Indicators (EGH) added indicator HH15 to the Core list of ICT Indicators. This indicator measures the skills of individuals by examining the activities they have carried out on digital devices to help link ICT usage and impact. These data may be used to inform targeted policies to improve ICT skills, and thus contribute to an inclusive information society. The UN Sustainable Development Goals (SDGs) also reference ICT Skills through SDG Indicator 4.4.1 (*Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill*).

The 5th Meeting of the EGH, which took place in Geneva, Switzerland, on 14-15 September 2017, agreed to create a subgroup within EGH to improve the measurement of ICT skills based on ICT household data to make proposals for:

1. a conceptual framework and dimensions of digital skills to be monitored through household surveys;
2. a review of the response categories in indicator HH15 to take into account skills beyond computer-related skills;
3. a review of indicator HH9 to ensure the response categories reflect common Internet activities at various level of difficulties that can be used to measure individuals' digital skills. The number of possible Internet activities listed in HH9 should also ideally be reduced.
4. evaluate the possibility to aggregate relevant indicators into one or several ICT skills indicator(s).

This subgroup operated from 2018-2020 and reported to EGH in each of these years, amending the response categories of HH15, reducing redundancy and filling data gaps in the skills that are currently measured. Following its proposals several response categories were added to the ITU's [Manual for Measuring ICT Access and Use by Households and Individuals](#) that are relevant for the measurement of cybersecurity- and trust-related behaviour:

- Setting up effective security measures (e.g. strong passwords, log-in attempt notification) to protect devices and online accounts
- Changing privacy settings on your device, account or app to limit the sharing of personal data and information (e.g. name, contact information, photos)
- Verifying the reliability of information found online

At its 2021 meeting, EGH decided to revive the subgroup on skills to reconsider ways to aggregate indicators on skills in a meaningful way given the additional skills indicators that were added. The goal was to provide users with an aggregated indicator of ICT skills which would allow for simpler assessment of the overall level of ICT skills of individuals in a given country or region.

2. Reflections from the sub-group on ICT skills

The subgroup met four times in 2022 through videoconference to discuss the issue of aggregating indicators on skills in a meaningful way. Participants also communicated through email to provide additional insight outside of the meetings. The subgroup agreed on recommendations through its discussion of several important and interlinking questions on ICT skills.

How should items be grouped?

The subgroup felt unanimous about moving away from the previous grouping by levels which was coded as *basic, intermediate, advanced*. From a methodological point of view, recently designed instruments to measure individuals' digital skills have moved to different methods (e.g. criteria based such as the European Commission's Digital Skills Indicator (DSI) [5], calculating averages across various areas of activities such as ySkills [2]). This approach allows gaining better knowledge about the domains in which digital activities take place rather than putting the focus on a level that a set of activities might represent. Also, digital activities that once required higher level of skills have often become easier thanks to new software and apps. Therefore, keeping levels relevant would require a constant revision of what is considered as a basic level activity, etc.

- Following the previous decision by the EGH to adopt DigComp 2.0 as a conceptual framework to guide skills questions, the subgroup suggests the grouping of items to transition towards the five areas of the DigComp framework (Information literacy; Communication and collaboration; Digital content creation; Safety; and Problem solving).

How to treat the additional new skills indicators?

Three new response categories were added to the ITU's Manual for Measuring ICT Access and Use by Households and Individuals (focus on trust-related behaviour, safety and privacy). The subgroup was asked to consider ways to aggregate indicators given that the new ones were added.

- The subgroup sees these new items fitting well to the conceptual framework (DigComp 2.0), and they are also very suitable from the perspective of previously documented good practices (e.g. UNESCO [3,4], DSI [5], DISTO [1], ySkills [2]).
- The newly added questions will fit well to the DigComp areas of *Safety* and *Information literacy*.

Do response categories reflect pertinent Internet activities?

The subgroup suggests that it is crucial that underlying data collected for ICT skills indicators can reflect individuals' engagement with digital technologies for participation in society as well as for individuals to succeed in the labour market.

- The subgroup recommends including 11 component indicators from HH9 to complement and rebalance the data underlying skills aggregates in order to have a range of activities as a base for aggregating skills indicators (Table 1, bracketed items. Figure 1 in Annex 1 shows the number of countries who collect these data).
- This suggestion follows other documented practices in skills assessment and monitoring - e.g. DSI also includes items from HH9 [5].

Aggregating relevant indicators into one or several ICT indicators?

One of the primary aims of the subgroup was to evaluate the possibility to provide users with an aggregated indicator of ICT skills in order to allow for simpler assessment of the overall level of ICT skills of individuals in a given country or region.

- Overall, the subgroup has a preference to compile data at the individual level rather than average of individuals selecting an activity (currently the case). This would allow for an overall aggregate of ICT skills by individuals – e.g., share of individuals who have undertaken 1 or more activities in each area. The subgroup acknowledges that such implementation at a global level could be quite challenging and it would possibly require ITU to offer assistance to countries for: (1) processing data in some cases, and/or (2) microdata to be provided to the ITU for processing
- Therefore, the suggestion by the subgroup is to treat groups/areas separately rather than as a single aggregate – e.g., the average of the share of individuals who have undertaken each activity within an area. This suggestion is in line with the subgroup's previous recommendation in 2020 that highlighted conceptual limitations and varying policy priorities in member countries.

How to address issues of data availability and other challenges?

The subgroup also reflected on the issue of data availability. Response categories on which data is collected at national level do not always overlap and the use of simple averages across groups/areas can result in incomparability of data across countries. Moreover, the fact that neither the current (e.g., the advanced group has only one item) nor the recommended groups contain a balanced number of component indicators remains problematic. In general, if the same number and content of items are not collected, comparability of ICT indicators through taking the average will remain poor. The issue of whether the average is aggregated at the individual level or taking the average of component indicators within each group/area will not change the underlying issue.

- The subgroup suggests that technical solutions are possible, such as determining an overall expected value for certain items for use in weighting items. However, these would be limited in their usefulness by the bias in data availability and a lack of simplicity when explaining results.
- Regarding the practical shortcomings of having more items in some groups/areas than others, the subgroup's suggestion of adding new HH9 items can better balance the pool. When items are allocated to the five DigComp areas, the tally is not entirely even (4-4-5¹-2-6). However all areas have at least two component indicators.
- Moreover, investigating the effect of moving to a new method (e.g. criteria-based) could help with this shortcoming. For example, in the European Commission's DSI [5], the number of component indicators per area vary. This is not a problem conceptually as not all areas in DigComp have an equal number of competences either (at the country level, data on the same component indicators are collected).
- Another alternative could be to standardise the number and content of items per area, e.g. 2 items per area while still keeping a mix between HH15 and 9. Further work would be needed to identify those items (e.g. see Pilot 3 in Annex 2).

¹ Note: There is a suggestion that when calculating an average per DigComp areas, "Writing a computer program" would be considered separately

Remaining issues and future work

It is recommended that the subgroup should continue next year to address remaining issues that are outlined below.

Interpretation of new outputs by data users

- While ITU can provide the average share of individuals having undertaken activities in the new five DigComp areas, benchmarks have not been established for users to interpret these aggregates through the current lens of basic/intermediate/advanced or other such hierarchies.
- Further work is needed to establish a better baseline (see Pilot 2 in Annex 2). It might be preferable that for a transitional period, using two methods of calculations (i.e. current and new based on 5 areas) would be used.

Determination of a country's overall level of ICT skills

- In the future, country's overall level of ICT skills could be derived from aggregation at the individual level, this is for example [done by Eurostat](#) in DSI [5]. However, this approach is less clear when the calculation deals with taking averages of components of each area as is suggested by the above recommendation.
- To study the feasibility of shifting to aggregation of ICT skills at the individual level, there is a need for pilot projects in countries in varying regions and of varying income levels. A possible "data pilot" is described in Annex 2 (see Pilot 1) which could help gather useful experience and inform decisions on this topic.
- More investigation about the value of alternative methods could be conducted. For example, moving to a criteria-based assessment means establishing a pre-determined criteria for what is meant by an individual having at least basic level of ICT skills. An example of such criteria-based method is DSI for which data is also collected through ICT Household Survey modules and it is computed at an individual level. The requirement is that individuals have at least one activity across all five DigComp areas (i.e. a broad-but-shallow set of skills).
 - a. Piloting a new, additional indicator could also be a viable solution for assessing the feasibility of criteria-based assessment. Pilot 3 in Annex 2 proposes adapting EU's DSI-mini to a global audience with a reduced set of component indicators (e.g. 10+1) from HH9 and HH15.
 - b. A narrower focus on two component indicators in each area could provide better comparability between countries

Updating indicators (HH9, HH15) to avoid collection of outdated information

- Further to the work carried out in 2018, a review of some response categories in HH9 and HH15 might be due in order to better reflect current and future in-demand categories for ICT skills. For example,
 - a. "Creating electronic presentations" could be amended to "Creating something that combines different digital media (e.g. photos, music, videos, GIFs, text or charts²)" in order to align it with skills requirements across diverse countries and devices used (e.g. using mobile phones to create content).
 - b. "Using basic arithmetic formula in a spreadsheet" could be simplified to "Using spreadsheet software³"

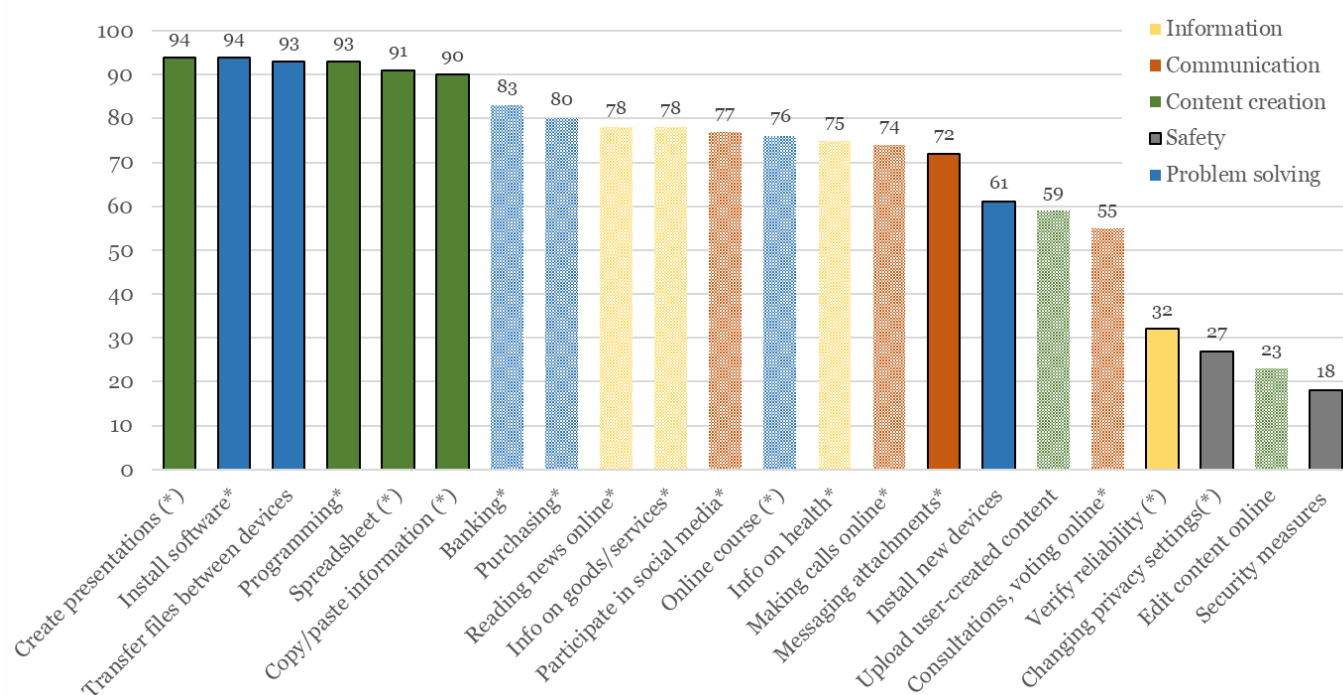
² Wording used in ySkills ICT measurement tool.

³ Current formulations in EU's DSI have been simplified.

- c. “Doing a formal online course” could be simplified to “Doing an online course²”
- d. Amending or dropping some HH15 items that are becoming obsolete when considering ICT use for citizens participation in society and worklife (e.g. Transferring files or applications between devices; Connecting and installing new devices)

Annex 1: Number of countries collecting HH9 and HH 15 component indicators outlined in Table 1.

Figure 1. Countries providing data to ITU for the proposed set of ICT skills component indicators from HH9 and HH15, since 2015



Note: Items with asterisks are also collected in DSI, items with () have an updated formulation.

Annex 2: Examples of pilot projects to aggregate data on ICT skills at the individual level

Pilot 1: Data simulations at country level

Pilot 1 is aimed at those countries who already collect data on HH15 and HH9 (see Table 2), additionally “Writing a computer program” would be considered its own area. Participating in the pilot requires using microdata at the country level. The aim is to simulate how the data would look when aggregated at the individual level and compare it to the current ITU method. This may require support for data processing routines, etc. For example, for Step 3 (see below) a resource package with more precise worked-out examples, formula to be used, sharing code could be envisaged.

Table 2. Pilot 1 component indicators, HH15 indicators in black and HH9 indicators in orange. Either full or reduced set is of interest for the pilot.

Information / data dataliteracy	Communication / collaboration	Digital content creation	Safety	Problem solving
1. Verifying the reliability of information	1. Sending messages (e.g. email, messaging service, SMS) with attached files	1. Using copy and paste tools	1. Changing privacy settings	1. Finding, downloading, installing and configuring software
[2. Seeking health-related information]		2. Creating electronic presentations	2. Setting up effective security measures	2. Connecting and installing new devices
[3. Reading or downloading newspapers, etc]	[2. Making calls (Telephoning over the Internet)]	3. Using basic arithmetic formula in a spreadsheet		3. Transferring files or applications between devices
[4. Getting information about goods or services]	[3. Participating in social networks]	[4. Using software run over the Internet for editing text documents]		[4. Electronic financial transactions]
	[4. Taking part in consultation or voting via Internet]	[5. Uploading self/user-created content]		[5. Doing an online course]
				[6. Purchasing or ordering goods or services]

Two different calculations would be recommended:

- **Step 1:** calculating averages at individual level. This means calculating average of activities at the individual level across the new groupings (=5 DigComp areas). In this case, the output is in 5 DigComp areas.
 - *Example of the output: In xx country, xx% of internet users have participated in activities related to Communication and collaboration.*
 - One could further test if an overall aggregate could be calculated this way.
- **Step 2:** using criteria-based method at the individual level (DSI 2.0). Basic level of ICT skills is pre-determined: at least 1 activity in each area across all 5 areas. Pre-determined criteria to be tested:
 - Any area → 0 = below basic; 1 or more activity = at least basic level

Pilot 2: Comparing current and proposed aggregates by level

Pilot 2 requires using data already aggregated at the individual level in Eurostat or in any countries participating in Pilot 1. The aim would be to allow ITU to see how data aggregated at the individual level into levels like low skills, basic skills, etc would compare to ITU's current aggregations (average of items in basic, intermediate and advanced groups).

Data used is the same as in Table 2. Within the European context, Eurostat collects all but one component indicator (missing: Setting up effective security measures), although some items have some small differences in their formulation. Although the Eurostat data is based on EU-countries and thus not directly transferable to a global context, simulations using such microdata could still yield some interesting insights.

Different calculations would be recommended and compared:

- Current practice: ITU aggregates as they are now (level)
- New recommendation: calculating aggregates similar to DSI (at the individual level)
- Other methods

The results would allow ITU and data users to assess how the outcomes would look and its impact as well as how data could be aggregated otherwise (e.g. is it possible to establish any benchmarks for users to interpret these aggregates through the current lens of basic/intermediate/advanced or other such hierarchies).

Pilot 3: Adapting DSI-mini to the global level

Pilot 3 requires using microdata such as that collected by Eurostat which at the later point would be compared to national data. The aim is to create a reduced scale of 10 items to pilot a new global indicator. The pilot builds on previous work by the EU, namely the DSI-mini, which is a short scale based on DSI 2.0. DSI mini reduces the items from 30 to **10**, and similarly to DSI but with less efforts, it could be used as a measurement tool to locate respondents on the digital capacity scale⁴. Thus, Pilot 3 aims to simulate how DSI-mini could be adapted to the global context (DSI Global).

Table 3 shows the candidate set of component indicators originating from HH15 and HH9, the ones included in DSI-mini are marked with a *star* (Figure 2 shows how many countries currently collect this set of items). For each area, the aim is to choose 2 items. New data analysis using Eurostat microdata is needed to accommodate existing constraints, namely:

- Selecting the most suitable HH9 items for areas of “Information literacy” and “Problem solving” (now indicated in orange in Table 3). The HH9 items in this proposal have been chosen and discussed by the experts in the subgroup, and deemed interesting at the global level. Although the Eurostat data is based on EU-countries and thus not directly transferable to a global context, the microdata is still an interesting source to guide the selection.
- Testing reliability of the set of chosen 10 items. Apart from the new HH9 items discussed above, the ITU module HH15 has 3 new items, they all fit well into the DigComp conceptual model (marked w/blue dot in Table 3). Only one (similar) item is included in DSI mini (changing privacy settings). Another similar one (verifying reliability online) is included in DSI 2.0. A recommendation from ITU is to include these new items. The analysis will focus on their fit into “DSI Global”.

⁴ A psychometric study was recently conducted by the Joint Research Centre of the European Commission and found that the reliability of the scale was good (Cronbach's alpha and EAP based reliability 0.793; McDonald's omega 0.799).

- Note: items with red text are proposals for ITU to modify the scope in order for it to be more suitable to the global context. This is out of scope for this year’s sub-group’s work, but it is one of the recommended follow-up work reviewed by the sub-group.
- Note 2: “Writing a computer program” would be considered as a separate category and should still be collected.

Table 3. A proposal of items for the selection of 10 items to be used as a DSI Global. The pilot would aim to choose the best 10 items using both psychometric and expert analysis (note: in areas of Information literacy and Problem solving, 1 of the items marked with “2.” will be selected).











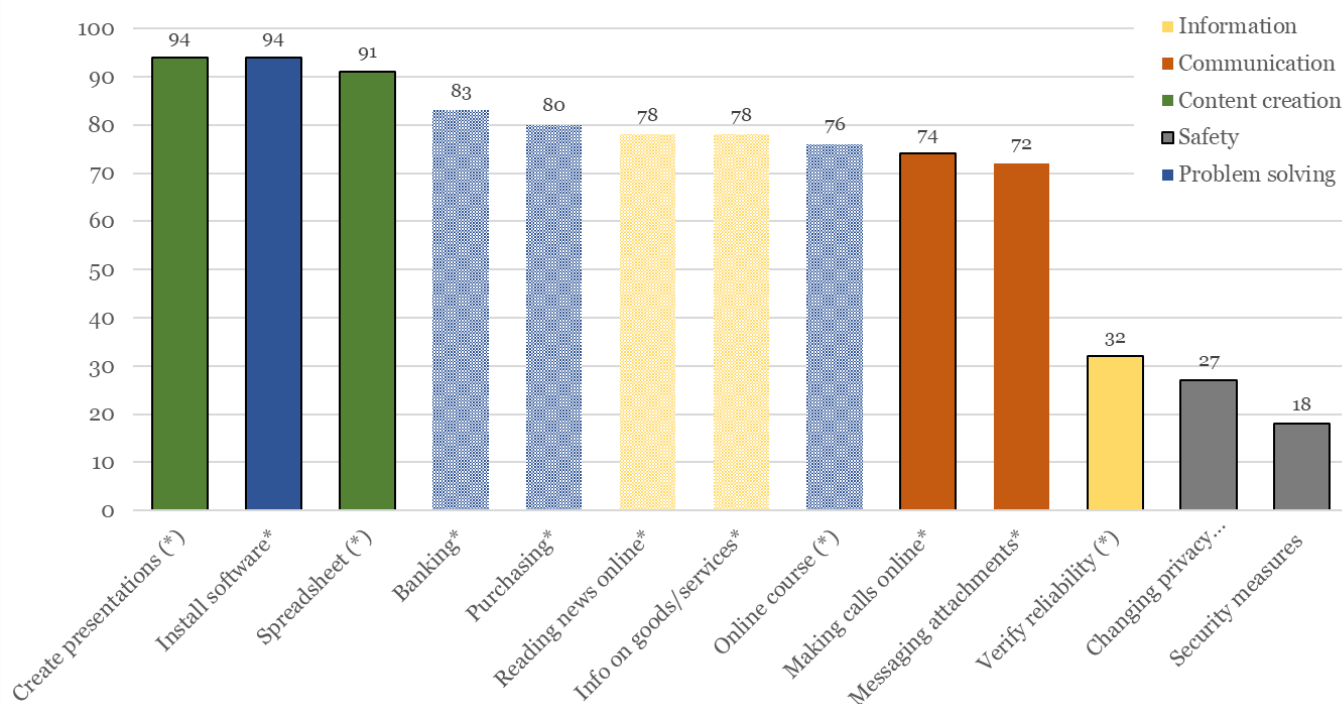
Information / data literacy	Communication / collaboration	Digital content creation	Safety	Problem solving
1. Verifying the reliability of information found online  [2. Getting information about goods or services]  [2. Reading or downloading newspapers, etc] 	1. Sending messages (e.g. email, messaging service, SMS) with attached files (e.g. document, picture, video)  [2. Making calls (Telephoning over the Internet/VoIP, using Skype, iTalk, etc.; includes video calls via webcam)] 	1. Creating electronic presentations something that combines different digital media (e.g. photos, music, videos, GIFs, text or charts) 2. Using basic arithmetic formula in a spreadsheet software 	1. Changing privacy settings on your device, account or app to limit the sharing of personal data and information (e.g. name, contact information, photos)   2. Setting up effective security measures (e.g. strong passwords, log-in attempt notification) to protect devices and online accounts 	1. Finding, downloading, installing and configuring software  [2. Purchasing or ordering goods or services] [2. Electronic financial transactions] [2. Doing a formal online course]

Figure 2. Countries collecting data on the candidate set of component indicators for DSI Global (reduced scale of 10 items), since 2015



Note: Items with asterisk are part of DSI-mini and items with () indicate a slightly modified formulation.

References

- [1] DISTO digital skills surveys with global outreach: <https://www.lse.ac.uk/media-and-communications/research/research-projects/disto/surveys>
- [2] Helsper, E., Schneider, L., van Deursen, A. J. A. M., & van Laar, E. (2020). The youth skills digital indicator: Report on the conceptualisation and development of the ySkills digital skills measure [Monograph]. KU Leuven. <https://yskills.eu/>
- [3] UNESCO. (2013). Global Media and Information Literacy Assessment Framework: Country Readiness and Competencies. ISBN 978_92_3_001221_2
- [4] UNESCO. (2018). A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2 (Information Paper No. 51, UIS/2018/ICT/IP/51). <http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf>
- [5] Vuorikari, R., J., N., Karpinski, Z., Pokropek, A. (forthcoming). Measuring Digital Skills across the EU: Digital Skills Indicator 2.0. Publications Office of the European Union, Luxembourg. <https://publications.jrc.ec.europa.eu/repository/handle/JRC130341>