youth SKILLS

Digital Skills: An Inventory of Actors and Factors

Verónica Donoso
Nike Retzmann
Willem Joris
Leen d'Haenens

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Digital Skills: An Inventory of Actors and Factors

Work Package 3 – Deliverable 3.4
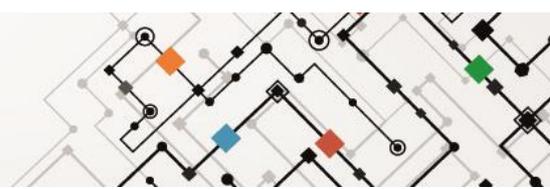
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1. The ySKILLS project

The ySKILLS (Youth Skills) project is funded by the European Union's (EU) Horizon 2020 programme. It involves 15 partners from 13 countries to enhance and maximise the long-term positive impact of the information and communication technology (ICT) environment on multiple aspects of wellbeing for children and adolescents by stimulating resilience through the enhancement of digital skills. Starting from the view that children are **active agents in their own development**, ySKILLS examines how digital skills mediate the risks and opportunities related to ICT use by 12- to 17-year-olds in Europe (see www.ySKILLS.eu).

> *The overarching aim of ySKILLS*
>
> *To enhance and maximise the long-term positive impact of the ICT environment on multiple aspects of wellbeing for all children by stimulating resilience through the enhancement of digital skills.*

ySKILLS will i**dentify the actors and factors** that undermine or can promote **children's wellbeing** in a digital age. The relations between ICT use and wellbeing will be critically and empirically examined over time.

> *ySKILLS' research objectives*
>
> 1. *To acquire extensive knowledge and better measurement of digital skills.*
>
> 2. *To develop and test an innovative, evidence-based explanatory and foresight model predicting the complex impacts of ICT use and digital skills on children's cognitive, physical, psychological, and social wellbeing.*
>
> 3. *To explain how at-risk children (as regards their mental health, ethnic or cultural origin, socioeconomic status, and gender) can benefit from online opportunities despite their risk factors (material, social, psychological).*
>
> 4. *To generate insightful evidence-based recommendations and strategies for key stakeholder groups in order to promote European children's digital skills and wellbeing.*

ySKILLS has proposed and will continue to develop **its conceptual model**. This review aims to contribute to the model development by exploring the evidence on the relationships between the different elements.

Figure 1.   ySKILLS CONCEPTUAL MODEL
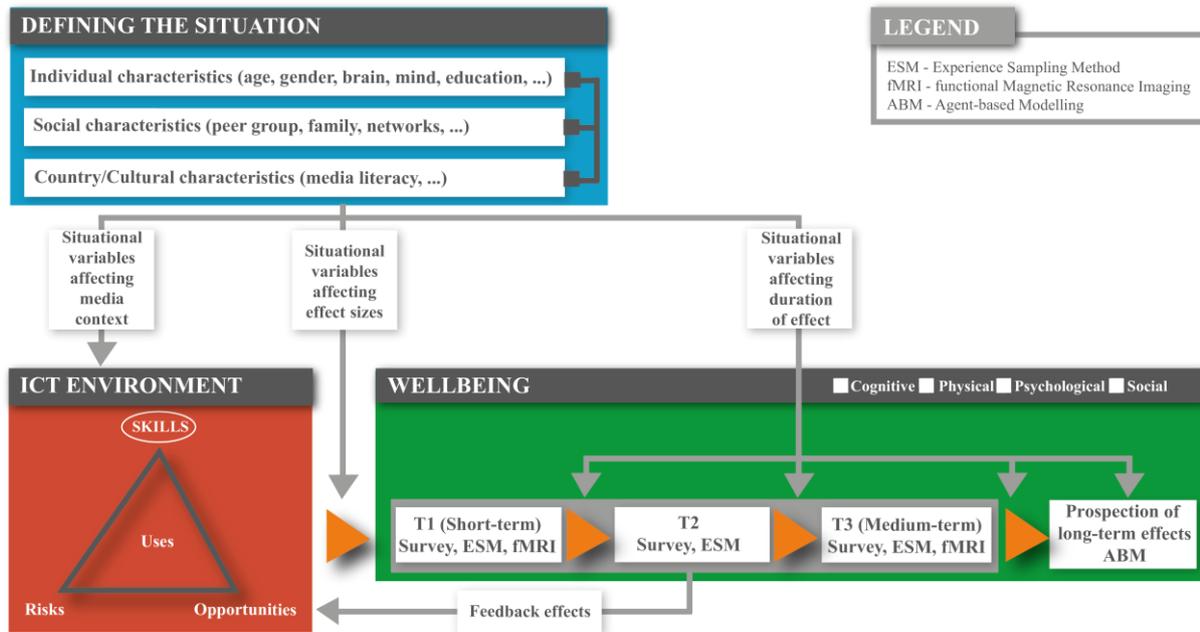
2.   The report

This report will inform the development of digital skills measures that will be validated for children and young people and influence the design of performance testing of ySKILLS. This report will bring a synopsis of the knowledge gained in four tasks performed in the first year of activities of the ySKILLS project (i.e. 2020): the **systematic evidence review** and a **secondary analysis of EU Kids Online data** collected in 2017-19 as well as **interviews with experts on digital skills** in schools and on the labour market and **roundtable discussions with children and young people**. The lessons learned from these tasks lead to an **inventory of actors and factors** whose roles in predicting and moderating digital skills acquisition and wellbeing will be tested in the school survey questionnaires through three new survey rounds in 2021, 2022 and 2023.

3. Lessons learned

3.1 Children's and Young People's Digital Skills: A Systematic Evidence Review (D 2.1)

What do we know about children's and young people's digital skills?

Given the considerable policy and practical importance of digital skills and literacies for young people's life chances, especially as regards inequalities and digital inclusion, and the increasing reliance on digital technologies for learning, employment and civic life, **a systematic evidence review** was conducted to answer this question. This review was informed by the International Telecommunication Union's (ITU) definition of digital skills: "the ability to use ICTs in ways that help individuals to achieve beneficial, high-quality outcomes in everyday life for themselves and others" and to "reduce potential harm associated with more negative aspects of digital engagement" (2018, p.23).

A preliminary rapid evidence mapping found that relatively little research was published in the early years of mass internet use (2000–09). Hence the systematic evidence review encompassed all research published between 2010 and 2020, thus representing the large majority of available studies. The search protocol, registered on PROSPERO, included studies of moderate to high quality (judged using the Weight of Evidence approach) that used quantitative methods, were published in the English language, and related directly to the digital skills of 12- to 17-year-olds.

The results of 110 studies were analysed to identify what is known about youth digital skills, and to examine the evidence for the antecedents (or factors influencing the acquisition) of digital skills, and the consequences of having digital skills. They were also scrutinised for research gaps and to generate questions and hypotheses for future investigation. In addition, they were examined for the many ways in which digital skills have been conceptualised and measured in the research literature.

How are youth digital skills conceptualised and measured?

- Both broad and narrow conceptions of "digital skills" are used in the literature, with some researchers conceiving of multiple dimensions of digital skills and others focusing on particular skills (e.g. information literacy or computer programming) as befits their topic. Moreover, **the definition of digital skills is not much discussed, making it difficult for the field to come to a consensus**. The plethora of definitions in use means that comparing study findings is a bit like comparing apples and oranges.

- **It is important to distinguish demonstrated or claimed digital skills from digital self-efficacy.** The former are revealed through performance tests or self-report surveys that ask direct and factual questions. Self-efficacy ("I am good at…" or "I am confident about…") is subject to social desirability biases, and we place less weight on such studies. We also excluded studies that infer skills from methods that measure digital uses or activities, but do not measure digital skills directly.

- The studies analysed were conducted in 64 different countries, with the USA and Europe generating most of the available research. **Most of the studies used self-report surveys, but a minority (almost one-third) conducted performance tests**, involving some form of task-based assessment. Most performance tests were used to examine the antecedents rather than the consequences of digital skills.
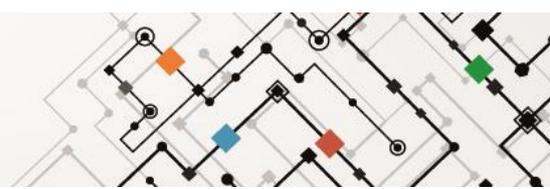
What are the main findings on the antecedents of youth digital skills?

- There is strong evidence that children's digital skills improve with **age**, as expected.

- Contrary to popular belief, the evidence regarding **gender differences is inconsistent**. Boys appear to claim better digital skills than girls, but when performance tests are used, there are no gender differences.

- **Ethnicity** is examined by a handful of studies as a **potential source of digital inequality,** with mixed results.

- A few studies suggest that **better cognitive skills** are associated with better digital skills.

- The higher a **child's academic achievement,** the better their digital skills. Motivation also plays a role and, possibly, learning style.

- Children with **positive attitudes towards information and communication technology (ICT)** have higher digital skills**.**

- Children from **higher socioeconomic status (SES)** households are found to have higher digital skills in around half of the studies that examine this relationship.

- When parents practise **restrictive mediation,** this is linked to lower digital skills for their children, while **enabling mediation** is generally linked to better digital skills, although some studies found no relationship.

- When **ICT is more available in schools**, children's digital skills tend to be better. Also, those with **earlier or broader access to ICT, including at home**, have better digital skills. Most studies do not examine possible underlying causes (such as household SES).

What are the main findings on the consequences of youth digital skills?

Studies of the consequences of youth digital skills are **scarcer** than studies of the antecedent factors that may lead to better skills. Nonetheless, the consequences of youth digital skills were found to be as follows:

- Few studies examined whether digital skills improve **wellbeing,** and even fewer found that they do.

- There is clearer evidence that greater digital skills are linked to **better learning outcomes** for children, although again, the evidence base is small.

- Of the few studies that looked for a relationship between digital skills and **youth civic engagement** (offline and online), all found it to be positive.

- Children with higher levels of digital skills may be better able to protect their **privacy online**.

- There is evidence that better digital skills are linked to more **online risk**, although the evidence also suggests that the type of skills matters: critical digital skills, for instance, are not linked to online risk. Moreover, better digital skills are not linked to more **harm**, and may even reduce harm, possibly because children with better digital skills appear better able to cope with online risks.

Modelling the relation between the antecedents and consequences of youth digital skills

Twelve studies sought to model the relation between the antecedents and consequences of youth digital skills, using statistical modelling techniques. Their findings are complex, and bear careful
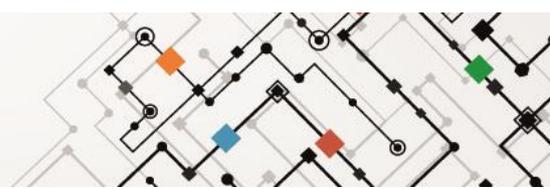
investigation, in crucial ways questioning the simple bivariate relationships between antecedents or consequences and digital skills. Notably, they show that:

- The association between better digital skills and more online risk is indirect, as **better skills are linked to more online opportunities, and those, in turn, are linked to more risk**.

- Relatedly, it seems that **enabling parental mediation has only an indirect association with digital skills, through its role in facilitating online opportunities.**

- Efforts to model the relations among factors to understand digital inclusion suggest that **the online and offline disadvantages that girls and children with lower level education face can be countered if efforts are made to improve their digital skills**. SES and age are independently associated with outcomes, but again, improving digital stills can mitigate inequalities.

What are the main conclusions of the systematic evidence review?

In addition to generating many specific insights that can improve the future evidence base, the review concluded with the following hypotheses and recommendations:

- As regards research methods, **factual questions** ("I know how to…") are preferable to self-evaluative questions ("I am good at…") because they introduce less measurement bias and help distinguish digital skills from self-efficacy. **Performance tests** should be preferred to self-report studies when social desirability biases are likely to be particularly strong (e.g. in relation to gender).

- Since it appears that children acquire better digital skills when they are younger and the process slows with age, **future research should seek to identify when, and under what circumstances, children are more receptive to learning particular types of digital skills**.

- **Girls also seem to have better digital skills than boys when they are younger,** and these differences disappear with age. Research could explore whether this is because girls fall behind with age, or boys catch up, or whether other factors are relevant.

- Scattered studies examine a range of personal and social factors that may influence youth digital skills, but if these are held to be important, a stronger rationale and concerted effort will be needed for clear results.

- **SES matters, insofar as it tends to result in differential ICT access and use**, but more research is needed on how it may continue to matter when children from different backgrounds gain similar digital access and how such inequalities can be mitigated.

- It may seem surprising that **some factors relating to teachers or schools show little association with youth digital skills**, and this bears further investigation.

- **It is intriguing that certain online activities accorded little value by society (e.g. gaming, communication) are linked to digital skills, while digital learning activities are not consistently linked to digital skills.** Clearly the process by which children and young people gain better skills needs more exploration,

- **While studies suggest that digital skills can benefit children's wellbeing, more research is needed to examine this relationship**, to establish more clearly which digital skills are worth promoting in relation to which desired outcomes.

- Similarly, although available studies suggest that better skills bring benefits to children's learning, participation and other outcomes, more research is needed to conclude with confidence, and to explore the factors that matter.
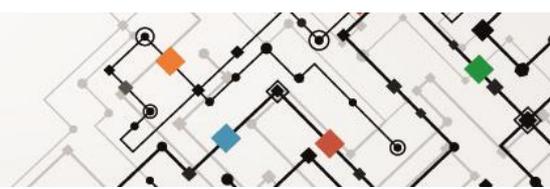
- The available research suggests that **better skills are linked to more risk, although it also supports the view that better skills help children cope and so, reduce harm**. However, the evidence base is weak, and further research is greatly needed given the importance of equipping children to cope with online risk so as to reduce harm.

Finally, we note that, while the internet is increasingly available world-wide, most research reviewed here was conducted in the Global North. In terms of future research methods, more studies should undertake statistical modelling to examine the indirect as well as the direct relations among multiple variables. Most important, although we (and the evidence base) have interpreted studies as having causal implications (differentiating the antecedents and consequences of digital skills), most of the studies reviewed use cross-sectional designs. Therefore, **longitudinal research** is greatly needed in the future.

Further reading:

The full report on the systematic evidence review can be downloaded from the ySKILLS website or Zenodo:

Haddon, L., Cino, D., Doyle, M-A., Livingstone, S., Mascheroni, G., & Stoilova, M. (2020). *Children's and young people's digital skills: a systematic evidence review*. KU Leuven, Leuven: ySKILLS.
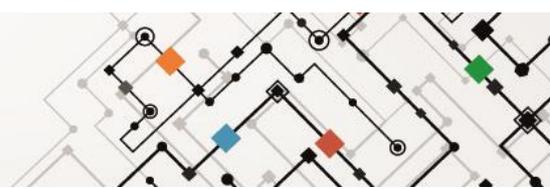
3.2 Digital skills, risks, and wellbeing among European children – Report on (f)actors that explain online acquisition, cognitive, physical, psychological and social wellbeing, and the online resilience of children and young people (D 2.2)

In 2020, EU Kids Online[1] mapped the risks and opportunities of the internet for children in Europe (Smahel et al., 2020). A survey of 25,101 children was conducted in 19 EU countries between autumn 2017 and summer 2019. The survey focused on topics such as the internet access, online practices, skills, online risks and opportunities for children aged 9–16 in Europe. In Work Package 2, further analysis of the EU Kids Online data collected across these 19 European countries was carried out, aimed at identifying the antecedents and consequences of digital skills among children. More specifically, the relationships between individual characteristics (age and gender), social characteristics (socioeconomic status [SES] and parental mediation), country characteristics, information and communications technology (ICT) use and skills were tested. Moreover, the relations between skills, risks and opportunities were examined. The **secondary analysis** was aimed at outlining gaps in the evidence base and in our current knowledge of digital skills acquisition, in order to inform future research in this area. Digital skills were measured by 10 items, two items for each of the five sub-scales: operational skills, including safety skills; information navigation skills, which enable critical engagement with online information; social skills, that is, the ability to manage online relationship with others; creative skills, namely, the capacity to produce and share content online; and mobile skills, related to the use of mobile devices.

Comparing children's digital skills across Europe

- First, our findings did not indicate clear-cut differences with respect to the North–South digital divide. Instead, **country differences in children's digital skills were small.** On the one hand, children from Southern European countries (France, Spain and Italy) reported the lowest scores of digital skills, while on the other hand, Serbian and Portuguese children outscored their peers in Northern European countries.

- **Gender differences were only statistically significant in four countries – Belgium (Flanders), the Czech Republic, Norway and Serbia** – where boys reported higher levels of digital skills than girls. While our findings were consistent with previous research showing that boys use technology more and thus have more opportunities to develop related skills, we should not underestimate that our analysis was based on self-reported skills. It may well be the case that boys tend to overestimate their abilities with digital technology and the internet, echoing a common-sense belief that boys are more naturally inclined than girls to like and be better at using technology.

- In most of the countries, except Belgium (Flanders), **older children reported higher levels of skills than younger children**.

Antecedents of digital skills

- The strongest and most common predictors of digital skills across the countries were **self-efficacy**, number of **online activities** children engage in, preference for **online social interactions**, and **feeling safe on the internet**.

[1] EU Kids Online is a multinational research network. It seeks to enhance knowledge of European children's online opportunities, risks and safety. It uses multiple methods to map children's and parents' experience of the internet, in dialogue with national and European policy stakeholders. For more information: https://www.lse.ac.uk/media-and-communications/research/research-projects/eu-kids-online

- Restrictive parental mediation was also significant in all the countries, but it predicted digital skills negatively everywhere. In other words, **when parents limit the time children spend on the internet, and the activities they do online, children score lower on digital skills.** Perhaps surprisingly, instead, the positive influence of active parental mediation on children's digital skills was small.

- Children who engage in more online activities – including communication, entertainment, education, etc. – also seemed to develop more skills. In fact, the number of online activities predicted digital skills positively in all the countries except for Poland.

- Self-efficacy – measured by children's confidence in their ability to solve problems in daily life – influenced digital skills in all the countries to some extent, although the reasons why may vary. On the one hand, this finding suggests that when children feel self-confident, this may positively reflect on their digital abilities. On the other hand, it may simply mean that more self-confident children tend to positively rate their digital skills.

- While the relationship between digital skills and children's online activities, or the practices of parental mediation they receive, has been investigated in prior studies, we also explored whether **preference for online social interaction (POSI)** and feeling safe on the internet influence the acquisition of digital skills.

- POSI was a positive predictor, suggesting that children who find it easier to express themselves online may actually benefit from this usage to develop skills relevant to the digital environment they feel more at ease in.

- **Feeling safe online** was a positive predictor in all the countries except for France, Italy and Slovakia. It can be argued that the more children familiarise themselves with the online environment and the more they feel safe online, the better knowledge and understanding of the internet they would gain, supporting their acquisition of digital skills.

- Other variables usually considered in research on the antecedents of digital skills among children, such as age, gender, average time spent online on a weekday and SES, did not predict digital skills equally across countries, nor were these relationships consistently statistically significant.

Consequences of digital skills

- Looking at the association between specific types of digital skills (including operational, informational, social and content creation skills) and digital engagement, online information-seeking activities were significantly associated with **information navigation skills**, emotional problems, active parental mediation and sensation-seeking.

- Communication and other social activities were, in turn, mostly associated with restrictive parental mediation (negatively), sensation-seeking and informational digital skills.

- Social digital skills were not statistically significant predictors of online communication activities in most of the countries.

- **Higher levels of digital skills** were associated with **more exposure to risky and potentially harmful online content**, including racist and discriminatory content, self-harm and pro-anorexia content, etc. This suggests that the more skilled children who explore the internet to a greater extent may be more likely to encounter risks. However, digital skills can also help children **prevent risks from translating into harm**.

- Digital skills also shaped the relationship between emotional problems and exposure to potentially harmful online content: this suggests that when children who suffer from emotional
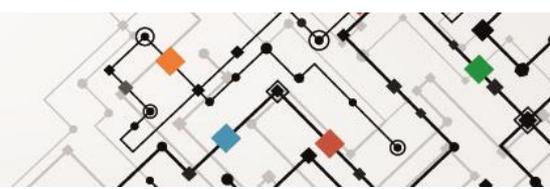
problems also have higher digital skills, they are more likely to be exposed to potentially harmful online content. Digital skills, in other words, increase the likelihood that children with emotional problems encounter risky content online.

Further reading:

The full report on the secondary data analysis can be downloaded from the ySKILLS website or Zenodo:

Mascheroni, G., Cino, D., Mikuška, J., Lacko, D., & Šmahel, D. (2020). *Digital skills, risks and wellbeing among European children. Report on (f)actors that explain online acquisition, cognitive, physical, psychological and social wellbeing, and the online resilience of children and young people*. KU Leuven, Leuven: ySKILLS.

3.3 Report on the Interviews with Experts on Digital Skills in Schools and on the Labour Market Interviews (D 3.1)

For the purpose of gaining a deeper knowledge on (1) the (digital) skills that young people need in the 21st century and (2) the role of digital skills education in formal, informal and non-formal learning settings, interviews were conducted with 34 experts from the educational sector and the labour market in six European countries (Estonia, Finland, Germany, Italy, Poland and Portugal). Among the experts were teachers, headmasters, researchers and representatives of NGOs as well as economists, policymakers and representatives of the IT sector. As a result of their professional and personal experiences, these experts were able to provide deep insights into the impact of digital technologies on the lives of young people. Their views are a valuable resource for providing evidence-based recommendations and strategies for key stakeholder groups with the aim of promoting digital skills and wellbeing.

What are the main findings of the expert interviews?

- Terms and **concepts that are usually being distinguished by academics, such as digital skills, competences and literacies, are in practice often used interchangeably by the wider public.** The interviewed experts found it difficult to provide a comprehensive definition of digital skills due to their complexity and time-sensitivity. In spite of this, all experts shared a similar understanding of digital skills. While considering operational skills as an essential basis, the experts felt that being 'digitally skilled' means more than possessing technical know-how. In fact, most experts regard digital social interaction skills, such as '*collaborating*' and '*interacting*' through digital technologies, and critical thinking skills as more important these days than (advanced) technical skills.

- The experts agreed that with digital technologies being more and more embedded in our daily lives, digital skills are becoming crucial. Particularly, the labour market experts underlined that **digital skills already are a key requirement for a successful integration into the working world.** "If you want to get a good job, you must have [digital skills]. There is no other way", stated an expert from Estonia. According to the interviewed labour market experts, advancing digitisation and developments such as automation and the use of artificial intelligence will lead to an even greater role of digital technologies in our future working lives. Some predicted that technological advancements result in the disappearance of entire professions. However, many believed that these changes also create new job opportunities: "We will need highly skilled employees to build and maintain all the tools that will replace them" (Poland, Labour market expert). Preparing young people for such a transformed labour market is referred to as a challenge. An expert from Germany noted that the children of today must be prepared for professions whose existence we do not know of yet. Thus, **young people need to be taught to adapt, to continuously use the resources available to them, to further educate themselves and learn new skills.**

- In this context, **most of the experts were sceptical regarding the existence of a 'digital native' generation**. Instead, in their experience, many young people are not as tech-savvy as adults or young people themselves tend to expect and need to be actively supported in acquiring the necessary skills.

> *We have an illusion – it seems that young people are born with a mobile phone in hands these days and that they automatically possess all skills needed to handle it, but it is like you are giving a Ferrari to a 5-year-old and saying: go ahead and drive.*
>
> *Finland, Labour market expert 1*

- Nonetheless, the experts stressed that **digital skills are also needed for many daily tasks and activities and, furthermore, are taking on an increasingly important role for social and political participation.** An education expert from Poland said:

> *We are living in some kind of media augmented reality where we no longer have the possibility of not using digital skills. Maybe we should call it 'competences of the future' or 'competences of continuous learning' rather than digital skills.*
>
> *Poland, Education expert 1*

- Considering the growing importance of digital technologies in nearly all areas of life, the experts highlighted that **digital skills are not just relevant for children or the workforce. Instead, every citizen needs to be supported in obtaining digital skills.** However, based on the experts' testimonies, access to the necessary tools, resources and education as regards digital skills development varies greatly, not only across but also within countries. "The current programmes offered at school and in university education are often not adequate. The digital world follows logics that are not those of classical education", commented a labour market expert from Italy. Observing that certain fractions of society remain excluded from access to good quality education and training, **the experts voiced concern about the risk of exacerbating existing social inequalities**. In their experience, children from socioeconomically disadvantaged backgrounds often have less access to both digital equipment and education. Additionally, they often do not receive as much support or guidance at home as their peers because their parents often struggle with digital technologies themselves. The experts feared that these children might be left behind on the labour market as well as be excluded from the various opportunities for social and political participation the online world has to offer: "Engaging in citizenship through digital technologies; being, as a citizen, part of society; being able to get your voice heard. That is necessary" (Finland, Labour market expert). Apart from socioeconomic inequalities, the interviewees identified several other factors of influence. In particular, inequalities along the lines of age and gender were mentioned.

- The formal education sector was identified as having a key role for the development of digital skills since it is in a unique position to reach all children and their families. However, **both labour market and education experts criticised the current state of digital skills education at schools.** In the view of many labour market experts, the educational system has been slow to adapt to the digital developments in the private economic sector. Additionally, according to them, no only do school curricula appear to be out of touch with children's reality outside of school, but they also do not reflect the requirements of the labour market. Thus, students are not being equipped with the skills in demand on today's job market. The education experts were more outspoken on positive aspects of digital skills development in the formal education system. They particularly stressed the motivation, openness, and interest
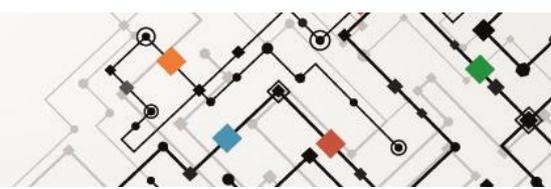
of teachers in digital technologies and their creative incorporation in teaching-learning experiences. Simultaneously, they felt that too often schools and teachers are left alone with the task of equipping their students with digital skills. They see a **special need for official standards** outlining which skills should be taught and how they should be assessed. The education experts also felt that more professional development opportunities for teachers need to be created.

- Furthermore, in most countries the labour market experts reported that the current workforce is not sufficiently digitally skilled. In relation to this, the experts pointed out **that greater efforts should be made to support lifelong learning, enabling citizens to reskill, upskill and educate themselves beyond school**. Therefore, although the formal educational sector has a special role in digital skills development, the interviewed experts stressed that it should not bear the sole responsibility for it. Experts agreed that cooperation between the formal educational system, the private economic sector and the research community has the potential to improve digital skills education. In the view of many experts, the current lack of cooperation between these agents results in a fragmented system. All involved stakeholders should instead engage in a coordinated effort with the aim of creating a systemic approach to digital skills development to ensure that everyone has access to both the necessary infrastructure and good quality education.

Further reading:

The full report on the interviews with experts can be downloaded from the ySKILLS website or Zenodo:

Donoso, V., Pyżalski, J., Walter, N., Retzmann, N., Iwanicka, A., d'Haenens, L., & Bartkowiak, K. (2020). *Report on Interviews with Experts on Digital Skills in Schools and on the Labour Market*. KU Leuven, Leuven: ySKILLS.

Additionally, another ySKILLS report presents the results of the analysis of interviews with experts from the education sector, which provides a deeper and more nuanced analysis of issues related to home-school communication. This report can be downloaded from the ySKILLS website or Zenodo:

Beilmann, M., Opermann, S., Kalmus, V., Donoso, V., Retzmann, N., & d'Haenens, L. (2020). *Home-school communication on children's digital skills development: Based on interviews with experts from the education sector*. KU Leuven, Leuven: ySKILLS.

## 3.4. Roundtable Discussions with Children and Young People (T3.4)

The ySKILLS project seeks to better understand which skills 12- to 17-year-olds must obtain to knowingly and critically use Information and Communication Technology (ICT) for their wellbeing, education and social life, and to improve our knowledge on how children and young people can build resilience against negative impacts. Young people's insights provide knowledge and a different angle than that of adults, which is essential to improve the measurement of youth digital skills, one of the key objectives of the ySKILLS project.

In September-November 2020, six roundtables discussions with teenagers were conducted in Belgium, Finland, and Portugal with the aim of (1) getting a deeper understanding of how young people conceptualise (digital) skills, (digital) social interaction and (digital) content creation and if and in what ways they value (digital) skills. In every country, two roundtables with young people were carried out. In Belgium and Portugal all roundtables were carried out face-to-face. In Belgium the roundtables took place at two different schools. In Portugal one roundtable took place at a school and another one at a youth centre connected to *Escolhas,* a national Action targeted to deprived children and youth. In Finland the roundtables were carried out online due to the COVID-19 restrictions at the time of the sessions. The children and young people provided personal insights on the impact of digital technologies on their lives. They openly shared their views about their digital media consumption, forms of engagement, creative experiences, but also the difficulties and frustrations they encounter on the online platforms they use every day.

Table 1	Roundtable participants per country		
Expert Profile	**Number of participants**	**Age**	**Location**
Roundtable 1 Belgium	8	Between 12-14 years old	School
Roundtable 2 Belgium	8	Between 15-18 years old	School
Roundtable 1 Finland	6	Between 14-15 year olds	Online
Roundtable 2 Finland	6	Between 15-18 year olds	Online
Roundtable 1 Portugal	9	Between 12-14 years old	School
Roundtable 2 Portugal	9	Between 15-18 years old	Youth Centre

The roundtables were conducted by 6 researchers from the ySKILLS consortium partners. While the original plan was to carry out the interviews face-to-face, the outbreak of the COVID-19 pandemic in Europe rendered a change of strategy necessary in Finland. Therefore, the teenagers were instead interviewed remotely via an online conferencing system. In Belgium and Portugal, the roundtables took place face-to-face, as originally foreseen, following the social-distance protocols in place at the schools and the Youth Centre where the roundtables took place. The Finnish researchers used the online platform for which their institution had a data processing agreement (DPA) in place. Hence, the MS Teams video conferencing platform was used. Apart from minor sound adjustments, no technical problems were encountered and the interaction in both roundtables ran smoothly.

All researchers conducted the fieldwork on the basis of the roundtable protocol developed for this purpose (See Appendix I). The protocol distinguished between three overarching themes for the interviews: (1) Conceptualizing digital skills, (2) (Digital) interaction skills and (3) (Digital) content creation skills. Following these themes, a set of questions were formulated. The roundtable questions were designed in a semi-structured fashion to provide space for individual, detailed responses and to allow for the emergence of unanticipated themes. Therefore, the researchers were free to inquire into any issue relevant for the research aim raised by the interviewees. Consequently, the length of roundtables varied between 60 and 90 minutes.
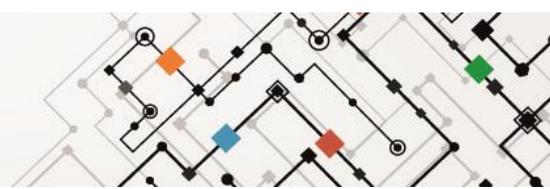
The roundtables started by asking teenagers to nominate a person in their social network who, according to them, was the most digitally skilled person they knew. After nominating this person, teenagers had to explain why that person had been chosen. The idea behind this question was to have teenagers reflect on their own views of digital skills and better understand what, in their opinion, were the competences that a digitally skilled person should have. This question was followed by asking them to describe a person who is less digitally skilled. A summary of the guiding questions that led the roundtable discussions can be found in Appendix 1.

Before any data was collected, ethical approval was granted by the Social and Societal Ethics Committee (SMEC) of KU Leuven to carry out the roundtables. Once participants were recruited and the participants were informed on how the collected data would be stored and processed, and their informed consent was obtained, the roundtables took place. The roundtables were recorded either in form of a video or an audiofile. The interviews were transcribed, and emergent themes were analysed, and then grouped together focusing on the guiding research questions that led the roundtable discussions.

Table 1	Themes and Questions
Overarching themes	**Key questions to be answered**
Conceptualizing digital skills	- How do children and young people conceptualise digital skills? - What digital skills do they consider as essential? Why?
Conceptualizing (digital) social interaction skills	- What do children and young people regard as important for digital social interaction? - Which digital tools do children and young people use for social interaction? - What do they struggle with when interacting with other people online? How do they cope?
Conceptualizing (digital) content creation skills	- What kind of digital content do children and young people produce? How important is the production of digital content for children and young people? - Which aspects do they take into consideration when producing content? - How do children and young people assess the quality of digital content?

What are the main lessons learned from the roundtables with children and young people?

- Interestingly but perhaps unsurprisingly, the views of the children and young people were different to that of the adult experts interviewed (D3.1). Although both groups recognised the importance of similar digital skills sets, they attributed different degrees of importance to

> *It is important to know how to work with Excel/Word/PowerPoint, because it will be important in the future, for college and work. The other digital competence that is important is sending an email because it is the most used professional communication.*
>
> *Teenager, Portugal*
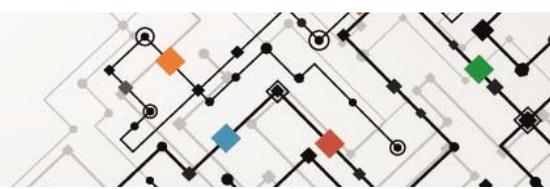
these skills. For instance, **in most roundtables with young participants they highlighted the importance of acquiring technical and operational skills as an essential component of digital skills.** They stressed the importance of being able to use computers, software programmes and e-mail as important tools for their future professional lives. Some of the younger teenagers referred to the importance of being able to use 'traditional' communication tools, such as sending text messages or making phone calls to stay connected with others, even in the absence of internet connectivity.

- As opposed to the adult experts, **teenagers spent considerable time discussing their concerns and frustrations related to online technologies**. Apparently, it was easier for them to discuss the negative aspects related to online technologies. We are not sure whether this reflects actual negative experiences with digital technologies or whether it is the result of the usually unbalanced, negative representations of social media and digital technologies in news headlines. The ease of discussing the negative aspects may also have to do with their exposure to numerous awareness-raising and educational efforts that tend to focus (too) much on online safety initiatives rather than on more comprehensive efforts to foster media and digital literacy.

> *Knowing how to stay safe on the internet, not visiting unsafe websites or sharing personal information with strangers as it is dangerous to surf the internet without security.*
>
> *Teenager, Portugal*

- Both the young people and the experts we interviewed considered **mastering digital skills as essential in increasingly digitised societies.** Retrieving and assessing the quality and veracity of information were considered as important skills to acquire. Interestingly, with the exception of Portuguese children, in spite of using digital technologies mainly to interact and share information, most teenagers did not spontaneously refer to communication or interaction skills as the most important digital skills that young people should acquire these days. This contrasts with the views of the experts who attached great importance to communication and cooperation skills.

- **As regards social interaction in digital environments, we could observe that young people use a wide variety of digital tools with different audiences and for different purposes**. We also noticed some differences in the types of tools and applications typically employed by adolescents when interacting with others. Despite these differences, some commonalities were evident. For instance, instead of creating different groups within an online service or application, most teenagers preferred using different digital tools with different groups. For instance, some teenagers explained that they used Instagram or TikTok with peers, Facebook Messenger or Snapchat with friends and WhatsApp with family members. Their choice of applications and online services used for communication purposes varied across countries, and in some cases also by age and gender. For instance, we could observe that in most countries Instagram was more popular among older teenagers than among younger ones. WhatsApp was popular among all age groups. We believe that this has to do with the fact that most teenagers referred to WhatsApp as a popular platform to be in touch with their parents and other family members.

- Especially among younger boys, **gaming consoles and the online platform Discord were referred to as popular tools to interact with peers**. A Belgian boy commented: "We often

communicate while we are playing". Another boy added: "What I actually like when I play a videogame with someone is that I also talk about [other things], barely about the game, we talk about different things, about the news and so on. We don't really talk much about the game itself". In general, 'traditional' means of communication such as talking with someone face-to-face, calling someone on the phone or sending text messages were highly valued among teenagers and were chosen as their preferred option to share more intimate and personal information with their peers and family members.

- **The opinions expressed by most roundtable participants seemed to indicate great awareness of their intended audiences**. In fact, several referred to the importance they attach to how their 'messages' and the different types of content they share online (e.g. pictures, video clips) are perceived and received by others.

> *Whether you are important or not, you are always going to have an influence on others. And this is why I think that you must think carefully about which image you want to project. Do I just want to post nice things and make people feel bad? Or do I want to [do something else]?*
>
> *Teenager, Belgium*

- During the roundtables, **teenagers referred to a wide range of concerns related to their online interactions.** These included excessive social media use, increasing pressure to be constantly online and the fear of missing out (FOMO), conflicts with peers such as misunderstandings as well as more severe forms of online aggression such as cyberbullying or hate speech. They also referred, but to a lesser extent, to privacy and commercial-related types of risks.

- As regards content creation skills, we asked young people what kind of digital content they produce, which aspects they take into consideration when producing digital content and how they assess the quality of digital content. **As regards the digital content teenagers produce, most referred to audio-visual content, especially pictures and (short) video clips of people, places or things they find interesting or pretty.** It was common for them to refer to events or holiday pictures, beautiful landscapes, pets, but also, in some cases, they produce other types of content such as (videogame) tutorials. As a teenager from Belgium stated: "for example I see the sun setting and I think 'oh that's nice!' And then I grab the camera and put it on Instagram". As opposed to audio-visual creations, written texts were mainly produced for personal communication with close friends and family. Only few participants mentioned that they produce more 'elaborate' types of content such as websites, blogs or artistic creations.

- **When asked which aspects they take into consideration when producing content, most interviewees referred to aesthetics aspects** (e.g. the image or video needs to be pretty) **and of good (technical) quality** (e.g. content with enough audio-visual elements or with "enough pixels"). For instance, when asked what is a good (Instagram) photo, a Finnish teenager replied: "Whether I look good in them. I pay attention actually only to that". In general, most adolescents mentioned that they share content they deem as beautiful, interesting or entertaining for themselves and their intended audience. When referring to the aspects that make a good video, a Finnish adolescent explained: "that depends on the person…but if it's interesting, and of good quality, and there is some music in the background…" Similarly, a
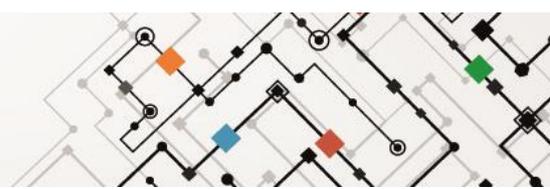
teenager from Belgium added that what makes a good video is "its sound and image quality, the content of the video, and a decent intro".

- **Some adolescents, especially girls, also attached importance to the potential reputational consequences of the content shared online**. When asked what is a good Instagram photo, a Finnish teenager replied: "the kind which will not give you a bad reputation, or have negative consequences" (Teenager, Finland). Most teenagers seemed to be relatively aware of privacy aspects and referred to the importance of respecting other people's privacy. Fewer teenagers referred to aspects such as copyright.

- **When asked about the type of digital content they consume and how they assess the quality, most teenagers highlighted similar aspects as the ones they consider important when creating their own online content (e.g. aesthetics and technical aspects)** but some older adolescents further added that they valued the fact that some types of online content (e.g. videos about current world issues) allowed them to get in touch with realities they would otherwise be unaware of. In these cases, the informative character of the content was also given importance and was considered as an added value.

> *A lot of people are making other people aware of problems in the world, for example, the things that happen in China. I used to know nothing, but then they make a video or post of it to explain what is happening there and I think it's very important.*
>
> *Teenager, Belgium*

- As the roundtables took place in September-November 2020, amidst the COVID-19 pandemic in Europe, we also asked participants how the crisis and the consequent 'social distancing' had impacted their social and school lives. **In general, young people agreed that during their confinement digital technologies were used much more intensely than otherwise.** In particular, many had to spend more time in front of screens to follow online classes or to do homework. Most also acknowledged that they had used social media platforms more intensely during confinement to keep in touch with their friends and peers, usually as a way to compensate for the physical social distance but also to fight boredom. Different teenagers expressed different opinions as regards following classes online. Some enjoyed the peacefulness of being at home and the possibility to better concentrate on their school chores, others, arguably most, missed the physical contacts with peers. In some countries, teenagers complained that the online offer provided by their school was chaotic, especially at the beginning of the confinement period, and that it took a while for their schools and teachers to organise online classes. Some referred to the different teaching approaches even within the same school and highlighted that some teachers were clearly better prepared to teach online than others. **According to our interviewees, teachers, especially older ones, struggled sometimes with technology.** Some young people also confessed that although they were following classes online, they were usually multitasking and doing other things online such as chatting with friends and, therefore, they did not always fully concentrate on what was being taught.

- **Many interviewees referred to the deficient digital skills of adults, especially the elderly**. Young people considered elderly people as the least digitally skilled in their surroundings. In fact, they referred to one or both of their grandparents as an example of the 'least digitally skilled' person they knew. They also mentioned the many difficulties elderly people

experience with digital devices such as a smartphone and their limited knowledge of (social media) platforms and online services. Interestingly, some teenagers told us how they supported their grandparents, and in a few cases also other adults such as an older teacher or a parent, by helping them solve technical problems or guiding them in the use of certain (online) applications or services.

> *I would like to add my grandparents. They are also old, of course. But because they didn't get it, they can't work with it […], they didn't grow up with it, I think these people really are the example of the least digitally skilled people I know.*
>
> *Teenager, Belgium*

What are the main conclusions of the roundtables?

- Young people seem to attach greater importance to technical skills and online safety than the adult experts interviewed. Information retrieval and interaction/communication skills are also considered as important, but to a lesser extent.

- A great variety, even confusion, was observed in understanding what digital skills mean. The academic community can play an important role in helping clarify this.

- A life-long learning perspective towards digital skills literacy and education is needed especially for those with less access to high quality digital literacy education at school.

- It is important to explore whether the easiness with which young people refer to concerns, as opposed to more positive aspects of their engagement with digital technologies, reflects real negative experiences encountered online or whether it is a reflection of a 'taught' discourse learned at school, via social and traditional media, from parents, etc.

- Last, from a research and policy-making perspective, it is important to think about whether we are paying enough attention to what young people are telling us. It is important to continue finding ways to incorporate their voices more actively into our research as well as in policy-making efforts related to children and young people's engagement with digital technologies.

### *How did the roundtables contribute to the development of the ySKILLS school survey?*

The findings from the roundtable were taken forward to inform the development of the school survey questions in WP4. Together with members of WP3 and WP4 it was agreed that the focus of the roundtables would be to inform the development of the performance tests with a special focus on 1) Communication and 2) Content development/consumption aspects. Consequently, the roundtable protocols were developed keeping this in mind. In particular, the following aspects were taken into consideration in the performance tests:

- We observed that teenagers are not actively using Facebook. If they use it, it is rare and only to keep in touch with their families. In some countries, Facebook Messenger is used to communicate with peers. Instagram and Snapchat seem to be the preferred platforms among teenagers. This finding was used to make the decision to use examples of Instagram and Snapchat or neutral platforms in the performance tests, though we continued to use Facebook
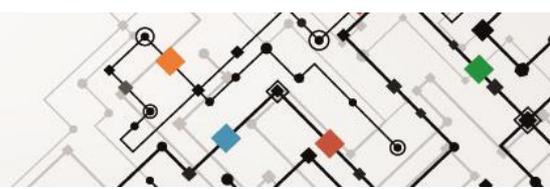
and other examples to see the extent to which young people can apply their skills in platforms that they are less familiar with.

- In all the roundtables, young people seemed quite aware of private-related risks and many participants acknowledged that compared to their first encounters with social media their approach to communication was more focused and less interested in reaching larger audiences as compared to when they were younger. This finding was important to adjust some questions related to youth's awareness of the visibility of their posts. The question was refined making it clear that this was not about whether they had shared content with lots of people but rather to find out whether they would be able to do this if they had to, and whether they understood that other people did this and why. Also, when we finally asked these questions in the knowledge items many showed that they did not know how to increase visibility in practise.

- It was interesting to observe that older teenagers not only use several different social media platforms, but they are also strategic and knowledgeable about their use depending on what they want to communicate, with whom and for what purposes. This finding helped us include questions in the knowledge and skills items on cross platform and multi-modality skills. In the performance tests, the first round, they were missing but they will be included in the next round. There is still the problem of lower adaptability and interactivity for the platforms that can be used for the performance tests. They cannot be custom-made due to the limited of resources for the performance tests, but alternative solutions are being sought.
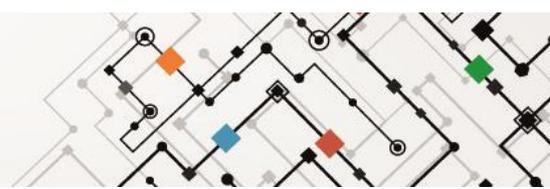
4. Conclusions

Both broad and narrow conceptions of digital skills are used in the literature, with some researchers conceiving of multiple dimensions of digital skills and others focusing on particular skills (e.g., information literacy or computer programming) as befits their topic. Moreover, **the definition of digital skills is not much discussed, making it difficult for the field to come to a consensus**. The plethora of definitions in use means that comparing study findings is a bit like comparing apples and oranges.

That being said, we point out the actors and factors that play a role in predicting and moderating the acquisition of digital skills. Children's socio-demographics have both a direct and an indirect impact on digital skills. There is strong evidence that children's **digital skills improve with age**. The evidence regarding gender differences is inconsistent: boys appear to claim better digital skills than girls, but when performance tests are used, these gender differences seem to disappear. The effect of household socioeconomic status is only indirect, mediated by access. Ethnicity is considered as a potential source of digital inequality, with mixed results. Together, socio-demographics and internet-related variables shape the progression in the take-up of online opportunities. Children with positive attitudes towards ICT have higher digital skills. When ICT is more available in schools, with broader and earlier access including at home, children's digital skills tend to be better. Although there is no clear-cut North-South divide, **different types of skills are unequally distributed** among European children.

Few studies examined whether digital skills improve well-being, and even fewer found that they do. There is clearer evidence that greater digital skills are linked to **better learning outcomes** for children, although again the evidence base is small. Children with higher levels of digital skills may be better able to **protect their privacy online**. Although research suggests that better skills bring benefits to children's learning, participation and other outcomes, more research is needed to conclude with confidence, and to explore the **factors that matter**.

Since having adequate levels of media literacy and digital skills is becoming increasingly important to perform everyday activities and to be able to engage in civic participation, the development of **effective strategies** to reduce existing social and digital inequalities is also of paramount importance. This was the joint conclusion of the roundtable discussions with youth and the interviews with experts. We need to ensure that **all** citizens have access to effective and meaningful education and capacity-building opportunities **throughout their lifespan**. The provision of access to digital technologies and the internet is a starting point, but more needs to be done so that today's young people can become tomorrow's digitally literate citizens.

One conclusion from the systematic evidence review was that it seems **surprising that some factors relating to teachers or schools show little association with youth digital skills**. However, the experts and the children we interviewed also told us that many schools are ill-prepared, and teachers lack the confidence or are reluctant to incorporate digital technologies at school. Some children complained that the technical, operational aspects of digital skills are mainly emphasised at school. Other children perceived (older) teachers as lacking digital skills. Children furthermore complained that digital literacy was practically absent from the curricula targeting the youngest pupils. Labour market experts also tended to see formal education systems as non-innovative and slow to adapt to the requirements of increasing digitised societies. All these factors could help explain why **ICT at school may still have little impact on the digital skills** of children and should act as a wake-up call for substantial changes so that digital skills are also nurtured at school.

In addition, it is **intriguing that certain online activities that are accorded little value by society** (e.g. gaming, communication) **are linked to digital skills**, while digital learning activities are not consistently linked to digital skills. Clearly the **process by which children and young people gain**
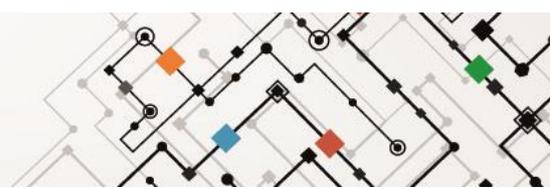
better skills needs more exploration. The value of new skills acquisition, for instance, **through gaming** and in **informal learning contexts** bears more investigation.

Digital skills are vital for successful participation in the labour market, which is why **decision-makers have a big responsibility in supporting the re- and upskilling of the current workforce**. However, it is essential **to not limit these efforts to the economic sphere**. Digital skills become also increasingly important to fully participate in society and to be active citizens, especially given the increasing digitalisation of services including e-government. e-health, among others. Hence, governments need to create **lifelong learning opportunities for all citizens** and pay special attention to those groups that are easily overlooked because they do not actively take part in the labour market, for example the elderly or the unemployed.
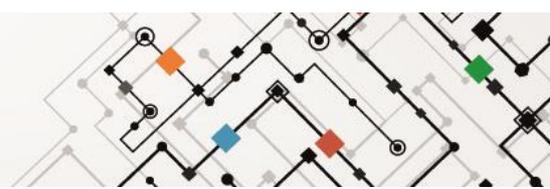
5. Recommendations

In this last section of the report, we present a series of recommendations aimed at relevant stakeholder groups.

Policymakers and regulators

❖ **More opportunities for all children to develop their digital skills are required.** Research suggests that improving digital skills can mitigate inequalities. Therefore, more opportunities need to be provided for children to develop these skills through formal education as well as in informal and non-formal educational settings (e.g. at home, in coding clubs, at libraries, youth centres).

❖ **Coherent educational policies in regard to digital literacy and increased digital skills as well as enough and good quality training opportunities for teachers and other professionals working with children (e.g. librarians, youth workers) are needed to ensure that all European children have sufficient opportunities to develop their digital skills.** The quality of digital education provision is dependent on the capacities and initiatives of individual schools and teachers. Therefore, it is important to create a cohesive, coordinated strategy for the development of digital skills ensuring even access for all children.

❖ **Investment in technical equipment is still required.** Access to the internet is widespread in European households with children, where the majority of young people possess some form of digital equipment and connectivity. Nevertheless, there are still groups who only have limited or no access to these technologies. The latter face growing educational and social exclusion as digital technologies become an ever more indispensable part of our daily lives. Therefore, there should be a continuous effort to invest in both hardware, especially at schools, and education initiatives to make sure that digital inequalities are minimised.

❖ **There is a need for more initiatives helping families to offer the guidance their children require regarding digital technologies.** Different styles of parental mediation seem to have different impacts on children's online opportunities and consequently on their digital skills. Therefore, it is important to support parents, particularly those in more vulnerable situations, so that they are better equipped to adequately mediate their children's engagement with digital technologies. This will require access to sufficient, good quality and accessible resources as well as other forms of support, when needed.

Educators

❖ **The formal educational sector plays a key role in the development of digital skills.** Schools occupy a unique strategic position, as they are able to reach practically all children and their families. Therefore, they are a key partner in the reduction of digital and social inequalities. However, they need to be supported in this task. This requires a cohesive overarching framework as well as enough investment in human capacity and technical resources not only for children, but also for school staff and parents.

❖ **Digital education in school should focus on both technical and non-technical aspects.** Children and young people need to know how to use digital technologies and understand how they work on a technical level. However, digital education cannot stop there. The digital skills children need, both as members of society and as future labour market participants, are

becoming increasingly complex. Comprehensive digital education programmes covering social interaction, communication, collaboration and content creation skills are therefore crucial. Equally, skills such as problem-solving and critical thinking skills need to be fostered among young people, so that they are able to critically assess and wisely use the vast amount of information and data available to them online.

❖ **Schools and teachers need to stay up-to-date with technological innovations and trends concerning young people's digital uses.** This requires the creation of training resources and opportunities for teachers to update and enhance their skills in the course of their career.

❖ **A closer coordination of the educational sector with the labour market is necessary to ensure that teaching content and requirements of the labour market are congruent.** Although equipping young people with necessary skills for their future entry into the labour market is an important objective of school education, the formal educational system appears to sometimes fail to adequately respond to the needs of the job market. Better coordination and an open exchange between the formal educational sector, the labour market and youths themselves about how young people can be best prepared for their professional lives and the role that digital technologies should play in their future are a priority.

Labour market and tech industry

❖ **Employees in all branches should provide enough opportunities for their employees to continue upskilling and reskilling their digital skills** after their leaving school. This will not only benefit the employees but also increase efficiency and quality of work and, thereby, strengthen the organisation.

❖ **The tech industry can cooperate more closely with the educational sector** and thereby support schools to prepare young people for their entry into the labour market. However, it is crucial that these partnerships take place within an ethical, non-commercial framework which fully respects all children's rights and safeguards their safety.

Families

❖ **Parents should be well-equipped to guide their children's online activities.** Digital technologies are already deeply embedded in the everyday lives of children and young people. While they expose children to certain risks, digital tools also offer vast opportunities. It is important that parents show interest in the digital activities of their children, communicate openly about potential risks and benefits of these technologies and offer guidance and support as well as regulate the uses of these tools, where necessary.

❖ **Parents need to be aware that they are role models for their children. This includes the use of digital technologies.** Therefore, parents should reflect on their own usage patterns and potential problematic aspects that could negatively impact their own children's engagement with digital technologies.

Children and young people

❖ **Children must play an active role in their own education.** The basis for this should be laid in schools where children not only learn how to learn but are also offered enough opportunities to actively participate in their school community. Children should also be given a more active role in the conceptualisation and development of the digital education aspects of school curricula.
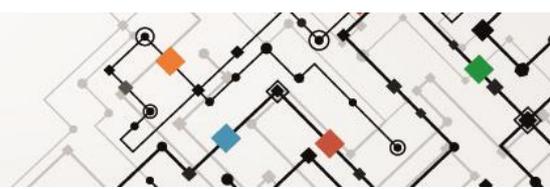
Academic research community

❖ **The research community should address the increasing complexity of the conceptualisation of 'digital skills' and related concepts causing confusion specially among stakeholders outside of the academic sphere.** While the academic research community conceptualises and defines and uses terms such as 'digital skills', 'digital literacy' and 'digital competences' more or less distinctively, non-academic actors tend to use these terms interchangeably. The lack of common definitions and understandings of concepts increases the difficulty of designing overarching, systematic strategies for the development of digital skills.

❖ **More research is needed on the consequences of digital skills.** Although available studies suggest that better skills bring benefits to children's learning, participation and other outcomes, more research is needed to conclude with confidence, and to explore the factors that matter.

❖ **Longitudinal research is greatly needed.** Moreover, as most of the studies use cross-sectional designs, more studies should undertake statistical modelling to examine the indirect as well as the direct relations among multiple variables.

❖ **The research community should engage in a stronger effort to make findings more accessible for a wider audience.** For instance, educators, policymakers and other practitioners working with children could profit from having access to evidence-based recommendations and reader-friendly scientific information about children's engagement with digital technologies and the consequences of their use.

Media outlets/journalists

❖ **Journalists should endeavour to provide a balanced coverage of digital technologies.** While it is highly important to inform the public about potential risks of digital technologies, the media should not one-sidedly concentrate its reporting on negative effects. Instead, the media coverage should present a nuanced view demonstrating also the opportunities of technical innovations and highlighting the importance of digital skills education.

❖ **The media sector can be a key partner in supporting media and digital literacy education efforts.** This can be achieved if the media sector takes on a more active role in informing and educating the broader public not only about the positive and negative effects of digital technologies, but also by helping them become more critical consumers of digital technologies.
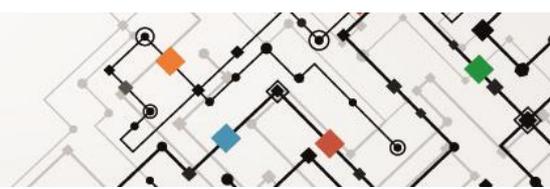
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Category	General factors	Selected dimensions/ subfactors
Individual	Sociodemographic factors	• Gender • Age
	Personal characteristics	• Self-efficacy • Sensation seeking
Social	Sociodemographic factors	• SES Ethnicity
	Parental mediation	• Enabling Restrictive Monitoring
	Social Network data	• Strength of the relationships • Assessment of digital skills of one and others • Mutual support in technology use
Media	ICT usage	• Device usage
	Online activities	• Communication • Specific activities • Sharing • Online civic engagement
	Online risks (axes of un/intended experiences + emotional impact)	• Sexting • Exposure to sexually explicit materials • Cyberhate exposure • Exposure to harmful content • Cyberbullying victimization • Experiences with mis/disinformation
Main empirical evidence	• EU Kids Online II + III + IV • From Digital Skills to Tangible Outcomes (DiSTO)	
Key theoretical and evidence reviews	• Haddon, L., Cino, D., Doyle, M-A., Livingstone, S., Mascheroni, G., & Stoilova, M. (2020). *Children's and young people's digital skills: a systematic evidence review*. KU Leuven: ySKILLS. http://doi.org/10.5281/zenodo.4274654 • Mascheroni, G., Cino, D., Mikuška, J., Lacko, D., & Smahel, D. (2020). *Digital skills, risks and wellbeing among European children: Report on (f)actors that explain online acquisition, cognitive, physical, psychological and social wellbeing, and the online resilience of children and young people*. KU Leuven: ySKILLS. https://zenodo.org/record/5226902#.YTsXthlxc2w	