youth SKILLS

Synthesis of ySKILLS results

Leen d'Haenens
Willem Joris
Emilie Bossens

Please cite this report as:

d'Haenens, L., Joris, W., & Bossens, E. (2022). *Synthesis of ySKILLS results*. KU Leuven: ySKILLS.

DISSEMINATION LEVEL

Public

Project:	ySKILLS – Youth Skills
GA:	870612
Call:	H2020-SC6-TRANSFORMATIONS-07-2019
Type of action:	RIA

Synthesis of ySKILLS results

Work Package 7 – Deliverable 7.1

Due date:	**31 August 2022**
Updated version:	**12 November 2023**
Lead Beneficiary:	**KU Leuven**
Authors:	**Leen d'Haenens, Willem Joris & Emilie Bossens**

Table of contents

1. The ySKILLS project

The ySKILLS (Youth Skills) project is funded by the European Union's (EU) Horizon 2020 programme. It involves 16 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.*

2. The synthesis

This synthesis provides a concise overview of the results of the empirical studies conducted within ySKILLS, employing multiple methods, including a three-year longitudinal survey, complemented by a series of qualitative and quantitative studies involving various target groups. This synthesis highlights the key insights from these studies and also provides links to the original reports, publications, and blog posts. In this way, it offers a convenient summary for anyone looking to quickly navigate through our empirical studies and gain an overview of their findings.

2.1 What are digital skills, and why do they matter?

The ySKILLS (Youth Skills) project examines how digital skills mediate the risks and opportunities related to ICT use by young people aged 12 to 17 years in Europe (see www.ySKILLS.eu). In ySKILLS we understand digital skills in a broad sense as **a diverse set** of technical/operational, information navigation, communication and interaction, and content creation and production skills, which are **unequally distributed** and influenced by individual, social and country characteristics. ySKILLS focuses on the role of digital skills as a possible buffer against potentially negative outcomes or as a reinforcement of the positive outcomes of the use of digital technologies (d'Haenens, 2021).

The primary aim of ySKILLS is to improve and maximise the lasting positive effects of the digital environment on different dimensions of children's wellbeing. We pursue this objective by fostering **resilience through the cultivation of digital skills**. This goal is based on the acknowledgment that the digitisation process in society has not been consistently implemented. Extensive research has revealed that disparities in access to and use of digital media can impact the development of digital skills.

We want children and young people to be digitally skilled, but we also know that these skills are **sharply unequally distributed**. Digital skills are necessary for pretty much everything these days. We need them for (remote) work, to learn, to check the news or the weather forecast, to keep in touch with friends, family, and colleagues, for online banking, and increasingly for ordinary chores such as looking for a recipe online, making a doctor's appointment or simply checking one's local bus timetable.

Digital skills are currently conceived as basic competences that everybody must possess regardless of age or socio-economic status. Digital skills are important because they provide **opportunities** for personal and professional development as well as civic participation. Lacking digital skills or failing to 'upgrade' them seriously limits one's chances for personal and professional development and active participation in society. In order to understand what digital skills are, we need **shared conceptualisations and terminology**, as well as adequate indicators to measure them. However, the **underdevelopment of sound measures and methodologies** to assess the skills that allow young people to interact with digital technologies creatively, critically, and safely is problematic.

2.2 Challenges of Using the Digital Economy and Society Index (DESI) to Assess Digital Access and Skills for Children and Young People

At the outset of the ySKILLS project, we selected countries for a school survey based on their rankings in the Digital Economy and Society Index (DESI), a European Commission tool

designed to evaluate digital performance. However, while DESI assesses various aspects of digitization at a national level, it falls short in capturing the specific digital needs and outcomes of children and young people (See Figure 1).

Challenges of DESI for Digital Skills Assessment among Children and Young People:

1. **Lack of Specificity:** DESI's broad focus does not account for crucial factors like online safety and digital literacy education that are essential to young individuals.
2. **Economic Disparities:** National-level perspective might overlook economic disparities within countries that significantly impact young people's digital skills.
3. **Dynamic Technology:** DESI's static indicators struggle to keep pace with the rapidly evolving digital landscape that youth adapt to quickly.
4. **Cultural and Societal Differences:** Standardized approach does not fully consider cultural and societal variations in technology attitudes and behaviors.
5. **Educational System:** DESI does not evaluate the quality of digital skills education or its integration into curricula.
6. **Privacy Concerns:** Unique privacy concerns of children and young people, like protecting personal information and understanding data practices, are not addressed.

Figure 1: ySKILLS focal countries - DESI 2022
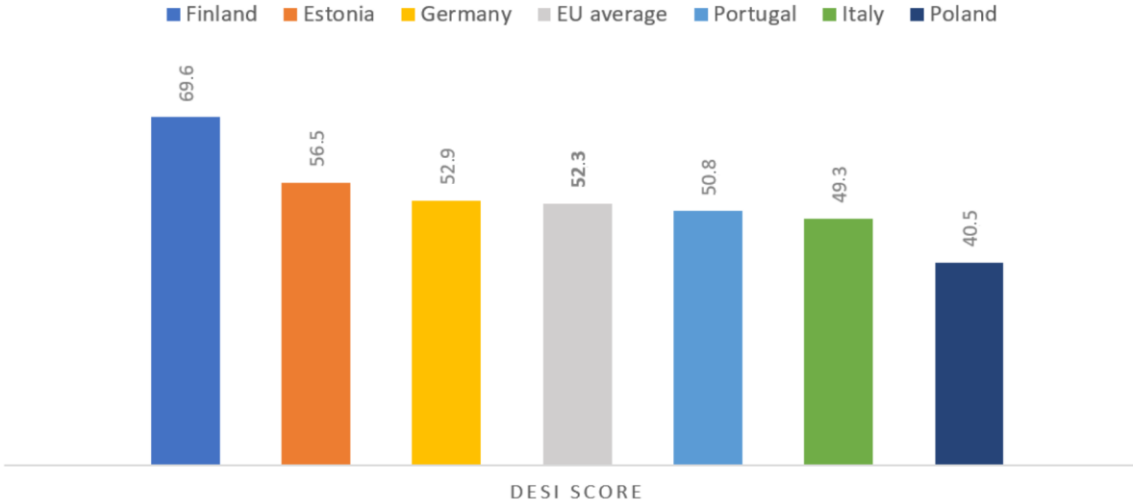
The Need for Targeted Surveys

To comprehensively understand the digital experiences of children and young people, a more focused approach on their specific needs, disparities, and evolving digital behaviors is essential. This is why targeted surveys like ySKILLS, which focus on digital access, engagement, skills development, and well-being, are crucial. These surveys serve as the basis for informed policy measures to equip young people for success in the digital age.

In Table 1, alongside the summary of digital skills, knowledge, and risks for each country, correlation scores with the DESI score are provided. Two notable observations emerge:

Low Correlation Scores: Firstly, the correlation scores are very low, indicating that the DESI index is not suitable for accurately assessing digital skills and knowledge.

Interesting Relationship with Digital Risks: Secondly, and more intriguingly, the DESI scores concerning digital risks, as reported by children and young people, consistently show negative correlations. In other words, higher positions on the DESI index are associated with lower perceived digital risks among children and young people, and vice versa.

This might suggest that children and young people in countries scoring high on the DESI index may also benefit from media literacy programmes, which may explain the lower perceived risks.

Table 1. Overview of digital skills, knowledge, and risks by country (N = 2,660)

	Finland	Estonia	Germany	Portugal	Italy	Poland	Correlation DESI
Digital skills							
Technical/operational (W1)	0.58	0.58	0.51	0.54	0.57	0.50	.03
W2	0.62	0.64	0.59	0.62	0.60	0.54	.03
W3	0.64	0.67	0.59	0.65	0.63	0.60	.02
Programming (W1)	0.06	0.04	0.07	0.03	0.03	0.13	-.07**
W2	0.10	0.06	0.08	0.04	0.04	0.11	-.00
W3	0.12	0.07	0.09	0.07	0.11	0.09	-.01
Information navigation/ processing (W1)	0.39	0.33	0.37	0.35	0.34	0.32	.04
W2	0.42	0.34	0.42	0.38	0.34	0.35	.04
W3	0.37	0.34	0.41	0.40	0.36	0.40	.02
Communication/ Interaction (W1)	0.70	0.67	0.62	0.64	0.65	0.57	.06**
W2	0.70	0.67	0.65	0.69	0.62	0.58	.08***
W3	0.68	0.67	0.66	0.73	0.63	0.63	.07**
Content creation/production (W1)	0.45	0.31	0.38	0.39	0.37	0.33	.08***
W2	0.44	0.33	0.43	0.41	0.36	0.34	.06**
W3	0.43	0.37	0.43	0.42	0.37	0.41	.03
Digital knowledge							
W1	0.59	0.46	0.52	0.44	0.48	0.54	.07**
W2	0.61	0.49	0.58	0.52	0.53	0.57	.07**
W3	0.65	0.49	0.63	0.58	0.56	0.57	.10***

Digital risks							
Intentional cyberhate exposure (W1)	1.42	1.63	1.44	1.66	1.60	2.01	-.14**
W2	1.50	1.79	1.52	1.71	1.68	2.09	-.16**
W3	1.40	1.69	1.49	1.68	1.71	2.02	-.15**
Unintentional cyberhate exposure (W1)	2.24	2.52	2.78	3.10	2.64	2.77	-.05
W2	2.13	2.63	2.74	2.97	2.60	2.89	-.12*
W3	1.99	2.63	2.74	2.89	2.61	2.68	-.18***
Intentional harmful content exposure (W1)	1.59	1.65	1.82	1.87	1.53	1.95	-.12*
W2	1.73	1.87	1.94	2.07	1.64	1.97	-.09
W3	1.61	2.00	2.10	1.95	1.73	2.13	-.15**
Unintentional harmful content exposure (W1)	1.87	2.08	2.66	2.79	2.15	2.37	-.04
W2	1.92	2.31	2.95	2.66	2.37	2.46	-.14**
W3	2.14	2.42	2.92	2.64	2.49	2.52	-.16**
Intentional sexting exposure (W1)	1.25	1.23	1.34	1.39	1.42	1.16	-.09
W2	1.32	1.34	1.51	1.47	1.60	1.55	-.09
W3	1.37	1.38	1.53	1.38	1.76	1.59	-.13**
Unintentional sexting exposure (W1)	1.58	1.67	2.22	2.01	1.78	1.77	-.03
W2	1.67	1.87	2.10	1.79	1.85	1.70	-.10*
W3	1.59	1.94	1.90	1.73	1.88	1.71	-.13**
N	*435*	*606*	*403*	*598*	*351*	*261*	

Since Table 1 may not provide a clear overview of the developments during the three waves, the following visualisations (Figures 2 to13) per country depict the trends in digital skills and online risks under study. These figures not only indicate that the country context matters, but also that the patterns in which the various dimensions of digital skills and knowledge develop are quite diverse.

Digital Literacy

Figure 2. Technical/operational skills
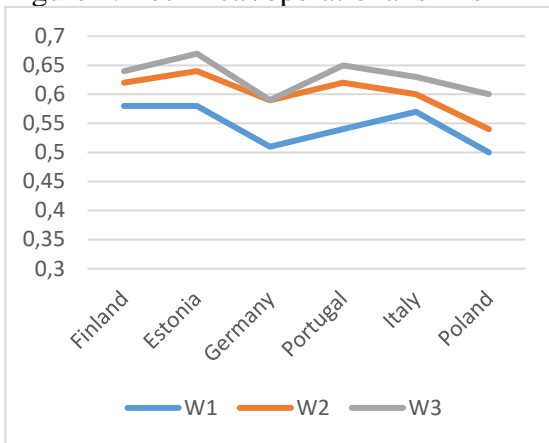
Figure 3. Programming skills
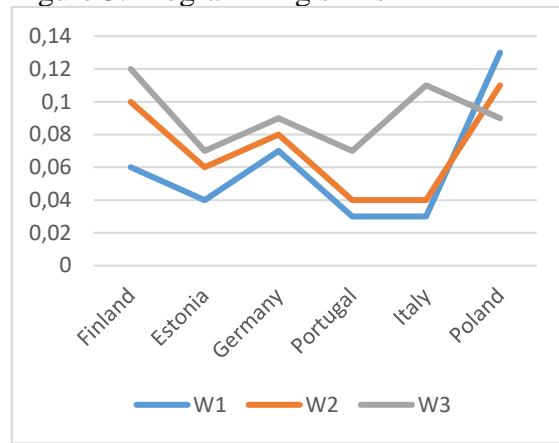
Figure 4. Information navigation/processing skills
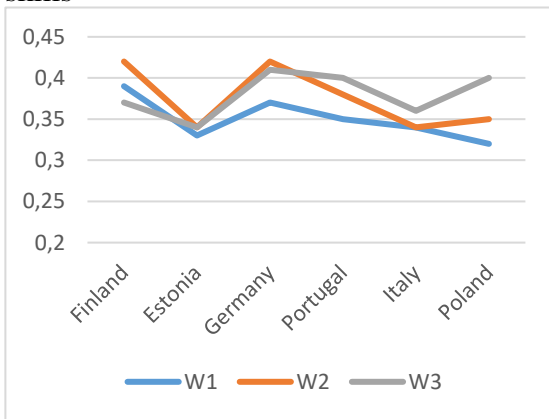
Figure 5. Communication/interaction skills
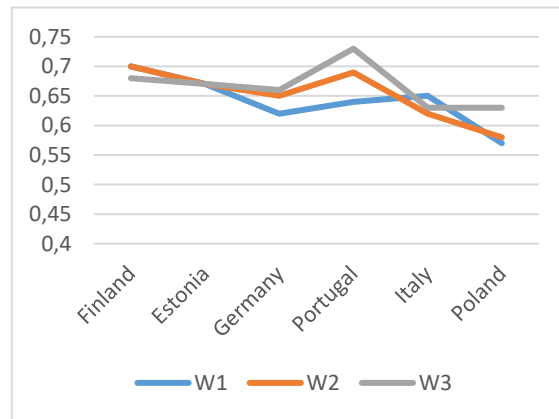
Figure 6. Content creation/production skills
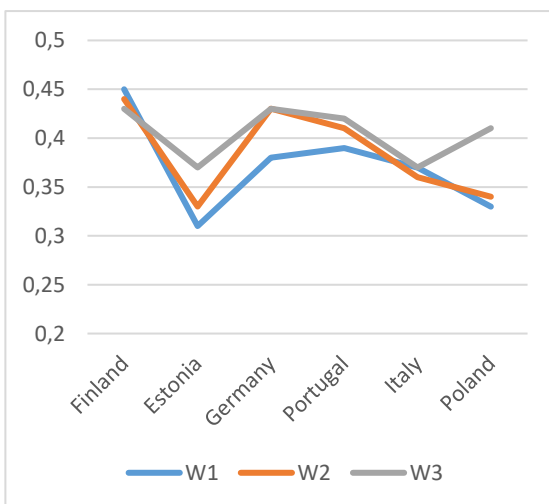
Figure 7. Digital knowledge
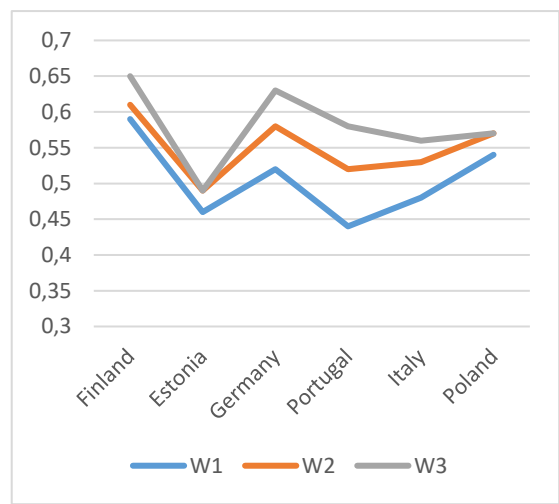
Digital Risks

Figure 8. Intentional cyberhate exposure
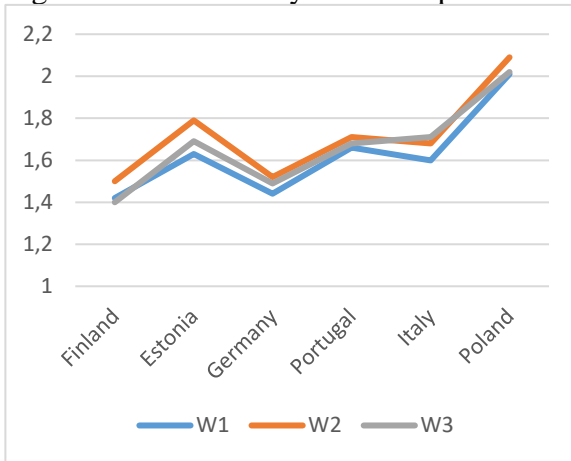
Figure 9. Unintentional cyberhate exposure
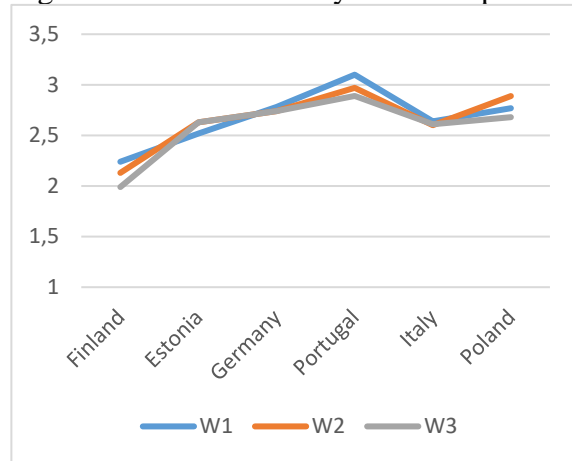
Figure 10. Intentional harmful content exposure
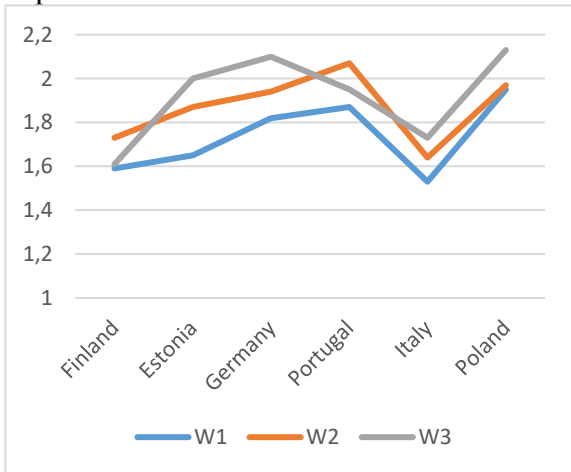
Figure 11. Unintentional harmful content exposure
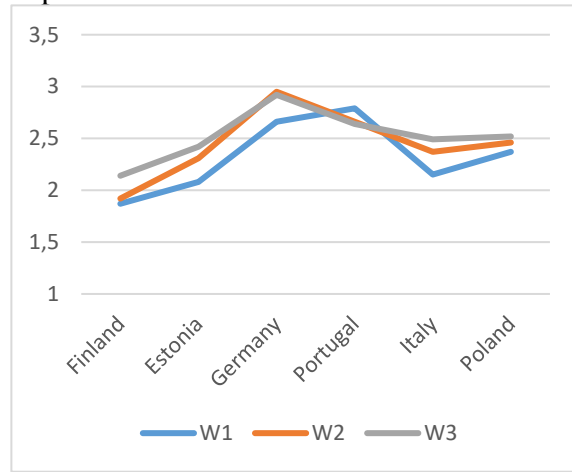
Figure 12. Intentional sexting exposure
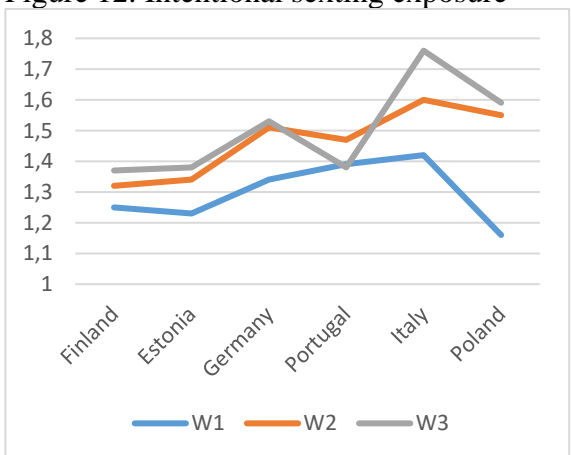
Figure 13. Unintentional sexting exposure
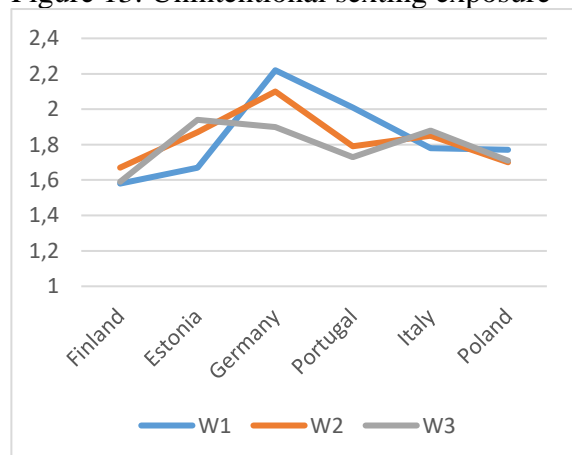
2.3 Do Digital Skills Mediate Wellbeing?

The ySKILLS project aims to explore the intricate relationship between digital skills and the wellbeing of young individuals. This complex connection involves the impact of digital technology use on mental and physical health and life satisfaction. While excessive internet use has been linked to reduced wellbeing and depression among youth, there are research gaps, especially regarding potential mediators in this relationship. Additionally, the ySKILLS project emphasizes the need for longitudinal research to better understand the role of digital skills in youth wellbeing.

Digital Skills and Wellbeing

Cross-sectional studies have shown that heavy internet users often possess more digital skills, which are associated with improved wellbeing. However, these studies frequently oversimplify digital skills as singular constructs, overlooking their multifaceted nature. Digital skills encompass technical skills, programming, information navigation, communication, and content creation, all of which are essential for full participation in digital societies. Yet, direct evidence of how these skill dimensions impact wellbeing remains scarce.

The Impact of Digital Skills

Analysis of the ySKILLS three-wave survey indicates that higher self-efficacy and increased daily digital activities lead to improvements in these skill dimensions, with a bi-directional effect. Moreover, children with higher skill levels demonstrate better social wellbeing and academic performance, highlighting the significant role of digital skills in these areas.

Direct Effects on Wellbeing

Psychological Wellbeing: Self-reported low psychological wellbeing at W2 strongly predicts a similar state at W3 (coefficient: 0.65), emphasizing the persistence of emotional states.
Physical Wellbeing: Self-reported physical health at W2 significantly predicts physical health at W3 (coefficient: 0.50), underlining the enduring nature of health perceptions.

Digital Engagement Effects

Online Time and Psychological Wellbeing: Time spent online at W2 has a slight positive effect on self-reported low psychological wellbeing at W3 (coefficient: 0.04), suggesting a potential influence of online activities on emotional wellbeing.
Online Time and Physical Wellbeing: Interestingly, more time spent online at W2 is associated with a negative effect on self-reported physical wellbeing at W3 (coefficient: -0.09), implying a potential dip in perceived health.

Digital Skills and Activities

Among the assessed digital skills and activities, only engagement in entertainment at W2 exhibits a positive direct effect on self-reported health at W3 (coefficient of 0.05), implying a positive contribution of leisure-oriented online activities to perceived health.

The cross-lagged model (Table 3) clarifies the complex associations between self-reported depression, self-reported health, time spent online, and digital activities. These findings underscore the persistence of emotional states and health perceptions over time and reveal

nuanced relationships between online engagement and various dimensions of wellbeing. They provide valuable insights into the evolving dynamics of digital interactions and their implications for mental and physical wellbeing.

Table 3. Cross-lagged model for self-reported psychological and physical wellbeing at W1, W2 and W3

	Psychological wellbeing W3	Physical wellbeing W3
Direct effects		
Self-reported psychological well-being W2	.65*** (.01)	-
Self-reported physical well-being W2	-	.50*** (.02)
Time spent online W2	.04** (.02)	-.09*** (.02)
Digital skills W2		
Technical/operational	ns	ns
Programming	ns	ns
Information navigation/processing	ns	ns
Communication/interaction	ns	ns
Content creation/production	ns	ns
Digital activities W2		
Online learning	ns	ns
Social relationships	ns	ns
Entertainment	ns	.05* (.02)
Content creation	ns	ns
Health information use	.09** (.02)	-.10*** (.02)
Indirect effects		
Self-reported psychological wellbeing W1	.25*** (.01)	-
Self-reported physical wellbeing W1	-	.39*** (.02)
Time spent online W1	.00 (.01)	.01 (.01)

Note: Standardized coefficients reported.

2.4 Identifying Vulnerable Youth

In the ySKILLS project (WP6), one of the focal points is on specific vulnerabilities among children and young people. In this synthesis introduction, we highlight six grounds of vulnerabilities identified in the survey data, which can be categorized into three groups: socioeconomic disparities, mental and/or physical health disparities, and academic disparities. Assessing vulnerabilities at W1 establishes a baseline measurement and understanding of participants' initial conditions. This baseline information serves as a reference point for subsequent waves, enabling the tracking of changes over time.

Table 4. Identifying vulnerable youth

		Vulnerabilities					
		Frequency (W1)	Percent (W1)	Frequency (W2)	Percent (W2)	Frequency (W3)	Percent (W3)
Valid	0.00	561	21.1	272	10.2	310	11.7
	1.00	1463	55.0	910	34.2	844	31.7
	2.00	462	17.4	1148	43.2	1109	41.7
	3.00	126	4.7	276	10.4	324	12.2
	4.00	35	1.3	49	1.8	59	2.2
	5.00	13	.5	5	.2	14	.5
	Total	2660	100.0	2660	100.0	2660	100.0

Note: Under row 0, you will find all children and young people who do not score on any of the six vulnerability grounds, row 1 represents those who score on one of the six, and so on.

For **socioeconomic disparities**, we examined subjective monthly family income (rated from 1 = very well off to 5 = struggling financially) and perceived ethnic discrimination (rated from 1 = never discriminated against to 6 = daily discrimination).

Regarding **health disparities**, we used indicators for self-reported physical health (rated from 1 = poor health to 5 = excellent health), life satisfaction (measured with 4 items, from 1 = low satisfaction to 4 = high satisfaction), and self-efficacy (measured with 4 items, from 1 = low self-efficacy to 4 = high self-efficacy).

Finally, participants' subjective views on their **academic performance** compared to their classmates were assessed (rated from 1 = grades much worse than classmates to 5 = grades much better than classmates). Each indicator was recoded into a binary variable for each vulnerability ground (0 = non-vulnerable, 1 = vulnerable) to facilitate the identification of vulnerable participants. See Table 1 for a summary of the recoding process.

Table 5. Recoding of indicators into vulnerability indices

Original indicator (coding)	Non-vulnerable group	Vulnerable group
Subjective family income (1–5)	1–3	4–5
Perceived ethnic discrimination (1–6)	1–4	5–6
Self-reported physical health (1–5)	3–5	1–2
Self-reported life satisfaction (1–4)	2.50–4	1–2.49
Self-efficacy (1–4)	2.50–4	1–2.49
Academic performance (1–5)	3–5	1–2

Note: Self-efficacy and life satisfaction were recoded differently because these were mean scores based on four items.

2.5 Trends in Digital Skills and Activities among Vulnerable Youth

In Tables 6 to 8, we present data pertaining to the development of digital skills and engagement in digital activities among different groups of vulnerable youth based on their socioeconomic status, mental and physical wellbeing, and academic achievement (cognitive wellbeing).

Digital Skills Development

Among non-vulnerable youth, a consistent pattern of gradual improvement in self-reported digital skills is observed across all vulnerability grounds over the observation waves. While not always statistically significant, the most significant enhancements occur between wave 2 and wave 3. Similar positive trends are noticed among vulnerable youth with low socioeconomic status, low self-efficacy, and low life satisfaction. This suggests that also within the vulnerable youth population, improvements in digital skills occur over the observation period for these specific vulnerability factors.

Negative Trends

However, negative trends are observed for certain subgroups of vulnerable youth. Specifically, vulnerable youth who reported experiencing regular discrimination, those with low academic achievement, and to a limited extent, those with low self-reported health exhibit less positive trends in digital skills development. Between wave 2 and wave 3, these groups show negative trends in their digital skill scores. Notably, the group facing regular discrimination experiences a significant decline, implying that these specific vulnerability factors may hinder digital skills development due to external challenges and barriers.

Digital Activities Trends

The trends observed in digital activities closely mirror those seen in digital skills. Generally, there is an improvement in engagement in digital activities across all vulnerability grounds, similar to the positive trends seen in digital skills. However, the negative trends observed for vulnerable youth facing discrimination and those with low academic achievement persist in both digital skills and activities.

In summary, the study reveals a pattern of improvement in both self-reported digital skills and engagement in digital activities for vulnerable youth, with notable improvements for non-vulnerable youth as well. However, the presence of negative trends in both digital skills and activities for vulnerable youth experiencing discrimination and having low academic achievement suggests that these specific vulnerabilities may pose challenges in developing digital skills and actively engaging in digital activities.

Table 6. SES and academic achievement

	Socioeconomic status						Academic achievement					
	Non-vulnerable			Vulnerable			Non-vulnerable			Vulnerable		
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
Digital skills												
Technical/operational	0.555	0.599	0.635	0.556	0.612	0.639	0.561	0.611	0.642	0.546	0.626	0.616
Programming	0.044	0.055	0.087	0.053	0.072	0.087	0.044	0.067	0.085	0.086	0.101	0.095
Information navigation	0.333	0.333	0.349	0.358	0.389	0.396	0.359	0.379	0.392	0.322	0.372	0.334
Communication	0.637	0.631	0.660	0.656	0.667	0.682	0.659	0.665	0.681	0.640	0.646	0.644
Content creation	0.356	0.359	0.380	0.379	0.398	0.423	0.378	0.391	0.408	0.386	0.414	0.422
Digital knowledge	0.489	0.544	0.569	0.506	0.546	0.579	0.505	0.550	0.582	0.503	0.525	0.544
Digital activities												
Online learning	2.70	2.69	2.82	2.61	2.66	2.73	2.68	2.71	2.78	2.49	2.49	2.64
Social relationships	3.59	3.59	3.64	3.54	3.59	3.67	3.58	3.62	3.68	3.57	3.55	3.47
Entertainment	4.25	4.18	4.26	4.00	4.07	4.06	4.06	4.09	4.12	4.17	4.31	4.12
Content creation	2.23	2.11	2.16	2.07	2.07	2.11	2.12	2.07	2.12	2.09	2.07	2.12
Health use	1.97	2.10	2.21	1.81	1.88	2.05	1.87	1.95	2.11	1.95	2.00	2.26

Note: Green cells indicate a statistically significant (p >. 05) positive difference between the wave under study and the previous wave. Red cells indicate a statistically significant (p >. 05) negative difference between the wave under study and the previous wave.

Table 7. Self-reported health and discrimination

| | Self-reported health | | | | | | Discrimination | | | | | |
| | Non-vulnerable | | | Vulnerable | | | Non-vulnerable | | | Vulnerable | | |
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
Digital skills												
Technical/operational	.551	.609	.640	.568	.612	.626	0.554	0.610	0.638	0.612	0.659	0.675
Programming	.050	.066	.090	.054	.081	.075	0.047	0.065	0.083	0.107	0.122	0.107
Information navigation	.348	.375	.383	.367	.391	.398	0.352	0.378	0.386	0.425	0.421	0.379
Communication	.652	.658	.681	.634	.681	.669	0.655	0.667	0.684	0.668	0.658	0.586
Content creation	.369	.385	.404	.405	.411	.424	0.374	0.390	0.406	0.462	0.450	0.427
Digital knowledge	.491	.538	.572	.531	.572	.590	0.499	0.548	0.579	0.511	0.563	0.539
Digital activities												
Online learning	2.61	2.64	2.73	2.85	2.85	2.90	2.62	2.67	2.74	3.08	2.85	2.86
Social relationships	3.53	3.59	3.67	3.72	3.70	3.70	3.56	3.61	3.66	3.84	3.74	3.62
Entertainment	4.03	4.07	4.11	4.25	4.31	4.21	4.05	4.10	4.11	4.66	4.33	4.23
Content creation	2.07	2.03	2.10	2.37	2.31	2.28	2.09	2.06	2.10	3.04	2.61	2.29
Health use	1.75	1.87	2.05	2.43	2.34	2.43	1.81	1.90	2.06	2.89	2.70	2.55

Note: Green cells indicate a statistically significant (p >. 05) positive difference between the wave under study and the previous wave. Red cells indicate a statistically significant (p >. 05) negative difference between the wave under study and the previous wave.

Table 8. Self-efficacy and life satisfaction

	Self-efficacy						Life satisfaction					
	Non-vulnerable			Vulnerable			Non-vulnerable			Vulnerable		
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
Digital skills												
Technical/operational	.569	.619	.643	.480	.559	.603	.555	.607	.640	.570	.620	.674
Programming	.049	.069	.091	.047	.058	.061	.041	.058	.084	.070	.091	.106
Information navigation	.368	.388	.394	.269	.309	.322	.348	.372	.381	.359	.364	.404
Communication	.671	.673	.684	.559	.598	.648	.651	.660	.679	.663	.682	.681
Content creation	.388	.402	.412	.297	.321	.361	.368	.379	.401	.399	.428	.443
Digital knowledge	.503	.549	.581	.481	.529	.545	.496	.540	.573	.526	.577	.576
Digital activities												
Online learning	2.68	2.69	2.77	2.46	2.53	2.66	2.65	2.68	2.76	2.73	2.75	2.83
Social relationships	3.58	3.59	3.66	3.46	3.61	3.69	3.58	3.61	3.69	3.62	3.70	3.68
Entertainment	4.10	4.08	4.11	4.00	4.23	4.19	4.09	4.10	4.14	4.22	4.34	4.23
Content creation	2.12	2.07	2.13	2.08	2.13	2.19	2.10	2.04	2.12	2.38	2.30	2.25
Health use	1.83	1.91	2.08	1.99	2.11	2.23	1.81	1.91	2.08	2.43	2.43	2.53

Note: Green cells indicate a statistically significant (p >. 05) positive difference between the wave under study and the previous wave. Red cells indicate a statistically significant (p >. 05) negative difference between the wave under study and the previous wave.

3. Key findings by task

3.1 Interviews with Experts on Digital Skills in Schools and on the Labour Market

	Overview
Aim	Getting a deeper understanding of (1) the (digital) skills that youth need in the 21st century, and (2) the role of digital skills education, both in formal and informal learning settings. Special attention was given to the technological transformations in the labour market.
Method	Interviews with experts from the educational sector and the labour market ($N = 34$)
Countries	Estonia, Finland, Germany, Italy, Poland, and Portugal

Key insights

Experts stressed the importance of digital skills

- The experts agreed that with digital technologies being more and more embedded in our daily lives, digital skills are becoming crucial.
- Digital skills are a key requirement for a successful integration into the working world.
- Digital skills play an increasingly important role for social and political participation.
- However, experts were sceptical regarding the existence of a 'digital native' generation. In their experience, many young people are not as tech-savvy as expected and need to be actively supported in acquiring the necessary digital skills.

Towards a shared conceptual understanding and commitment

- 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.
- A shared understanding of digital skills and adequate indicators to measure them are essential. Without this common ground, development of effective evidence-based interventions or informing policies is difficult.

Digital inequalities

- The experts voiced concern about the risk of exacerbating existing social inequalities.
- 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 identified several other factors of influence. In particular, inequalities along the lines of age and gender were mentioned.

Formal education sector plays a key role

- Young people need to be taught to adapt, to continuously use the resources available to them, to further educate themselves and learn new digital skills.
- Both labour market and education experts criticised the current state of digital skills education at schools. The educational system has been slow to adapt to the digital developments in the private sector.
- Not only do school curricula appear to be out of touch with children's reality outside of school, they also do not reflect the requirements of the labour market.
- The quality of digital education provision greatly depends on formal education, especially on the capacities and initiatives of individual teachers and schools. More coherent strategies to foster digital skills in formal education are needed, as well as stronger collaboration and concerted efforts with stakeholders beyond education.
- The experts see a special need for official standards outlining which skills should be taught and how they should be assessed.
- Greater efforts should be made to support lifelong learning, enabling citizens to reskill, upskill and educate themselves beyond school.
- Experts agreed that cooperation between the formal educational system, the private sector and the research community has the potential to improve digital skills education. All relevant stakeholders should 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.

Want to read more?

Full reports:

- 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.
- 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.

Related ySKILLS blogs:

- International education experts discuss: how to dismantle communication barriers between home and school?
- How prepared is Europe's youth for a transformed labour market and a more digitised society? The views of labour market experts
- What do experts in education think of Europe's young people's digital skills?

3.2 Children's and Young People's Digital Skills: A Systematic Evidence Review

	Overview
Aim	To identify what is known about youth digital skills, and to examine the evidence on the antecedents (or factors influencing the acquisition) of digital skills, and the consequences of having digital skills.
Method	Systematic evidence review ($N = 110$ articles)

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 exercise 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 that used quantitative methods, were published in the English language, and related directly to the digital skills of 12- to 17-year-olds.

Key insights

- 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.
- 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**.

Want to read more?

Full report:

- 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.

Related ySKILLS blogs:

- What do we know about the roles of digital literacy and online resilience in fostering young people's wellbeing?
- All digital skills are not all created equal, and teaching technical skills alone is problematic
- Beyond "digital natives": are young people skilled online, and does it matter?

3.3 Digital Skills, Risks, and Wellbeing among European Children and Young People

	Overview
Aim	To identify the antecedents and consequences of digital skills among children, and to outline gaps in the evidence base and in our current knowledge of digital skills acquisition, in order to inform future research in this area.
Method	Secondary analysis of EU Kids Online survey (N = 25,101)
Countries	Croatia, Czech Republic, Estonia, Finland, Belgium (Flanders), France, Germany, Italy, Lithuania, Malta, Norway, Poland, Portugal, Romania, Russian Federation, The Republic of Serbia, Spain, and Switzerland.

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 ySKILLS' Work Package 2, further analysis of the EU Kids Online data collected across these 19 European countries was carried out. More specifically, the relationships between individual characteristics (age and gender), social characteristics (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.

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.

Key insights on antecedents of digital skills

- Children who **engage in more online activities** seemed to develop more digital skills.
- **Self-efficacy** – measured by children's confidence in their ability to solve problems in daily life – influenced digital skills. 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.
- **Preference for online social interaction** 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.

---

[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.

- Restrictive parental mediation was also significant in all the countries, but it predicted digital skills negatively everywhere. **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.

Key insights on 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.

Want to read more?

Full report:

- 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.

Related ySKILLS blogs:

- Digital Skills and Online Risks: A Complicated Relationship?
- Masters of the Digital? Who are the children who self-report online aggression?
- How is parental mediation related to children's digital skills? What is the relation between digital skills and exposure to online risks?

3.4 Roundtable Discussions with Children and Young People

	Overview
Aim	Getting a deeper understanding of how young people conceptualise (digital) skills, (digital) social interaction and (digital) content creation and in what ways they value (digital) skills
Method	Roundtable discussions ($N = 6$) with in total 46 adolescents
Countries	Belgium, Finland and Portugal

In September-November 2020, six roundtables discussions with teenagers (aged 12 to 18) were conducted in Belgium, Finland, and Portugal. 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.

Key insights

- **Young people 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.
- 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.
- **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, 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.
- The ease of discussing these 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.
- Surprisingly, "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 children and young people, and were chosen as their preferred option for sharing more intimate and personal information with their peers and families.

- 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.** 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.
- 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.
- 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.
- Some adolescents, especially girls, also attached importance to the potential reputational consequences of the content shared online.
- **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.
- 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.

Want to read more?

Full report:

- Donoso, V., Retzmann, N., Joris, W., & d'Haenens, L. (2020). *Digital skills: An inventory of actors and factors.* KU Leuven, Leuven: ySKILLS.

Related ySKILLS blogs:

- The impact of the COVID-19 crisis: Is online teaching increasing inequality and decreasing well-being for children?
- Understanding, measuring and fostering digital skills: Lessons learned from the first year of the ySKILLS project

3.5 Youth Digital Skills Indicator (yDSI)

	Overview
Aim	To develop a unique, high-quality, cross-culturally validated measurement instrument for digital skills among young people.
Method	Review of the academic literature (conceptual framework for digital skills); validation of the yDSI (several steps)
Countries	Estonia, Finland, Germany, Italy, Belgium/Netherlands, Poland, Portugal, United Kingdom

A fresh approach for digital skills testing

The youth Digital Skills Indicator (yDSI) is a unique, extensively cross-nationally validated measurement tool with 31 items, distributed over digital skills and digital knowledge questions, that can be used for large-scale population research.

The yDSI is the only **measurement tool for youth digital skills** that has been tested using the full range of validation practices. Over a period of six months, consultation with experts (face validity), cognitive interviews (content validity), pilot surveys (construct validity) and performance tests (criterion validity) with young people were conducted in a wide range of European countries.

A review of the literature led to a framework identifying **four dimensions that constitute digital skills**: (1) technical and operational skills; (2) information navigation and processing skills; (3) communication and interaction skills; and (4) content creation and production skills.

Across all four dimensions a distinction should be made between being able to use the functionalities of information and communication technologies (ICTs) (**functional aspects**) and understanding why ICTs are designed and content is produced in certain ways and being able to use that knowledge in managing interactions in and with digital spaces (**critical aspects**).

Existing publications that report on survey instruments to measure digital skills, tend to cover technical and operational and information navigation and processing skills more than they do communication and interaction and content creation and production skills. Furthermore, functional aspects are more commonly measured than critical aspects of skills.
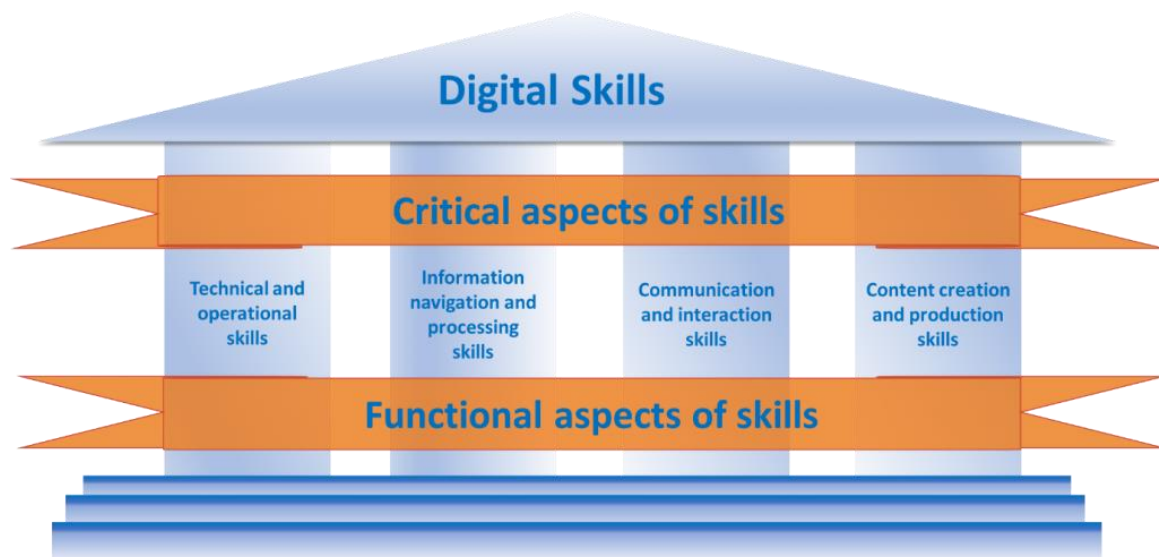
The four yDSI digital skills domains incorporating functional and critical aspects

Want to read more?

Full report:

- Helsper, E.J., Schneider, L.S., van Deursen, A.J.A.M., & van Laar, E. (2020*). The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure.* KU Leuven, Leuven: ySKILLS.

yDSI questionnaire:

- youth Digital Skills Indicator questionnaire (English version)
- Versions in other languages are available on the ySKILLS website

Related ySKILLS blogs:

- The yDSI – measuring young people's digital skills and knowledge
- Exploring the ySKILLS Indicator (the yDSI) with high school students: A joint initiative together with a Portuguese policy maker

3.6 Longitudinal three-wave school survey

	Overview
Aim	To measure short- and medium-term impact of ICTs on children and adolescents while testing different dimensions of ICT uses and digital skills.
Method	Regional three-wave longitudinal survey in schools with children and adolescents (aged 12-17) ($N = 10,820$ in at least one wave; $N = 2,660$ in all three waves)
Countries	Estonia, Finland, Germany, Italy, Poland, and Portugal

ySKILLS developed a **robust longitudinal survey** to measure both short and medium-term impact of information and communication technologies (ICT) on youth. The data is collected in three waves. The survey focuses on **four dimensions of wellbeing** (cognitive, physical, psychological, and social) and several areas related to **ICT use**. The questionnaire is divided into the sections listed below:

- **Sociodemographic information** (age, gender, SES, ethnicity)
- **Individual characteristics** (perceived discrimination, sensation seeking)
- **Network data** (resources, influences)
- **Physical wellbeing** (physical health, physical fitness)
- **Psychological wellbeing** (self-efficacy, life satisfaction)
- **Social wellbeing** (friend support, family support, class environment)
- **Cognitive wellbeing** (school performance)
- **Civic engagement** (online engagement)
- **Parental mediation** (restrictive mediation, enabling mediation, monitoring)
- **Internet use** (time online, access at home, devices, COVID-19 related access at home)
- **Digital skills** (technical and operational, information navigation and processing, communication and interaction, content creation and production, knowledge items)
- **Online communication** (SNS use, sharing)
- **Online risks** (cyberhate, harmful content, sexting, sexually explicit materials, misinformation and fake news, cyberaggression)
- **Online activities** (school and learning, social relationships, entertainment, content creation, internet use for health)

Key insights

- **Nuanced approach to digital skills**: The report emphasises the need for a multidimensional approach to understanding digital skills, as they exhibit diverse trajectories of development and are influenced by various factors.
- **Different dimensions of digital skills have distinct developmental patterns:** While some skills, like technical, operational, programming, and digital knowledge, showed progress over time, others, like information navigation, communication, and content creation, remained stagnant or improved minimally.
- **Factors influencing digital skills:** The report examines the influence of individual, digital, and social factors on digital skills development.
    - Self-efficacy positively impacted almost all digital skills dimensions, while the number of daily online activities positively affected specific skills like information navigation and communication.
    - Restrictive parental mediation had a negative impact on technical and operational skills, while programming skills and digital knowledge were not significantly impacted by the examined factors.

- **Digital skills and engagement:** The study investigates how digital skills influence digital engagement and online activities.
  - More frequent online communication was positively impacted by technical and operational skills as well as communication and interaction skills.
  - Content creation skills positively influenced the creation of online content and the tendency to search for health information online.
  - Programming skills, on the other hand, were negatively associated with online communication but positively associated with creating online content.
- **Digital skills and risky experiences:** The report explores the relationship between digital skills and risky online experiences.
  - Most digital skills did not directly impact risky experiences, except for content creation and production skills, which increased the likelihood of exposure to health-oriented harmful content.
  - The analysis suggests an indirect link between digital skills and risky experiences through online activities.
- **Digital skills and wellbeing:** The study examines the impact of digital skills on different dimensions of youth's wellbeing.
  - There is limited direct impact of digital skills on wellbeing, except for communication and interaction skills, which had a small positive impact on perceived academic performance.
  - Various associations were found between digital skills dimensions and wellbeing indicators, indicating a complex interplay between skills and wellbeing.
- **Implications and future research:** The report underscores the importance of considering the multidimensional nature of digital skills and the need for nuanced approaches to research and policy. It suggests that future research should investigate moderated and mediated effects of different dimensions of digital skills, and explore specific online activities that may contribute to diverse outcomes.

Want to read more?

Full report:

- Machackova, H., Jaron Bedrosova, M., Tolochko, P., Muzik, M., Waechter, N., & Boomgaarden, H. (2023). *Digital skills among children and youth: A report from a 3-wave longitudinal study in 6 European countries*. KU Leuven: ySKILLS.
- National reports and infographics can be downloaded from the ySKILLS website.

Related ySKILLS blogs:

- Longitudinal data collection in schools during the pandemic
- Ethical issues in comparative and longitudinal research with children
- News from the first wave of the ySKILLS school survey
- Digital activities and digital skills of non-binary youth: Reconfiguring the gender paradigm?
- One-year later European adolescents report higher digital skills related to privacy issues

3.7 Children and Adolescents Experiencing Internet-related Mental Health Difficulties

	Overview
Aim	To study whether digital skills improve or undermine the wellbeing of adolescents with lived experience of diverse mental health difficulties.
Method	In-depth interviews with 62 adolescents (aged 12-22) who have experienced mental health problems of varying severity
Countries	Norway and United Kingdom

Key insights on digital engagement and mental health

- **Adolescents actively engage with the digital world.** They also shape its parameters, sometimes going against the grain of what was envisioned by design (e.g. moving between platforms, curating audiences, and merging app functionalities) in ways that serve them.
- **The potential of social media can undermine the well-being of adolescents with mental health problems**. They try to anticipate and manage the potential threats, emotional upsets and extreme events that might occur during their digital lives, as well as search for recognition and support.
- **Platform algorithms are often "out of sync".** Algorithms act as a distorting mirror, magnifying problematic content and pushing young people with mental health vulnerabilities down a spiral of ever more overwhelming, upsetting or extreme content that they find hard to break away from.

Key insights on digital skills and mental health difficulties

- **Sophisticated digital skills do not necessarily make for better mental health and wellbeing outcomes.** Being skilled internet users can also result in riskier online engagement, at times breaching young people's abilities to cope, with detrimental consequences.
- **Adolescents with mental health difficulties may develop particular digital skills.** For example, identifying a callous algorithm, recognizing an extreme space or a dangerous person or, more positively, knowing how to game the algorithm to make one's feed positive or locate 'safe' spaces or trustworthy people.
- **Managing to gain skills**. Adolescents with mental health difficulties do not always manage to gain the needed skills, nor put them into practice. Feeling on their own – digital and beyond – can be ambiguous, uncertain, unsupportive or worse.
- **The mastery of digital skills is not sufficient to understand "at-risk" behaviours and mental health outcomes.** Understanding the psychosocial context and the developmental needs of each adolescent is crucial to situate their digital experiences in the context of their wider lives.

Key insights on barriers to developing digital skills and resilience

- **Digital journeys are linked to fluctuations in mental health, but they also contribute to the development of resilience**. Adolescents report dynamic journeys in and out of harmful situations – digital or otherwise - that could unfold over time and on interlocking timescales (minutes, weeks, years). Experiences of hardship are often understood as part of growing up in a digital world.
- **Digital encounters: a welcome break or reinforcing mental health problems**. Digital encounters are often social and collaborative and these adolescents share insights, tips and tactics with online peers or niche online communities in ways that offer support and facilitate coping. When leaving unhelpful communities or problematic online spaces may be experienced as a betrayal of that community, adding to the isolation of young people.
- **Finding a way out of difficult situations may be a lonely endeavour.** Rarely do adolescents seek help or advice when they were in trouble. This was due to do with feeling shame and guilt for engaging in risky behaviour, fearing that adults would not understand and could not be trusted, or being afraid of the consequences.

Want to read more?

Full reports:

- Livingstone, S., Stoilova, M., Stänicke, L.I., Jessen, R.S., Graham, R., Staksrud, E., & Jensen, T. (2022). *Adolescents experiencing internet-related mental health difficulties: the benefits and risks of digital skills*. KU Leuven, Leuven: ySKILLS.
- Baptista, R., Mascheroni, G., Vissenberg, J., Georgiou, M., Livingstone, S., d'Haenens, L. & Ponte, C. (2022).*Vulnerabilities and digital skills. Interactive report on the in-depth studies*. KU Leuven, Leuven: ySKILLS

Related ySKILLS blogs:

- Young people's online engagement and mental health: the role of digital skills.
- The role of digital skills in the lives of vulnerable and at-risk children and young people

3.8 Digital Skills Practices in Non-Formal Learning Contexts

	Overview
Aim	To gain a deeper understanding of how to design inclusive digital skills workshops in non-formal learning contexts.
Method	Observations of digital skills workshops (N = 16)
	Interviews with organisers and moderators (N = 11)
	Co-design activities (N = 4) with children (aged 9-18), organisers, moderators and researchers (see picture for an example of output created by children)
Countries	Belgium, Denmark, and Italy
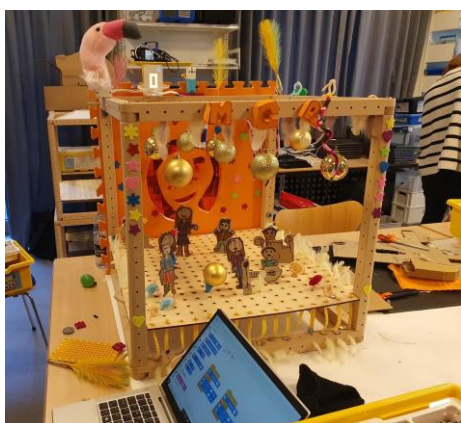
Example of output created by children

In a first phase, the study consisted of 16 observations of digital skills workshops and 11 interviews with organisers and moderators of such activities. The main aim was to first map existing situated experiences of digital skills workshops in the countries under study, investigate their structure and teaching philosophies, and inform co-design activities. The second research phase consisted of four co-design activities with the collaboration of children, organisers, moderators, and researchers. With this, the aim was to gain knowledge about potential future trajectories, drawing insights from best practices and formulating recommendations, with Italy focusing on teaching style, Denmark on technology and tools, and Belgium on policy.

Key insights on workshop formats

- **Struggling in attracting a diverse range of participants.** One-fits-all solutions and "open doors" workshops do not necessarily ensure the diversity of participants. Parents' and children's interests function as the main incentives.
- **Tailored approaches are successful.** Ensuring a flexible degree of formality, these approaches consider the needs and experiences of specific groups of children and young people.
- **Child-centred teaching styles.** Digital skills activities that are close to children's interests, competencies, experiences and needs improve inclusivity and engagement.
- **Re-framing digital skills as a social accomplishment**. Learning and social goals complement and reinforce each other. Observations and co-design sessions suggested multiple complementary strategies to achieve this goal (e.g., children-led activities, peer mentoring...).
- **Balancing (un)planned activities**. Organisers and moderators should balance spontaneous and guided interactions among children, child-led and moderator-led activities, formality and flexibility of the workshop structure.

Key insights on tools and digital learning environment

- **Collaborative activities can foster inclusivity and integrate learning and social goals**. Collaboraton among children should be highly considered by the teaching style, activity structure and material organization of the space. The implicit and explicit social and material structures that constitute the activities and interactions with technologies should be also considered in the design of appropriate learning and activities.

Want to read more?

Full reports:

- Cino, D., Brandsen, S., Bressa, N., Mascheroni, G., Eriksson, E., & Zaman, B. (2022). Young people's digital skills practices in non-formal learning contexts: observations, interviews, co-design. KU Leuven, Leuven: ySKILLS.
- Baptista, R., Mascheroni, G., Vissenberg, J., Georgiou, M., Livingstone, S., d'Haenens, L. & Ponte, C. (2022).*Vulnerabilities and digital skills. Interactive report on the in-depth studies. KU Leuven, Leuven: ySKILLS*

Related ySKILLS blogs:

- About fostering young people's digital skills practices in non-formal learning contexts
- The role of digital skills in the lives of vulnerable and at-risk children and young people

3.9 The Role of Critical Information Skills in Recognising Mis- and Disinformation

	Overview
Aim	To gain more insight into how 12- to 15-year-olds understand and engage with online news.
	To assess to what degree they are able to differentiate between truths and falsehoods and how they arrive at these judgments.
	To understand the role of digital skills in these processes.
Method	Online surveys: Youth Digital Skills Indicator (yDSI) and News Literacy Scale
	Performance tests (12 news items - 6 true and 6 false)
	Focus groups
	N = 257 adolescents (12 to 15-year-olds)
Countries	Belgium, Finland and The Czech Republic

The study was set up as follows: First, in an online survey, the participants were asked a number of general questions relating to their news use, digital skills (yDSI), and news literacy. Next, they were presented 12 news messages spread over four shorter moments during two school days. Six of these news messages were true and based on real news stories, while the other six were false and fabricated by the research team. The participants were each time asked to take a look at the message, to indicate how credible they found the message, and why they made this judgement. Finally, the participants were invited to take part in a focus group discussion that allowed us to deepen the insights gathered from the quantitative data.
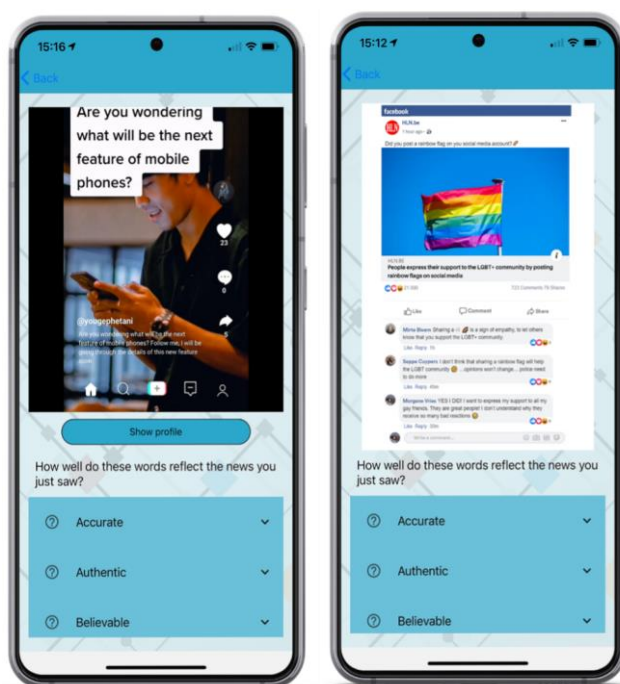
Two examples of the task of the performance test

Key insights

- For young people**, social media** are the **main way of keeping up to date with current events**, followed by television and online news sites. However, social media **are trusted the least** as sources of reliable and credible information. This particularly illustrates the **strong position of public service media** in the news landscape: across the entire sample, news from sources associated with the public broadcaster was seen as the most reliable.
- Self-reported **technical and operational skills, as well as communication and interaction skills, are far higher** than information navigation and processing skills as well as content creation and production skills. The participants are quite optimistic about their news literacy levels.
- **Participants estimated correctly the credibility of 12 news messages**. False news was on average perceived as not credible; true news was generally seen as credible. The focus groups revealed awareness of mis- and disinformation on the internet and the importance of credibility evaluation skills. However, participants' knowledge about credibility cues was superficial and limited to source and visual cues.

Want to read more?

Full reports:

- Vissenberg, J., Spurava, G., Terčová, N., Morávková, H., Bedrošová, M., Bossens, E., Macháčková, H., Kotilainen, S., d'Haenens, L. (2022). *Report on the role of critical information skills in recognising mis- and disinformation*. KU Leuven, Leuven: ySKILLS.
- Baptista, R., Mascheroni, G., Vissenberg, J., Georgiou, M., Livingstone, S., d'Haenens, L. & Ponte, C. (2022).*Vulnerabilities and digital skills. Interactive report on the in-depth studies*. KU Leuven, Leuven: ySKILLS

Related ySKILLS blogs:

- The age of "fake news": Stimulating adolescents' news literacy through news credibility evaluation skills
- How good are young people at spotting online mis- and disinformation? Findings from a multi-method study
- The role of digital skills in the lives of vulnerable and at-risk children and young people
- Safer Internet Day: Better Internet for Kids? A Closer Look at Adolescents' Experiences with Cyberhate and Online Disinformation

3.10 Refugee and Migrant Children and Adolescents: Vulnerable or Media Savvy Youth Europe's Margins?

	Overview
Aim	To examine how young refugees use digital technologies to navigate transnational life before, during and after migration.
	To investigate how young refugees develop age-related skills and manage risks more generally through their use of digital technologies.
	To understand how digital technologies support or hinder wellbeing among young people with experience of forced migration.
Method	Interviews with young refugees (aged 14-18)
	Asset mapping workshops to identify digital needs, risks and resources for wellbeing
Countries	Belgium, Greece, and United Kingdom

Engagement with young refugees was organised through two main methods: individual interviews (90+) and creative, "asset-mapping" workshops across the three countries. During the **interviews**, conducted in a language participants felt more comfortable with, questions were asked about digital opportunities, skills and risks, encouraging participants to speak about them through their experiences of transnational, transitional and sometimes radical life changes. During **the "asset-mapping" workshops**, participants used visual tools (colourful worksheets, stickers and pens) to together identify their digital skills as assets that help them manage their transnational lives; the workshops also enabled them to visually identify the risks that they see in their uses of smartphones, computers and the internet, especially social media.

Young refugees exploring the asset mapping exercise

Key insights

- **Young refugees acquire various digital skills through learning by doing.**
  This is linked to the crucial role of digital connectivity in tackling their numerous needs. Many developed high levels of digital skills, particularly in communication and information. Others revealed obstacles to digital literacies, associated with precarious lives, interrupted educational experiences and social exclusion more broadly.
- **Digitial skills for life: using digital technologies to meet fundamental needs.**
  Many young refugees developed skills to seek information for education and for learning languages or to support schoolwork. In some cases, social media compensated for weak or failing structures of educational support. Many develop identity-related skills, which are necessary for their socio-emotional and cognitive development, as well as to navigate their transnational lives.
- **Most young refugees are active and engaged communicators, often across different social media platforms**.
  As engaged communicators, their challenges include (1) limited digital literacies as a result of general literacy limitations, and (2) different understanding of risks compared to other groups, especially as young refugees have beenexposed to multiple past high-risk environments and experiences
- **Most young refugees are aware of online risks and their coping strategies vary**.
  Some employ proactive problem-solving strategies (e.g. blocking unwelcome contacts), others are avoidant or indifferent (e.g. sounding indifferent about risks or ignoring them). A minority does not really understand the potential implications of online risks and how to manage them (e.g. feeling anxious about social media making them unhappy).
- **Entanglement of skills and risks.**
  Sometimes, information skills (e.g., seeking information about their country of origin on social media) mean being exposed to harmful content (e.g., violent war content) that makes them anxious. In some cases, awareness of different technological affordances means that they skilfully make choices that are also risky.

Want to read more?

Full report:

- Baptista, R., Mascheroni, G., Vissenberg, J., Georgiou, M., Livingstone, S., d'Haenens, L. & Ponte, C. (2022).*Vulnerabilities and digital skills. Interactive report on the in-depth studies*. KU Leuven, Leuven: ySKILLS

Related ySKILLS blog:

- The role of digital skills in the lives of vulnerable and at-risk children and young people

3.11 Youth Digital Skills Indicator Performance Test

	Overview
Aim	To develop a high-quality, task-based measurement instrument – real-life performance testing – for a range of digital skills amongst young people.
	To expand knowledge on how to design a performance test and encourage other researchers to use this direct assessment method of digital skills.
	To measure digital skill levels among children in six European countries in a reliable and valid way.
Method	Cognitive interviews, performance tests and evaluation
Countries	Design phase: Estonia, Portugal, Belgium and The Netherlands
	Measurement phase: Estonia, Finland, Germany, Italy, Poland, and Portugal

Key insights

Designing a performance test

- Make the topics appropriate to the online experiences of children and replicate their lived experiences to motivate them to complete tasks.
- Choose universal themes (for example climate change or COVID-19) to make search task topics applicable cross-nationally and across age groups.
- Reserve ample time to walk through the coding scheme with the team of researchers involved in this process to make sure everyone has the same understanding of the criteria.
- Avoid app- or platform-specific tasks in real-life performance tests.
- Let participants choose the search engine of their preference to find the answer on a fact-based question.
- Involve children early in the process and take the children's level of understanding and experience as a starting point in the design process.

Implementing a performance test

- Present tasks in an interactive way, instead of using static screenshots. This can help mitigate the effects of increased cognitive demands. A more interactive way could for example be that children can watch words appear as they are being typed.
- Use cognitive interviews (in addition to an expert round) to explore how children interpret the tasks.
- Perform cognitive interviews in all countries involved as they bring unique experiences and perspectives to consider.
- Split up two-pronged questions (for example by letting the child answer if one would send a picture or not and then asking to provide the explanation in a separate text box).

Analysing a performance test

- Include as much answer options in advance as possible, but at the same time leave one option open in the coding scheme to cover unexpected answers.
- Limit the dependence between skills actions as successful performance should not depend on how the participant performs the previous task.
- Restrict the numbers of coders per country to one or two and ensure all coders are instructed in a similar manner.
- Include a training when working with a team of researchers before the start of the performance test analysis to make sure everyone is on the same page.

Results from the performance tests

- **Information navigation and processing skills**: children experience most difficulties with performing tasks focussed on evaluating information (e.g., selecting the most reliable website, naming the intention of a post).
- **Communication and interaction skills**: appropriate and courteous online behaviour is not self-evident for children.
- **Content creation and production skills**: many children succeed in uploading a copy-right free image but only a small minority designed a presentation slide according to the pre-established guidelines.
- **Overall**, the results raise doubts whether children have sufficient digital skill levels. Factors that often contribute to digital skill levels in large-scale survey research (self-assessment), such as age and gender, seem less relevant in performance tests.

Want to read more?

Full reports:

- Van Laar, E., van Deursen, A. J. A. M., Helsper, E. J., & Schneider, L. S. (2022). *The youth Digital Skills Performance Tests: Report on the development of real-life tasks encompassing information navigation and processing, communication and interaction, and content creation and production skills*. KU Leuven: ySKILLS.
- Van Deursen, A. J. A. M., van Laar, E., Helsper, E. J., & Schneider, L. S. (2023). *The youth Digital Skills Performance Test Results: Report on the results of real-life information navigation and processing, communication and interaction, and content creation and production skills tasks*. KU Leuven: ySKILLS.

Related ySKILLS blog:

- Key lessons learned using performance tests to measure digital skills
- Unveiling Insights from the Youth Digital Skills Performance Test Results

3.12 The Influence of Social Structure and Networks on Online Resilience and Digital Skills

	Overview
Aim	To explore how peer networks affect digital skills among children and adolescents
Method	Survey to collect network data
Countries	Germany, Italy and Portugal

This study seeks to shed new light on the actual network processes that are at play when it comes to peer effects on digital skills. It presents first insights into the relationships between youth social structures and digital skills, with a special emphasis on peer networks.

Based on unique socio-centric network data collected across school classes in three different countries it does provide a fresh perspective on how to integrate peer networks into the analyses of youth digital skills.

The empirical insights are based on three subtypes of peer networks as adolescents' social structure – a friendship network, and two (digital skills-related) advice giving and advice seeking networks.

Key insights

Gender importance

- Students of the same gender tend to disproportionately be friends, tend to ask advice in matters of digital technology, as well as seek advice with each other

Proficiency in digital skills

- Students tend to ask for advice and seek advice from other students with a similar proficiency in digital skills.
- Advice giving and advice seeking are probably by nature characterised by seeking social approval and confirmation.
- However, advice network ties were more common among children or adolescents with different school performance levels.

Specific skills on giving and seeking advice

- An adolescent with a high digital skill level is often asked for advice and frequently provides advice to peers.
- An adolescent with low digital skill level frequency seeks and receives a high amount of advice from others.

Some adolescents are super helpers since their expertise does potentially travel through classrooms.

Want to read more?

<u>Full report:</u>

- Boomgaarden, H., Tolochko, P., & Song, H. (2022). *Report on the influence of situational variables and personal networks on online resilience and digital skills*. KU Leuven: ySKILLS.

<u>Related ySKILLS blog:</u>

- Unveiling the Power of Peers: Exploring the Impact of Peer Advice Networks on Digital Skills Development

3.13 The Impact of Policy Interventions on Young People's Digital Skills Development: A Simulation Approach

	Overview
Aim	To test the effectiveness of intervention programs that aim at improving digital skills with a focus on testing their effects on particularly vulnerable groups.
Method	Simulation approach
Countries	Estonia, Finland, Germany, Italy, Poland, and Portugal

This report underscores the significance of fostering digital skills among children and young people, particularly targeting vulnerable groups, and highlights the role of well-designed interventions in narrowing digital divides and promoting equal opportunities for all.

Key insights

- **Importance of digital skills**: In the modern era, digital skills are crucial for academic and labour market success among young individuals. However, unequal distribution of digital skills persists, emphasising the need for policy interventions to ensure equal opportunities for all.

- **Integration into education**: Digital skills are integral to academic achievements and school performance. Proficiency in digital tools, critical thinking, and information evaluation are essential for students' engagement, problem-solving abilities, and adaptability to evolving learning environments.

- **Digital divides**: Despite the assumption that young people naturally acquire digital skills, digital divides still exist. These divisions are no longer solely based on access to technology but extend to the usability of technology and empowerment in its use. Vulnerable and disadvantaged groups are particularly affected.

- **Need for Interventions**: Policymakers must prioritise the integration of digital literacy and computational thinking into formal education systems. Collaborations with schools, community organisations, and the private sector can provide access to digital resources and training, especially for underserved groups.

- **Simulation Approach**: The report employs agent-based modelling (ABM) to simulate the dynamics of digital skill development among children and young people. ABM allows researchers to study emergent patterns and assess the potential impacts of intervention programmes.

- **Three intervention types:** The report explores three intervention strategies: improving access to ICT hardware and resources, enhancing digital literacy programmes in formal education settings, and fostering peer support and mentoring.

- **Effectiveness of interventions**: Simulation results show that interventions focused on enhancing students' receptivity to learning and acquiring digital skills are most effective in closing digital divides. Such targeted interventions are more successful than interventions solely aimed at improving hardware access.

- **Targeting vulnerable groups:** The findings emphasise the importance of targeted interventions that address the needs of vulnerable children and young people, enhancing their digital skills and bridging gaps in digital literacy.

- **Evidence-based decision making:** The simulation model serves as a foundation for evidence-based policymaking, offering insights into the complex dynamics of digital skills development and academic performance among children and adolescents.

Want to read more?

Full report:

- Song, H., Boomgaarden, H., Tolochko, P., & Kronschnabl, H. (2023). *The Impact of Policy Interventions on Young People's Digital Skills Development: A Simulation Approach*. KU Leuven: ySKILLS.

3.14 Measuring the effects of digital technology use on wellbeing with ESM

	Overview
Aim	To investigate how information and communications technology (ICT) skills and use are associated with adolescents' wellbeing on momentary and daily levels.
Method	Experience Sampling Method (ESM)
Countries	Belgium and Finland

The ESM study was conducted in two waves, during the early and late autumn 2022, respectively. In addition, a supplementary data collection was carried out in Finland in spring 2023. The data consists of 17,671 momentary and diary questionnaire responses from 456 participants. The participants were 13- to 17-year-old adolescents (63% girls) from seven different schools.

ESM, a momentary survey method, was used to collect data *in situ* with participants' mobile phones. Four momentary and two diary questionnaires were administered during the 14-day data collection period in each wave. The method allows assessing experiences and behaviour that are situational and context-specific, reducing retrospective bias. Moreover, ESM allowed collecting data from a variety of topics by administering both momentary and diary-type questionnaires.

The study was concerned with assessing adolescents' specific forms of technology use, such as interacting with others by messaging or browsing websites, rather than focusing on screentime or use of specific apps. Additionally, the psychological wellbeing of participants was examined by assessing their affective states. Participants were also requested to report on their sleep daily. Other topics of interest were daily online experiences and activities related to news and comments, problematic social media use, self-determination in ICT use, and face-to-face interaction.

Key insights

- Participants reported frequent engagement with technology, particularly browsing social media and messaging. Passive use, like browsing, was more common than active interaction and creation. Adolescents often engaged in multiple activities simultaneously while using technology.
- Technology use was associated with increased feelings of boredom, relaxation, and loneliness. From the specific forms of ICT use, browsing social media showed this kind of patterns, while watching videos was linked to increased relaxation. Between-level associations indicated more frequent ICT use was related to higher average levels boredom and loneliness and less relaxation.
- Concerning sleep, adolescents reported going to bed later, sleeping for shorter durations and having lower quality sleep when doing homework before going to sleep. In addition, browsing, listening to music, and using phone in bed were related to shorter sleep duration. Between-level correlations revealed that spending time family before bed more often was related to better and longer sleep. Adolescents who reported using phone in bed and browsing social media and websites more experienced less sleep overall.

- Adolescents rarely shared news items or encountered suspected fake news. Reading online comments was more common, with offensive comments being encountered somewhat frequently. Problematic social media used was infrequently reported but still prevalent among nearly one-fifth of the adolescents. Participants reported a moderate sense of self-determination in their daily ICT use, with a sense of importance and belongingness. Additionally, adolescents reported engaging in face-to-face interaction with friends outside of school on approximately half of the days.

Want to read more?

Full report:

- Salmela-Aro, K., Alho, K., Järvinen, J., Salonen, V., Mannerström, R., Hietajärvi, L., Maksniemi, E., Puukko, K., Gale, J., Bossens, E., Ylinen, A., Wikman, P., Bellon, E., & De Smedt, B. (2023). *Report on the effects of ICT use on attention related cognitive functions measured with ESM and fMRI. Focus on ESM and fMRI methods to measure effects of ICT skills and use on wellbeing and cognitive functions.* KU Leuven: ySKILLS.

- Järvinen, J., Maksniemi, E., Hietajärvi, L., Gale, J., Bossens, E., & Salmela-Aro, K. (2023). *Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland.* KU Leuven: ySKILLS.

Related ySKILLS blog:

- Measuring effects of digital technology use with mobile technology and brain imaging

3.15 Collected (f)MRI Data related to Effects of Intensity of ICT Use on Brain Activity associated with Attention and with Linguistic and Mathematical Processes

	Overview
Aim	To investigate whether adolescents' digital skills and digital activities are associated with cognitive skills, brain activity, and task performance.
Method	Cognitive tasks and functional Magnetic Resonance Imaging (f)MRI
Countries	Finland

The fMRI study involved 189 participants aged 12-14. The researchers performed mathematical tasks during scanning of their brain activity with fMRI. In half of the conditions, adolescents' performance was distracted with task-irrelevant speech and babble mimicking classroom voices. The aim of this fMRI study was to determine whether ICT skills and use, measured with the ySKILLS questionnaire, are associated with performance and brain activity in these attention-demanding conditions.

Key insights

- **Associations between digital skills and mathematical tasks:** No significant associations were found between the participants' digital skills or activities and their performance in mathematical tasks. This lack of correlation might partly stem from the limited variation in mathematical skills, considering participants' inclusion criteria of average or above-average school mathematics grades.

- **Associations between digital skills and linguistic tasks:** Associations between digital skills and performance in linguistic tasks were observed. Communication and interaction skills, as well as content creation and production skills, interacted with Task (reading vs. listening) and Distractor (present vs. absent), indicating that higher scores on these digital skills correlated with lower semantic classification performance during distracted reading, non-distracted reading, and non-distracted listening. This suggests a potential negative association between these digital skills and linguistic abilities.

- **Online gaming and linguistic task performance:** The frequency of online gaming demonstrated a gradual increase in performance accuracy in linguistic tasks. This suggests that gaming might contribute to the development of linguistic or attention skills necessary for the tasks. However, excessive gaming ("several times a day" or "almost all the time") led to decreased performance accuracy, suggesting that the detrimental effects of excessive gaming outweighed the positive effects on cognitive skills.

- **Brain activity and digital skills:** Higher content creation and production skills correlated with stronger fMRI responses in the parietal white matter of the left hemisphere during mathematical tasks. However, the functional significance and reliability of fMRI findings in white matter are not firmly established. The anterior insula of the left hemisphere showed higher activity with participants' higher information, navigation, and processing skills during linguistic tasks. This aligns with previous research suggesting the involvement of this brain area in linguistic processing.

- **Associations with attention and working memory skills:** In Belgian participants (n = 51, 12-13 years old), lower attention skills correlated with higher online activities and more sharing on social media. However, the causal direction remains unclear; whether lower attention skills lead to increased online activity or vice versa. Participants with lower working memory task performance reported higher communication and interaction skills, yet the causal direction is unresolved.

- **Cognitive skills and digital skills performance tests:** A subgroup of Belgian participants (n = 19) showed a positive association between cognitive skills (attention and working memory) and performance on digital skills performance tests. However, questionnaire-based ICT skills assessment did not correlate with performance tests, implying that these measures might tap into different aspects of digital skills.

- **Cross-sectional data limitations:** Given the cross-sectional nature of the data, strong causal implications cannot be drawn from the observed associations. Future research with longitudinal designs could provide clearer insights into causal relationships.

Want to read more?

Full report:

- Alho, K., Hartmann, H., Ylinen, A., Hannula-Sormunen, M. M., McMullen, J., Lehtinen, E., Rinne, N., Hietajärvi, L., Salmela-Aro, K., Wikman, P., Bellon, E., & De Smedt, B. (2023). *Report on collected fMRI data related to effects of intensity of ICT use on brain activity associated with attention and with linguistic and mathematical processes*. KU Leuven: ySKILLS.

Related ySKILLS blog:

- Measuring effects of digital technology use with mobile technology and brain imaging
- Examining the Relationship Between Youth's Digital Skills, Cognitive Abilities, and Brain Activity: A Cross-Sectional Study

4. Acknowledgements

5. References

d'Haenens, L. (2021). *Towards a Better Understanding of Digital Skills: On Inequalities and Their Impact*. KU Leuven: ySKILLS. https://doi.org/10.5281/zenodo.5821079

Donoso, V., Retzmann, N., Joris, W., & d'Haenens, L. (2021). *Digital Skills: An Inventory of Actors and Factors*. KU Leuven: ySKILLS. https://doi.org/10.5281/zenodo.4525639

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: ySKILLS. https://doi.org/10.5281/zenodo.5226910

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. https://doi.org/10.5281/zenodo.4274654

Helsper, E.J., Schneider, L.S., van Deursen, A.J.A.M., & van Laar, E. (2021). *The Youth Digital Skills Indicator: Report on the Conceptualisation and Development of the ySKILLS Digital Skills Measure*. Zenodo. https://doi.org/10.5281/zenodo.4608010

International Telecommunication Union (ITU) (2018). *Measuring the Information Society report, Volume 1*. Geneva, Switzerland: ITU Publications. Available at: www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf.

Smahel, D., Machackova, H., Mascheroni, G., Dedkova, L., Staksrud, E., Ólafsson, K., Livingstone, S., & Hasebrink, U. (2020). *EU Kids Online 2020: Survey results from 19 countries.* EU Kids Online. doi:10.21953/lse.47fdeqj01ofo.

APPENDIX: list of ySKILLS articles in journals

Alho, K., Moisala, M., & Salmela-Aro, K. (2022). Effects of media multitasking and video gaming on cognitive functions and their neural bases in adolescents and young adults. *European Psychologist, 27*(2),131–140. https://doi.org/10.1027/1016-9040/a000477

Beilmann, M., Opermann, S., Kalmus, V., Vissenberg, J., & Pedaste, M. (2022). The Role of School-Home Communication in Supporting the Development of Children's and Adolescents' Digital Skills, and the Changes Brought by Covid-19. *Journal of Media Literacy Education*. https://digitalcommons.uri.edu/jmle-preprints/40/

Cino, D., Brandsen, S., Bressa, N., Eriksson, E., Mascheroni, G., & Zaman, B. (2023). Children's digital skills acquisition in non-formal educational contexts: pedagogical practices, learning, and inclusion opportunities in coding and robotics workshops. *Italian Journal of Educational Research, 30*, 54-72. https://doi.org/10.7346/sird-012023-p54

Cino, D., Lacko, D., Mascheroni, G., & Šmahel, D. (2022) Predictors of children's and young people's digital engagement in informational, communication, and entertainment activities: findings from ten European countries. *Journal of Children and Media*, DOI: 10.1080/17482798.2022.2123013

De Coninck, D., & d'Haenens, L. (2023). Gendered perspectives on digital skills and digital activities: Comparing non-binary and binary youth. *Comunicar, 75*. https://doi.org/10.3916/C75-2023-03

De Coninck, D., Vissenberg, J., Joris, W., & d'Haenens, L. (2023) Perceived discrimination and digital inequalities among children and young people: studying the multidimensional concepts of digital skills and digital knowledge. *Information, Communication & Society*, 10.1080/1369118X.2023.2205508

Haddon, L., Cino, D., & Doyle, M.-A. (2023). The challenges of conducting systematic evidence reviews: A case study of factors shaping children's digital skills. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique*. https://doi.org/10.1177/07591063221141730

Kalmus, V., Opermann, S., & Tikerperi, M-L. (2022). Conducting school-based online survey during the COVID-19 pandemic: Fieldwork practices and ethical dilemmas. In: Kotilainen, Sirkku (Ed.). *Methods in practice: Studying children and youth online*. (53−56). Hamburg: Leibniz-Institut für Medienforschung | Hans-Bredow-Institut (HBI); CO:RE – Children Online: Research and Evidence. https://doi.org/10.21241/ssoar.83031.

Kalmus, V., Tambaum, T., & Abuladze, L. (2023). Use of digital tools, digital skills and mental well-being. In M. Sisask (Ed.), *Estonian Human Development Report 2023: Mental Health and Well-Being* (235−250). SA Eesti Koostöö Kogu. https://inimareng.ee/en/4-1-use-of-digital-tools-digital-skills-and-mental-wellbeing/

Livingstone, S., Mascheroni, G., & Stoilova, M. (2021). The outcomes of gaining digital skills for young people's lives and wellbeing: A systematic evidence review. *New Media & Society*. https://doi.org/10.1177/14614448211043189

Mascheroni, G., Cino, D., Mikuška, J., & Smahel, D. (2022). Explaining inequalities in vulnerable children's digital skills: The effect of individual and social discrimination. *New Media & Society*, *24*(2), 437–457. https://doi.org/10.1177/14614448211063184

Tolochko, P., & Boomgaarden, H.G. (2024). Same but different: A comparison of estimation approaches for exponential random graph models for multiple networks. *Social Networks, 76*, 1-11,https://doi.org/10.1016/j.socnet.2023.05.003.

Vissenberg, J., d'Haenens, L., Livingstone, S. (2022). Digital Literacy and Online Resilience as Facilitators of Young People's Well-Being? A Systematic Review. *European Psychologist*, *27* (2), 76-85. doi: 10.1027/1016-9040/a000478

Vissenberg, J., De Coninck, D., Mascheroni, G., Joris, W., & d'Haenens, L. (2023). Digital Skills and Digital Knowledge as Buffers Against Online Mis/Disinformation? Findings from a Survey Study Among Young People in Europe. *Social Media + Society, 9*(4). https://doi.org/10.1177/20563051231207859

Waechter, N., Kalmus, V., Mascheroni, G., & Opermann, S. (2023). Large-Scale Comparative School-Based Survey Research: Challenges and Solutions for Sampling, Fieldwork and Informed Consent. *Methods, Data, Analyses, 17*(2), 303-324. https://doi.org/10.12758/mda.2023.03