



youth
SKILLS

**Children and young
people (aged 12-17)'s
digital skills:
Evidence-based
recommendations for
policy and practice**

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ySKILLS – Children and young people (aged 12-17)’s digital skills: Evidence-based recommendations for policy and practice

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Executive summary

In European societies most, if not all, social, educational, and civic activities involve some degree of digital interaction. Young people therefore need digital skills to participate in these societies. Such skills can support the realisation of many cultural, educational, social and civic opportunities in ways that both promote and improve wellbeing (Helsper, 2022). They can also protect young people from harm by increasing their resilience and efficacy in managing online risks (Mascheroni et al., 2020).

In this report, we present evidence-based recommendations for policy and practice arising from the ySKILLS project, a Horizon 2020 funded Research and Innovation Action, carried out between 2020 and 2023. The project has investigated the relationship between 12–17-year-old’s digital skills and their wellbeing. **The overall aim has been to enhance and maximise the positive long-term impact of the ICT environment on multiple aspects of wellbeing for all children and young people by stimulating resilience through the enhancement of digital skills.** This aim is grounded in an understanding that unequal opportunities to access and use digital media can influence how people develop digital skills which in turn can introduce, sustain and enhance inequalities in the potential outcomes of having digital skills, including for the wellbeing of young people (Helsper, 2022).

The overall recommendations for pan-European, national policymakers and educational authorities are:

Ensure young people have safe and equal access to opportunities to develop digital skills:

- **Strengthen the coordination of policies and strategies** aimed at developing children and young people’s digital skills;
- **Recognise vulnerabilities** by acknowledging the influence of individual and social factors on children and young people’s safety and vulnerability in digital environments. Implement strategies to maximise opportunities and minimise risks arising from these different factors.

Ensure consistency in the conceptualisation and measurement of young people’s digital skills and in the strategies implemented to enhance opportunities to develop these skills in practice, this entails:

- **Recognition and monitoring of four dimensions:** Acknowledge, ensure and closely monitor the four dimensions of digital skills outlined by the ySKILLS project. These encompass technical and operational, information navigation and processing, communication and interaction and content creation and production skills. Combined with digital knowledge, these items are considered to form the core of ‘Digital Literacy’.
- **Ensure recognition and monitoring of digital skills amongst all European children and young people:** These actions should extend to all European children and young people (regardless of age, gender, SES, or other individual or social factors) and to the educators and other professionals who work with them.
- **Methodological diversity for evolving digital skills:** Facilitate the advancement of a range of methodological approaches for assessing digital skills, as these continue to evolve.

Implement regulation to enhance the positive outcomes of digital media use for children and young people’s wellbeing. This involves:

- **Internal market regulation** to ensure the protection of children and young people’s rights in areas such as communication, data protection and privacy and protection from commercial exploitation.

Implementing policy recommendations can be both costly and time consuming, we therefore demonstrate how our recommendations build on evidence developed during the ySKILLS project. We have also simulated the hypothetical implementation of three recommendations using Agent-Based Modelling (see report D5.3). We recommend that further research tests the implementation of all recommendations outlined in this report, to provide policy makers with an even more robust evidence base to support their work. A separate [multi-media report](#), presenting the overall recommendations for policy and practice is available online.



1. Introduction

1.1 The ySKILLS project

The ySKILLS (Youth Skills) project is funded by the European Union (EU's) Horizon 2020 programme. It involves 16 partners from 13 countries to enhance and maximise the long-term positive impact of the information and communications technology (ICT) environment on multiple aspects of wellbeing for children and young people 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 <https://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 **identify 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

To acquire extensive knowledge and better measurement of digital skills.

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.

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).

To generate insightful evidence-based recommendations and strategies for key stakeholder groups in order to promote European children's digital skills and wellbeing.

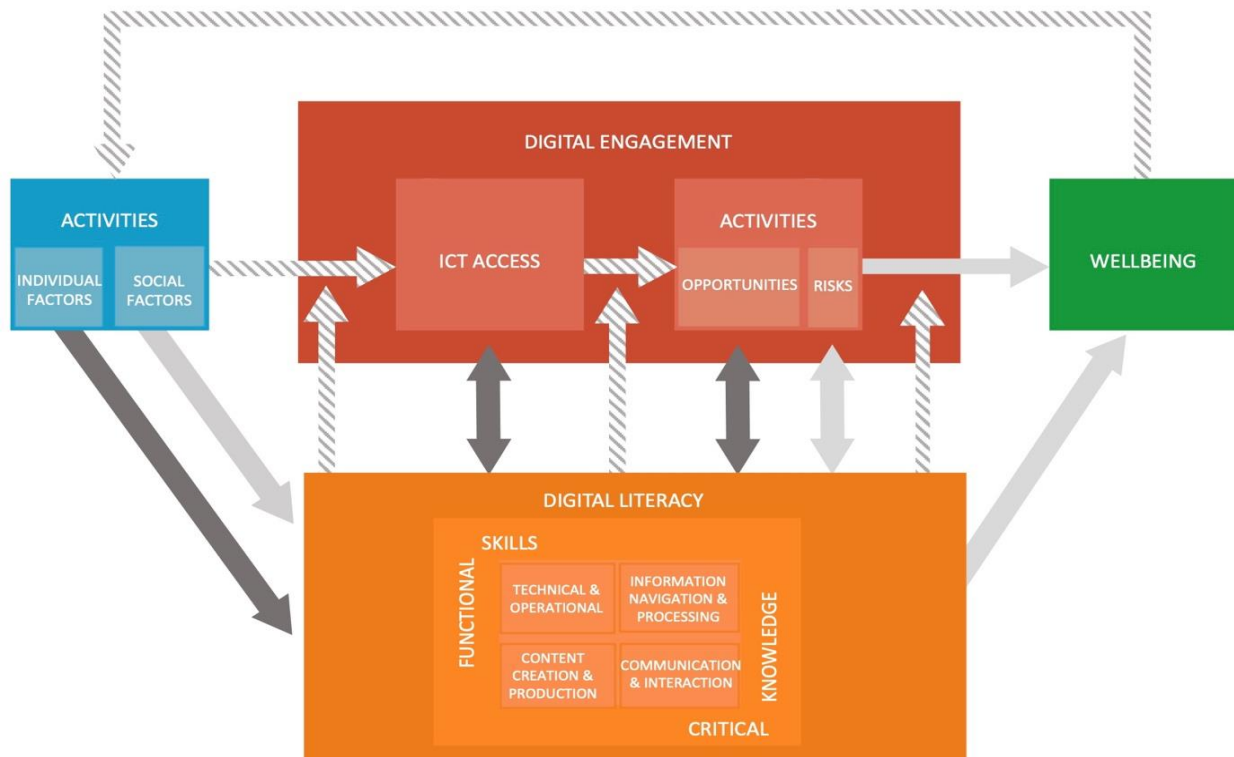
This report presents the project's main recommendations for future policy and practice, in the form of pan-European evidence-based recommendations, appropriately qualified according to the strength of the evidence and any potential limitations. The recommendations aim to promote children and young people's digital inclusion and wellbeing in close collaboration with stakeholders.



During the project period, the ySKILLS team has worked to develop its **conceptual model** (see Figure 1 below):

Figure 1

New theoretical model that displays relations of digital skills to other concepts



Source: Šmahel, D., Mascheroni G., Livingstone, S., Helsper, E., van Deursen, A.J. A.M., Tercova, N., Stoilova, M., Georgiou, M. A., Machackova, H., & Alho, K. (2023). *Theoretical Integration of ySKILLS: Towards a New Model of Digital Literacy*. KU Leuven: ySKILLS. (Deliverable 2.3)

The revised model (Figure 1) indicates how various individual and social factors relate to children’s digital engagement and can lead to the uneven distribution of digital skills and literacy. These in turn influence and are influenced by children’s wellbeing. This model is based on the premise that our understanding of digital skills can be improved if the differential antecedents and consequences of diverse skills are identified, examined and acted upon.

Importantly, ySKILLS differentiates between four key dimensions of digital skills, i.e. technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills. Combined with digital knowledge, these functional skill items are considered to form the core of ‘Digital Literacy’.

The ySKILLS project makes important contributions to the fields of digital skills and literacy research, where narrower conceptualisations and measurements of digital skills have made it difficult to design policies to support children and young people’s development and wellbeing. An over-reliance on self-efficacy scales (primarily measuring perceived rather than practical skills), combined with a lack of robust measurements of non-technical skills (i.e. content creation and interaction), and critical information literacy characterised research and practice in the field (i.e. PISA, the OECD’s Programme for International Student Assessment, which is focused on the educational context and misses out on ‘softer skills’; and DigComp, that focuses on the needs of the job market and does not provide sufficient measurements of critical information or social-interactive skills).



Understanding how these different dimensions develop and are influenced by a range of individual, social, and contextual factors is fundamental to supporting children in achieving positive and avoiding negative outcomes in their everyday digital lives (see Helsper et al., 2021; Livingstone, Mascheroni & Staksrud, 2018; Van Deursen & Helsper, 2018).

The ySKILLS project demonstrates that these different dimensions of digital skills are often unequally distributed amongst European children. As such, designing policy that supports their development needs to account for and understand the differences between different dimensions of digital skills, as well as the individual, social and contextual factors that influence their development. It also requires an appreciation of the actual and potential consequences of the uneven distribution of digital skills across populations of children and young people. Children and young people need to develop all four dimensions of digital skills if they are to fully enjoy the benefits of digital citizenship and to actively participate in digital democracy and society as well as in the labour market.

The ySKILLS project indicates that better digital skills are linked to more online risk, although the evidence also suggests that the type of skills matters: critical digital skills, for instance, are not linked to online risk. Moreover, when children familiarise themselves with the online environment, and feel safer online, they gain a better understanding of the internet, which in turn supports their acquisition of digital skills (Mascheroni et al., 2020). Engaging in digital environments may also contribute to the development of resilience (Livingstone et al., 2022 D6.1).

In this report, we provide recommendations to support both European and national policymakers and educational authorities to design and implement policies that will facilitate the realisation of opportunities and minimisation of risks arising from children's digital engagement. Such policies should also be designed to enhance cognitive, physical, social, and psychological wellbeing. A key to achieving these goals is to acknowledge the different dimensions of digital skills as outlined by ySKILLS and how their development and consequences are influenced by individual and social factors, as well as by various aspects of digital engagement and literacy.

This model is a useful visual and analytical tool that will allow policymakers to identify how a wide range of factors must be accounted for in order to develop digital skills and literacy, and to promote social equality, inclusion and overall wellbeing amongst children and young people. The model can also be used analytically to support critical and empirical analyses of the relationship between digital engagement, literacy, and wellbeing both systematically and over time.

1.2 This report

This report *ySKILLS – Children and young people (aged 12-17)'s Digital Skills: Evidence-based recommendations for policy and practice* presents the project's main recommendations for future policy and practice, in the form of pan-European evidence-based recommendations. The recommendations aim to promote children and young people's digital inclusion and wellbeing in close collaboration with stakeholders.

Our aim is to make recommendations that will support digital skills development in educational settings, at home, and in leisure and other contexts that are relevant to children and young people's everyday lives. We therefore target three main groups: (a) the European Union and European Economic Area ('EU/EEA') and pan-European legislators and policy makers¹ (b) national governments and policy makers, and (c) educational authorities. These stakeholders are both

¹ The ySKILLS [report D7.4](#) provides more information on the competences of the European Union and maps the relevant policies and strategies that relate to children and young people's digital skills.



responsible for, and competent to, implement policies that influence children and young people's digital everyday lives and wellbeing.

Our recommendations are also aimed at educational authorities who provide direction and input to the work of schools, educators, clinicians, social workers, youth associations, parents and caregivers, and NGOs who are directly involved in the implementation of practice that influences children and young people's digital skills.

The recommendations are also relevant for international stakeholders and institutions working with children and young people including UNESCO, UNICEF, WHO (World Health Organisation), ITU (International Telecommunication Union) and ILO (International Labor Organization) as well as the global digital industries. They also hold relevance for academics working in this field.

Following this introductory chapter, we outline the background for our work. Thereafter we include a chapter summarising the overall strength and quality of the evidence underpinning the recommendations (Chapter 3). This is followed by a summary of the relevance of the DESI index for the ySKILLS project (Chapter 4), and an overview of the outcomes of the co-design jams, where the ySKILLS recommendations were reviewed by children and young people (Chapter 5). The contextual background for the recommendations is presented in Chapter 6. This is followed by a detailed presentation of the recommendations (Chapter 7). Finally, in Chapter 8, we provide a concluding comment on the importance of developing policies that prioritise positive outcomes for European children and young people, through the development of digital skills.

2. Background

The ySKILLS recommendations for policy and practice are a synthesis of the many studies, publications and outputs within the project. They also incorporate the responses of children and young people to the project findings in co-design jams organised in the spring of 2023. The co-design jams facilitated consultation and deliberation with children and young people, inviting their input, facilitating their sharing of experiences, respecting their voices, and enabling their creative and deliberative engagement with the results and recommendations of the project (see report D7.2).

In making recommendations for policy and practice, we draw on a broad definition of policy outlined for example by Mulcahy (2006, p. 320), and refer to the politically determined actions of governments that aim at achieving discernible societal outcomes. In the European context, this includes both the European Union, within the confines of its competences (for more information see [report D7.4](#)), and national, and in some cases regional, governments who have an overall responsibility for the design and implementation of policies, including those of particular relevance to the ySKILLS project such as youth, education and health (European Union n.d.). We also present a set of recommendations for educational authorities who provide direction for and input on the work of schools, educators, clinicians, social workers, youth associations, parents, caregivers, and NGOs who are directly involved in the implementation of practice that influences children and young people's digital skills.

When developing the recommendations, we have considered the strength of the cumulative output from the ySKILLS project, including research, empirical findings and consultations. We also assess the quality of the evidence underpinning the recommendations and present any relevant limitations. These considerations are presented in the following chapter.

3. The overall strength and quality of the evidence underpinning the recommendations

In this chapter we identify the relevant studies and sources of supporting evidence from the ySKILLS project, as well as the methods used to acquire this evidence. We include a comment on each study



design, sample size and measurements where relevant. We also include a comment on relevant limitations. More detailed information about each study and their respective strengths and limitations can be found in the respective deliverable reports. We provide links to the relevant reports for ease of access to further information. In the appendix, we further specify how each of the recommendations we have derived draws on a range of studies, and we indicate and link to the studies in question.

When considering the quality of evidence in academic research, key criteria are the appropriateness and rigour of the **study design** (e.g., experimental or observational; longitudinal or collected at one point in time), and the method or methods used (i.e., cross-sectional survey research, qualitative interviews, focus groups, expert interviews, experience sampling methods etc.) (Grønmo, 2019). Different methods have different strengths and limitations, making some more appropriate for use than others, depending on the goal(s) of the study. Research can also involve primary or secondary data, i.e. the generation of new empirical evidence, or the review of existing sources and material, for example through a literature review.

For the ySKILLS project, it has been important to develop valid and reliable measurements to test children and young people's digital skills and to observe how different antecedents influence the development of these skills, as well as how digital skills can have a range of consequences for children and young people, including for their wellbeing (e.g. Helsper et al., 2021). The ySKILLS project therefore designed a longitudinal three-wave survey in six countries. This enabled the research team to identify trajectories of ICT use, digital skills and wellbeing and to investigate the impact of ICT use on wellbeing in the short and medium terms.

A further key criterion for research quality is how the **sample of participants** has been selected and recruited. In general, when referring to quantitative research, evaluations of quality will also consider the *size of the sample*. Larger sample sizes can produce more reliable results as they facilitate the comparison of data across a broader range of participants. In many of the studies implemented in ySKILLS *purpose-driven sampling* has been used. For example, in the qualitative study exploring the consequences of children's participation in informal learning contexts for their digital skills, participants were recruited through relevant workshops organised in informal learning contexts.

A further consideration in quantitative research is whether the sample is *representative* of a specific national, regional or local context. Representativity is however not the only hallmark of quality, and convenience or purposive sampling techniques are also applied (Etikan et al., 2016). In the ySKILLS project, the longitudinal study aimed to gather evidence about the antecedents and consequences of 12-17-year-olds' digital skills as these changed and developed over time. It was also important that these children and young people were attending the same or similar schools in the same or similar regions. The strength of the evidence is therefore that it provides empirical data about these changes. A related limitation is the extent to which the same sample participated in the study over time, i.e. the level of 'panel attrition'. This is also reported on in the relevant deliverable reports.

The **generalisability** of the findings should also be considered, i.e., whether and to which extent the study's finding can be generalised to other populations, settings or contexts. In ySKILLS generalisability is supported by implementing the same or similar research design in a number of different national and regional contexts. All ySKILLS studies have been implemented in a minimum of two countries, i.e. in the longitudinal survey, children from six different European countries participated. The participating countries were originally selected according to their position on the DESI (Digital Economy and Society) index, to ensure that the young participants represented a diverse spectrum of socio-economic and digitally advanced societies. Similarly, when conducting qualitative research exploring how children with mental health problems developed and used digital skills, participants were recruited in both Norway and the UK, and from a range of different population groups characterised by the specific nature of mental health problems they were experiencing (Livingstone et al., 2022 D6.1).



All research generated by the ySKILLS project has undergone an internal **peer review** process, where three members of the consortium who have not been involved in the specific study have reviewed reports on research design and outcomes. The outcomes of the studies have further been *published* in academic journals and books. Where this is the case, the research design and methods have also been reviewed in the *double-blind peer review process* implemented in the academic publishing process (see Horbach & Halffman, 2019).

Another procedure that can support the quality of evidence is **expert consensus**. Field experts who have not been directly involved in the research are asked for their opinions and interpretations of the evidence. The ySKILLS team has actively consulted experts and stakeholders throughout the four-year duration of the project. Digital and physical round tables, webinars and workshops have been organised to facilitate this consultation. Research team members have also presented their findings at international academic conferences. Furthermore, the team has actively published information about the design of the various studies, and their outcomes, on the project website.

Finally, the extent to which research is conducted **ethically** and respects both legal and ethical requirements in the context in which it is implemented should also be considered (see NESH, 2022). All ySKILLS research teams have explicitly reported to the European Commission on the ethical considerations associated with their study designs. Furthermore, the ySKILLS management team have reported on these ethical considerations and their consequences on an annual basis.

Below, we provide an overview of the various methods applied in the ySKILLS project and comment on their quality, strengths and, where relevant, limitations. We also indicate whether the studies are original or secondary research.

It is important to note in general, that most recommendations are derived based on the combined insights of various studies. As such, there is a range of empirical and secondary research underpinning each recommendation. In general, we therefore draw on a strong empirical base. Policy makers will at the same time be able to identify variations in the type of evidence generated. Some recommendations for example draw on the outcomes of the longitudinal panel survey, while others build primarily on expert interviews and other qualitative research methods.

3.1 Overview of ySKILLS studies and methods

D2.1: Children and young people’s digital skills: A systematic literature review

Method: Systematic evidence review

A combination of database searches, application of inclusion criteria, and rigorous screening to identify and analyse relevant research articles on children and young people’s digital skills.

Type of evidence:

Secondary research efficiently screening many research outputs through the Web of Science Core Collection interface. This supported the identification of knowledge gaps regarding digital skills, as well as an evaluation of the strengths and limitations of previous research approaches. This provided a solid evidence-based point of departure for further research in the ySKILLS project.

D2.2: Digital skills, risks and wellbeing amongst European children

Method: Secondary survey data analysis

Examines the digital skills of 12-16-year-olds as outcomes, predictors and moderators, using nationally representative data from the EU Kids Online 2020 survey in 19 European countries.



Type of evidence:

Secondary analysis of statistically representative data gathered in 19 European countries through the EU Kids Online survey. Used to identify which variables predict the digital skills of 12-16 year-olds ($n=13,138$, 50% female, mean age = 13.93, $SD = 1.37$) and the consequences of digital skills.

D3.1: Report on the interviews with experts in digital skills

Method: Expert interviews

34 in-depth interviews with experts from the educational sector and labour market in Estonia, Finland, Germany, Italy, Poland and Portugal. The interviews aimed to get a deeper understanding of (1) the (digital) skills that youth need in the 21st century, and (2) the role of digital skills in education, both in formal and informal learning settings.

Type of evidence:

Original research and analysis of in-depth interviews with purposely sampled experts from ‘Expert Profiles’ working in the educational sector and labour market in six European countries. The interviews provide information-rich insights into expert experience and opinion regarding 21st century digital skills.

D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector

Method: Expert interviews

20 in-depth interviews with experts from the educational sector (out of a total sample of 34 experts, including 14 experts from the labour market) in Estonia, Finland, Germany, Italy, Poland and Portugal.

The interviews aimed to get a deeper understanding of (1) the (digital) skills that children and young people need in the 21st century, and (2) the role of digital skills in education, both in formal and informal learning settings.

Type of evidence:

Original research and analysis of a sub-set of 20 of the expert interviews conducted in D3.1. In this deliverable, the analysis focused on the interviews of the 20 experts working in the educational sector. The interviews provide information-rich insights into expert experience and opinions.

D3.3: The youth Digital Skills Indicator (‘yDSI’): Report on the conceptualisation and development of the ySKILLS digital skills measure

Method: Literature review and conceptual framework, validated through cognitive interviews and pilot surveys

Pilot surveys were conducted with an older age group (18-25) to validate the statistical properties of the items and scales.

Type of evidence:

Original research resulting in the development of high-quality, cross-culturally validated measurements for the digital skills of children and young people through both secondary reviews of



literature, measurement design, and two rounds of validation through cognitive interviews and pilot surveys and performance tests.

D3.4: An inventory of actors and factors

Method:

A report synthesising the outcomes of studies relying on four different methods

Systematic evidence review (D2.1):

A combination of database searches, application of inclusion criteria, and rigorous screening to identify and analyse relevant research articles on youth digital skills.

Secondary survey data analysis (D2.2):

Examines the digital skills of 12-16-year-olds as outcomes, predictors and moderators, using nationally representative data from the EU Kids Online 2020 survey in 19 European countries.

Expert interviews (D3.1):

34 in-depth interviews with experts from the educational sector and labour market in Estonia, Finland, Germany, Italy, Poland and Portugal. The interviews aimed to get a deeper understanding of (1) the (digital) skills that children and young people need in the 21st century, and (2) the role of digital skills in education, both in formal and informal learning settings.

Roundtable discussions with children and young people (D3.4):

Insights from children and young people provide knowledge and a different angle than that of adults, which is essential to improve the measurement of youth digital skills. Children and young participants were included in six roundtable discussions in Belgium, Finland and Portugal.

Type of evidence:

Secondary and original research synthesising D2.1, D2.2 and D3.1 and the outcomes of six roundtable discussions with children and young people from three different countries. The insights provided by children and young people are critical from a research and child rights perspective, as their experiences and opinions must be accounted for in matters that concern them.

D4.3: The youth Digital Skills performance tests

Method: Development and implementation of performance tests

Performance tests were developed and informed by the Youth Digital Skills indicator ('yDSI') (D3.3) and designed to measure three dimensions of digital skills, accounting for practical, critical and technical aspects. Sub-components for each dimension were conceptualised based on a literature review.

The performance tests were split into two modules to limit the cognitive load on participants. The first module focused on information navigation and processing skills and content creation and production skills, and the second module on communication and interaction skills.

The development of the performance testing protocol followed an *iterative process* in six countries (Estonia, Finland, Germany, Italy, Poland, Portugal).



Type of evidence:

Original research involving the iterative design and development of performance tests to measure children and young people's digital skills including literature review, pilot studies, cognitive interviews, and regular feedback sessions in the six partner countries. The performance tests were used to measure the digital skills of children and young people aged 12-17.

D5.1 Report on the influence of situational variables and personal networks on online resilience and digital skills

Method: Cross-sectional survey

The data was collected through the implementation of the ySKILLS survey in classes across different countries and schools. The dataset includes information on 123 networks (school classes) across 15 schools in Germany, Italy, and Portugal. The students' age range was 12 to 20 years.

Type of evidence:

This research relied on data from the first wave of the ySKILLS survey gathered in 15 schools in Germany, Italy and Portugal. The dataset allowed for the analysis of specific networks within classes and for an identification of characteristics of and relations between different participants in the networks. The participants were also known beforehand. The dataset allows for analysis of several hierarchical levels of variables in personal networks. The networked data also provide for more accurate estimations of the influence of these variables on online resilience and digital skills than other similar methods.

D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries

Method: Longitudinal survey

The study used a three-year longitudinal survey. It aimed for a purposive, non-probability sample of children aged 12 to 15 attending secondary schools. The sample size varied across waves and countries, with a total of $N=2660$ participants across three waves.

Type of evidence:

This robust method enables the measurement of short- and medium-term impacts of individual, social, country and digital media variables on digital skills acquisition and online resilience among children and young people. It also enables the investigation of how these factors influence four dimensions of wellbeing: cognitive, physical, psychological and social. By surveying the same children over a span of three years, this method facilitates the prediction of trajectories in which the use of ICTs can lead to either beneficial or harmful impacts for wellbeing, and the role of digital skills in shaping this relationship. The survey design was also based on literature reviews and secondary data analysis (D2.1 and D2.2) as well as two rounds of cognitive testing, all contributing to the strength of the measurements and of the evidence generated.

D5.3: The Impact of Policy Interventions on Young People's Digital Skills Development: A Simulation Approach



Method: Agent-based modelling

Agent-Based Modelling (ABM) was used to assess the impact of policy interventions on the development of digital skills among children and young people. ABM is particularly valuable for studying complex social systems. Researchers can programme agents to engage in various activities, like learning from peers, seeking advice, and navigating digital content, while considering factors like the agents' digital skills, social networks, and demographic characteristics. Through simulations, researchers can observe emergent patterns of digital skills resulting from policy interventions.

We tested three policy interventions addressing digital skill disparities among children and young people. These focused on improving access to ICT resources, implementing ICT training and digital literacy programmes in education, and promoting peer support and mentoring. The modelling was based on theoretical and empirical evidence from prior research and the ySKILLS survey.

ABM can be used to predict potential policy outcomes prior to implementation in complex social situations, especially when real-world experiments are costly or ethically problematic.

Type of evidence:

The use of ABM is grounded in both theoretical and empirical research. The modelling uses computational and simulation-based methods and is based on literature reviews and data from the ySKILLS longitudinal survey. ABM offers an ethical and effective means to experiment with policy interventions and their potential outcomes, which may be impractical in real-life scenarios.

D5.4: Situational and daily technology use and wellbeing among adolescents: A report on the findings from an ESM study conducted in Belgium and Finland

Method: Experience Sampling Method (ESM)

Two waves of intensive longitudinal data were gathered in both Belgium and Finland, with an additional third wave collected in Finland. In the first wave, data were collected from adolescents in Belgium ($N=251$, 13-17-year olds) and Finland ($N=129$, 15-16-year olds), in the second wave 86 Belgian, and 120 Finnish adolescents participated. In the third wave, which was implemented in Finland only, 42 adolescents participated. In both countries, the participants responded to six daily surveys with a momentary assessment app on their phones during a 14-day period. The questionnaires in these surveys were designed to capture adolescents' daily ICT use (e.g., momentary ICT use and daily screen time) and aspects of their wellbeing, including emotions, self-efficacy, problematic social media use and sleep.

In Finland, the participants also participated in the ySKILLS three-wave longitudinal study (see 5.2 below) and thus completed the ySKILLS survey questionnaire as part of this study. In Belgium, the participants were not part of the three-wave longitudinal study. However, they also completed the ySKILLS survey questionnaire in advance of the first wave of the ESM study.

Type of evidence:

The ESM method allowed for intra and inter individual comparisons on how technology use was related to situational deviations from the participants' subjective baseline states as well as examining trends and more constant effects in the relationships between individuals. This data could then be compared to the responses to the ySKILLS three-wave longitudinal study in the case of the Finnish participants, and the responses to this questionnaire in advance of the first wave of the study in the case of the Belgian participants.



An advantage of the ESM method applied is that it uses ecologically valid momentary assessments and thereby reduces recall bias and allows examining within-person effects and temporal processes underlying the links between ICT use and wellbeing.

Girls were slightly overrepresented in the sample compared to the population. The majority of the participants in both Finland and Belgium also scored highly on self-reported socio-economic status. While the data is subject to these limitations, the strength of this study lies in its generation of data about the main topic of interest i.e. capturing real-time experience of digital device use and exploring the relationship between this use and the emotions of the participating adolescents.

The data was to be gathered in three waves but due to difficulties in retaining participants some new participants were added in the third wave, conducted in Finland only.

D5.5: 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

This study involves the implementation of mixed methods to investigate how information and communications technology (ICT) skills and use are associated with cognitive skills and related brain activity, as measured with cognitive tasks and functional magnetic resonance imaging (fMRI) in Finland and Flanker, n-back and ySKILLS performance tests in Belgium. These methods are then combined with an analysis of the outcomes of the ySKILLS three-wave longitudinal study in Finland, and responses to the ySKILLS survey in Belgium.

Methods: fMRI and ySKILLS 3-wave longitudinal study

In Finland, participants in the fMRI study also participated in the ySKILLS three-wave longitudinal study ($N=189$, 12-14-year olds). All of these undertook mathematical tasks under fMRI conditions. 60 undertook additional linguistic tasks under these conditions. All participants were volunteers with an average or higher grade in mathematics. They were all native Finnish speakers, right-handed, with normal hearing and vision and no self-reported history of neurological or psychiatric disorders. These limited conditions were necessary in order to conduct a focused analysis of the relationship between the performance of the selected tasks and images of brain activity under fMRI. The aim of the 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.

The data generated in this mixed-method study is the first of its kind in that it tests task performance during fMRI or Flanker, n-Back and ySKILLS performance tests, and compares this to the participants responses to the ySKILLS/yDSI measurements.

Methods: Flanker, n-Back, ySKILLS survey questionnaire and ySKILLS performance tests

In Belgium, the Flanker task, n-back task and ySKILLS survey questionnaire were completed by students in the first grade in secondary school ($N=51$, 12-13-year olds). 19 of these also completed the ySKILLS performance tests to measure digital skills (see D4.3 above). All data in Belgium were collected online due to COVID-related restrictions.

In the Flanker task, the participants' task was to indicate the direction of a target arrow, that is, a left or right pointing arrow, by pressing the corresponding key, that is, left or right key. The target arrows were flanked by distractors, that is, two arrows on each side of the target. Thus, the participants were to indicate the direction of the target arrow while suppressing the direction of the distractors.



In the n-back task, two sequences of 20 coloured images (e.g., a rocket, a sweater) were shown. For each image, the participants were to indicate whether the presented image was identical to the image presented 2 trials back by answering ‘yes’ or ‘no’ by pressing a response key (‘j’ for yes, ‘f’ for ‘no’).

In the ySKILLS performance tasks, the test consisted of a series of tasks in which the participants had to search for information online, had to be critical towards online conversations and had to create online content. This test was executed online during a conversation with the researcher. The participants’ responses were coded according to the coding scheme of Helsper et al. (2020).

Type of evidence

The fMRI method allows for the comparison of associations of digital skills with distractibility during semantic and mathematical tasks. This despite the differences between the applied tasks and the distractors delivered during them. Previous studies in adults and adolescents have shown that these experimental settings efficiently reveal task-, attention-, and distraction-related changes in brain activity. The Flanker and n-Back methods allow for the generation of similar data.

The sample sizes in both country contexts were relatively low although this relates to the intense nature of the fMRI study and the voluntary recruitment of participants to the research. In both cases the samples included more females, and in the Finnish case the sample also included children and young people who performed well academically and were native speakers, right-handed and without self-reported hearing, vision or neurological or psychiatric disorders. While this means that both samples included a limited range of children and young people in the national context, the data sets are also comparable as they have a similar structure.

D6.1: Young people experiencing internet-related mental health difficulties

Method: In-depth interviews

In-depth interviews with $N= 62$ children and young people aged 12–22 (46 girls and 16 boys) from the UK and Norway who had experienced varying degrees of mental health difficulties.

Type of evidence:

Original qualitative research on children and young people’s mental health and digital experiences via in-depth interviews based on open questions and in-depth analysis. This research provides important insight into how children and young people with mental health difficulties understand and make sense of their digital skills and use of digital media in their everyday lives. The research includes participants from populations of children and young people experiencing different mental health illnesses including engaging with risky content online, experiences of excessive internet use, cyberbullying or online sexual abuse.

The research can complement context-independent results derived from the quantitative studies that are usually implemented in this field. It allows for insight into how digital skills can open some pathways for these children and young people, while at the same time potentially introducing additional risks, possibly resulting in upsetting circumstances.



D6.2: Young People's Digital Skills Practices in Non-formal Learning Contexts

Methods:

Observation of workshops (n=16) in different socioeconomic neighbourhoods, plus interviews with workshop organizers and moderators (n=11) to gain insights into teaching philosophies, technological imaginaries, and digital skills acquisition, and co-design sessions (n=4) focusing on specific aspects (multi-stakeholder approach, new tools, learning activities).

Type of evidence:

Original qualitative research in three countries (Belgium, Denmark and Italy). This included co-design intervention programmes to leverage the insights generated and yield future-oriented knowledge to promote digital skills and design inclusive programmes. This evidence provides a nuanced description of how programming workshops are conducted, access to the experiences and understandings of organisers and moderators and insight into how to improve the design and implementation of such workshops in the future.

The initial research design was affected by COVID-19 restrictions. The consequent shift to workshops organized by CoderDojo and similar organisations influenced the sociodemographic characteristics of the participants. Actions were implemented to address these limitations. Although the research teams were not able to include libraries in both wealthier and more deprived areas, the combination of workshops accessed in all three country contexts allowed for access to participants from different socioeconomic and vulnerable backgrounds.

The focus on programming workshops, while also narrowing the range of potential participants, allowed a consistent comparability of the data collected across all country contexts.

D6.3: Report on the role of critical information skills in recognising mis- and disinformation

Methods: Online Survey and News Exposure

In the first phase of this study, participants aged 12-15 in Belgium, the Czech Republic, and Finland took an online survey covering digital skills, news consumption, and trust. They later assessed the credibility of twelve news messages, half real and half fake, using specific criteria. Then, in a second phase of the study, focus groups (N=244) were conducted with the same participants to delve deeper into findings from the first phase.

Type of evidence:

Original research including the application of a two-phase data collection design in Finland, Belgium and the Czech Republic. The research design was informed by a pilot phase in Finland where students completed a questionnaire about their digital experiences on their mobile phones. This was followed by a group discussion. Following this, data collection in all three countries took place in October 2021 and February 2022. Given that restrictions were in place due to COVID, the data collection took place both online and in physical classroom, depending on the nature of the restrictions in the relevant context.

While the study contains a relatively small sample in each country context, its application in three countries, in addition to the two-phase data collection design, strengthen the quality of the evidence.



4. The European Commission's Digital Economic and Society Index (DESI)

Table 1. presents the DESI (digital economic and society index) ranking for each participating country at the outset of the project. The DESI ranking is generated by the European Commission to support EU Member States in identifying and prioritising actions to promote digitalisation, including implementing policies to close gaps in digital skills and improve access to high-quality infrastructure (European Commission, (a) n.d.). It can as such be considered an indication of how European countries, at an overall level, are performing in terms of implementing digitalisation and providing equal opportunities to citizens to access and use digital tools and services.

Finland	Denmark	Norway	UK	Estonia	Belgium	Germany	Czechia	Portugal	Italy	Poland	Greece
69.9	68.8	66	61.9	60.0	59.4	54.5	50.0	49.2	43.9	41.6	38.0

Table 1. Countries participating in ySKILLS studies according to DESI score from 2018. Average EU-score = 52.5.

The DESI index rankings also echo previous research indicating differences in the levels of digital skills amongst European children and young people (Smahel et al., 2020; Helsper et al., 2013). For example, in the recent EU Kids Online study, children and young people in countries in northern European (such as Finland and Estonia) reported higher levels of information and navigation skills than those in central and southern Europe (such as Germany and Italy) (Smahel et al., 2020).

The results of the ySKILLS project indicate continued differences in levels of self-reported skills amongst European children according to the four dimensions of digital skills that are identified and measured. Furthermore, the implementation of additional methods such as performance tests, complicate previously established understandings of differences in digital skills across European countries, i.e. participating children and young people from Finland achieve lower results in performance tests than those participating in Italy and Portugal.

Research from the ySKILLS project therefore indicates that, while the application of consistent measurements of digital skills, such as the yDSI, are required in order to cross-sectionally and longitudinally ascertain and compare levels of different dimensions of digital skills amongst children and young people, the implementation of additional methods, such as performance tests, Experience Sampling Method and fMRI can provide further insight into cognitive and practical aspects of the use of digital skills which provide important and nuanced knowledge about the application and use of digital skills in different countries and situational contexts.

Furthermore, qualitative studies reveal striking similarities between the everyday lives of children and young participants across different country contexts (e.g., Livingstone et al., 2022 D6.1). This suggests that previously identified differences in ICT use and development between for example Northern and Southern European countries might be a less urgent matter for policy makers to address when compared to the overall importance of considering how children and young people across Europe might be missing out on opportunities to participate in, or indeed be excluded from, increasingly digital societies. Focusing instead on how different factors influence the uneven distribution of digital skills, across the four core skills dimensions identified by the project, is the recommended approach.

The ySKILLS project in particular identifies how more nuanced approaches to policymaking are required in order to recognise how pre-existing inequalities (such as gender, socio-economic status, ethnicity, health, disability and other factors) at the pan-European level influence the development and outcomes of digital skills amongst children and young people. Addressing these factors, and their consequences for opportunities to develop digital skills, are essential to ensure the digitalisation of European societies in a way that provides equal opportunities to all children and young people to



access and use digital tools and services and by consequence to ensure that those who are already disadvantaged do not fall further behind.

Further research implementing and combining the insights from a range of methods, as has been done in the ySKILLS project, can therefore provide European policymakers with a contextual and nuanced understanding of children and young people's digital skills, as these are a central element in ensuring the equitable digitalisation of European societies.

5. Integrating the perspectives of children and young people

During the spring of 2023, a series of co-design jams were conducted with children and young people in six European countries. The participants were asked to make recommendations based on the project outcomes. The full list of recommendations devised are provided in detail in D7.2. We summarise them briefly here, as they are of relevance for the overall recommendations presented in this report.

5.1 Policy level:

- Share findings on the different dimensions of digital skills, and on the results (including percentages) from studies in the six survey countries.
- Make politicians aware of the weakest points of children and young people's digital skills (for example information navigation and processing skills, or technical and operational skills), and how these skills are progressing differently across various skill dimensions and over time.
- Convince politicians to set up new projects to study the digital skills of children and young people, and how these skills are evolving in the future.

5.2 Educational authorities working with schools:

- Facilitate workshops for teachers to learn how to support children and young people in developing their digital skills and protecting them from online risks. The ySKILLS team has developed a participatory toolbox to support the implementation of such workshops. This is available at: <https://yskills.eu/resources/>.
- Use more devices in class (e.g. for schoolwork) and include the topic of 'digital skills' in the curricula, especially to support children and young people with limited digital skills, and to prevent harm from online risks (such as scam).
- Make sure that children and young people know that they can turn to teachers and other relevant staff to talk about their online experiences, for example, with the student counsellor.

5.3 Educational authorities working with children and young people:

- Focus on the types of digital skills that need improvement (e.g. information navigation skills) and teach children and young people how to improve these skills.
- Focus on informing children and young people about the risks of scam and phishing.
- Advise children and young people that they could watch series about online risks on Netflix, such as Catfish.
- Support parents, caregivers and young people in developing digital skills. Children and young people currently feel they must educate their parents and caregivers about the digital world and online risks.



6. Evidence-based recommendations for policy and practice

6.1 Key recommendations

The implementation of policies and actions to promote the development of digital skills vary greatly within and across European countries. The expert interviews conducted within the ySKILLS project for example emphasise the **need for greater collaboration and coherence in policy and practice** (see D3.1 and D3.2). One potential consequence of these diverse approaches, actions and strategies is a variation in opportunities for children and young people to engage with the internet and digital media. This variation is described in previous research and reports (i.e. reports commissioned by the Better Internet for Kids agenda, the European Commission and Safer Internet Centres (Better Internet for Kids, n.d.)).

A complicating factor for policymakers is that the EU has policies aiming to develop both ‘media literacy’ and ‘digital literacy’. While media literacy infers a broader understanding and ability to acknowledge and reflect on messages circulated in what has been referred to as ‘mainstream media’, the policies that concern this kind of literacy also refer to digital contexts. Similarly, digital literacy is considered to encapsulate elements of media literacy, such as critical information literacy referred to above (see Wuyckens et al., 2022 for a review of these core concepts). In an increasingly digitalised world, where both ‘mainstream’, social and other media are largely digitalised, the differentiation between these policies and the scope of their application must be carefully reconsidered.

It is recommended that future policy work focuses on the development of digital literacy as a precise and core concept, including establishing and consistently measuring the distinction between different dimensions of digital skills, identified by the ySKILLS project, i.e. technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills. It should also be recognised that the combination of these different dimensions of digital skills with digital knowledge form the core of ‘Digital Literacy’.

At the same time, and since the inception of the ySKILLS project in 2020, pan-European initiatives and regulations have been introduced to improve the coordination and implementation of policies and strategies to support the development of digital skills. These include the Digital Education Action Plan, the European Skills Agenda, the 2030 Digital Compass, and the Digital Services Act (and more, see D7.4 for a more detailed account and analysis of the implications of these initiatives) (see also European Commission, (b), n.d.). The impact of these recent actions in terms of addressing the hitherto fragmented approach to developing digital skills in Europe, as well as the need for a more efficient and sustainable policy framework is currently unknown. The D7.4 report provides a detailed overview of the European legislative and policy framework and should be consulted for more information about the current situation.

Despite these recent initiatives, evidence from ySKILLS indicates that children and young people across Europe continue to experience different levels of, and trajectories towards the development of, digital skills. They need support to develop and harness their digital skills in order to increase social inclusion and equality, reduce vulnerabilities and enhance wellbeing. The implementation of policies at a pan-European and national level should therefore continue to focus on the importance of enhancing the digital skills of all children and young people, recognising their diversity and vulnerabilities, through coordinated efforts. This is essential to avoid a situation where traditionally disadvantaged groups continue to be underserved or vulnerable in increasingly digital societies.

6.2 The importance of recognising and addressing vulnerabilities

In order to better understand how to conceptualise children and young people’s digital skills, the factors that influence these and their potential outcomes, the ySKILLS tem has studied children and young people’s online experiences. Through this research, the team have identified seven factors that influence children and young peoples’ vulnerability in the digital age. These include low



socioeconomic status, poor or fair self-reported health, low academic performance, perceived discrimination, low self-efficacy, low family and peer support and restrictive parental mediation (i.e. the extent to which parents restrict their children's use of the internet).

The longitudinal survey conducted in the ySKILLS project has found that children and young people with low levels of self-reported health, and children and young people who perceived discrimination had greater digital skills, greater content creation skills and a higher frequency of digital activities. The same children and young people also report considerably more risk behaviour than their peers. Children and young people with low academic performance also report higher intended risk behaviour than their peers. Furthermore, children and young people with low self-efficacy and low levels of peer and family support experience more exposure to cyberhate than their peers. Low family support is also linked to an increased risk of exposure to harmful content and unintended exposure to sexting. At the same time, high degrees of restrictive parental mediation are linked to lower levels of intended exposure to harmful content (Macháckova et al., 2023). Children and young people who participate in digital societies can therefore be vulnerable in different ways, and the range of factors that contribute to these vulnerabilities should be acknowledged.

Interestingly, there were only limited differences in levels of digital skills between vulnerable and less vulnerable children and young people participating in the three-wave longitudinal survey. Those with lower self-reported health and those who felt discriminated against had higher content creation skills. Those with low academic performance also report low information navigation and communication skills. Children and young people with low self-efficacy reported lower levels of digital skills, but no difference in digital knowledge. Furthermore, children and young people receiving minimal peer and family support tend to have lower communication and interaction skills (De Coninck et al., 2023).

Moreover, vulnerabilities were also linked to lower levels of engagement in communication-based activities and a higher degree of using the internet for mental health-related purposes. Children and young people with low self-efficacy were less engaged in information searching activities. However, vulnerable children and young people in general, and particularly those with low health or experiencing regular discrimination reported a higher frequency of digital activities than their peers. This difference was particularly apparent when considering the extent to which these children and young people searched for health-related information online through communicating with friends, following the news or learning something new (De Coninck et al., 2023).

Complementing this longitudinal research, the ySKILLS team also implemented three qualitative case studies to identify how children and young people who were either underserved or digitally disadvantaged in different ways (i.e. coming from low SES homes, refugee and migrant families, and/or experiencing mental health difficulties, as well as being in at-risk situations), participated in online activities and experienced opportunities or risks in these contexts. These studies explored whether digital skills contribute to improving outcomes in terms of the participants' wellbeing.

This qualitative research challenges normative definitions of digital skills, as being exclusively positive and protective in the face of risk situations, and requires recognition that extreme or difficult circumstances can lead children and young people to develop distinct and significant digital skills. Such skills include how to block or avoid negative algorithmically generated content, or where and how to seek help when they are confronted with negative online experiences. Policymakers and educators may not always recognise or value these skills. Policymakers should consider how they can implement measures to ensure that children and young people can develop these skills (see D6.1).

Collectively, these studies indicate how diverse factors influence children and young people's engagements in the digital environment, and how these in turn influence the development of digital skills, and exposure to opportunities and risks. Policymakers need to take account of this broad range



of factors at the individual and social level when crafting policies that will facilitate children and young people in participating in digital environments in ways that are both empowering and safe.

Strengthening children and young people's digital skills is therefore a multi-stakeholder effort that also requires **investment in the digital skills of those working and living with children**, such as teachers and health professionals. Parents and caregivers also play an important role in advancing children and young people's digital skills development, and states should therefore **target the digital skills of parents and caregivers specifically**.

6.3 Ensuring consistency in the conceptualisation and measurement of digital skills

To address inconsistencies in previous measurements of digital skills, the ySKILLS project conceptually outlined four key dimensions of digital skills (i.e., technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills) (Helsper et al., 2021). Combined with digital knowledge, these items are considered to form the core of 'Digital Literacy'. Children and young people's own perceptions of their digital skills within these dimensions have been measured within the project. A key recommendation arising is that a consistent conceptual and methodological approach is required in order to ascertain and analyse the levels of digital skills amongst European children and young people as well as their trajectories of change and development over time. It is important that these different dimensions of digital skills should be considered, and consistently measured, when designing policies and strategies to monitor and promote digital skills.

Complementing the self-reported measures, performance tests, experience sampling and fMRI tests have also been conducted to measure the application of digital skills in practice and under different conditions. Critically, the ySKILLS project finds significant differences in levels of digital skills reported by children and young people according to their self-perceptions, and the application of these skills in practice (van Laar et al., 2022). This confirms the results of the systematic evidence review conducted by the ySKILLS team, which indicated differences between levels of self-perception of digital skills, and the practical application of these skills (Livingstone et al., 2023). In some countries, such as Finland, the differences are substantial.

The project also indicates that while some children and young people have high levels of digital skills, on the whole, they still need access to opportunities to develop these skills, in particular as these relate both to information navigation and processing skills, communication and interaction skills and content creation and production skills.

A further key recommendation arising from the ySKILLS research is therefore that a combination of self-reported (such as survey responses) and behavioural measures (such as performance tests, or fMRI), provide greater and more nuanced insights into children and young people's digital skills.

Furthermore, the use of different measurements, beyond self-efficacy, should also be considered in the monitoring and evaluation of levels of digital skills amongst European children and young people.

In the next section, we provide more detailed information and specific action items relating to our overall recommendations. To summarise, the overall recommendations for pan-European and national policymakers and educational authorities are as follows:

Ensure young people have safe and equal access to opportunities to develop digital skills:

- **Strengthen the coordination of policies and strategies** aimed at developing children and young people's digital skills;
- **Recognise vulnerabilities** by acknowledging the influence of individual and social factors on children and young people's safety and vulnerability in digital environments. Implement strategies to maximise opportunities and minimise risks arising from these different factors.



Ensure **consistency** in the conceptualisation and measurement of young people’s digital skills and in the strategies implemented to enhance opportunities to develop these skills in practice, this entails:

- **Recognition and monitoring of four dimensions:** Acknowledge, ensure and closely monitor the four dimensions of digital skills outlined by the ySKILLS project. These encompass technical and operational, information navigation and processing, communication and interaction and content creation and production skills. Combined with digital knowledge, these items are considered to form the core of ‘Digital Literacy’.
- **Ensure recognition and monitoring of digital skills amongst all European children and young people:** These actions should extend to all European children and young people (regardless of age, gender, SES, or other individual or social factors) and to the educators and other professionals who work with them.
- **Methodological diversity for evolving digital skills:** Facilitate the advancement of a range of methodological approaches for assessing digital skills, as these continue to evolve.

Implement regulation to **enhance the positive outcomes of digital media use for children and young people’s wellbeing**. This involves:

- **Internal market regulation** to ensure the protection of children and young people’s rights in areas such as communication, data protection and privacy and protection from commercial exploitation.

The recommendations outlined in this report have been formulated based on the outcomes of the research conducted in the ySKILLS project. For an overview of the supporting evidence and the methodologies used to derive these recommendations, please see Appendix Three.

7. Detailed recommendations for policy and practice

Implementing policies and strategies to support the development of digital skills are key to secure children and young people’s opportunities and rights in the digital world both now and in their future. The ySKILLS project reveals that different dimensions of digital skills (i.e. technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills) are unequally distributed amongst European children and young people, and that the trajectories of development of these skills are influenced by a range of individual and social antecedents.

Policy actions that support the development of children and young people’s digital skills need firstly to recognise these different dimensions, and further to acknowledge the factors that influence their development as well as the potential consequences of their uneven distribution across populations of children and young people. Children and young people need to develop all four dimensions if they are to fully enjoy the benefits of digital citizenship and to actively participate in a digital democracy and society as well as the labour market.

7.1 Recommendations for EU and pan-European legislators and policy makers²

Based on the evidence generated in the ySKILLS project, we recommend that the European Union ‘EU’/ European Economic Area ‘EEA’:

² The ySKILLS [report D7.4](#) provides more information on the competences of the European Union and maps the relevant policies and strategies that relate to children and young people’s digital skills.



Ensure young people have safe and equal access to opportunities to develop digital skills:

1. Ensure and monitor the implementation of a cohesive, coordinated European strategy for the development of digital skills to provide equal access and opportunities for all children and young people, recognizing their diversity in terms of gender, age and cognitive abilities, as well as their potential vulnerabilities.
2. Strengthen the focus on developing children and young people's digital skills on the policy, research, and public agenda. This will help strike a balance between protecting children and young people from online risks and enabling their active participation in society. Such a focus ensures that children and young people's engagement in digital environments enhances their overall cognitive, psychological, physical and social wellbeing.
3. Ensure the implementation of an efficient and sustainable pan-European policy framework that recognises and addresses factors that can influence and cause vulnerabilities amongst children and young people. These include low socioeconomic status, poor or fair self-reported health, low academic performance, perceived discrimination, low self-efficacy, low family and peer support and restrictive parental mediation (i.e. the extent to which parents restrict their children's use of the internet).
4. Ensure that these policies are communicated to the intended stakeholder groups, i.e. educational authorities, parents, children and young people, etc.

Ensure coherent approaches to support the development of children and young people's digital skills.

5. Ensure coherent European educational policies and practices to enhance digital skills, including quality training opportunities for teachers and other professionals working with children and young people.
6. Prioritise the development of strategies to enhance dimensions of digital skills that are found to be less well developed amongst children and young people. Higher levels of digital skills in general are associated with more exposure to risky and potentially harmful online content (Mascheroni et al., 2020), however links to harmful outcomes are unclear (Livingstone et al., 2023). At the same time, children and young people participating in the ySKILLS project record lower levels information navigation and processing skills. These skills are also found to decrease risks of experiencing cyberhate content (Macháckova et al., 2023).

Ensure consistency in the conceptualisation and measurement of young people's digital skills and in the strategies implemented to enhance opportunities to develop these skills in practice, this entails:

7. Acknowledging the different dimensions of digital skills as conceptualised by ySKILLS, *i.e. technical and operational skills, information navigation and processing skills, communication and interaction skills, and content creation and production skills*. Recognise that children and young people develop these dimensions in various ways and that their development is influenced by a range of individual, social and contextual factors.
8. Integrate the dimensions and measurements outlined in the ySKILLS project (i.e. the youth Digital Skills Indicator 'yDSI'), with existing instruments such as DigComp, PISA and DESI to strengthen the conceptual basis, measurement and evaluation of the quality and level of digital skills among children and young people in all EU/EEA countries. Use these evaluations to adjust evidence-based policy and initiatives that aim to promote digital skills.

Implement regulation to enhance the positive outcomes of digital media use for children and young people's wellbeing. This involves:



9. Enforce and monitor the provisions of current legislation, including the Digital Services Act, to curb excessive risks posed to young people's safety and wellbeing by the actions of commercial providers of digital products and services, especially global media and communication platforms.
10. Involve relevant media and technology industry partners in the promotion of all dimensions of digital skills, including technical and operational skills (specifically privacy management) and information navigation and processing skills, among the broader public.
11. Monitor and evaluate the implementation of the GDPR to ensure the protection of data and privacy of young people.

Continue to promote support for research to investigate the development of young people's digital skills as these are influenced by ongoing social and technological developments, such as the current increasing diffusion of AI.

12. Design, fund and implement pan-European research programmes to ensure a robust and methodologically diverse knowledge base (accounting for the differences in results when measuring skills according to different methods such as self-perception, performances tests and fMRI) to inform policy making and support the development of children and young people's digital skills.

7.2 Recommendations for national policy makers

In addition to supporting the implementation of EU and pan-European policies outlined above (i.e. in section 5.1), we recommend that national governments and policy makers:

Ensure that educational authorities provide all children and young people with safe and equal access to opportunities to develop digital skills, by implementing policies including (but not limited to):

1. Providing multiple formal and informal opportunities for all children and young people to access digital environments and train all dimensions of digital skills as conceptualised by the ySKILLS project. This includes non-formal learning activities offered for free, on an accessible location and with materials provided by government entities or in collaboration with external stakeholders.

Support educational authorities in implementing and evaluating measures to address inequalities in access to digital technologies in educational contexts.

2. Identify and address social inequalities in access to a varied and current range of digital tools and services by evaluating and implementing investments in hardware and education initiatives that provide universal access to digital tools and services for all children and young people, especially at schools.
3. Develop systematic evidence-based plans to select and use devices, platforms, software programs and learning technologies for educational settings. Ensure predictability and stability in digital learning environments for all parties (teachers, students and families).
4. Regularly monitor and update national school curricula to keep track of accelerated technical advances that continue to change every-day social and civic life as well as the future labour market.
5. Recognise the importance of digital skills in risk reduction and implement a system to ensure the early detection of children and young people at risk of being left behind both in



terms indicators of vulnerability as identified by the ySKILLS project and of how these predict different outcomes regarding digital skills and wellbeing. Design and implement appropriate services and support to address these factors.

6. Implement structural and policy actions to ensure refugee children and young people are given access to a meaningful or institutional form of education where digital skills development facilitates their settlement, as well as their social, democratic, and economic integration and inclusion.

Recognise how digital skills interact with indicators of vulnerability as identified by the ySKILLS project and implement actions to mitigate against potential negative outcomes for children and young people's wellbeing.

Indicators of vulnerability identified in the ySKILLS project include low socioeconomic status, poor or fair self-reported health, low academic performance, perceived discrimination, low self-efficacy, low family and peer support and restrictive parental mediation (i.e. the extent to which parents restrict their children's use of the internet).

7. Enable educational authorities (broadly considered) to recognise factors that contribute to the vulnerability of children and young people and to support them in recognising and managing risk in their digital lives.
8. Support educational authorities in creating and sustainably developing digital skills initiatives to address the factors that contribute to the vulnerability of children and young people online.
9. Ensure young people are aware that they can consult and seek the advice of educational authorities regarding their experiences in digital environments.

Identify and implement policy actions to enhance positive outcomes of digital media use for children and young people:

10. Foster peer-to-peer education, as co-use of ICT with peers and learning from peers are associated with higher levels of digital skills and empowerment.
11. Involve children and young people in the national implementation of the digital skills agenda and in the development of the digital education curriculum.

Ensure that health practitioners are prepared to support young people in their digital everyday lives:

12. Provide expertise, training, and sufficient funding for mental health services so that children and young people can be confident of timely and appropriate therapy and support as needed for the difficulties they may encounter. Further, ensure that mental health services engage with the digital lives of young people in the same way they would address the offline factors that influence their mental health.
13. Develop public health strategies to raise awareness of problematic internet use and highlight the distinction between optimal and suboptimal forms of internet use.

7.3 Recommendations for educational authorities

In line with the pan-European and national recommendations outlined above (5.1 and 5.2), we recommend that educational authorities:

1. Implement policy actions to support the development of all four dimensions of digital skills, as outlined in the ySKILLS project, amongst all children and young people.



Support the development of digital skills amongst teachers and other educational practitioners and professionals who work with children and young people.

2. Implement digital skills development as an integral part of initial and continuous teacher-training programmes, as well as in the professional training of people who work with children and young people across the range of educational services.

Develop and implement strategies for home-school communication and interaction to enhance the digital skills of parents or caregivers and children and young people.

3. Raise parents and caregivers' awareness that a positive attitude towards ICT in the domestic environment contributes to higher digital skills and greater ability to cope with online risks.
4. Provide training for all parents and caregivers, focusing on the fundamental difference between parental protectionism versus support, and educating in the context of digital skills development and children and young people's rights in relation to the digital environment.

8. Concluding remarks

European societies are increasingly digitalised. This impacts most, if not all, social, educational and civic activities. As such, digital skills are required in order to fully participate in society. European policymakers therefore need to ensure that children and young people have the skills they need to participate in these societies. This policy making should be grounded in evidence-based research.

The ySKILLS project demonstrates that previous research regarding the conceptualisation of digital skills, as this pertains to children and young people, has lacked robust theoretical and empirical indicators to support the implementation, measurement and evaluation of relevant policies. It has therefore developed a robust indicator for children and young people's digital skills, the 'yDSI indicator'. This outlines four dimensions of digital skills (i.e. *technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills*). Together with knowledge items these dimensions form the basis of digital literacy. A central recommendation of the ySKILLS project is that the yDSI indicator be consistently integrated in approaches to measuring and evaluating levels of digital skills among children and young people.

When examining and exploring the antecedents and consequences of children and young people's digital skills, the ySKILLS team also identified grounds of vulnerability that interact with and influence the extent to which young people can develop digital skills, as well as the outcomes of these skills. These include low socioeconomic status, poor or fair self-reported health, low academic performance, perceived discrimination, low self-efficacy, low family and peer support and restrictive parental mediation (i.e. the extent to which parents restrict their children's use of the internet). It is imperative that European policymakers recognise these vulnerabilities, and design policies and strategies that account for them and enable differentiated approaches to developing digital skills amongst European children and young people.

Finally, although Europe is comprised of distinct countries, regions and cultures and 'united in diversity', it is important that policies and strategies aiming to promote digital skills strive for a coherent approach. While contextual experiences may vary, the ySKILLS project has identified that there are key individual and social factors that influence the development of digital skills. Adapting a coherent approach to the implementation of policy will increase the likelihood that strategies and actions aiming to address these factors will be effective and lead to positive outcomes.



Ultimately, European policymakers should ensure that children and young people have safe and equal access to opportunities to participate in digitalised societies, in a way that minimises risk and maximises benefits for their cognitive, psychological, physical and social wellbeing.



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Appendix One: Background documentation considered

Journal articles (peer-reviewed)

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- De Coninck, D., Waechter, N., & d’Haenens, L. (accepted). Predicting self-reported depression and health among adolescents: Time spent online mediated by digital skills and digital activities. *Cyberpsychology, Behavior and Social Networking*

Project Reports

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- **D2.2:** Mascheroni, G., Cino, D., Mikuška, J., Lacko, D., & Smahel, D. (2020). *Digital skills, risks and wellbeing among European children: Report on (f)actors that explain online acquisition, cognitive, physical, psychological and social wellbeing, and the online resilience of children and young people*. KU Leuven: ySKILLS. <https://zenodo.org/record/5226902#.Y9vBNK3MKUI>
- **D3.1:** 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://zenodo.org/record/5226910#.Y9vBMK3MKUI>
- **D3.2:** Beilmann, M., Opermann, S., Kalmus, V., Donoso, V., Retzmann, N., & d’Haenens, L. (2021). *Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector*. KU Leuven: ySKILLS. <https://zenodo.org/record/5226897#.Y9vCqK3MKUM>
- **D3.3:** 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: ySKILLS. <https://zenodo.org/record/4608010#.Y9vAXK3MKUM>
- **D3.4:** Donoso, V., Retzmann, N., Joris, W., & d’Haenens, L. (2020). *Digital skills: An inventory of actors and factors*. KU Leuven: ySKILLS. <https://zenodo.org/record/4525639#.Y9vBP3MKUM>



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- **D4.4:** Bedrosova, M.; Dufkova, E.; Fikrlova, J. & Machackova, H. (2023). *Longitudinal Survey 2nd Wave Technical Report. Estonia, Finland, Germany, Italy, Poland, Portugal,* KU Leuven: ySKILLS.
- **D4.5:** 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. (2022). *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. <https://doi.org/10.5281/zenodo.7620520>
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- **D5.2** Machackova, H., Bedrosova, M., Tolochko, P., Muzik, M., Waechter, N., & Boomgaarden, H. (2023). *Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries.* KU Leuven: ySKILLS. DOI 10.5281/zenodo.8304511
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- **D6.2:** Cino, D., Brandsen, S., Bressa, N., Eriksson, E., Mascheroni, G., & Zaman, B. (2022). *Young People's Digital Skills Practices in Non-formal Learning Contexts: observations, interviews, co-design.* KU Leuven: ySKILLS <https://zenodo.org/record/6832846#.Y9vBSa3MKUk>
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Appendix Two: Review and coding process

1. All publications and draft outputs from the ySKILLS project were identified and collated via the project website, Zenodo, Dropbox, a literature search by project team members in relevant databases (i.e. Google Scholar and Web of Science), and consultation with all WP leaders.
2. All publications were reviewed by at least two members of the D7.3 team.
3. Recommendations were identified and categorised according to the relevant stakeholder group (as stated in the publication).
4. Note: 14 stakeholder groups were identified including researchers. General recommendations, i.e., recommendations that were not addressed at any specific stakeholder groups, were also identified.
5. Recommendations per stakeholder group were inputted in an excel spreadsheet.
6. A total of 238 recommendations were recorded. Note: Where recommendations were aimed at multiple stakeholder groups these were input for each group.
7. Three D7.3 members synthesised all recommendations for each stakeholder group, removing duplicates and combining where appropriate.
8. Three key stakeholder groups were identified from the work of WP8, namely the European Union 'EU'/European Economic Area 'EEA' policy makers and regulators, national policy makers and regulators and educational authorities.
9. Recommendations for each of the 14 stakeholder groups identified, plus general recommendations were recoded according to these three key stakeholder groups.
10. Recommendations for researchers were removed.
11. Key recommendations were presented for the ySKILLS consortium at a meeting in Vienna on 3 March 2023. The consortium was then asked to consider the recommendations and identify why (based on their own research and findings) they were relevant for policy and practice. The recommendations were redrafted based on this input.
12. Recommendations from publications issued between March 2023 and August 2023 were identified and synthesised with the overall list of recommendations, per stakeholder category.
13. The outputs of the children's co-design jams, and recommendations arising, were synthesised and included in the report.
14. Key recommendations for policy and practice were synthesised.

The recommendations are now presented in this document.



Appendix Three: Overview of recommendations and underpinning evidence

Table one: Recommendations for EU policy makers

Ensure young people have safe and equal access to opportunities to develop digital skills	
1	Ensure and monitor the implementation of a cohesive, coordinated European strategy for the development of digital skills to provide equal access and opportunities for all children and young people, recognizing their diversity, recognizing their diversity in terms of gender, age and cognitive abilities, as well as their potential vulnerabilities.
	<u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See pages 6, 13, 49 93-96 and 106-107
	<u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See pages 10-12, 17-18, 26 and 42
	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 33, 56-57, 64, 67-68
	<u>D3.4: An inventory of actors and factors</u> See page 7, 8, 10, 14-15, 20-21, 23
	<u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See page 18, 33-34
	<u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21
	<u>D5.5: 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</u> See page 4 and 21
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 14, 17, 19, 29-30, 48, 87 and 106
	<u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 31, 37, 41, 74-75
	<u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43
2	Strengthen the focus on developing children and young people’s digital skills on the policy, research, and public agenda. This will help strike a balance between protecting children and young people from online risks and enabling their active participation in society. Such a focus ensures that children and young people’s engagement in digital environments enhances their overall cognitive, psychological, physical and social wellbeing.
	<u>D3.1: Report on the interviews with experts in digital skills</u> See page 29, 70
	<u>D3.4: An inventory of actors and factors</u> See page 19, 20, 25



	<p><u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See pages 35, 48 and 52-53</p>
	<p><u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25</p>
	<p><u>D5.5: 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</u> See page 4 and 21</p>
	<p><u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 19, 25 and 86</p>
	<p><u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43</p>
3	<p>Ensure the implementation of an efficient and sustainable pan-European policy framework that recognises and addresses factors that can influence and cause vulnerabilities amongst children and young people. These include low socioeconomic status, poor or fair self-reported health, low academic performance, perceived discrimination, low self-efficacy, low family and peer support and restrictive parental mediation (i.e. the extent to which parents restrict their children's use of the internet).</p>
	<p><u>D2.1: Children and young people's digital skills: A systematic literature review</u> See page 13</p>
	<p><u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See pages 30, 39 and 42</p>
	<p><u>D3.4: An inventory of actors and factors</u> See page 23 and 24</p>
	<p><u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See pages 18-19, 23-24, 26, 28, 32-33, 35, 48, 52-54</p>
	<p><u>D5.3: The Impact of Policy Interventions on Young People's Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21</p>
	<p><u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 12,14-15, 17, 25, 31, 34, 39, 49, 52, 64, 71, 79-80, 83, 86, 90, 106</p>
	<p><u>D6.2: Young People's Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design</u> See pages 6, 27, 41, 47, 51, 53-54 and 74-75</p>
	<p><u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 9 and 40-43</p>
4	<p>Ensure that these policies are communicated to the intended stakeholder groups, i.e. educational authorities, parents, children and young people, etc..</p>
	<p><u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 71-80</p>



	<p>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design See pages 6, 27, 41, 47, 51, 53-54 and 74-75</p>
<p><i>Ensure coherent approaches to support the development of children and young people’s digital skills</i></p>	
5	<p>Ensure coherent European educational policies and practices for digital skills, including quality training opportunities for teachers and other professionals working with children and young people.</p>
	<p>D2.1: Children and young people’s digital skills: A systematic literature review See page 42, 66-69</p>
	<p>D3.1: Report on the interviews with experts in digital skills See pages 12, 38-40, 66-69</p>
	<p>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach See pages 4, 7-8, 11, 13 and 15-21</p>
	<p>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills See pages 71-75</p>
	<p>D6.3: Report on the role of critical information skills in recognising mis- and disinformation See page 40-43</p>
6	<p>Prioritise the development of strategies to enhance dimensions of digital skills that are found to be less well developed amongst children and young people. Higher levels of digital skills in general are associated with more exposure to risky and potentially harmful online content (Mascheroni et al., 2020), however links to harmful outcomes are unclear (Livingstone et al., 2023). At the same time, children and young people participating in the ySKILLS project record lower levels information navigation and processing skills. These skills are also found to decrease risks of experiencing cyberhate content (Macháckova et al., 2023).</p>
	<p>D2.1: Children and young people’s digital skills: A systematic literature review See page 86 and 96-103</p>
	<p>D2.2: Digital skills, risks and wellbeing amongst European children See pages 9-10</p>
	<p>D3.3: The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure See pages 5, 14-26 and 55-63</p>
	<p>D4.5: Report on the effects of ICT use on attention-related cognitive functions measured with ESM and fMRI See pages 4, 8-11, 15 and 24</p>
	<p>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries See pages 18-19, 21-23, 26-35, 36-44, 46-48, 51-53, 54</p>
	<p>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland See pages 4-5, 8-9, 21 and 23-25</p>



	<u>D5.5: 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</u> See pages 21-23
	<u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43
<i>Ensure consistency in the conceptualisation and measurement of young people's digital skills and in the strategies implemented to enhance opportunities to develop these skills in practice, this entails:</i>	
7	Acknowledging the different dimensions of digital skills as conceptualised by ySKILLS (<i>i.e. technical and operational skills, information navigation and processing skills, communication and interaction skills and content creation and production skills</i>). Recognise that children and young people develop these dimensions in various ways and that their development is influenced by a range of individual, social and contextual factors.
	<u>D2.1: Children and young people's digital skills: A systematic literature review</u> See pages 39, 49, 111-113
	<u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See page 11, 17-19, 28-29 and 40-42
	<u>D3.1: Report on the interviews with experts in digital skills</u> See page 17, 65
	<u>D3.2: Home-school communication on children's digital skills development: Based on interviews with experts from the education sector</u> See pages 9-11, 16-20, 22-30 and 43
	<u>D3.3: The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure</u> See pages 5, 14-26 and 55-63
	<u>D3.4: An inventory of actors and factors</u> See page 6, 14 and 21
	<u>D4.5: Report on the effects of ICT use on attention-related cognitive functions measured with ESM and fMRI</u> See pages 4, 8-11, 15 and 24
	<u>D5.1: Report on the influence of situational variables and personal networks on online resilience and digital skills.</u> See pages 7, 11 and 24
	<u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries.</u> See pages 17-19, 32-35, 48, 51, 53, 54
	<u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25
	<u>D5.5: 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</u> See pages 21-23



	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 9, 13, 49, 55, 79, 87 and 89
	<u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 51, 37-41, 49, 53, 58, 71-75
	<u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43
8.	Integrate the dimensions and measures outlined in the ySKILLS project (i.e. the youth Digital Skills Indicator ‘yDSI’), with existing instruments such as DigComp, PISA and DESI to strengthen the conceptual basis, measurement and evaluation of the quality and level of digital skills among children and young people in all EU/EEA countries. Use these evaluations to adjust evidence-based policy and initiatives that aim to promote digital skills.
	<u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See pages 30-33, 41, 55, 86, 114
	<u>D4.3: The youth Digital Skills performance tests</u> See pages 8, 11 and 20
	<u>D4.5: Report on the effects of ICT use on attention-related cognitive functions measured with ESM and fMRI</u> See pages 4, 8-11, 15 and 24
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 48 and 87-90
	<u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43
<i>Implement regulation to enhance the positive outcomes of digital media use for children and young people’s wellbeing. This involves:</i>	
9.	Enforce and monitor the provisions of current legislation, including the Digital Services Act, to curb excessive risks posed to young people’s safety and wellbeing caused by the practices of commercial providers of digital products and services, especially global media and communication platforms.
	<u>D3.3: The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure</u> See pages 51-59; 74.
	<u>D4.3: The youth Digital Skills performance tests</u> See pages 13-14, 16, 18-20 and 22-24
	<u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See pages 34-35, 44-47, and p. 52
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 9, 378, 48, 83, 87-88
10.	Involve relevant media and technology industry partners in the promotion of all of the dimensions of digital skills, including technical and operational skills (specifically privacy management) and information navigation and processing skills, among the broader public.



	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 39, 60, 64 and 66
	<u>D3.4: An inventory of actors and factors</u> See page 24
	<u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 23-25
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See page 88
	<u>D6.2: Young People's Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 51-54
	<u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See pages 41-43
11	Monitor and evaluate the implementation of the GDPR to ensure the protection of data and privacy of young people.
	<u>D3.1: Report on the interviews with experts in digital skills</u> See page 30
	<u>D3.2: Home-school communication on children's digital skills development: Based on interviews with experts from the education sector</u> See page 45
	<u>D3.4: An inventory of actors and factors</u> See pages 7, 18 and 21
	<u>D6.1: Young people experiencing mental health difficulties</u> See pages 27-28, 37 and 88
<i>Continue to promote support for research to investigate the development of young people's digital skills as these are influenced by ongoing social and technological developments, such as the current increasing diffusion of AI.</i>	
12	Design, fund and implement pan-European research programmes to ensure a robust and methodologically diverse knowledge base (accounting for the differences in results when measuring skills according to different methods such as self-perception, performances tests and fMRI) to inform policy making and support the development of children and young people's digital skills.
	<u>D3.3: The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure</u> See pages 5, 14-26 and 55-63
	<u>D4.3: The youth Digital Skills performance tests</u> See pages 7, 9 and 20
	<u>D4.5: Report on the effects of ICT use on attention-related cognitive functions measured with ESM and fMRI</u> See pages 4, 8-11, 15 and 24



	<u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See page 10
	<u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25
	<u>D5.5: 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</u> See pages 21-23

Table two: Recommendations for national policy makers

<i>Ensure that educational authorities provide all children and young people with safe and equal access to opportunities to develop digital skills, by implementing policies including (but not limited to):</i>	
1.	Providing multiple formal and informal opportunities for all children and young people to access digital environments and train all dimensions of digital skills as conceptualised by the ySKILLS project. This includes non-formal learning activities offered for free, on an accessible location and with materials provided by government entities or in collaboration with external stakeholders.
	<u>D3.1: Report on the interviews with experts in digital skills</u> See page 58, 60, 67
	<u>D3.4: An inventory of actors and factors</u> See page 22 and 23
	<u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21
	<u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 51, 37-41, 49, 53, 58, 71-75
<i>Support educational authorities in implementing and evaluating measures to address inequalities in access to digital technologies in educational contexts.</i>	
2	Identify and address social inequalities in access to a varied and current range of digital tools and services by evaluating and implementing investments in hardware and education initiatives that provide universal access to digital tools and services for all children and young people, especially at schools.
	<u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See pages 6-7, 11, 41, 45, 61, 67, 86-87
	<u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See pages 9-11, 17-18, 26-27
	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 6, 10, 23, 40, 44-46



	<u>D3.4: An inventory of actors and factors</u> See pages 23
	<u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See page 18, 33-34
	<u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 29, 49, 74, 87-90, 107
3	Develop systematic evidence-based plans to select and use devices, platforms, software programs and learning technologies for educational settings. Ensure predictability and stability in digital learning environments for all parties (teachers, students and families).
	<u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See page 11
	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 19, 23 and 68
	<u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See page 29-30
	<u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21
	<u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 29, 49, 74, 87-90, 107
4	Regularly monitor and update national school curricula to keep track of accelerated technical advances which continue to change every-day social and civic life as well as the future labour market.
	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 22-23, 38-39, 58, 56-63
	<u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See page 29-30
	<u>D3.4: An inventory of actors and factors</u> See pages 14
	<u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25
	<u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 29, 49, 74, 87-90, 107



	<p><u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43</p>
5	<p>Recognise the importance of digital skills in risk reduction and implement a system to ensure the early detection of children and young people at risk of being left behind both in terms indicators of vulnerability as identified by the ySKILLS project and of how these predict different outcomes regarding digital skills and wellbeing. Design and implement appropriate services and support to address these factors.</p>
	<p><u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See pages 84-86, 99-101</p>
	<p><u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See page 38-40</p>
	<p><u>D3.1: Report on the interviews with experts in digital skills</u> See pages 59 and 66</p>
	<p><u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See pages 19, 25, 28-29</p>
	<p><u>D3.4: An inventory of actors and factors</u> See pages 8 and 14</p>
	<p><u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See page 34-35, 43-44, 52</p>
	<p><u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 71-90</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See page 50</p>
	<p><u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43</p>
6	<p>Implement structural and policy actions to ensure refugee children and young people are given access to a meaningful or institutional form of education where digital skills development facilitates their settlement, as well as their social, democratic, and economic integration and inclusion.</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 93-94</p>



Recognise how digital skills interact with indicators of vulnerability as identified by the ySKILLS project and implement actions to mitigate against potential negative outcomes for children and young people’s wellbeing.

7	Enable educational authorities (broadly considered) to recognise factors that contribute to the vulnerability of children and young people and to support them in recognising and managing risk in their digital lives.
	D2.1: Children and young people’s digital skills: A systematic literature review See page 104
	D2.2: Digital skills, risks and wellbeing amongst European children See pages 29-30, 39-40
	D3.1: Report on the interviews with experts in digital skills See pages 23, 47, 54, 68
	D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries See pages 18-19, 23-24, 26, 28, 32-33, 35, 48, 52-54
	D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland See pages 4-5, 8-9, 21 and 23-25
	D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills See pages 71-90
	D6.3: Report on the role of critical information skills in recognising mis- and disinformation See page 40-43
8	Support educational authorities in creating and sustainably developing digital skills initiatives to address the factors that contribute to the vulnerability of children and young people online.
	D2.2: Digital skills, risks and wellbeing amongst European children See page 14
	D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries See pages 18-19, 23-24, 26, 28, 32-33, 35, 48, 52-54
	D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills See pages 71-90
	D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design See pages 6, 51 and 74-75
	D6.3: Report on the role of critical information skills in recognising mis- and disinformation See page 40-43
9	Ensure young people are aware that they can consult and seek the advice of educational authorities regarding their experiences in digital environments.
	D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills See pages 55-56, 61-71, 71-90



	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 30-31, 52 and 61</p>
<p><i>Identify and implement policy actions to enhance positive outcomes of digital media use for children and young people</i></p>	
10	<p>Foster peer-to-peer education, as co-use of ICT with peers and learning from peers are associated with higher levels of digital skills and empowerment.</p>
	<p><u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See page 70, 73</p>
	<p><u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See page 28</p>
	<p><u>D3.1: Report on the interviews with experts in digital skills</u> See pages 32 and 69</p>
	<p><u>D5.1: Report on the influence of situational variables and personal networks on online resilience and digital skills.</u> See pages 7, 11 and 24</p>
	<p><u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21</p>
	<p><u>D6.1: Young people experiencing mental health difficulties: the benefits and risks of digital skills</u> See pages 8-9, 16, 29, 37, 54, 59, 80-84</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts - Observations, interviews, co-design</u> See pages 48-52, 55-61 and 72-75</p>
11	<p>Involve children and young people in the national implementation of the digital skills agenda and in the development of the digital education curriculum.</p>
	<p><u>D3.4: An inventory of actors and factors</u> See page 24</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design</u> See pages 20, 29-30, 47-50, 58, 72-75</p>
<p><i>Ensure that health practitioners are prepared to support young people in their digital everyday lives</i></p>	
12	<p>Provide expertise, training, and sufficient funding for mental health services so that children and young people can be confident of timely and appropriate therapy and support as needed for the difficulties they may encounter. Further, ensure that mental health services engage with the digital lives of young people in the same way they would address the offline factors that influence their mental health.</p>
	<p><u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25</p>



	D6.1: Young people experiencing mental health difficulties See pages 71-90
13	Develop public health strategies to raise awareness of problematic internet use and highlight the distinction between optimal and suboptimal forms of internet use.
	D4.5: Report on the effects of ICT use on attention-related cognitive functions measured with ESM and fMRI See pages 8-10 and 16
	D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries See page 34-35, 43-44, 52
	D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland See pages 4-5, 8-9, 21 and 23-25
	D5.5: 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 See pages 21-23
	D6.1: Young people experiencing mental health difficulties See pages 64-68, 83-84, 86-88, 105-108
	D6.3: Report on the role of critical information skills in recognising mis- and disinformation See page 40-43

Table three: Recommendations for educational authorities

<i>1. In line with pan-European and national recommendations arising from the ySKILLS project, implement policy actions to support the development of all four dimensions of digital skills amongst all children and young people.</i>	
	D3.3: The youth Digital Skills Indicator: Report on the conceptualisation and development of the ySKILLS digital skills measure See pages 5, 14-26 and 55-63
	D4.3: The youth Digital Skills performance tests See pages 6-9 and 19-20
	D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries See pages 18-19, 21-23, 26-35, 36-44, 46-48, 51-53, 54
	D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach See pages 4, 7-8, 11, 13 and 15-21
	D5.5: 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 See pages 21-23
	D6.3: Report on the role of critical information skills in recognising mis- and disinformation See page 40-43



Support the development of digital skills amongst teachers and other educational practitioners and professionals who work with children and young people.

2	Implement digital skills development as an integral part of initial and continuous teacher-training programmes, as well as in the professional training of people who work with children and young people across the range of educational services.
	<u>D3.1: Report on the interviews with experts in digital skills</u> See pages 12, 38-40, 66-69
	<u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See page 11 and 29
	<u>D3.4: An inventory of actors and factors</u> See pages 15, 19, 21, 23
	<u>D5.3: The Impact of Policy Interventions on Young People’s Digital Skills Development: A Simulation Approach</u> See pages 4, 7-8, 11, 13 and 15-21
	<u>D6.1: Young people experiencing mental health difficulties’ and WP6 Interactive report</u> See pages 71-90
	<u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design</u> See pages 72-75

Develop and implement strategies for home-school communication and interaction to enhance the digital skills of parents or caregivers and children and young people.

3	Raise parents and caregivers’ awareness that a positive attitude towards ICT in the domestic environment can contribute to higher digital skills and greater ability to cope with online risks.
	<u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See page 110, 114
	<u>D2.2: Digital skills, risks and wellbeing amongst European children</u> See pages 20-22, 24, 28, 30-31-32, 35, 41, 51
	<u>D3.1: Report on the interviews with experts in digital skills</u> See page 35
	<u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See page 18, 23, 27, 29
	<u>D3.4: An inventory of actors and factors</u> See page 8, 10-11 and 23
	<u>D5.1: Report on the influence of situational variables and personal networks on online resilience and digital skills.</u> See pages 9-11 and 33



	<p><u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See pages 19, 25-26, 32-33 and 54</p>
	<p><u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25</p>
	<p><u>D5.5: 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</u> See pages 21-23</p>
	<p><u>D6.1: Young people experiencing mental health difficulties´ and WP6 Interactive report</u> See pages 71-90</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design</u> See pages 72-75</p>
5	<p>Provide training for all parents and caregivers, focusing on the fundamental difference between parental protectionism versus support, and educating in the context of digital skills development and children and young people’s rights in relation to the digital environment.</p>
	<p><u>D2.1: Children and young people’s digital skills: A systematic literature review</u> See page 98</p>
	<p><u>D3.2: Home-school communication on children’s digital skills development: Based on interviews with experts from the education sector</u> See page 29</p>
	<p><u>D5.2: Digital skills among children and youth: A report from a three-wave longitudinal study in six European countries</u> See pages 19, 25-26, 32-33 and 54</p>
	<p><u>D5.4: Situational and daily technology use and wellbeing among adolescents. A report on the findings from an ESM study conducted in Belgium and Finland</u> See pages 4-5, 8-9, 21 and 23-25</p>
	<p><u>D5.5: 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</u> See pages 21-23</p>
	<p><u>D6.1: Young people experiencing mental health difficulties´ and WP6 Interactive report</u> See pages 71-90</p>
	<p><u>D6.2: Young People’s Digital Skills Practices in Non-formal Learning Contexts – Observations, interviews, co-design</u> See pages 72-75</p>
	<p><u>D6.3: Report on the role of critical information skills in recognising mis- and disinformation</u> See page 40-43</p>

