Media and Communication
2025 • Volume 13 • Article 8963
https://doi.org/10.17645/mac.8963

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Open Access Journal

Digital Skills' Role in Intended and Unintended Exposure to Harmful Online Content Among European Adolescents

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Submitted: 15 July 2024 **Accepted:** 12 November 2024 **Published:** 23 January 2025

Issue: This article is part of the issue "Evaluating and Enhancing Media Literacy and Digital Skills" edited by Leen d'Haenens (KU Leuven) and Willem Joris (Vrije Universiteit Brussel), fully open access at https://doi.org/10.17645/mac.i466

Abstract

Digital skills play a crucial role in shaping adolescents' online experiences, serving both as a shield against harmful content and as a gateway to accessing it. Previous studies on online harmful content have predominantly focused on general exposure, overlooking the distinction between intended and unintended exposure (i.e., whether the adolescent deliberately sought out the content or was unexpectedly exposed to it). Moreover, existing studies did not consider the role of adolescents' digital skills. This exploratory study aims to newly examine the role of the subtypes of digital skills in the intended and unintended exposure to harmful online content among adolescents from four European countries, as well as the influence of protective and risky factors according to the problem behavior theory. Using multinomial logistic regression, a sample of 3,934 adolescents aged 12 to 17 (M = 14.4, SD = 1.3; 51% boys) from Estonia, Finland, Italy, and Poland was examined. The results show different associations with respect to the type of exposure. For instance, knowledge skills and technical/operational skills were found to be associated with unintentional exposure to harmful online content, but not with intentional exposure. Similarly, the protective role of the family was suggested in intentional exposure but not in unintentional exposure. These findings underscore the importance of raising awareness among educators and parents regarding the dual nature of digital skills. Rather than solely emphasizing their protective potential, we shall acknowledge and address the potential risks associated with certain facets of digital proficiency.

Keywords

adolescents; digital skills; harmful online content; intended exposure; risk factors; unintended exposure

1. Introduction

Nowadays, adolescents enter the online environment at an ever-younger age. This brings concerns about their safety in terms of their potential exposure to online risks (Livingstone & Helsper, 2010). These risks, which include a diverse set of intended and unintended experiences, may include encountering harmful online content (HOC; e.g., Livingstone & Haddon, 2008). HOC is defined as a wide range of content that depicts or promotes psychologically and physically harmful behaviors, attitudes, and experiences (Keipi et al., 2017). It is often encountered by adolescents; within the European context, 8–17% of adolescents stated that they were exposed to various types of harmful content online at least monthly (Smahel et al., 2020). According to current research, the exposure of adolescents to harmful content is associated with reduced subjective well-being and mental health issues (Hökby et al., 2016; Keipi et al., 2017; Mars et al., 2020), as well as involvement in risky activities in offline settings (Branley & Covey, 2017). Previous studies about HOC examined only general exposure, and they did not distinguish between intended and unintended exposure, nor did they consider the role of the adolescents' digital skills (e.g., Kvardova et al., 2021). This study is the first to investigate the role of digital skills related to adolescents' intended and unintended exposure to harmful online content (EHOC), while newly differentiating three dimensions of digital skills—technical and operational skills; communication and interaction skills; and knowledge skills—which could differ in their roles in EHOC. Further developing the problem behavior theory (Jessor, 2014), the study also explores the role of potentially risky factors (i.e., sensation seeking, low life satisfaction) and protective factors (i.e., social support from family, social support from friends). The study includes adolescents from four European countries—Estonia, Finland, Italy, and Poland.

2. HOC

Adolescence is marked by increased risk-taking behaviors, such as experimenting with illegal drugs and alcohol (Jackson et al., 2016). In our digital era, adolescents may encounter online content that depicts such risky behaviors, introducing them to digital risks (Livingstone & Helsper, 2010). Digital risks are defined as situations that may result in harm, either intentionally or unintentionally (Livingstone & Stoilova, 2021). Digital risks can take many forms, including EHOC in depictions of drug use, alcohol consumption, and unhealthy dieting. Such exposures have been linked to an increased risk of depression and self-harm (Hökby et al., 2016; Mars et al., 2020). These outcomes may not only result from such digital risk encounters but also act as predictors of further exposure to similar risks. Moreover, digital risks are increasingly recognized for their potential to negatively affect young people's mental well-being (Mascheroni et al., 2020).

Concerns about adolescents' online safety are therefore widely discussed (Haddon et al., 2020), as adolescents may lack the digital skills needed to properly assess HOC (Keipi et al., 2017). Online content related to drug use may include the disclosure of drug-related activities, guidelines for drug use, and debates about morality and legality (Costello et al., 2016). Online content that depicts alcohol consumption can contain personal descriptions of alcohol use and pictures of people drinking alcohol (Moreno et al., 2009), which often convey positive attitudes toward its consumption (Beullens & Schepers, 2013). Similarly, online content that depicts harmful and unhealthy eating may encourage adolescents to adopt unhealthy lifestyles. Such content may include pictures of ultra-thin bodies, the experiences of users with eating disorders, and tips for sustaining eating disorders (Ging & Garvey, 2018).

Notably, EHOC increases the likelihood of adolescents engaging in offline risky behaviors (Branley & Covey, 2017), which reinforces these activities as social norms (West et al., 2012). For example, adolescents may mimic behaviors like drug use after being exposed to online depictions, especially when endorsed by influencers (Motyka & Al-Imam, 2021). Similarly, content about alcohol can encourage offline drinking (Beullens & Vandenbosch, 2016). Moreover, social media's interactive nature can amplify peer-driven comparisons, leading to issues like disordered eating (Hummel & Smith, 2015). Overall, EHOC poses significant risks not only to adolescents' online experiences but also to their offline lives, including their mental health, as these risks may be intertwined with emotional problems (Mascheroni et al., 2020).

3. Intended and Unintended EHOC

Our study employs the CO:RE classification of online risk by Livingstone and Stoilova (2021), which views online risk as arising from the interaction between a child's agency and the digital environment, including algorithms. This classification outlines four dimensions of risk: content, contact, conduct, and contract. Since we focus on HOC in our study, we are exploring a form of content risk that may be viewed either unintentionally or intentionally. Unintentional exposure occurs when adolescents stumble upon HOC, such as explicit, violent, age-restricted material or content, that promotes dangerous behaviors, like drug abuse or anorexia (Răcătău, 2013). Intentional exposure may, on the other hand, involve purposefully seeking out harmful materials, such as searching for extreme diet tips, pornographic material, or types of illegal drugs. This study differentiates between unintentional and intentional EHOC, unlike previous studies (Kvardova et al., 2021), emphasizing the importance of understanding different influential factors.

4. Problem Behavior Theory: Protective and Risky Factors of Online Behavior

While risks arise from both online and offline contexts, their presence does not guarantee harm or a uniform impact on all adolescents (Livingstone, 2013). Some of them, labeled as "vulnerable" (Sonck & de Haan, 2013), may face heightened risks and harm online, which is influenced by individual and social factors like parent–child relationships (Livingstone, 2010). Problem behavior theory (Jessor, 2014) posits social support (e.g., family, friends) as a protective deterrent to risky behavior, while risk factors amplify engagement in problematic actions through models and opportunities (Jessor et al., 2003). Recent studies successfully extended this theory to online behaviors (Kvardova et al., 2021). Our study focuses on potential risky (i.e., low life satisfaction, sensation seeking) and protective (i.e., family and friend support) factors that influence adolescents' EHOC. It is important to note that our study is based on cross-sectional data and, as such, we cannot infer the directionality of the observed associations.

4.1. Protective Factors of Online Risks and HOC

According to theoretical propositions, it seems that similar online activities and online risks are clustered, and the same risky and protective factors (i.e., variables) can impact the cluster of online risks in similar ways (Smahel et al., 2022). Therefore, in this section, we look at the important variables that serve as protective factors for different online risks and HOC.

4.1.1. Role of Family Support

Adolescence is a period when the family is a key protective factor against risky behaviors, both offline and online (Loke & Mak, 2013). Parental support, marked by warmth and involvement, aids the smooth transition from childhood to adulthood (Newland, 2014). Conversely, a lack of support escalates the chances for risky behaviors (Becoña et al., 2012). Family support is pivotal in deterring harmful actions, including EHOC (Livingstone & Smith, 2014). Supportive practices, such as parental mediation, a process through which parents guide and regulate their children's media use, are one of the key protective strategies in ensuring safer digital use (Livingstone & Helsper, 2008). This is particularly effective in helping children understand and critically evaluate the content they encounter (Livingstone & Helsper, 2008), including HOC. Family support can help children navigate online environments more safely, reducing their exposure to risky content. Previous studies have also shown that individual risk factors for EHOC can be mitigated by a positive family environment (Kvardova et al., 2021).

4.1.2. Role of Friend Support

The transition to adolescence reshapes youths' social networks, with peers becoming vital support (Brown & Larson, 2009). Cooperative skills and diverse perspectives develop through peer interactions (Molleman et al., 2022). Adolescents discuss online experiences, seek advice, and shape digital conduct with friends (Wolak et al., 2006). Supportive relationships with friends may therefore play a protective role against offline and online risky experiences (Wolak et al., 2006). However, previous studies (Molleman et al., 2022) suggested that peer influence may be a double-edged sword: It can prompt rule compliance and promote pro-sociality, but it can also provoke rule violations and reduce pro-sociality. Relatedly, previous research on EHOC (Kvardova et al., 2021) indicated the importance of friends' negative influence, with friend support emerging as a risk factor. It is thus essential to examine the role of friend support more closely by distinguishing between intentional and unintentional EHOC.

4.2. Risky Factors of Online Risks and HOC

4.2.1. Role of Sensation Seeking

Sensation seeking is a personal trait defined by a thirst for novelty and adventure, and a general willingness to undertake risks (Pikó & Pinczés, 2019). Unlike curiosity, which drives intellectual exploration and learning, sensation seeking often leads to engagement in risky behaviors with potential negative consequences. There is a risk factor to engaging in various risky situations, like the abuse of alcohol (Lac & Donaldson, 2021). It has been shown that sensation seekers tend to take more risks, both in offline and online environments. The internet, in particular, provides numerous opportunities for adolescents to experiment with risky behavior (Livingstone & Smith, 2014). Even with no intention to encounter potentially harmful online content, sensation seekers tend to use the internet more frequently and often visit a variety of online spaces where such content can be found (Sheldon, 2012). Previous studies have shown that higher sensation seeking is associated with higher EHOC (Kvardova et al., 2021).

4.2.2. Role of Low Life Satisfaction

Life satisfaction, which is defined as one's perceived quality of life based on individual preferences across various areas (Henrich & Herschbach, 2000), tends to drop during adolescence, often reaching all-time lows (Gomez et al., 2013). It is a significant predictor of depressive disorders and suicidal thoughts (Park et al., 2005), and it is linked to adverse health behaviors (Valois et al., 2003). Adolescents with lower life satisfaction are more susceptible to online risks, like HOC, cyberhate, and violent extremism (Stoilova et al., 2021). This study focuses on whether low life satisfaction acts as a risk factor in EHOC.

5. Role of Digital Skills in EHOC

Given that all children are not similarly affected by the risks they encounter, it is particularly important to understand the role of digital skills (Haddon et al., 2020). Digital skills are defined as the ability to use information and communication technologies (ICTs) in ways that help achieve beneficial, high-quality outcomes in everyday life for individuals and others, while reducing potential harm associated with the more negative aspects of digital engagement (International Telecommunication Union, 2018). Digital skills are two-sided in terms of their implications because they come with both opportunities and risks (Mascheroni et al., 2020). The link between digital skills and online risk is not straightforward. Better skills are associated with more online opportunities, which are linked to more risk. Young people with higher levels of digital skills generally take advantage of more online opportunities and, as a result, spend more time online (Haddon et al., 2020). Hence, higher levels of digital skills are related to more exposure to risky and potentially harmful online content (Donoso et al., 2020). However, higher levels of digital skills were also shown to be associated with better achievement of positive outcomes and avoidance of negative consequences from internet use (van Deursen, 2020). It is likely that the harmful consequences of using the internet may be avoided by learning and improving specific digital skills (Sonck & de Haan, 2013).

The evidence suggests that the types of skills matter (Donoso et al., 2020). Research shows that digital skills are multidimensional and can be divided into various categories, each of which plays a unique role in navigating online risks and opportunities. For example, technical and operational skills (i.e., the ability to use devices, software, and networks effectively) are foundational for accessing online content and interacting with digital environments (Helsper et al., 2020). However, as previous studies (e.g., Carretero et al., 2017; Helsper et al., 2020) have pointed out, technical skills alone are insufficient to fully navigate the complexities of the digital world. Without additional critical and evaluative skills, technical competencies often lead to more passive engagement, resulting in exposure to online risks such as HOC (van Deursen & van Dijk, 2014).

Moreover, communication and interaction skills are essential for meaningful participation in online spaces, as they enable users to engage with others, share content, and express opinions while managing online relationships (Helsper et al., 2020). Strong communication skills help mitigate the risks associated with harmful online interactions, such as cyberbullying and exposure to inappropriate content, by equipping users with the tools to recognize, manage, and respond to online threats (Livingstone et al., 2016). Finally, knowledge skills are increasingly recognized as vital for navigating the digital environment, especially in relation to critically evaluating the credibility of online information and avoiding misinformation or harmful content (Helsper et al., 2020).

Even though previous research and frameworks, such as DigComp (e.g., Carretero et al., 2017), have acknowledged the need to differentiate between various digital skills, many studies still adopt a one-dimensional approach, focusing primarily on technical skills like software installation and device control (Helsper et al., 2020). As Helsper et al. (2020) note:

> Having just functional skills (understanding the functionalities of ICTs and being able to use them) is associated with more passive, consumptive participation in digital societies, while critical skills (understanding how and why technologies are designed and certain content is produced in particular ways) are essential for more active, constructive participation. (p. 15)

As a result, there is a lack of sufficient evidence that fully explores the broader range of digital skills.

In this study, we identify three types of digital skills that we believe are linked to EHOC: technical and operational skills; communication and interaction skills; and knowledge skills (Helsper et al., 2020). Technical and operational skills involve "the ability to manage and operate ICTs and the technical affordances of devices, platforms, and apps, from 'button' knowledge to settings management to programming" (Machackova et al., 2023, p. 8). Communication and interaction skills refer to "the ability to use different digital media and technological features to interact with others and build networks, as well as to critically evaluate the impact of interpersonal mediated communication and interactions on others" (Machackova et al., 2023, p. 9). Lastly, knowledge skills describe "the knowledge of the different aspects of internet-related properties (e.g., the functionality of hashtags)" (Machackova et al., 2023, p. 9). All these skills are part of the broader concept of digital literacy. The ySKILLS framework defines digital literacy as encompassing both functional digital skills and critical knowledge, which includes the understanding of the societal implications of digital technology and the ability to critically assess content (Smahel et al., 2023). While digital literacy is a broader construct, this study focuses specifically on the digital skills that adolescents may apply in relation to EHOC.

6. Control Variables

In addition to digital skills and the risk and protective factors on which this article focuses, previous research has identified additional variables that predict youth susceptibility to online risky behavior. Time spent online (Costello et al., 2016) and age (Sonck & de Haan, 2013) have been found to have positive associations with risky online encounters. For instance, older individuals spend more time online, visit more online platforms, and interact with more people online, thus being more likely to visit risky or harmful places (Oksanen et al., 2016). Similarly, gender may also play a role in exposure to potentially risky content. It has been shown that boys more frequently report looking at online content related to self-harm and suicide (Keipi et al., 2017) and at sexually explicit material (Peter & Valkenburg, 2006). Socio-economic status (SES) has also been found to be related to adolescents' EHOC (Notten & Nikken, 2014). On that basis, the analysis in the current study controlled for gender, age, SES, time spent online, and differences among countries.

7. Current Study

This exploratory study aims to shed light on the role of digital skills and selected risky and protective factors in the exposure of adolescents to HOC, both intended and unintended. Past research is broad in its conception of

digital skills and often lacks differentiation between sub-skill types (Haddon et al., 2020). Moreover, previous studies (e.g., Kvardova et al., 2021) did not distinguish between unintentional and intentional exposure to such content. The present study aims to fill this knowledge gap. It explores the following research questions (see Figure 1 for a graphical representation of the research questions):

> RQ1: What are the associations among three types of digital skills (i.e., technical and operational skills; communication and interaction skills; and knowledge skills) and intentional online harmful content exposure, while considering the role of risk factors (i.e., low life satisfaction, sensation seeking) and protective factors (i.e., social support from family, social support from friends)?

> RQ2: What are the associations among three types of digital skills (i.e., technical and operational skills; communication and interaction skills; and knowledge skills) and unintentional online harmful content exposure, while considering the role of risk factors (i.e., low life satisfaction, sensation seeking) and protective factors (i.e., social support from family, social support from friends)?

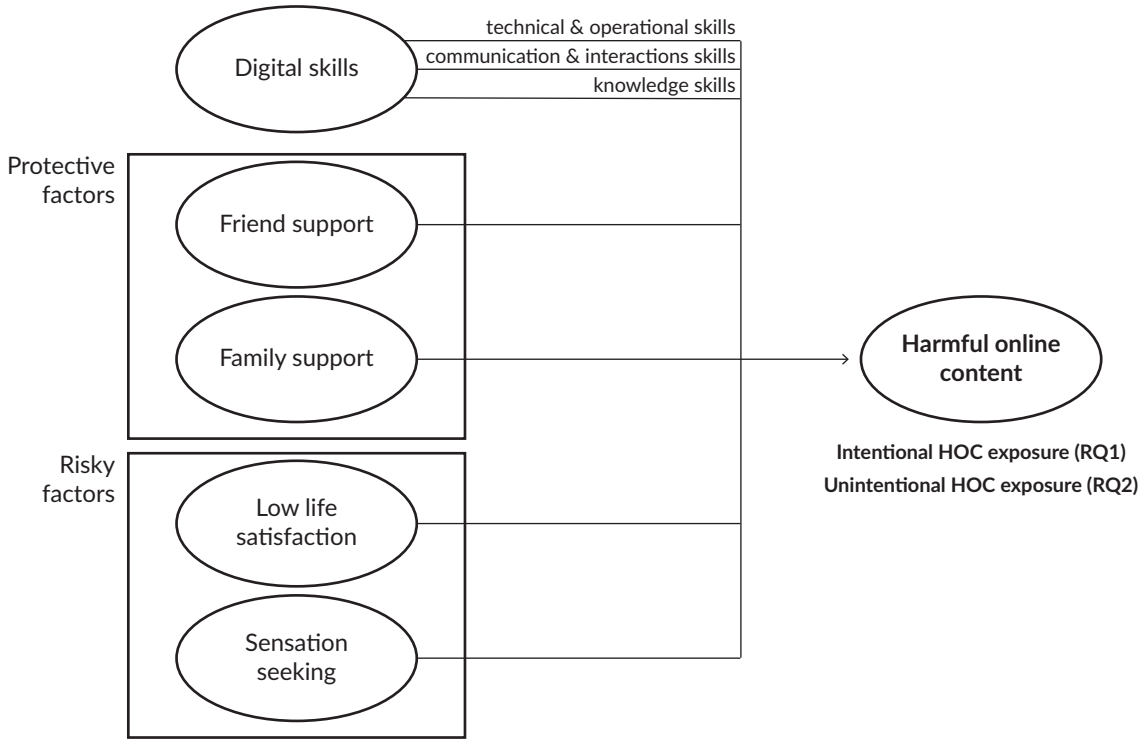

Figure 1. Graphic display of research questions.

8. Methods

8.1. Sample

The current study utilized data from the ySKILLS project. The sample encompasses 3,934 Estonian, Finnish, Italian, and Polish adolescents aged 12 to 17 (M = 14.4, SD = 1.3; 51% boys). Individual samples included 1,221 adolescents from Estonia (age: M = 14.97, SD = 1.22; 50.6% girls), 713 from Finland (age: M = 13.95, SD = 1.07; 52.7% girls), 943 from Italy (age: M = 14.03, SD = 1.24; 58.2% boys), and 1,057 from Poland (age:

M = 14.18, *SD* = 1.35; 51.6% girls). For the purpose of this study, these four countries were selected because they all included the risk-related questions we focus on in our study. For more information about the country sampling, see Machackova et al. (2024) and Machackova et al. (2023).

8.2. Procedures

Data were collected between April and December 2021 in Estonian, Finnish, Italian, and Polish schools. The schools were selected based on their SES to ensure diversity. Convenience sampling was used. Computer-assisted online questionnaires were completed by the children in school computer classrooms or at home during distance learning. To address translation quality and ensure equivalence in meaning across the countries, members of the ySKILLS team in each of the participating countries coordinated and supervised the translation of the questionnaire. This process included two phases of cognitive testing to assess the participants' understanding of the questions. The initial phase, conducted in August and September 2020 with 60 participants across six countries, focused on evaluating the youths' comprehension of question wording, examples, and digital skills items. Based on this feedback, the questionnaire was revised and tested again in January and February 2021 with 37 youth participants, including 12 from the youngest age group who also evaluated the length of the questionnaire. These two rounds of testing helped confirm that the questions were clear and consistent in meaning across the translations (Machackova et al., 2024). The research has been approved by institutional review boards in each participating country. Informed consent (active or passive) from the children and their legal guardians was obtained prior to the administration of the questionnaires. Adolescents were assured anonymity and given the option to respond with "I prefer not to say" or "I don't know/I do not understand what you mean by this" for each question. For more details about the data collection, see Machackova et al. (2024) and Machackova et al. (2023).

8.3. Measures

In terms of EHOC, we distinguished between intended and unintended exposure. Intended exposure is when the adolescent looked for the content or expected to receive it from somebody else. Unintended exposure is when the adolescent did not look for the content or did not expect to receive it or encounter it, yet still saw it. Adolescents were given the following instruction:

> On the internet, you may also encounter content (texts, images, videos) that is not healthy or that can be harmful. This includes content about taking drugs, alcohol, harmful and unhealthy dieting or eating, or other behavior which can be harmful for your health.

Subsequently, they were asked if they had seen something like that content online or on a phone in the past year (yes or no); and how often they had seen something like that when they intended/did not intend to see it: "How often have you seen something like this when you INTENDED to see it?"; "How often have you seen something like this when you DID NOT INTEND to see it?" Respondents answered on a scale that ranged from 1 (*never*) to 6 (*daily or almost daily*).

Digital skills were sorted into three dimensions: technical and operational skills; communication and interaction skills; and knowledge skills. They are based on how Helsper et al. (2020) conceptualized these dimensions within the youth Digital Skills Indicator (yDSI).

Technical and operational skills were assessed with the following:

> Please indicate how true the following six statements are of you when thinking about how you use the internet and technologies such as mobile phones or computers (e.g., I know how to adjust privacy settings; I know how to turn off the location settings on mobile devices).

Adolescents were asked to respond on a scale that ranged from 1 (*not at all true of me*) to 5 (*very true of me*). The internal consistency was $\omega = 0.75$.

Communication and interaction skills were assessed with the following:

> Please indicate how true the following six statements are of you when thinking about how you use the internet and technologies such as mobile phones or computers (e.g., I know when I should mute myself or disable video in online interactions; I know how to report negative content relating to me or a group to which I belong).

Adolescents responded on a scale that ranged from 1 (*not at all true of me*) to 5 (*very true of me*). The internal consistency was $\omega = 0.76$.

Knowledge skills were assessed with the following:

> To what extent are the following six statements about technologies such as the internet and mobile phones true or not true? (e.g., The first search result is always the best information source; Whether I like or share a post can have a negative impact on others; Using hashtags # increases the visibility of a post).

Adolescents were asked to respond on a scale that ranged from 1 (*definitely not true*) to 3 (*definitely true*). The internal consistency was $\omega = 0.42$, possibly because different items covered different online situations and may not always apply. This is further discussed in the Limitations section.

Sensation seeking was measured with the Brief Sensation Seeking Scale (Hoyle et al., 2002). Adolescents reported how strongly they agreed or disagreed with four statements (e.g., I would like to explore strange places; I like to do frightening things) on a scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The internal consistency was $\omega = 0.75$.

Life satisfaction was measured with the Short Depression–Happiness Scale (Joseph et al., 2004). Adolescents were asked how true six statements were about themselves in the past year (e.g., I felt happy; I felt pleased with the way I am; I felt that life is enjoyable). They were asked to respond on a scale that ranged from 1 (*never*) to 4 (*often*). The internal consistency of the scale was $\omega = 0.79$.

Family support was measured with three items that asked about family support (i.e., When I speak someone listens to what I say; My family really tries to help me) and feeling safe (i.e., I feel safe at home). The first item was adapted from the Health Behavior in School-Aged Children survey (WHO, 2016); the second item was drawn from the Multidimensional Scale of Perceived Social Support (Zimet et al., 2010); and the third

item was developed for the EU Kids Online Survey. Participants reported the extent to which these three statements were true on a scale that ranged from 1 (*not true*) to 4 (*very true*). The internal consistency of the scale was $\omega = 0.76$.

Friend support was assessed with three items from the Friends Subscale of the Multidimensional Scale of Perceived Social Support (Zimet et al., 2010). Adolescents rated how truthful the following three statements were: "My friends really try to help me"; "I can count on my friends when things go wrong"; and "I can talk about my problems with my friends." Participants responded on a scale that ranged from 1 (*not true*) to 4 (*very true*). The internal consistency was $\omega = 0.85$.

Time spent online was measured with the following question: "About how long do you spend on the internet during a regular weekday (i.e., school day)?" Answers ranged from 1 (*little or no time*) to 9 (*about 7 hours or more*).

SES was assessed with the following question: "Which of the following best describes your financial situation and that of the people with whom you live?" (Centrum Badania Opinii Społecznej, 2014). Answers ranged from 1 (*we live very well – we can purchase luxury items and still have money left over*) to 5 (*we struggle to get by – we sometimes do not have enough money to afford basic needs, such as food and clothes*).

8.4. Analysis

We conducted a multinomial logistic regression. Two models were created: one for intentional EHOC and another for unintentional EHOC. Before running the models, we checked for multicollinearity, assessed residuals' independence, and tested linearity using the Box-Tidwell Test. Linearity assumptions were violated for SES, friend support, and low life satisfaction in the intentional exposure model, and for sensation seeking in the unintentional exposure model. Quadratic terms were included in these models to explore potential curvilinear relationships.

9. Results

9.1. Missing Data

Regarding the occurrence of missing values in the dependent variables, 28.2% of the values were missing for intentional EHOC and 27.5% for unintentional EHOC. This pattern suggests that the missingness may not be entirely random but may be potentially influenced by the sensitive nature of EHOC, where respondents might have chosen not to answer specific questions. Further details on how missing data was categorized and managed in this dataset can be found in Machackova et al. (2024), where each missing value type is coded and the implications are discussed comprehensively. The occurrence of missing values is further discussed in the Limitations section.

9.2. Descriptive Statistics and Data Transformation

We transformed the dependent variables for our models (i.e., intentional EHOC; unintentional EHOC) into three frequency categories: never; rarely; at least monthly. The "rarely" category consisted of the options: once; a few times. The "at least monthly" category included the options: at least every month; at least every

week; daily or almost daily. We did this to distinguish no exposure from non-frequent and high exposure in order to keep a solid number of respondents in each category for the analysis. As for the sub-dimensions of digital skills, we calculated the proportion of skills at a high level by dividing the high-skill score by the number of items in the given dimension (Helsper et al., 2020). The digital skill scale was scored with a value of zero to one. Descriptive statistics for the continuous variables are listed in Table 1. The full model results are listed in Tables 2 and 3.

Table 1. Descriptive statistics of continuous variables.

	M	*SD*	Min	Max
Age (years)	14.35	1.30	12	17
SES	2.20	0.64	1	5
Time spent online	6.09	1.92	1	9
Family support	3.50	0.61	1	4
Friend support	3.22	0.75	1	4
Sensation seeking	3.21	0.92	1	5
Low life satisfaction	2.49	0.84	1	4
Technical and operational skills	0.56	0.31	0	1
Communication and interaction skills	0.64	0.30	0	1
Knowledge skills	0.50	0.25	0	1

Notes: For the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); the model with the dependent variable set to intentional exposure has a significantly better fit than the null model ($\chi^2(28) = 323.34$, $p < .001$, Nagelkerke $R^2 = .20$).

Table 2. Intentional EHOC (RQ1).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	*b*	OR	LL	UL
Intercept	−0.23	—	—	—	−1.82***	—	—	—
Age	0.23***	1.25	1.13	1.38	0.25***	1.28	1.11	1.49
Gender	−0.08	0.92	0.71	1.21	0.10	1.11	0.75	1.65
SES	−0.02	0.98	0.80	1.19	−0.03	0.97	0.75	1.27
SES ²	0.09	1.09	0.92	1.30	0.26*	1.29	1.05	1.58
Time spent online	0.08*	1.09	1.01	1.17	0.24***	1.27	1.14	1.41
Friend support	−0.09	0.92	0.74	1.14	0.12	1.13	0.82	1.56
Friend support ²	−0.29**	0.75	0.61	0.92	−0.08	0.93	0.71	1.21
Family support	−0.10	0.90	0.71	1.15	−0.42**	0.66	0.48	0.90
Sensation seeking	0.68***	1.98	1.70	2.30	0.72***	2.06	1.64	2.58
Low life satisfaction	0.39***	1.48	1.24	1.77	0.36**	1.44	1.11	1.87
Low life satisfaction ²	−0.22*	0.81	0.68	0.96	−0.17	0.85	0.66	1.09
Technical and operational skills	0.25	1.28	0.77	2.13	0.14	1.15	0.55	2.41
Communication and interaction skills	−0.28	0.76	0.45	1.28	−0.28	0.76	0.35	1.63
Knowledge skills	0.36	1.44	0.84	2.46	0.13	1.14	0.52	2.51

Table 2. (Cont.) Intentional EHOC (RQ1).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	*b*	OR	LL	UL
Finland	−0.26	0.77	0.51	1.16	0.07	1.08	0.56	2.07
Italy	−0.01	1.01	0.72	1.41	0.27	1.31	0.77	2.23
Poland	−0.63***	0.53	0.37	0.77	−1.06***	0.35	0.21	0.57

Notes: $N = 1{,}809$; *b* = unstandardized regression coefficient; OR = odds ratio; LL = lower level; UL = upper level; * $p < .050$, ** $p < .010$, *** $p < .001$; the reference category is Never; the reference country is Estonia; Gender 0 = boys, 1 = girls.; for the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); variables with a superscript ² indicate their quadratic (curvilinear) transformations included in the analysis to capture non-linear effects; the model with the dependent variable set to unintended exposure outperforms the null model ($\chi^2(28) = 326.65$, $p < .001$, Nagelkerke $R^2 = .19$).

Table 3. Unintentional EHOC (RQ2).

	Never vs. Rarely				Never vs. At Least Monthly			
			95% CI				95% CI	
	b	OR	LL	UL	b	OR	LL	UL
Intercept	−0.11	—	—	—	−0.80	—	—	—
Age	0.19***	1.21	1.10	1.32	0.13*	1.14	1.01	1.29
Gender	−0.62***	0.54	0.42	0.68	−0.88***	0.41	0.30	0.57
SES	0.18*	1.20	1.00	1.43	0.25*	1.29	1.02	1.62
Time spent online	0.07*	1.07	1.00	1.14	0.14**	1.15	1.05	1.25
Friend support	−0.07	0.94	0.79	1.12	−0.16	0.85	0.68	1.06
Family support	0.14	1.15	0.92	1.44	0.13	1.14	0.86	1.52
Sensation seeking	0.35***	1.43	1.25	1.62	0.47***	1.60	1.32	1.94
Sensation seeking ²	−0.13*	0.88	0.79	0.99	−0.21**	0.81	0.68	0.97
Low life satisfaction	0.29***	1.33	1.14	1.56	0.50***	1.65	1.34	2.04
Technical and operational skills	0.49*	1.63	1.03	2.57	0.45	1.58	0.85	2.92
Communication and interaction skills	−0.30	0.74	0.46	1.18	−0.24	0.78	0.41	1.48
Knowledge skills	1.34***	3.83	2.33	6.28	1.90***	6.66	3.39	13.08
Finland	0.58**	1.79	1.24	2.61	0.36	1.43	0.88	2.33
Italy	−0.01	0.99	0.73	1.34	0.02	1.02	0.67	1.55
Poland	−0.33*	0.72	0.52	1.00	−0.30	0.74	0.48	1.15

Notes: $N = 1{,}831$; *b* = unstandardized regression coefficient; OR = odds ratio; LL = lower level; UL = upper level; * $p < .050$, ** $p < .010$, *** $p < .001$; the reference category is Never; the reference country is Estonia; Gender 0 = boys, 1 = girls; for the variable Low life satisfaction, higher scores indicate a higher degree of low life satisfaction (i.e., lower overall life satisfaction); variables with a superscript ² indicate their quadratic (curvilinear) transformations included in the analysis to capture non-linear effects.

9.3. Digital Skills

None of the three types of digital skills were significant in relation to intentional EHOC. Regarding unintentional exposure, two significant relationships were supported, namely for technical and operational skills, and knowledge skills. The likelihood of rare unintentional EHOC increases 1.6 times with higher

technical and operational skills in adolescents (odds ratio [OR] = 1.63). As for knowledge skills, the likelihood of rare unintentional EHOC increases almost 4 times when adolescents have higher knowledge skills (OR = 3.83). Similarly, with higher knowledge skills, an adolescent's likelihood of more frequent (at least monthly) unintentional EHOC increases 6.7 times (OR = 6.66). Thus, for knowledge skills, there was a significant difference between rare exposure and more frequent (at least monthly) exposure (i.e., the effect of knowledge skills increases with higher frequency of unintentional EHOC).

9.4. Protective Factors

Regarding family support, it did not show a significant relationship with rare intentional EHOC. However, for more frequent (at least monthly) intentional exposure, a noteworthy finding emerged. Adolescents with higher family support are nearly 1.5 times less likely to experience such exposure (OR = 0.66).

In the case of friend support, a curvilinear relationship was significant for the rare intentional EHOC. This finding implies that lower friend support is associated with a lower risk for rare intentional EHOC.

9.5. Risky Factors

Higher sensation seeking in adolescents is associated with a higher likelihood of rare (OR = 1.98) and more frequent (at least monthly; OR = 2.06) intentional exposure. As for unintended exposure, a significant curvilinear relationship exists for both frequency categories. With higher sensation seeking in adolescents, the likelihood of unintended EHOC increases; however, for those who score at the highest level of sensation seeking, the likelihood does not increase anymore.

Regarding rare intentional exposure, a significant curvilinear relationship was found. As for unintentional exposure, the likelihood of rare unintentional EHOC increases 1.3 times with lower life satisfaction in adolescents (OR = 1.33). The likelihood of more frequent (at least monthly) unintentional EHOC also increases with lower life satisfaction among adolescents, by 1.6 times (OR = 1.65). Thus, there is a slight increase in the influence of this factor with more frequent (at least monthly) unintentional EHOC.

10. Discussion

10.1. Role of Digital Skills

Regarding the association of digital skills to intentional EHOC, no relationship was supported for any of the three types of examined skills. We can speculate that searching for such content is so simple that it does not require the use of enhanced digital skills.

Our study revealed that higher technical and operational skills are associated with a greater likelihood of rare unintentional EHOC. These skills, involving the management and use of ICTs and the technical aspects of devices, platforms, and applications (Helsper et al., 2020), offer adolescents wider access to online content. Consequently, more skilled adolescents who explore the internet extensively may have an increased risk of encountering harmful content (Donoso et al., 2020). Similarly, higher knowledge skills were associated with a heightened likelihood of unintentional EHOC, with a more pronounced effect at higher exposure frequencies.

This suggests that possessing the theoretical knowledge for using ICTs may not effectively shield adolescents from practical risky encounters. Moreover, having the skills to avoid online risks does not necessarily mean that adolescents actively employ them for protection. It is also important to consider that negative online experiences, including unintentional EHOC, may themselves lead to an increase in adolescents' knowledge of online harms. This suggests a potential bidirectional relationship, where exposure to such content enhances the awareness of risks. In contrast, communication and interaction skills showed no significant relationship, implying that the ability to interact with other users and communities may enhance intentional exposure experiences but it does not directly correlate with an increased likelihood of EHOC.

10.2. Role of Protective Factors

In our research, we prove that it is possible to use Jessor's theory in the context of adolescents' online behavior. Family support has been shown to act as a protective factor in more frequent intentional EHOC (i.e., it reduces the likelihood of such exposure). This result is in line with the findings of previous studies (e.g., Chng et al., 2015; Cho & Cheon, 2005) that have examined the protective effect of the family against adolescents' online risky behaviors. In cohesive families, parents' moral authority and influence dissuade engagement with harmful content (Cho & Cheon, 2005). Lower friend support was associated with lower rare intentional EHOC, which reflects the influence of social networks on adolescent risk-taking (Gardner & Steinberg, 2005). Adolescents may adopt harmful content to conform to peer behavior, mirroring friends' conduct (Jessor, 1987). Reduced friend support may decrease intentional exposure, suggesting its role as a potential risk factor for EHOC (Kvardova et al., 2021). However, no such relationship was found for more frequent intentional exposure, underscoring the enduring importance of family support at higher exposure rates.

Our study did not find any relationship between friend and family support and unintentional EHOC. While both friends and family influence conscious decisions, especially at a moral level (Cho & Cheon, 2005), their impact on unintended actions is limited. To mitigate unintentional exposure to risky content, families often use parental mediation, including restrictive measures (e.g., limiting platform access) and active approaches (e.g., highlighting hidden dangers; Padilla-Walker et al., 2012). However, such mediation is more common in younger children, which could explain the lack of a connection in our study focusing on adolescents.

10.3. Role of Risky Factors

Sensation seeking emerged as a potential risk factor for intentional EHOC in all frequency categories, consistent with prior research (Helsper & Smahel, 2019). Sensation seekers are drawn to HOC for the thrills it offers (Pikó & Pinczés, 2019). Low life satisfaction, corroborating earlier findings on online risky behavior (Stoilova et al., 2021), is linked to higher intentional EHOC. This suggests that adolescents may engage in risky online behaviors as a maladaptive coping mechanism for dealing with low life satisfaction (Valois et al., 2002), such as seeking content related to unhealthy dieting when dissatisfied with their bodies. Furthermore, the curvilinear findings reveal that adolescents scoring the lowest in life satisfaction do not experience the same continued increase in intentional EHOC. This could suggest that adolescents with extremely low life satisfaction may shift toward different coping mechanisms, possibly moving away from HOC as they explore other forms of distraction or escapism (Jiang et al., 2019; Milas et al., 2021). Additionally, it is possible that these adolescents develop a heightened awareness of the negative impacts of HOC on their emotional state, prompting a self-regulatory reduction in intentional exposure. In some cases, severe dissatisfaction may

result in a general lack of motivation, avoidance, or shifting to offline risky activities, such as alcohol or drug abuse (Milas et al., 2021), reducing their drive to seek out HOC.

Sensation seekers are consistently associated with higher unintentional EHOC across all frequency categories, aligning with prior research (Helsper & Smahel, 2019). This may suggest that their penchant for exploring various online spaces (Sheldon, 2012) increases the likelihood of inadvertently encountering such content. Nevertheless, the observed curvilinear relationship suggests that as sensation-seeking behavior in adolescents increases, the likelihood of unintended EHOC initially rises; however, among those with a very high level of sensation seeking, this likelihood plateaus. One explanation for this pattern could be that adolescents with the highest levels of sensation seeking may have developed specific strategies or knowledge about where to find the thrilling content they seek intentionally, reducing the chance of "accidental" EHOC. This aligns with research that suggests that sensation seekers may exercise more selective exposure, filtering their digital environments to engage primarily with the specific content they desire, usually containing high sensory stimulation (Lin & Tsai, 2000). Another explanation could involve desensitization or a change in perception regarding what constitutes harmful content. High-sensation seekers, who are often drawn to intense or thrilling experiences, might not perceive certain types of content as "harmful" or "unintended" once they have been repeatedly exposed to it. This could mean that their threshold for what they regard as harmful is higher, resulting in reporting less unintentional EHOC than those with lower sensation-seeking levels.

The observed association between lower life satisfaction and higher unintentional EHOC was affirmed in all frequency categories, suggesting that individuals seeking distractions due to life dissatisfaction might spend more time online and thus stumble upon various content, including HOC. The observed association between lower life satisfaction and higher unintentional EHOC across all frequency categories supports the notion that adolescents who experience dissatisfaction may spend more time online seeking distractions. This increased online time might inadvertently expose them to a wider variety of content, including HOC. This interpretation is consistent with the idea that, for individuals experiencing lower life satisfaction, online activities may serve as a coping mechanism or escape, albeit one that increases the risk of unintentional EHOC. Additionally, this pattern raises the possibility of a reversed relationship, where unintentional EHOC negatively impacts life satisfaction. Encountering HOC on social media could be negatively associated with adolescents' well-being by reinforcing feelings of distress, depression, or anxiety (Blanchard et al., 2023; Keles et al., 2019). This bidirectional relationship suggests that adolescents who are already vulnerable due to lower life satisfaction may become caught in a feedback loop: Lower life satisfaction leads to more time online (i.e., seeking distraction), which in turn raises the likelihood of EHOC, further diminishing life satisfaction.

10.4. Limitations and Future Directions

Our study has limitations worth noting. The knowledge-skills scale (Helsper et al., 2020) exhibited insufficient reliability due to its broad scope and low inter-item correlations, suggesting a need to divide it into smaller, related items for future research. The missing values observed in the dependent variables could be due to the sensitive nature of EHOC, leading some young individuals to prefer not to respond. The cross-sectional design constrains causal interpretations, warranting longitudinal and complex models for a comprehensive understanding of the factors that precede and follow intentional and unintentional EHOC. Future research can explore the differences among the sub-forms of HOC as well as focus on the country

differences. Additionally, follow-up studies may explore the motivations behind intentional and unintentional EHOC, or whether parental mediation and parental digital skills play a role. Even though we have observed a correlation between higher digital skills and unintentional EHOC, research (Donoso et al., 2020) indicates that digital skills can mitigate harm. Therefore, future studies may examine how skilled adolescents manage such exposures, assessing whether higher skills aid in coping, preventing harm, and fostering resilience to the effects of EHOC.

11. Conclusion

This study explored the cross-sectional associations between digital skills and EHOC among adolescents. By focusing on various subtypes of digital skills, we found that specific skills were associated with unintended EHOC, indicating potential risk factors. Building upon Jessor's problem behavior theory (1987), our research extended the investigation of risky and protective factors to the online environment. Sensation seeking and low life satisfaction were found to be associated with intentional and unintentional EHOC, while family support was suggested to be rather protective, particularly in cases of frequent EHOC. Friend support, typically considered a protective factor, was found to be associated with harmful content exposure, possibly acting inversely as a risk factor, as suggested by previous studies (Kvardova et al., 2021). These findings emphasize that merely possessing digital skills was not found to guarantee their effective use in safeguarding adolescents from EHOC. This underscores the importance of comprehensive prevention strategies that simultaneously incorporate digital skills and address risky online behaviors. Educators and parents should grasp the dual nature of digital skills to guide children in maximizing the opportunities of ICTs while mitigating the associated risks.

Funding

The work on this publication was supported by the project Research of Excellence on Digital Technologies and Wellbeing (CZ.02.01.01/00/22_008/0004583), which is co-financed by the European Union. The data used in this publication are from the ySKILLS project, which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 870612. This publication reflects only the authors' views, and the European Research Executive Agency is not responsible for any use that may be made of the information it contains.

Conflict of Interests

The authors declare no conflict of interests.

Data Availability

The research data associated with this article can be found in Machackova et al. (2024).

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