



# The Role of Digital Skills in Adolescent Sexting: An Exploratory Study

## El papel de las habilidades digitales en el sexting adolescente: Un estudio exploratorio

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### ABSTRACT

Adolescents need to be equipped with skills to foster healthy sexual development. We argue that this idea must be extended to digital skills, nowadays needed to engage in digitally intimate behaviors, such as sexting, where the role of digital skills remains scientifically underexplored. Building on the integrative digital skills framework and advancing on existing research, we explore the relationship of technical (i.e., privacy protection), communication (i.e., safe online interaction), and content production (i.e., ability to edit images) skills with the expected and unexpected receiving and sending of sexual messages. Data were collected using a survey with a sample of 2,953 adolescents (12–17 years old, 48.1% girls) from Estonia, Italy, and Finland collected in 2021; we analyze these relationships using multinomial logistic regression. The results show that communication skills are not related to sexting, technical skills do not decrease the likelihood of receiving unexpected sexual messages, and content creation skills increase the likelihood of all sexting types. While digital skills are crucial, they do not automatically translate into safer sexting behaviors. Instead, a more nuanced approach is needed in education and policy, ensuring that adolescents learn not only how to use digital tools but also how to apply them in ways that promote healthy sexual development and minimize risks. Our study challenges traditional risk-based perspectives on sexting and underscores the need for comprehensive digital literacy frameworks that integrate both protective and expressive aspects of adolescent online sexuality.

### RESUMEN

La población adolescente debe contar habilidades que promuevan un desarrollo sexual saludable. Esta idea debe extenderse a las habilidades digitales, que son esenciales en la actualidad para participar en comportamientos íntimos en línea, como el sexting. Sin embargo, el papel de las habilidades digitales en el sexting sigue estando poco explorado científicamente. Basarse en el marco integrador de competencias digitales y avanzando sobre investigaciones previas, se analiza la relación entre las habilidades técnicas (protección de la privacidad), comunicativas (interacción segura en línea) y de creación de contenido (edición de imágenes) con el envío y la recepción de mensajes sexuales esperados e inesperados. Los datos se recogieron mediante una encuesta. Con una muestra de 2,953 adolescentes (12-17 años, 48.1% mujeres) de Estonia, Italia y Finlandia, recogidos en 2021, se aplicó una regresión logística multinomial. Los resultados muestran que las habilidades comunicativas no están relacionadas con el sexting, las habilidades técnicas no reducen la recepción de sexts inesperados y las habilidades de creación de contenido aumentan la probabilidad de todas las formas de sexting. Aunque las habilidades digitales son fundamentales, no garantizan automáticamente prácticas de sexting más seguras. Es necesario un enfoque educativo y político más preciso, que enseñe no solo a utilizar herramientas digitales, sino a aplicarlas de manera que promuevan un desarrollo sexual saludable y minimicen riesgos. El presente estudio desafía perspectivas basadas en el riesgo y destaca la necesidad de una alfabetización digital integral que combine aspectos protectores y expresivos de la sexualidad en línea.

### PALABRAS CLAVE | KEYWORDS

Quantitative Analysis, Digital Media, Media Literacy, Digital Skills, Sexting, Adolescents.

Análisis cuantitativo, medios digitales, competencia mediática, habilidades digitales, sexting, adolescentes.

## 1. Introduction

Sexting is characterized as sending or receiving sexual content containing oneself or others, typically online in the form of text, pictures, images, or video (Ngo, Jaishankar, & Agustina, 2017). In Europe, 6% of adolescents send sexual messages, and 22% receive them (Smahel et al., 2020). Receiving sexual messages may be expected or unexpected, and its outcomes range from beneficial to harmful (Barroso et al., 2023). To foster healthy sexual development, adolescents need to develop essential skills (Arbeit, 2014). Nowadays, digital technologies are integral to adolescents' lives: in Europe, more than 80% of adolescents use smartphones to access the Internet at least daily and approximately 43% do so via their computer (Smahel et al., 2020). With digital technologies increasingly integral to relationships and intimacy, digital skills—such as managing privacy, editing content, and responsible online communication—are vital for safe sexting (Van Ouytsel, Walrave, & Ponnet, 2019). However, the role of digital skills in sexting remains underexplored. First, studies often treat digital skills broadly, failing to distinguish between specific skills and behaviors (Sonck & de Haan, 2012; Teimouri et al., 2018; Vandoninck, d'Haenens, & Roe, 2012). Second, research focuses on online risks without acknowledging the nuances of sexting behaviors, such as expected and unexpected receiving and sending of sexts. Third, previous studies treat sexting as a behavior to be prevented. Yet, sexting is a normal part of adolescent sexual development, and we must equip adolescents with skills to engage in it safely. To promote safe sexting, we need to identify the role of concrete skills in specific sexting behaviors. Such insights would guide parents, educators, and policymakers in providing the necessary skills, protecting adolescents, and supporting their healthy sexual development.

Building on Arbeit's (2014) theory of skills-based sexual development, we address the three gaps. Using a robust measurement of digital skills (Helsper et al., 2020), we identify three domains relevant to sexting: the ability to maintain privacy, appropriately communicate online, and edit content. Our research shows whether adolescents might benefit from having these skills when they engage in distinct sexting behaviors. Using data from three countries — Estonia, Finland, and Italy — from the ySKILLS project, this exploratory study aims to answer the following research questions: (RQ1) What are the associations between three types of digital skills (i.e., technical/operational; communication/interaction; and content creation/production) and different types of sexting behaviors (expected and unexpected receiving and sending sexts of oneself)?

## 2. Sexting and the Importance of (Digital) Skills

Previous research framed sexting as an online risk. By recognizing sexting as a nuanced behavior that is developmentally normal (Hasinoff, 2013; Uhls, Ellison, & Subrahmanyam, 2017), we acknowledge that different types of sexting may have different outcomes, which are not only negative (Barroso et al., 2023). This study focuses on three sexting behaviors: expected receiving (i.e., when receiving a sext was wanted), unexpected receiving (i.e., when receiving a sext was unwanted), and sending sexts. To safely engage in sexting and understand its — both positive and negative — consequences, adolescents need to be equipped with skills. Skills help adolescents promote the positive potential of sexuality and manage the potential risks (Arbeit, 2014). These skills, such as boundary setting and consent negotiation, help adolescents to “do well for themselves (e.g., experience their own sexuality with pleasure) and be good towards others (e.g., treat other people with respect)” (Arbeit, 2014, p. 260). Considering that sexting requires an understanding of digital media (Hasinoff, 2013), we propose that digital skills need to be considered to navigate healthy sexual development.

Digital skills are closely related to digital literacy (i.e., understanding and using information available through information and communication technologies; Haddon et al., 2020) and digital self-efficacy (i.e., the belief in one's capacity to enact a skill). While digital skills and efficacy are now considered distinct aspects of digital literacy, previous research often conflates these concepts. Teimouri et al. (2018) examined the association between digital literacy, online self-efficacy, and exposure to online risks, including sexting. They found that digital literacy (e.g., being able to delete browser history) increases overall exposure to risks, and online self-efficacy (e.g., claiming to know a lot of information about the internet) decreases it. Vandoninck et al. (2012) operationalized digital literacy as 17 online activities and eight online skills. They investigated the relationship between digital literacy and coping behavior after experiencing online risks (with sexting among them). They found that more digitally literate adolescents tended to respond more proactively to receiving unwelcome sexting messages. Finally, Sonck and de Haan (2012) also operationalized

“self-reported internet skills” as a range of 17 online activities and eight digital skills; however, these were investigated as separate constructs. They found that adolescents who reported receiving sexual messages online had, on average, significantly more digital skills than those who did not. Adolescents who reported being harmed by receiving sexual messages had significantly lower digital skills. Thus, the ability to navigate the online world safely and efficiently does not decrease exposure to online risks but equips adolescents with the capability to mitigate the potential harm they might suffer. This finding is echoed in a systematic review of studies on digital skills across different domains: overall, while digitally literate children and adolescents are more active online, they are better at coping with online risks and protecting their privacy online (Haddon et al., 2020).

In summary, previous research provided insightful evidence yet suffers from drawbacks. First, digital skills were conceptualized inconsistently and in a general manner, thus limiting our understanding of specific skills that might relate to preventing harm and facilitating safe sexting. Second, prior measurements of sexting experiences are reductive, failing to distinguish between different sexting behaviors. Third, existing research is dominated by the risk perspective that highlights potential negative outcomes of sexting and is limited in acknowledging its benefits and positive role in youth development. This study defines digital skills as “the ability to use ICTs [information and communication technologies] in ways that help individuals to achieve beneficial, high-quality outcomes in everyday life for themselves and others” and to “reduce the potential harm associated with more negative aspects of digital engagement” (International Telecommunication Union, 2018, p. 23). Based on this definition and a previous review of studies on digital skills (Haddon et al., 2020), Helsper and colleagues (2020) propose a new measure that is used in this study, the Youth Digital Skills Indicator (yDSI), to conceptualize digital skills as a range of knowledge levels across four dimensions: (a) information, navigation and processing skills that entail “the ability to find, select and critically evaluate digital sources of information;” (b) communication/interaction skills encompassing “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;” (c) content creation and production skills which include “the ability to create digital content to a high standard, understand how and why content is produced and published and how it generates impact;” (d) technical and operational skills which are characterized by “the ability to manage and operate ICTs and the technical affordances of devices, platforms and apps, from ‘button’ knowledge to settings management” (Smahel et al., 2023, p. 13).

## 2.1. Digital Skills Domains Related to Sexting

The relationship with specific skills dimensions is yet untested, and though we cannot formulate specific hypotheses, we propose several expectations that will guide our approach.

### 2.1.1. Communication and Online Interaction Skills

Sexting is a communicative process that may result in positive and negative outcomes (Barroso et al., 2023). The skills of communication/interaction, as conceptualized by Helsper et al. (2020), consider the ability to use different digital media and their features to form connections and interact, critically evaluate the impact of conversations, and know when it is appropriate to share certain information and with whom. Molla-Esparza, López-González and Losilla (2020) found that the more time Spanish adolescents (12 – 18 years) spent using communicative technologies, the more sexts they were likely to receive. Answering the authors’ call to explore the relationship, we expect the communication/interaction skills to increase the likelihood of receiving and sending sexts. We assume that adolescents skilled in communication/interaction would more likely avoid potentially risky interactions, thus reducing the likelihood of receiving sexts unexpectedly.

### 2.1.2. Content Creation and Production Skills

Hasinoff (2013) proposed to reframe sexting as media production: a notion since bolstered by qualitative findings that explain how images are produced and circulated (e.g., Ringrose, Regehr, & Whitehead, 2021b). Content creation/production skills, which entail the ability to create and edit various content (Helsper et al., 2020), might be essential for safe sexting, as they provide a means to conceal one’s identity and thus

lower the risk of coercion and non-consensual dissemination. We expect content creation/production skills to be related to sending sexts.

### 2.1.3. Technical and Operational Skills

Technical/operational skills include operating and managing technologies, their affordances, different platforms, and apps, and effectively managing their settings — such as privacy settings (Helsper et al., 2020). It is crucial to identify the effectiveness of technical/operational skills in limiting unexpected receiving of sexts, as adolescents with these skills should be able to block users and manage their privacy settings. However, we acknowledge that it may also be plausible that technical/operational skills might come into play after receiving unexpected sexts and prevent receiving even more rather than preventing receiving sexts altogether.

### 2.1.4. Control Variables Related to Sexting

In addressing the relationships between digital skills and the frequency of sexting behaviors, we controlled for the following variables that were shown to be associated with sexting among adolescents (Barroso et al., 2023; Mori et al., 2019; Ringrose et al., 2021b): age, gender, depression symptoms, sensation seeking, and time spent online.

## 3. Current Study and Research Questions

The relationship between digital skills and sexting is critically underdeveloped despite the ubiquity of technologies in adolescent sexual development. This study addresses three research gaps by adopting a nuanced approach to digital skills that allows us to distinguish specific skills and their relevance to three different sexting behaviors. In doing this, we recognize sexting as a normal part of adolescent development and emphasize the role of skills as facilitators of healthy sexual development while minimizing the potential risks. In this study, we newly explore: (RQ1) What are the associations between three types of digital skills (i.e., technical/operational; communication/interaction; and content creation/production) and different types of sexting behaviors (expected and unexpected receiving and sending sexts of oneself)?

## 4. Method

### 4.1. Participants and Procedure

We used data from the ySKILLS project on digital skills, online risks, and opportunities across six European countries. In each country, a convenience sample with a target of at least 1,000 adolescents selected from schools based on their socio-economic status was collected from April to December 2021 during the COVID-19 pandemic. This study uses a subsample from the first wave, which was comprised of adolescents from three countries (Estonia, Finland, and Italy), aged 12-17, 48.1% girls, total N = 2,953 (Estonia: N = 1,249, Finland: N = 739, Italy: N = 965). Estonia, Finland, and Italy were the only countries where sexting items were asked of all participants. Data were collected using a computer-assisted online questionnaire that adolescents completed in school computer classrooms or at home during distance learning necessitated by the COVID-19 pandemic. The data are freely available (Machackova et al., 2024). Research Ethics Committees approved the data collection at each of the participating universities. Informed consent was obtained from both the participants and their legal guardians. Participants could answer “I prefer not to say” or “I don’t know” to each item. For detailed information about sampling in each country and incentives, see the technical report (Bedrosova et al., 2022).

### 4.2. Measures

Expected and unexpected receiving of sexual messages was assessed by a general question of whether the participant “received a sexual message online or on a phone,” including “words, images, or video” in the past year (0 = No; 1 = Yes). If participants answered Yes, they were asked two follow-up questions: “How often have you received something sexual when you EXPECTED (or intended) to receive it?” plus “And how often have you received something like this when you DID NOT EXPECT (or intend) to receive it?” (1 = never; 2 = once; 3 = a few times; 4 = at least every month; 5 = at least every week;

and 6 = daily or almost daily). Sending of sexual messages was assessed by “How often did you send or post sexual images (photos or videos) of yourself?” The response scale was 1 = never; 2 = once; 3 = a few times; 4 = at least every month; 5 = at least every week; and 6 = daily or almost daily.

Digital Skills were assessed by the Youth Digital Skills Indicator (yDSI) (Helsper et al., 2020). Respondents were asked to “indicate how true the following statements are of you when thinking about how you use the internet and technologies such as mobile phones or computers. Reply thinking about how true this would be of you if you had to do it now, on your own. If you do not understand what the question is asking, tick the box I don’t understand what you mean by this.” The response scale included five items: 0 = I don’t understand what you mean by this; 1 = not at all true of me; 2 = not very true of me; 3 = neither true nor untrue of me; 4 = mostly true of me; and 5 = very true of me. We computed the digital skills scores by counting the number of items for which the participant selected “5 = very true of me” (as recommended by Helsper et al., 2020). This resulted in scores ranging from 0 (no items with value 5) to 1 (all items with value 5) for each dimension. For this study, three dimensions were selected: technical/operational; communication/interaction; and content creation/production. The technical/operational dimension was assessed by six statements, such as “I know how to adjust privacy settings.” The internal consistency was  $\omega = .70$ . The communication/interaction dimension was measured by six statements, including “I know which images and information of me it is OK to share online.” The internal consistency was  $\omega = .71$ . Finally, content creation/production dimension was evaluated by six statements, such as “I know how to edit existing digital images, music and videos.” The internal consistency was  $\omega = .78$ . Participants with a missing score on three or more items were excluded from getting a score for the respective dimension.

Sensation seeking was measured by four statements of the Brief Sensation Seeking Scale (Hoyle et al., 2002). Participants were instructed to indicate how strongly they (dis)agree with four statements, such as “I prefer friends who are excitingly unpredictable.” The response scale comprised five items: 1 = strongly disagree; 2 = disagree; 3 = neither disagree nor agree; 4 = agree; and 5 = strongly agree. The scale had an internal consistency of  $\omega = .74$ . Symptoms of depression were assessed by three statements from the negative dimension of the Short Depression-Happiness Scale (Joseph et al., 2004). Participants were asked: “In general, how true were these things of you in the PAST YEAR?” The items included statements like “I felt dissatisfied with my life.” The response scale had four items: 1 = never; 2 = rarely; 3 = sometimes; and 4 = often. Thus, a higher score indicated higher depressive symptoms. The internal consistency of the scale was  $\omega = .78$ .

Age was assessed by asking the participants what year and month they were born. For the purpose of analysis, the variables were recoded into age at the time of data collection. Gender was measured by the question “What is your gender?” with options to answer 0 = Boy; 1 = Girl; and 2 = Other. Due to the low number of participants in the Other category ( $N = 54$ ), gender was recoded into a binary variable where 0 = Boys and 1 = Girls, and participants identifying as “Other” were treated as missing. Time spent online was measured by “About how long do you spend on the internet during a regular weekday (i.e., school day)?” with the options 1 = Little or no time; 2 = About half an hour; 3 = About 1 hour; (...); 9 = About 7 hours or more. Information on the country where data were collected was filled in by administrators in each country.

## 5. Analysis

To compare groups of different sexting-behavior frequencies, we had to make several transformations due to the low number of participants who engaged in sexting and the positive skewness of sexting variables (many participants never sexted). The responses were divided into three categories: 0 = never; 1 = once or a few times in the past year; and 2 = at least monthly. Table 1 provides a detailed overview of the participants’ sexting engagement by gender. We only used data from participants who provided valid responses to variables in the analysis. In the case of the analysis of the expected receiving of sexual messages, excluded adolescents did not differ in age ( $t(1,965.1) = 1.44, p = .149$ ) or gender ( $\chi^2(1, N = 2,894) = 0.58, p = .401$ ). For the unexpected receiving of sexual messages, no differences were found in age ( $t(1,939.1) = 1.38, p = .168$ ) and gender ( $\chi^2(1, N = 2,894) = 3.18, p = .074$ ). In the case of sending sexts, adolescents did not differ in age ( $t(1,173.2) = 1.69, p = .092$ ) and gender ( $\chi^2(1, N = 2,894) = 0.00, p = .960$ ). Descriptive statistics for continuous variables are reported in Table 2.



Table 1: Sexting Engagement by Gender.

|                                      | Receiving Sexts |      |            |      | Sending Sexts |      |
|--------------------------------------|-----------------|------|------------|------|---------------|------|
|                                      | Expected        |      | Unexpected |      |               |      |
|                                      | N               | %    | N          | %    | N             | %    |
| Never                                |                 |      |            |      |               |      |
| Boys                                 | 775             | 50.2 | 685        | 55.3 | 1035          | 52   |
| Girls                                | 768             | 49.8 | 553        | 44.7 | 948           | 48   |
| Total                                | 1543            | 100  | 1238       | 100  | 1983          | 100  |
| Once or a Few Times in the Past Year |                 |      |            |      |               |      |
| Boys                                 | 131             | 59.3 | 193        | 43.9 | 32            | 51.6 |
| Girls                                | 90              | 40.7 | 246        | 56.1 | 30            | 48.4 |
| Total                                | 221             | 100  | 439        | 100  | 62            | 100  |
| At Least Monthly                     |                 |      |            |      |               |      |
| Boys                                 | 40              | 55.5 | 61         | 36.7 | 11            | 44   |
| Girls                                | 32              | 44.5 | 105        | 63.3 | 14            | 56   |
| Total                                | 72              | 100  | 166        | 100  | 25            | 100  |
| Total N                              | 1836            |      | 1843       |      | 2070          |      |

Table 2: Descriptive Statistics of Continuous Variables.

|                                    | M     | SD   | min | max |
|------------------------------------|-------|------|-----|-----|
| Age                                | 14.41 | 1.28 | 12  | 17  |
| Sensation seeking                  | 3.31  | 0.91 | 1   | 4   |
| Symptoms of depression             | 2.44  | 0.84 | 1   | 5   |
| Time spent online                  | 6.17  | 1.92 | 1   | 9   |
| Technical/operational skills       | 0.58  | 0.30 | 0   | 1   |
| Communication/interaction skills   | 0.67  | 0.29 | 0   | 1   |
| Content creation/production skills | 0.37  | 0.34 | 0   | 1   |

To assess the relationship between digital skills and sexting behaviors, we performed a multinomial logistic regression. The reference category was never. We also controlled for the country of origin. We chose Estonia as the reference country as it was the largest category. The analysis was carried out in SPSS v.28.0.0.0.

## 6. Results

### 6.1. Association of Digital Skills with Expected Receiving

The first model examined the association of digital skills and the expected receiving of sexual messages. The detailed results are listed in Table 3. Communication /interaction skills were not significantly related to the expected receiving of sexual messages among adolescents who received sexts only a few times in the past year and monthly. Content creation/production skills significantly increased the likelihood of receiving sexts both a few times a year and at least monthly. Finally, technical/operational skills were related to receiving sexts in neither of the groups.

Table 3: Association of Digital Skills with Expected Receiving of Sexual Messages.

|                         | Never vs. Once or a Few Times |      |      |             | Never vs. at Least Monthly |      |      |              |
|-------------------------|-------------------------------|------|------|-------------|----------------------------|------|------|--------------|
|                         | B (SE)                        | p    | OR   | 95% CI      | B (SE)                     | p    | OR   | 95% CI       |
| Intercept               | -8.26 (.95)                   | .000 |      |             | -15.06 (.34)               | .000 |      |              |
| Age                     | .23 (.06)                     | .000 | 1.26 | [1.11-1.42] | 0.43 (.11)                 | .000 | 1.54 | [1.23-1.92]  |
| Gender (ref. girls)     | .37 (.17)                     | .026 | 1.45 | [1.05-2.01] | 0.26 (.28)                 | .362 | 1.30 | [0.74-2.27]  |
| Sensation seeking       | .37 (.09)                     | .000 | 1.45 | [1.21-1.73] | 0.74 (.17)                 | .000 | 2.10 | [1.51-2.93]  |
| Symptoms of depression  | .36 (.10)                     | .000 | 1.44 | [1.18-1.75] | 0.39 (.16)                 | .013 | 1.48 | [1.09-2.01]  |
| Time spent online       | .140 (.04)                    | .001 | 1.15 | [1.06-1.25] | 0.19 (.08)                 | .014 | 1.21 | [1.04-1.40]  |
| Technical skills        | .17 (.34)                     | .621 | 1.18 | [0.61-2.31] | -0.04 (.63)                | .944 | 0.96 | [0.28-3.26]  |
| Communication skills    | -.33 (.34)                    | .333 | 0.72 | [0.37-1.40] | 1.14 (.70)                 | .105 | 3.12 | [0.79-12.37] |
| Content creation skills | .58 (.29)                     | .046 | 1.79 | [1.01-3.16] | 1.36 (.49)                 | .006 | 3.88 | [1.48-10.18] |
| Finland                 | .03 (.25)                     | .897 | 1.03 | [0.64-1.67] | -0.67 (.36)                | .062 | 0.51 | [0.25-1.03]  |
| Italy                   | -.69 (.19)                    | .000 | 0.50 | [0.35-0.72] | -0.45 (.33)                | .172 | 0.64 | [0.34-1.22]  |

Note: N=1836, OR – odds ratio. The reference category is never. The reference country is Estonia.  $\chi^2$  (20) = 208.46,  $p < 0.001$ , Pseudo- $R^2 = .11$  (Cox & Snell), Nagelkerke  $R^2 = .17$

## 6.2. Association of Digital Skills with Unexpected Receiving

Next, we focused on unexpected receiving of sexual messages. See Table 4 for detailed results. Communication/interaction was not related to the unexpected receiving of sexual messages in either of the groups. Content creation/production skills increased the likelihood of receiving unexpected sexts at least monthly. Technical/operational skills were not related to unexpected receiving of sexual messages only a few times a year and they were not related to unexpected receiving of sexts monthly.

**Table 4: Association of Digital Skills with Unexpected Receiving of Sexual Messages.**

|                         | Never vs. Once or a Few Times |      |      |             | Never vs. at Least Monthly |      |      |             |
|-------------------------|-------------------------------|------|------|-------------|----------------------------|------|------|-------------|
|                         | B (SE)                        | p    | OR   | 95% CI      | B (SE)                     | p    | OR   | 95% CI      |
| Intercept               | -7.27 (.75)                   | .000 | 1.23 |             | -10.43 (1.14)              | .000 |      |             |
| Age                     | 0.21 (.05)                    | .000 | 0.63 | [1.12-1.36] | 0.22 (.08)                 | .000 | 1.24 | [1.07-1.44] |
| Gender (ref. girls)     | -0.46 (.13)                   | .000 | 1.56 | [0.49-0.81] | -0.77 (.20)                | .000 | 0.46 | [0.31-0.68] |
| Sensation seeking       | 0.44 (.07)                    | .000 | 1.50 | [1.36-1.79] | 0.63 (.11)                 | .000 | 1.87 | [1.51-2.33] |
| Symptoms of depression  | 0.41 (.08)                    | .000 | 1.11 | [1.29-1.75] | 0.56 (.11)                 | .000 | 1.75 | [1.40-2.18] |
| Time spent online       | 0.10 (.03)                    | .003 | 1.49 | [1.04-1.18] | 0.12 (.05)                 | .004 | 1.13 | [1.02-1.25] |
| Technical skills        | 0.40 (.27)                    | .136 | 1.08 | [0.88-2.51] | 0.60 (.41)                 | .147 | 1.82 | [0.81-4.07] |
| Communication skills    | 0.08 (.27)                    | .770 | 1.27 | [0.64-1.83] | 0.51 (.44)                 | .242 | 1.67 | [0.71-3.94] |
| Content creation skills | 0.24 (.23)                    | .300 | 1.01 | [0.81-2.01] | 0.88 (.34)                 | .009 | 2.41 | [1.25-4.68] |
| Finland                 | 0.01 (.17)                    | .936 | 0.86 | [0.72-1.43] | -0.13 (.24)                | .595 | 0.88 | [0.55-1.41] |
| Italy                   | -0.15 (.15)                   | .320 |      | [0.65-1.15] | 0.35 (.23)                 | .136 | 1.42 | [0.90-2.24] |

## 6.3. Association of Digital Skills with Sending Sexts

The final model assessed the relationship of digital skills with sending of sexual messages. The full results are listed in Table 5. Communication/interaction skills were not related to sending sexts a few times a year and monthly. We found a significant positive relationship between the content creation/production skills and sending sexual messages once or a few times a year and at least monthly. Finally, technical/operational skills were not related to sending sexts at all.

**Table 5: Association of Digital Skills with Sending Sexual Messages.**

|                                     | Never vs. Once or a Few Times |      |      |             | Never vs. at Least Monthly |      |      |              |
|-------------------------------------|-------------------------------|------|------|-------------|----------------------------|------|------|--------------|
|                                     | B (SE)                        | p    | OR   | 95% CI      | B (SE)                     | p    | OR   | 95% CI       |
| Intercept                           | -11.70 (1.38)                 | .000 |      |             | -14.54 (2.49)              | .000 |      |              |
| Age                                 | 0.35 (.09)                    | .000 | 1.41 | [1.19-1.69] | 0.51 (.16)                 | .001 | 1.67 | [1.23-2.27]  |
| Gender (ref. girls)                 | 0.24 (.23)                    | .295 | 1.27 | [0.81-2.00] | 0.17 (.41)                 | .679 | 1.18 | [0.53-2.64]  |
| Sensation seeking <sup>a</sup>      | 0.60 (.14)                    | .000 | 1.81 | [1.39-2.37] | 0.64 (.24)                 | .008 | 1.90 | [1.18-3.06]  |
| Symptoms of depression <sup>b</sup> | 0.42 (.14)                    | .003 | 1.52 | [1.16-2.00] | 0.44 (.23)                 | .056 | 1.56 | [0.99-2.46]  |
| Time spent online                   | 0.16 (.06)                    | .010 | 1.17 | [1.04-1.33] | 0.38 (.11)                 | .001 | 1.46 | [1.16-1.82]  |
| Technical skills                    | -0.69 (.46)                   | .135 | 0.50 | [0.20-1.24] | -0.50 (.83)                | .552 | 0.61 | [0.12-3.12]  |
| Communication skills                | -0.70 (.47)                   | .137 | 0.49 | [0.20-1.25] | -0.59 (.85)                | .490 | 0.56 | [0.10-2.95]  |
| Content creation skills             | 1.08 (.40)                    | .008 | 2.95 | [1.33-6.52] | 1.37 (.69)                 | .047 | 3.94 | [1.02-15.23] |
| Finland                             | 0.05 (.36)                    | .882 | 1.05 | [0.52-2.13] | -2.28 (.61)                | .000 | 0.10 | [0.03-0.34]  |
| Italy                               | -0.51 (.25)                   | .044 | 0.60 | [0.36-0.99] | -2.39 (.55)                | .000 | 0.09 | [0.03-0.27]  |

Note: N = 2086, OR – odds ratio. The reference category is never; the reference country is Estonia.  $\chi^2(20) = 149.98$ ,  $p < 0.001$ , Pseudo- $R^2 = .07$  (Cox & Snell), Nagelkerke  $R^2 = 0.16$ . a – The assumption of linearity between the sensation seeking and the log odds of the dependent variable was violated in the ‘once or a few times’ category. b – The assumption of linearity between depression and the log odds of the dependent variable was violated in the ‘once or a few times’ category.

## 7. Discussion

Acquiring skills is necessary for healthy sexual development (Arbeit, 2014). Nowadays, that includes digital skills, which are necessary for digital intimate practices, such as sexting. This study was the first to explore the relationship between three digital skills domains, communication/interaction, content creation/production, and technical/operational skills, and three sexting behaviors, that is, expected and unexpected receiving of sexual messages and sending of sexts.

### 7.1. Communication/Interaction Skills and Sexting

We expected that communication/interaction skills could be positively related to the expected receiving and sending of sexts (Molla-Esparza et al., 2020) and negatively related to the unexpected receiving of sexts. We did not find a relationship between communication/interaction skills and the three types of sexting. While our findings contradict our expectations and earlier research (Molla-Esparza et al., 2020), it is possible that general awareness of what is appropriate to communicate, how, and to whom is not related to whether adolescents decide to send a sexual message, nor does it protect them from receiving sexts. Research on sexting among emerging adults (Greer et al., 2022) shows that sexting in different contexts (e.g., in committed vs. casual relationships) is driven by different motivations that could be more powerful than general knowledge of appropriate communication, as adolescents could believe something more important is at stake (i.e., their relationship; Greer et al., 2022). Future research needs to explore how adolescents navigate sexting and how they decide what (i.e., sexual messages or sexually explicit photos), to whom (i.e., romantic partner, potential romantic interest), how (i.e., sending photos in a private mode that will make them disappear in a few seconds), and why they will send, but also who are the senders of sexts they receive. A thorough understanding of sexting could help develop concrete domains of skills that would help adolescents facilitate safe and pleasurable sexting and minimize negative experiences. No relationship between communication/interaction skills and receiving unexpected sexts supports the important notion that the victim is not to blame for receiving unexpected sexual messages (Hasinoff, 2013). The ability to avoid unsafe communication does not protect adolescents from receiving sexts, as they are often – even non-consensually – disseminated in peer groups that adolescents cannot avoid (Ringrose, Regehr, & Whitehead, 2021a). While research shows that adolescents are starting to adopt this notion too (e.g., Burén & Lunde, 2018), there is a continuing need to draw attention to the prevention of image-based harassment instead of sexting safety (Gavey et al., 2023).

### 7.2. Content Creation/Production Skills and Sexting

In line with our expectations, we found an association between content creation/production skills and sending sexts. Moreover, these skills were positively related to all three types of sexting, albeit at different frequencies. Concretely, high content creation/production skills increased the likelihood of receiving expected sexts only a few times and at least monthly, receiving unexpected sexts at least monthly but not a few times, and sending sexts only a few times and at least monthly. While content creation/production skills are not needed for receiving sexual messages, they are crucial for sending such messages, and research shows that sexting behaviors are correlated (Lu, Baumler, & Temple, 2021). Thus, it may be that adolescents with content creation/production skills who engage in sending sexts also receive such sexts in return.

High content creation/production skills increased the likelihood of receiving unexpected sexts at least monthly, but not only a few times a year. A possible explanation could be that adolescents apply their content creation skills when managing their social media profiles – using filters and adjustments (Masanet et al., 2020) – which in turn could make their profile more popular and visible (Márquez, Lanzeni, & Masanet, 2022). Adolescents visible on social networking sites face various forms of sexual harassment, including gender harassment, unwanted sexual attention, and coercion (Van Royen, Vandebosch, & Poels, 2015). We speculate that digital skills facilitate content creation, increasing visibility to both peers and strangers and, consequently, exposure to unexpected sexts—explaining the lack of association in infrequent cases but a positive relationship for monthly occurrences. A U.S. survey of 135 content creators found that ~70% experienced sexual harassment, bullying, or identity attacks more than rarely (Thomas et al., 2022).

Our results show that content creation skills increase the likelihood of sending sexts, supporting Hasinoff's (2013) view of sexting as digital media production. While these skills facilitate sexting, further research should examine whether adolescents use them to enhance appearance or protect against unauthorized photo circulation by editing out personal features. This raises a key question in Arbeit's (2014) framework—while skills can promote healthy sexual development, their application varies, especially in digital contexts. Our findings highlight the need for sex education programs that go beyond STI and pregnancy prevention to teach adolescents how to engage in sexual activities safely and confidently (Goldfarb & Lieberman, 2021).

### 7.3. Technical/Operational Skills and Sexting

We expected technical/operational skills to protect against non-consensual sexting by reducing unexpected



sexts but found no such relationship across sexting types. This raises a key question—are adolescents not applying these skills, or are they simply ineffective in preventing unexpected sexts? Our findings suggest that technical/operational skills offer little protection, likely due to the nature of unexpected sexting. Blocking a sender is only possible after receiving an unwanted sext, and harassment across multiple platforms limits these skills' effectiveness. Research shows unwanted sexts—especially from males—are common, with girls facing persistent requests (Mishna et al., 2023). While privacy settings can limit contact with strangers, many unexpected sexts come from peers (Ringrose et al., 2021a). Ultimately, our results reinforce that victims are not responsible for receiving unexpected sexts, as even strong privacy management cannot prevent persistent perpetrators.

#### 7.4. Limitations

Our findings are limited by the cross-sectional nature of the data, which made it impossible to disentangle the temporal unfolding of digital skills application and sexting. In this study, we differentiated between expected and unexpected receiving of sexual messages instead of consensual and non-consensual. This decision stems from cognitive testing of the questionnaire that showed adolescents rather identified receiving sexts as expected and unexpected, with a similar meaning to how researchers understand consensual and non-consensual. However, it may be possible that while unexpected, some sexual messages may also be wanted. Another limitation is the low prevalence of sexting behavior among adolescents, especially sending sexual messages, which limits the statistical power. The data collection took place during the COVID-19 period; however, research shows that the patterns of sexting among adolescents remained the same (Maes & Vandenbosch, 2022). While our study linked concrete digital skills to specific sexting behaviors, our approach was exploratory, and more research is needed to test our interpretations. Future studies could use qualitative methods, such as focus groups or semi-structured interviews, to better understand what digital technologies and platforms adolescents use to sext, and what skills they need to navigate sexting safely.

#### 8. Conclusion

Developing skills is vital to healthy sexual development (Arbeit, 2014). Especially nowadays, when sexuality is facilitated through technologies, we argue for the importance of digital skills in enhancing the positives and mitigating risks. Our study makes a novel contribution by addressing three key research gaps in the relationship between digital skills and sexting behaviors. Importantly for policymakers, parents, and educators, we found that: a) being skilled in appropriately communicating and interacting online is not related to sexting behavior, b) the skills of content creation/production are positively linked to all three sexting behaviors, and c) knowing how to protect one's privacy online does not protect from receiving unexpected sexts. Our results raise several important points. First, our findings highlight a key question in line with Arbeit's (2014) argument: digital skills serve adolescents in various domains of their life, and as our results show through various non-significant relationships, digital skills do not have to be used in service of safe sexting and in extension, healthy sexual development. How can we encourage adolescents to use their digital skills in this context? Currently, there are digital inclusion policies aimed at acquiring digital skills needed to navigate today's world (Helsper & van Deursen, 2015) and sex education programs aimed at teaching the youth about skills related to sexuality (e.g., Lee & Lee, 2018; Millanzi, Kibusi, & Osaki, 2022); however, they are often targeted rather at acquiring digital skills and STI prevention, and not at navigating a sexual behavior, such as sexting, safely while managing risks, which is a preferred approach to sexting (Gavey et al., 2023).

Our findings provide a foundation for an educational framework that integrates digital skills into sex education. To promote safe sexting and healthy sexual development, we need to encourage content creation/production skills and underline the importance of editing photos to prevent the potential risks and harms that are linked to the non-consensual sharing of sexts. Although the technical/operational skills seem to be ineffective in preventing unexpected receiving of sexts, it is still important to equip adolescents with the means to protect their privacy and deal with potential abusers. In our study, we focused on the cognitive dimension of digital skills, but some researchers suggest also other dimensions, such as the socio-emotional (i.e., the ability to recognize potentially dangerous online situations or scams; Ngo et al., 2017). Thus, apart from the digital skills we explored in this research, policy frameworks and sex education curricula could also

cover the skills to recognize potentially risky situations and inform them of the potential harm of receiving unexpected texts, as well as of the issues of online visibility, which might make them more susceptible to receiving such messages, and the mechanisms of coping with and solving non-consensual situations. Second, our finding that technical/operational digital skills do not protect adolescents from unexpected receiving of sexual messages supports Hasinoff's (2013) notion that the responsibility in preventing unexpected receiving of sexts (in this research, via digital skills) does not lie on the victim. Therefore, we should adopt policies that would reflect the limited individual responsibility over sexting, and instead of victim-blaming and criminalizing sexting altogether focus on non-consensual sexting and its perpetrators (Chatzinikolaou & Lievens, 2021; Gavey et al., 2023).

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