

# AN EXPLORATORY STUDY ABOUT THE ROLE OF GENDER IN CYBERSECURITY AWARENESS FOR CHILDREN

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## ABSTRACT

Gender disparities in technology use and cybersecurity are a persistent and growing concern among researchers and society. This paper presents the results from a qualitative study conducted with 25 parents in Norway, exploring the role of gender (of either the child or the parent) in parents' perceptions of their children's cybersecurity awareness and the mediation strategies of children's online activities. Our research reveals certain patterns regarding parents' technology use, perceptions of their children's technology preferences, and exposure to online risk depending on gender. By investigating parents' views from a gender perspective, our study offers insights for practitioners and researchers engaged in gender research, designing and implementing cybersecurity awareness solutions. In addition, we provide suggestions for future research and application.

## KEYWORDS

Cybersecurity Awareness, Parents, Children, Gender

## 1. INTRODUCTION

Managing technology use at home is an evolving endeavor that has recently developed rapidly, posing new issues and concerns for parents (Quayyum et al., 2021). Parents play a significant role in mediating children's online activities and are essential stakeholders in raising cybersecurity awareness among children. Therefore, exploring and understanding any gender influence among the parents is crucial. Moreover, demographic changes, culture, customs, and parental socioeconomic status can also impact socially structured parenting patterns in the face of children's cybersecurity needs (Elstad & Stefansen, 2014).

Many researchers have acknowledged the gender gap in the cybersecurity domain. Researchers have explored gender differences in many areas, such as in computer self-efficacy (e.g., Aesaert & Van Braak, 2015), enjoyment of STEM fields (e.g., Miller et al., 2006), programming and coding activities (e.g., Papavlasopoulou et al., 2020), cybersecurity engagement and self-efficacy among teens (e.g., Amo, 2016) and so on. However, little research has been done on how and whether the gender of adults (parents in our case) has any influence when it comes to children's cybersecurity awareness and behavior. In this study, we have investigated the role of gender in parents' perceptions of their children's cybersecurity awareness as well as among the children themselves in terms of cybersecurity risks and practices. We believe understanding parental perceptions and any possible gender influence can support the development of fairer and more inclusive cybersecurity awareness solutions and technologies for users. Thus, in this study, we pose the following research questions:

**RQ1:** *What role does gender play in parents' perceptions of their children's cybersecurity and concerns?*

**RQ2:** *What role does gender play in how parents mediate their children's online activities and internet use?*

In Section 2, we describe the background and context of this study. We then present our research methods in Section 3 and the results in Section 4. In Section 5, we discuss the findings and study limitations. Finally, we conclude by presenting the implications of the findings and suggesting future research directions in Section 6.

## **2. GENDER DISPARITIES AND CYBERSECURITY**

Gender disparities in attitudes toward technology use and education have long been a concern for researchers and society in general (Cai et al., 2017). Studies have revealed evidence of gender differences surrounding beliefs and behavioral intentions regarding cybersecurity (e.g., Anwar et al., 2017). Gender has been associated with exposure to risky or uncomfortable situations (Savoia et al., 2021). Amo (2016) found gender differences in cybersecurity engagement and self-efficacy among teenagers. While the use of the internet and social networking sites are universal for all genders, research also shows gender-related differences in the scope and depth of its use (Iwilade, 2015). Perceptions of and exposure to risks can also vary with gender. Gustafson (1998) investigated how gender can contribute to understanding risk and revealed differences in how males and females perceive risks in general and regarding cybersecurity risks in particular. Many other studies, including Dempsey et al. (2018), Desimpelaere et al. (2020), and Hoy & Milne (2010), show that gender is related to the degree of online privacy concerns, with females showing greater privacy concerns than males. Women place greater importance on perceived control and privacy risks when sharing information on social networking sites than men (Hajli & Lin, 2016). Exposure to some types of harmful content may also depend on gender. A recent study (Kvardova et al., 2021) shows that girls can be exposed more often to harmful content on the internet, at least in some contexts. Gender differences are also relevant in terms of cyberbullying. Notar et al. (2013) conducted a literature review on cyberbullying and presented a stark gender comparison: girls are more likely to experience cyberbullying than boys.

In addition, Sezer et al. (2015) investigated the awareness levels of teachers concerning cyberbullying, finding that male teachers have a higher level of awareness than female teachers. Mıhçı Türker & Kılıç Çakmak (2019) found that female students had significantly higher awareness than male students in terms of internet addiction, cyberbullying, netiquette, online privacy, inappropriate content, copyright, and cybersecurity. Though these two studies had different target groups (students and teachers), it is clear that gender differences can exist among children and adults. Therefore, it is crucial to investigate whether and how gender influences adults' perceptions of and actions toward children's cybersecurity.

Research suggests that parental mediation strategies and parents' security concerns influence children's online behavior and internet use (Wisniewski et al., 2015). However, findings regarding the relationship between gender and the amount or type of parental mediation are mixed. While some researchers have found a relationship between a child's gender and the amount or style of parents' mediation (Nikken & Jansz, 2014; Sonck et al., 2013), others found no such connection (Livingstone & Helsper, 2008). Considering all the literature mentioned above and their findings, we extend the gender studies in the cybersecurity domain by exploring whether parents' cybersecurity concerns and mediation strategies have any relationship with gender (of either the child or the parent) in our study context.

## **3. RESEARCH METHODOLOGY**

We conducted semi-structured interviews with 25 parents living in Norway. Since this study aimed to concentrate on parents' perceptions and actions, we performed the interviews with only the parents and did not include the children. The interviews were exploratory in nature, and we asked the participants open-ended questions. We asked questions about parents' perceptions of children's cybersecurity awareness, concerns about online activities, the experience of risk exposure, and how they mediate their children's internet use at home. We asked open-ended questions so that they could respond in detail to our questions and introduce any issues that they considered relevant. We did not ask the parents any direct questions related to gender as we wanted to determine whether the parents' behavior or perceptions differed depending on gender in a natural setting rather than what they said when questioned directly on the issue.

Moreover, as our sample was not gender-balanced (eight fathers and 17 mothers), we attempted to identify if there were any gender-related patterns in the parents' answers rather than making direct comparisons. By "pattern," we mean repeated selective elements found in parents' responses to the interview questions. We conducted a thematic analysis of the interview data following the steps recommended by Cruzes and Dyba (2011) to identify any gender-specific patterns.

We recruited participants with at least one child in our target age group (10–15 years old). Interviews were conducted face-to-face or online, lasting from 10 to 34 minutes (depending on how much the parents

shared and elaborated on their answers). The sample comprised eight fathers and 17 mothers (including five couples), and their ages ranged from 38 to 56. The interviewees had 53 children, whereas 26 children (six girls and 20 boys) were in our targeted age range. All the participating parents had higher education, varying from a bachelor's degree or higher. Before starting the data collection process, the researchers received approval from the Norwegian Centre for Research Data (NSD). Following ethical approval from the NSD, we obtained informed consent from all the participants.

## 4. RESULTS AND FINDINGS

### 4.1 Parents' Risk Perceptions

We have identified multiple privacy- and security-related risks about which parents are concerned regarding their children (Figure 1). We have categorized these concerns by their nature and divided them into five major categories of risks: (i) privacy risks, (ii) online content, (iii) online contact, (iv) online conduct, and (v) consumer risks.

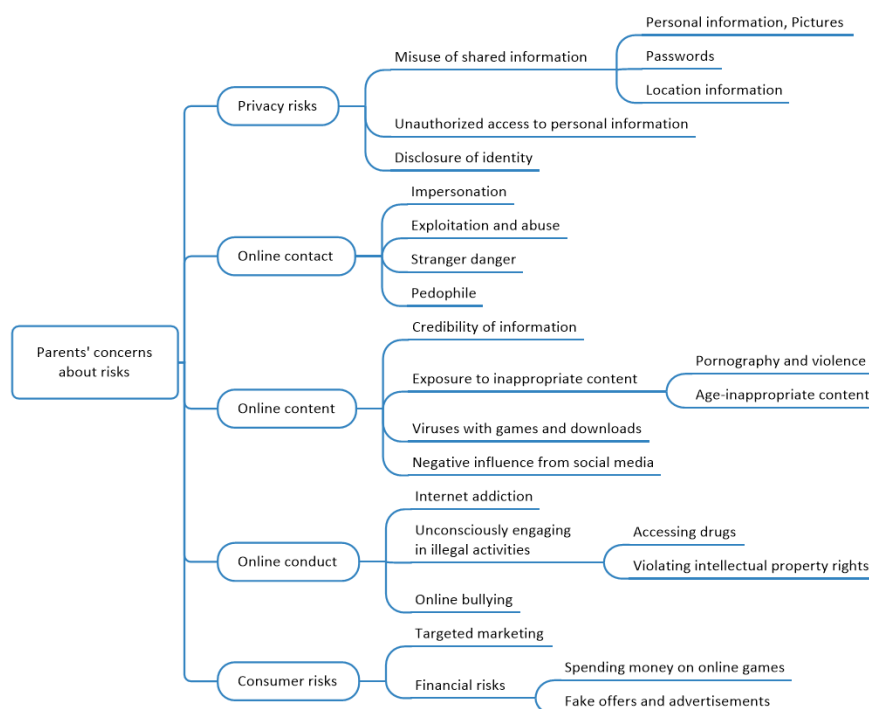


Figure 1. Parents' risk concerns for children

**Privacy risks.** Twelve of 25 parents expressed concern about their children's privacy. Parents worried that children could share sensitive personal information (location, pictures, identity, etc.) on social media and game forums. Sharing personal information makes it easy for people (both known and unknown) to track or misuse it. One parent also expressed concern about freedom of speech and the opinion that today's children share information on social media that others can exploit in the long term; this parent cited Facebook and Cambridge Analytica as examples. Parents also expressed concerns about how sharing one's location online could result in physical harm. Moreover, children's poor password practices can also result in privacy breaches. Risky practices like sharing passwords with online friends can result in disclosing one's identity and sensitive information, losing control of devices and information, exploitation, and abuse by friends or others connected—however remotely—to someone with whom a child shares a password.

**Online contact.** Another major cybersecurity concern is online contact, which 14 of 25 parents mentioned. It is related to the fact that children can easily contact strangers through social media or online

games. Parents are worried that their children can get into danger by contacting strangers. Impersonation, pedophiles, exploitation, and abuse are some of the common forms of danger that parents mentioned.

**Online content.** Parents' online content-related concerns include exposure to inappropriate content, the credibility of online information, the negative influence of online content, and the risk of viruses that can result from downloading online content. Nine parents noted concerns related to content that children can access over the internet.

**Online conduct.** Seven parents mentioned issues related to online conduct. The most common form of online conduct-related risk is cyberbullying. The parents' interviews showed that most online bullying cases occur on social media platforms or online video game forums. Parents are concerned that such online bullying experiences can affect their children mentally and that children might feel uncomfortable sharing such experiences, even with their parents. Becoming addicted to the internet or online games, unconsciously engaging in illegal activities like accessing illegal products, and violating intellectual property rights were the other forms of conduct-related risks that parents mentioned.

**Consumer risks.** The fifth category of parental concerns is related to the risks that arise when children are treated as potential consumers. Three parents reported concerns about how third-party organizations access personal data and children's usage patterns from their online activities to employ in targeted marketing. One parent also mentioned that a child's internet behavior and activities might not significantly affect them today; however, when their data are collected and monitored by third parties, children could be affected over the long term. Such risks can also come from online games and advertisements. In addition to the parents who expressed data and usage-related privacy concerns, seven other parents expressed concerns about children being tricked into spending money on online games, fake offers, or online advertisements.

#### 4.1.1 Influence of Gender on Risk Perceptions

The parents in the present study expressed concerns about their children similarly, regardless of the gender of the parents. As presented above, parents have expressed a wide range of security concerns about their children's online presence. While some of these concerns are relevant for all children regardless of gender, we have seen some concerns that do relate to the gender of the child. For example, some cybersecurity risks that the parents mentioned referred only to their sons. Risks like spending money on online games and exposure to pornography were specifically mentioned for male children; none of the parents expressed these same concerns for their daughters. Similarly, the concern regarding the negative impact of online games and the risk of becoming addicted to them were noted only for sons. Seven parents from our sample referred to worries about their children sharing personal information, such as photos, on social media. Though the parents had this concern for both boys and girls, four of the seven parents emphasized sharing personal pictures more in relation to girls, as stated by this parent,

*"It is perhaps the consequence that can occur in ten years if you have shared something that should not have been shared then. Typically, perhaps more in relation to girls, but it applies to boys as well. You are sharing photos where you're barely dressed or things like that, and it can be abused by someone. That may be what I think of first and foremost as the biggest concern."*

Another parent who has an 11-year-old daughter stated that "[I am concerned] mostly in terms of being tricked by someone, so they're tempted to suddenly send some sensitive or personal photos or meet some people other than what they pretend to be."

#### 4.2 Parental Mediation Strategies

The parents in our study reported using a variety of strategies to mediate children's internet use and related cybersecurity risks. Following the literature (Livingstone & Helsper, 2008; Nathanson, 2001), we have divided the strategies into three broad categories, as presented in Figure 2.

**Active mediation.** The most common strategy in active mediation is talking with children. Parents felt that raising awareness and disseminating knowledge are important, rather than simply being strict and controlling the use of devices or the internet in general. A majority of parents (16 of 25) explicitly mentioned talking about online security issues with their children, using either their own cybersecurity experiences or a cybersecurity case in the media as examples.

**Restrictive mediation.** Many parents also mentioned setting rules for and restrictions on internet use. Using device- or site-driven parental control tools is also a common strategy to set specific rules and

restrictions. Thirteen of 25 parents reported using parental controls, mostly a device's default features. The parents used parental controls to limit screen time, restrict access to different websites, set age limits for accessing websites, and limit download opportunities. Other restrictive strategies include limiting children's access to specific activities (such as downloading apps or buying anything on their own).

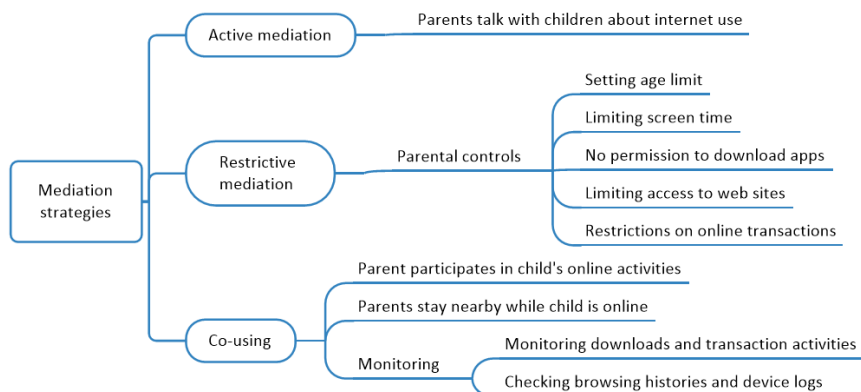


Figure 2. Parents' mediation strategies

**Co-using.** The co-using strategies mentioned by our study parents include strategies in which a parent tries to participate in the child's activities or simply stays nearby and watches those activities. Two parents said that they try to engage in online activities with their children (such as playing online games together or creating accounts on social media to follow each other). Nine parents reported staying nearby and observing the child using the internet and devices, but they do not necessarily have any direct interaction with the child at those times. Ten parents also mentioned that they occasionally or routinely check their children's devices and device logs to monitor the activities that their children are participating in, even if they don't restrict their activities. Because the parents reported doing so with an agreement with the children, we have classified this device log-checking as co-using. These parents said that their children are aware of the fact that they periodically check their phones, even though the children may not like it.

#### 4.2.1 Gender Patterns in Mediation Strategies

The parents use active and restrictive mediation strategies similarly regardless of their gender and their children's gender. However, we have observed that when it comes to monitoring children's personal devices and activity logs, mothers from our sample do this more than fathers. Just over a third (six of 17) of mothers reported checking their children's mobile phones and devices to monitor their online activities, whereas a quarter (two of eight) of fathers reported checking their children's phones or devices.

Even though more mothers reported checking children's devices, some mothers (four of 17) reported that fathers take care of technical issues in the home, such as setting parental control tools, controlling downloads, and assessing specific software or games and related permissions. For example, when asked about using parental control tools, one mother stated, *"I guess we have one of those apps that limits [the access on phones], but I'm not sure. It's my husband who fixes it"*. Another mother responded that *"I didn't do it; it was my husband—but I think we set an upper age limit. It was also for not accidentally getting into inappropriate websites."*

### 4.3 Parents' Views on Children's Online Activities and Gender Influence

In terms of children's online activities and behaviors, we observed some patterns that relate to the gender of the children (Figure 3). Before presenting them, we note that they are based on the parents' descriptions, as our interviews were conducted only with parents. Thus, we acknowledge that the children may have different perspectives on their choices and preferences.

**Participation in programming activities.** Seven parents reported that their children were taking or had taken elective courses on programming (either at school or as an extracurricular activity): notably, all seven children are boys. None of the parents' daughters were taking or had taken any elective programming courses in schools or outside.

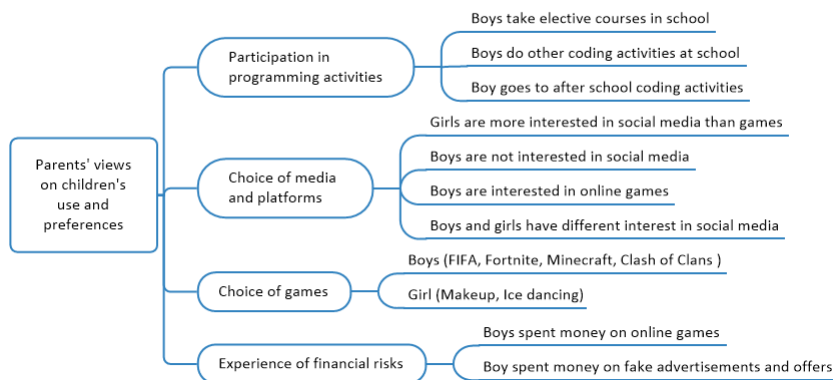


Figure 3. Parents' views on children's online activities, media use, and preferences

**Choice of media and platforms.** Following the parents' descriptions, we have identified a few patterns in the children's media and platform choices. Only one parent noted her daughter playing online games, while some parents (seven of 25) acknowledged their sons frequently playing online games. There can also be variations in the games available. The 10-year-old daughter enjoys playing games like dress-up, ice dance, and makeup, while the sons apparently enjoy playing FIFA, Fortnite, and Minecraft (as mentioned by the parents). Additionally, seven parents claimed that boys are not interested in social media; rather, they believe that boys are more into games and that girls are more interested in social media.

**Risk experiences.** The parents mentioned multiple episodes in which their children were exposed to different risky situations that resulted from online activities, such as meeting strangers they contacted online, sharing passwords with friends, being bullied on social media platforms, exposure to inappropriate content, falling victim to online frauds and advertisements, and so on. Interestingly, we have noticed that all the experiences related to spending money online were reported for boys. Nine parents said that their sons had spent money on online games and fake advertisements without fully understanding what they were doing. The most commonly cited example was related to the game "Fortnite". However, none of the parents mentioned having their girls experience the same occurrences.

## 5. DISCUSSION

### 5.1 Parents' Cybersecurity Perspectives and the Role of Gender

As presented in Section 2, previous studies have shown the effect of gender on various aspects of cybersecurity, including cybersecurity engagement, behavior, and users' risk experiences. Our study also revealed some patterns among the parents, as presented above. One example is taking care of technical issues. As Cai et al. (2017) show, gender-based differences in attitudes toward technology have long been a concern. These differences still may exist to date. Our study results showed that some mothers prefer fathers to take care of technical issues at home, even though both parents are equally responsible for ensuring their children's online security. This finding can indicate the existence of the stereotypical view of technology use and gender. However, we must acknowledge that only four mothers from our study (out of 17) revealed this behavior; the majority did not show similar behavior regarding technology usage.

Another gender pattern we observed is the gender influence in terms of risk exposure, which is supported by the findings in other studies (Kvardova et al., 2021; Savoia et al., 2021). Being tricked into spending money on games or fake advertisements is a risk we have found parents mentioned only for their sons. This

finding also relates to another pattern we found; some parents reported that their boys like to play online games (such as FIFA and Fortnite), whereas girls like to spend time on social media. We also noticed that parents worry about some risks more for their sons but not at the same level for their daughters, such as exposure to pornography, internet addiction, and online shopping. A few parents also emphasized the risk of exposing sensitive personal photos more for girls. These results once more raise the possibility of gender stereotypes and beliefs. However, as was previously indicated, our sample size was small and unbalanced in terms of gender. As a result, we were unable to directly compare these findings based on gender.

## **5.2 Parental Mediation and the Role of Gender**

In terms of mediation, we have seen that all the parents expressed about using similar strategies for the children's internet use and activities regardless of the gender of the children. This supports the findings of Livingstone & Helsper (2008). We did see, however, that mothers were more likely than fathers to check their children's device logs. Nevertheless, it is important to note that given that we included considerably fewer fathers than mothers in our study, this pattern could change. In our upcoming research, we can delve more into this topic. Apart from that, we have seen that mothers and fathers use active, restrictive, and co-using mediation techniques similarly.

## **5.3 Limitations**

While we note the importance of the findings in this study, we do acknowledge certain limitations. The main limitation is the lack of a gender-balanced sample. Our study had more mothers than fathers, making direct comparisons of gender-based findings impossible. Our goal in this study, however, was to identify patterns that could serve as a valuable foundation for our future work and future researchers. Future gender-focused studies can explore the perceptions of parents using a more gender-balanced sample and identify any possible differences from the results of this study. Another limitation is that the result of this study reflects only parents' perceptions. As we have already noted, the children may have different opinions about their online activities and choices than what their parents reported. Thus, we would like to acknowledge that understanding and investigating both children's and parents' perceptions could complement our findings.

## **6. CONCLUSION**

This study presents the results of a qualitative study exploring the role of gender in parents' perceptions and mediation strategies regarding children's cybersecurity awareness and attitudes. Our study provides some insights about potential gender influences in terms of parents' attitudes toward their children's cybersecurity, risk exposure, and parental mediation. As gender influence in cybersecurity engagement, behavior, and risk experiences have been demonstrated in both previous research and our study, it is essential to explore this factor more in future endeavors.

It is natural that children learn and develop the behavioral attributes they see in their parents and at home. Thus, the presence of any gender stereotypes in parents could lead to the development of similar stereotypes and attitudes among their children. Such stereotypes could also influence the children's future lives and choice of career paths, prolonging the gender inequality problem of today's society over the long term and resulting in inequalities for all genders. Understanding the role of gender regarding cybersecurity and technology use, in general, could be crucial for designing and developing inclusive and effective cybersecurity educational and awareness opportunities for both children and parents. Thus, we suggest that cybersecurity awareness solutions should be more inclusive, and designing inclusive technologies and solutions that fully consider the gender perspective is essential. Our current research findings will serve as inspiration for our future work, which will focus on designing an inclusive cybersecurity awareness application for children that considers parental expectations and influences.

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