Behind the Screens: The Security & Privacy Advice Landscape of Children in Grades 5 & 6

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ABSTRACT

Human-centered security research often aims to improve online security of end users through education, but work in the field rarely considers children as end users. Despite the inevitable need to empower children against online threats, the space of what children know about security and privacy is insufficiently explored. This is of interest not only to security researchers, but also to educators. As a first step in exploring the space of children's knowledge about security and privacy, we set out to collect security and privacy advice of children in grades 5 & 6, as well as from their parents and teachers. We collect the advice through a survey for each of the aforementioned groups. We consider pieces of advice collected to uncover gaps in the security knowledge of children and their support network enabling further insights and research in this area.

CCS CONCEPTS

• **Security and privacy → Social aspects of security and privacy**; • **Social and professional topics → K-12 education**.

KEYWORDS

IT security, cybersecurity, privacy, education

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1 INTRODUCTION

Users are faced with ever increasing threats to their security and privacy. Not only technical but also educational measures to those challenges should be considered, leading to the growing research field of human-centered security, concerned with the human factor in securing our digital lives. Much of this research has focused on adults (e.g. [10, 11]), but not on children. While curricula challenge educators to address the topic [2, 3], they lack depth and do not address areas like human factors in security [12]. What do children know about secure online behavior? Their thoughts on this topic may be unique as they have their own usage patterns [5] in the Internet, possibly introducing different types of threats. Existing research often focuses on the conceptions children hold: Borowkski et al. [1] give a broad overview of the questions children have in the area of computer science, including some security topics. Specific topics are also covered, such as "cryptography" for K-12 students [6] or "malware" for primary school students [4]. Work dealing with children usually involves verbal interviews with self-reports of the children (and sometimes of their parents) for risks or concerns in the Internet, e.g. [7, 14]. While some try to uncover the underlying mental models, they rely on the children and parents being able to identify threats. However, children might not know about all the diverse technological threats possible [8]. A hypothesized factor not investigated yet is a child's support network, namely by their parents, teachers, and peers, who have their own ideas of advisable behavior. For this factor, we consider children in grades 5 & 6. We assume that while children this age are still young enough to still be forming beliefs strongly influenced by the support network, they are old enough to be surveyed with a questionnaire. This enables us to map out the advice present in the network in a comparable way for all groups. The results can supplement existing interview-based data and enable future work in the area of conceptions. Altogether, this leads to the following research questions:

RQ1 What advice for secure online behavior on the Internet do children in grades 5 and 6 give?

RQ2 What advice for secure online behavior on the Internet do their teachers and parents give to children in grades 5 and 6?

RQ3 What are the sources of this advice?

2 METHODOLOGY

To answer RQ1 and RQ2, we opted for a physical, example-based questionnaire, also considering the age (9 to 12) of the children. The questionnaire's first page presents three randomly chosen situations out of 39 example situations[1] relating to online security risks.

[1] For English versions of the questionnaires and descriptions of the situations, see https://osf.io/zx28q/?view_only=6e5f3b13ba2d4f39b217a6a9f4471534. The original language of these documents is German.

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Each situation is visually supported by a sketch style image generated by "DALL-E 2". Participants are instructed to write their advice into the empty speech bubble. The second page contains a larger speech bubble for general advice. To investigate the influencing groups concerning security and privacy (RQ3), the participants are asked to rank their sources of advice. The questionnaire concludes with demographic questions and a self-assessment. The 39 example situations were created based on the taxonomies of [13] and [8]. We assumed a simple threat model consisting of an adversary, the goal of an attack, and the victim (a child). By considering different attackers and goals we tried to come up with descriptions of situations potentially carrying risks described by those taxonomies. We use both taxonomies to cover as many potential security threats as possible since the first one is more global and the second one presents more fine-grained online risks for children.

To recruit participants, we asked schools about using one of their computer science lessons to conduct the survey with specific classes. Parents receive a survey beforehand and also give consent, while teachers fill out the survey with the children. We follow up the survey with a unit about "online security and privacy" enriched by the answers from an online expert survey conducted beforehand. This way, they are not primed to the subject for the survey but still receive guidance afterwards. The experts are recruited through a local security research group, a graduate program and regional security conferences, being at least PhD students working on security topics. Each expert is presented five randomly chosen situations out of our 39 situations. We again used the setting of a child seeking guidance, asking the experts for advice. The online expert survey also ends with inquiring about more general advice.

To ensure informed consent of participants (or of their legal guardians), we provide a privacy policy, a consent form, and a letter explaining our research to these groups. The privacy policy was reviewed and approved by the data protection officer of our university. Children whose legal guardians did not consent to data processing could still attend the classroom session, but their survey data was excluded. We do not gather personal data from the experts. To ensure the appropriateness and comprehensibility of the presented situations [9], three experts with an educational background (degree and/or experience in K-12 education) reviewed all situations. They deemed all situations fitting and comprehensible, except for some minor changes in two situations. A pilot study was conducted with two children as cognitive interviews, following recommended best practices [9].

Currently, we survey only some actors in the support network of the children. While we argue that parents, teachers, and peers are usually the main actors, there might be influences currently unknown to us. We expect to learn more about such influences with this work. We have no fine-grained control over the study's participants since we need to work with the participating classes as-is, and can practically only work with local schools. Hence, we cannot guarantee a representative sample in our studied age group (and neither for the parents nor teachers). Concerning the expert survey, we have an academic bias since none of our recruited experts works in the industry.

3 CONCLUSION

We introduced a research project focused on investigating the security advice landscape of children. We created different surveys, framed as the advice given to the child by parents, teachers and peers. For these surveys, we constructed example situations based on two taxonomies and tested the quality of these situations with both security and education experts. Gathering advice from security experts allowed us to conceptualize a classroom session as follow-up to the survey. The collected data will help us gain insights into the ideas of advisable behavior children (RQ1) and their support network (RQ2) have. We hope to verify the hypothesized influence of the support network (RQ3).

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