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Narrative Persuasion in a Mobile Environment: Effectiveness of a Mobile Application for Promoting Digital Skills and Coping Strategies in Adolescents

ISABEL RODRÍGUEZ-DE-DIOS[1]
Pompeu Fabra University, Spain

JUAN-JOSÉ IGARTUA
University of Salamanca, Spain

LEEN D'HAENENS
KU Leuven, Belgium

Digital skills and coping strategies have emerged as key competences for adolescents because of concerns about online risks and opportunities. With smartphones nigh ubiquitous nowadays, mobile applications are a promising tool for reaching adolescents and developing their competences. Because narratives have demonstrated their effectiveness for knowledge acquisition and attitudes, this study explores their use in mobile environments. A mobile application with narrative content was developed for teaching digital skills and coping strategies. A quasi-experiment conducted among 245 adolescents showed that the application was effective. Its use raised the level of personal security skill and intention to use active coping strategies when facing contact online risks. Identification with the main character and mobile acceptance predicted the impact of the app, but narrative transportation did not. This study suggests that narratives in mobile apps can be effective for adolescents.

Keywords: digital skills; coping strategies; online risks; narrative persuasion.

In a digital world, concerns have arisen about the experience of minors in online ecosystems fraught with all manner of risks. Online risks are online behaviors that are associated with a certain likelihood of having a negative experience (Sonck & de Haan, 2013). These include cyberbullying, harmful contact with strangers, exposure to pornography and violence, and so on. Given the pervasive nature of such risks,

Isabel Rodríguez-de-Dios: isabel.rodriguez@upf.edu
Juan-José Igartua: jigartua@usal.es
Leen d'Haenens: leen.dhaenens@kuleuven.be
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research has been focusing on ways to safeguard young people against them while maximizing online opportunities and benefits. Thus, some claim that adolescents can avoid online risks if they manage to acquire the right digital skills (Cernikova, Dedkova, & Smahel, 2018; Sonck & de Haan, 2014)—the skills needed to function effectively and safely in cyberspace (Rodríguez-de-Dios, van Oosten, & Igartua, 2018). The literature shows that more digitally skilled adolescents face more risks, but also benefit from more opportunities (Livingstone & Helsper, 2010; Rodríguez-de-Dios et al., 2018). Online opportunities are communication, entertainment, and information options viewed in a positive light (Livingstone & Helsper, 2010). Digital skills do not effectively reduce risks, but they remain essential because they help adolescents take advantage of such online opportunities.

Because of the difficulty of reducing online risks, "coping strategies" have emerged as a key tool. Research shows that the negative impact of online risks can be mitigated by coping strategies (Vissenberg & d'Haenens, 2020). Hence, adolescents need to both acquire digital skills and become proficient in coping strategies.

Interventions against online risks and for promoting digital skills have shown promising results (Gradinger, Yanagida, Strohmeier, & Spiel, 2016; Vanderhoven, Schellens, & Valcke, 2014). Digital interventions seem especially beneficial when targeting adolescents, given that the use of technology is engaging for them (Nocentini, Zambuto, & Menesini, 2015). Similarly, there is evidence that fictional narratives, compared with nonnarrative formats, are more effective in changing attitudes, beliefs, and behaviors (Murphy, Frank, Chatterjee, & Baezconde-Garbanati, 2013). Based on the this, we can conclude that digital interventions and narratives are a promising tool to encourage online safety for adolescents, but research is needed to assess their effectiveness.

Consequently, the goal of this study is to develop a mobile application, complete with narrative content, that is intended to reinforce coping strategies and digital skills, and to evaluate its impact on adolescents.

Digital Skills and Coping Strategies to Face Online Risks

Online risks are categorized as risks because they are linked to potential harm (Sonck & de Haan, 2013). Nevertheless, not all adolescents exposed to online risks suffer harm. For instance, in the case of contact with online strangers, adolescents report both positive (e.g., meeting new friends; Cernikova et al., 2018; or socializing with people in similar life situations; Hillier & Harrison, 2007) and negative ones (e.g., threat to their safety; Heirman et al., 2015). Therefore, what is construed as an online risk can also bring benefits, provided the hazard element is averted—hence, the need for prevention and education (Cernikova et al., 2018).

As seen previously, online risks include cyberbullying, potentially harmful contact with strangers, engagement in sexting, and exposure to online pornography and online violence. Among them, contact with strangers (online contact risk) is the most common risky activity among adolescents (Rodríguez-de-Dios et al., 2018). Thus, it has been found that one in four adolescents have an online "relationship" with someone they have never met and who is unconnected with their social circle (Livingstone, Mascheroni, & Staksrud, 2018). However, interventions usually focus on cyberbullying (DeSmet et al., 2017; Williford et al., 2013) and not on other online risks. Consequently, this study focuses on online contact risks.

When it comes to online risks, some authors point out the importance of digital literacy and digital skills (Cernikova et al., 2018; Sonck & de Haan, 2014). Digital literacy refers to "the awareness, attitude, and ability . . . to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others" (Martin, 2005, p. 135). Previous literature (e.g., Eshet-Alkalai & Chajut, 2009) conceptualized digital literacy as a skill-based literacy. According to Rodríguez-de-Dios and colleagues (2018), six different skills refer to different abilities and that comprise digital literacy: (a) technological: effective use digital technologies; (b) informational: finding online information and evaluating its relevance; (c) communicational: communicating through digital technologies; (d) critical: critically analyzing the information found in the online environment; (e) personal security: ensuring personal safety and managing online privacy; and (f) device security: keeping digital devices safe.

Some studies have suggested that adolescents can avoid negative online experiences by developing digital skills (Cernikova et al., 2018), while others show that more skilled adolescents experience more online risks. They do, however, also benefit from more online opportunities (Cabello-Hutt, Cabello, & Claro, 2018; Sonck & de Haan, 2013). In other words, while digital skills are not effective in reducing risks, they are an essential tool for locating online opportunities. Furthermore, recent literature points out that even though digital literacy does not reduce online risks, it is still important for knowing how to face these negative experiences (Festl, 2020). Digital skills are therefore a crucial tool for adolescents, which is why this study focuses on their development.[2]

In addition to digital literacy and digital skills, recent literature has also highlighted the relevance of coping strategies for facing online negative experiences (Vissenberg & d'Haenens, 2020). Coping strategies can be defined as the different ways that people respond to stress, such as seeking help, or denial (Skinner, Edge, Altman, & Sherwood, 2003). In the case of online risks, this stress would be provoked by a negative experience online, such as falling prey to cyberbullies. Research has shown that the effective use of coping strategies can help youths to protect their well-being and mitigate the negative impact of online risks (Vissenberg & d'Haenens, 2020).

Roth and Cohen (1986) created a twofold typology of coping strategies based on approach and avoidance: active strategies (i.e., dealing with a problem and looking for a direct solution) and passive strategies (i.e., escaping the problem to avoid discomfort). Regarding online risks and young people, literature is scarce. Developed by Vandoninck and d'Haenens (2015), one of the few existing classifications describes four types of coping strategies: (a) indifference (a passive "strategy" in which the adolescent hopes the problem will go away by itself, and tries not to think about it); (b) avoidance (a passive strategy that involves stopping any use of digital devices and avoiding problematic situations); (c) communication (an active strategy in which, after facing

[2] Since our experiment was to take place in (secondary) schools, we needed to consider their busy schedules. As principals would only allow one session per group of students, app content had to be limited. Consequently, we focused only on the development of personal security digital skills, as some items were related to active coping strategies. This let us develop more coherent narratives and contents. Targeting all digital skills as part of our intervention seemed too ambitious and, frankly, unattainable.

an online risk, the adolescent will talk out the problem with a third person); and (d) proactive behavior (an active strategy that amounts to tackling the problem head-on and finding an effective way to solve it).

Previous literature shows that active coping strategies are more effective than the passive ones because they aim to reduce or eliminate harm (Vissenberg & d'Haenens, 2020). In contrast, passive coping strategies are not sustainable solutions, considering the benefits and opportunities that online technologies might offer. Moreover, such a strategy "may further reduce their capacities for resilience and online opportunities" (Vandoninck, d'Haenens, & Segers, 2012, p. 209). Consequently, this study will focus on the development of active coping strategies (i.e., proactive and communicative) in the face of online contact risks. Nevertheless, we will also measure the intention to use passive coping strategies (i.e., passive and avoidance) to check whether our intervention has any effect on them.

Effectiveness of Previous Interventions Against Online Risks

Given this situation, some scholars argue that increasing education and awareness about online risks is the optimal solution (Patchin & Hinduja, 2010). Accordingly, interventions and educational packages that contain information about online safety—such as how to protect personal data—have been developed (e.g., Vanderhoven et al., 2014). Nonetheless, these initiatives usually lack a theoretical base or an evaluation of their effectiveness (Chibnall, Wallace, Leicht, & Lunghofer, 2006; Fernández-Montalvo, Peñalva, Irazabal, & López-Goñi, 2017)—hence, the need to conduct experiments (or quasi-experiments) to determine the effectiveness of these initiatives.

Most initiatives deploying (quasi)experimental procedures have proved to be effective; participants in the experimental groups (in comparison with the control group) gained more knowledge about online safety or digital skills (Chibnall et al., 2006; Fernández-Montalvo et al., 2017; Vanderhoven et al., 2014), or they became less prone to online risks (Cross et al., 2016; Gradinger et al., 2016; Williford et al., 2013). These results tend to indicate that interventions may be an effective tool for both reducing online risk behaviors and increasing digital skills. To test the effectiveness of our specific intervention, we propose the following research question:

RQ1: What is the effect of the mobile application on the development of the personal security digital skill (RQ1a)? What is the effect of the app on the intention to use active (proactive [RQ1b] and communicative [RQ1c]) coping strategies for facing online risks? What is the effect of the app on the intention to use passive (passive [RQ1d] and avoidance [RQ1e]) coping strategies for facing online contact risks?

It must be said that interventions are not equally effective for all minors. Previous studies have shown that such initiatives have a greater impact on younger participants (Chibnall et al., 2006; Williford et al., 2013), but the evidence is scarce because research is usually conducted among pupils in a single grade (Cross et al., 2016; DeSmet et al., 2017; Fernández-Montalvo et al., 2017). Given the lack of consistent findings, we propose the following research question:

RQ2: What role does age play in the impact of the app on personal security digital skills (RQ2a)? What role does age play in the impact of the app on the intention to use proactive (RQ2b) and communicative (RQ2c) coping strategies for facing online contact risks?

Similarly, a few studies have shown that gender does not play a relevant role (Gradinger et al., 2016; Williford et al., 2013), but earlier research evidence is scarce. Therefore, we formulate the following research question:

RQ3: What role does gender play in the impact of the app on personal security digital skills (RQ3a)? What role does gender play in the impact of the app on the intention to use proactive (RQ3b) and communicative (RQ3c) coping strategies for facing online contact risks?

Moreover, having previous experience with online risks might be relevant for the effectiveness of the intervention. Gradinger and associates (2016) showed that interventions against cyberbullying were more effective for people who had suffered or had committed cyberbullying—in other words, who had at least some experience with online risks. As far as we know, this is the only study to have considered the relevance of previous online risks. Therefore, we argue that more research is needed, and we formulate the following research question:

RQ4: What role does frequency of online contact risks play in the impact of the app on personal security digital skills (RQ4a)? What role does frequency of online contact risks play in the impact of the app on the intention to use proactive (RQ4b) and communicative (RQ4c) coping strategies for facing online contact risks?

Mobile Interventions and the Importance of Mobile Acceptance

With regard to the characteristics of the interventions, some authors argue that the use of information and communication technologies in their development offers several advantages, such as being more attractive to adolescents or allowing users to simulate real-world experiences and practice new skills (Nocentini et al., 2015). Specifically, mobile interventions seem particularly promising for young users (Willoughby & Liu, 2018).

In relation to mobile interventions, we also must consider the relevance of mobile (technology) acceptance or mobile application acceptance. Based on the technology acceptance model (TAM) from Davis (1989), *technology acceptance* refers to the perception of usefulness and ease of use of a technology, such as a mobile application. This concept is especially relevant because it has been shown to predict the effectiveness of a digital intervention (Al-hawari & Mouakket, 2010). Hence, according to previous research, the perception of a mobile application as useful and easy to use will predict its effectiveness.

This mobile application acceptance can be facilitated by including gamification and constructivism elements (Baptista & Oliveira, 2017). According to constructivism, individuals construct their knowledge by making connections between current and past knowledge, and they profit from working with real-life tasks. Hence, content must be linked to current and past knowledge, and to real-life tasks (Crompton, 2013; Sandberg, Maris, & de Geus, 2011). Second, gamification content refers to game elements and principles, such as points

and badges (Khaleel, Sahari-Ashaari, Tengku Wook, & Ismail, 2016), that are added to nongaming content with the aim of enhancing motivation and engagement. Given that constructivism and gamification predict mobile acceptance, and mobile acceptance predicts the effectiveness of an intervention, we can assume that mobile interventions should follow the basis of constructivism and gamification to promote mobile acceptance and, as such, the effectiveness of the intervention.

Despite the promising nature of mobile interventions, previous digital interventions have been developed mostly using computer programs (e.g., DeSmet et al., 2017; Williford et al., 2013). Because literature has noted the advantages of using mobile technology, and there is a research gap regarding interventions related to digital skills and online contact risks, more research based on mobile interventions is required.

The Power of Narratives: Narrative Persuasion and Its Use in Mobile Applications

When thinking about developing interventions targeted to adolescents, it might be helpful to consider the potential of narrative persuasion given that narratives are a powerful tool for changing attitudes and behaviors. Previous studies have demonstrated the effectiveness of narratives for the prevention of alcohol use (Shin, Miller-Day, Hecht, & Krieger, 2018) and sexual assaults (Hust et al., 2017) among adolescents, which also entails increasing health knowledge (Shen & Han, 2014).

Two main mechanisms explain the effects of narrative persuasion: narrative transportation and identification with character (Moyer-Gusé, 2008; Slater & Rouner, 2002). First, narrative transportation refers to the experience of being so completely immersed in a story that one forgets about the outside world (Green & Brock, 2000; Moyer-Gusé, 2008). This experience can be facilitated by increasing the familiarity with the material in the narrative, because reminders of personal experiences seem to be important in determining the level of transportation (Fitzgerald & Green, 2017). Second, identification with characters refers to an emotional and cognitive process in which the individual takes on the role of the fictional character (Cohen, 2001; Igartua & Barrios, 2012). This mechanism can be facilitated by including characters that are similar to the audience (Igartua, Wojcieszak, & Kim, 2019). Prior literature has suggested that both narrative transportation and identification predict the impact of the narrative (de Graaf, Hoeken, Sanders, & Beentjes, 2012; Green & Brock, 2000; Igartua & Barrios, 2012; Murphy et al., 2013). Furthermore, research has revealed that narratives are more useful for changing attitudes, beliefs, and behaviors than are nonnarrative formats (Murphy et al., 2013).

Nevertheless, research on the application of narrative persuasion in mobile environments is practically nonexistent (Willoughby & Liu, 2018). Considering the current relevance of mobile devices and the positive outcomes of narratives, it is essential to explore the effectiveness of their combination. Consequently, in the present study, we developed a mobile application that considers mobile application acceptance and narrative persuasion theories. In view of the research previously mentioned, we propose the following hypotheses:

H1: Mobile application acceptance will increase the user's personal security digital skills (H1a). Mobile application acceptance will increase the user's intention to use proactive coping strategies (H1b) and communicative coping strategies (H1c) for facing online contact risks.

H2: *Narrative transportation will increase the user's personal security digital skills (H2a). Narrative transportation will increase the user's intention to use proactive coping strategies (H2b) and communicative coping strategies (H2c) for facing online contact risks.*

H3: *Identification with the main character will increase the user's personal security digital skills (H3a). Identification with the main character will increase the user's intention to use proactive coping strategies (H3b) and communicative coping strategies (H3c) for facing online contact risks.*

Method

Participants

A power analysis was conducted with G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the required sample size. Based on previous meta-analyses with mobile interventions (Sung, Chang, & Liu, 2016; Tingir, Cavlazoglu, Caliskan, Koklu, & Intepe-Tingir, 2017) with mean effect sizes of 0.52 and 0.48 (Hedge's *g*), we calculated the sample size for a medium effect size. Results indicated that a sample size of 128 participants would be needed to yield a power level of .80 (α = .05) in a study with two groups.

Data were collected from 245 students of secondary education at three schools in Spain. Participants were asked to obtain a consent form signed by their parents/caregivers. Students were 12–16 years old (M = 13.22; SD = 1.01), and 53.5% of them were male.

Design and Procedure

This study followed a quasi-experimental design; adolescents were not randomly assigned to each of the conditions. When researching in schools, randomization presents a challenge because teachers and principals usually insist on keeping the class structure intact (Sandberg et al., 2011). To address this limitation, we asked principals for two classes[3] that were as similar as possible: One was the experimental group, which used the app, and the other was the control group, with no intervention. Consequently, as in the meta-analysis by Braddock and Dillard (2016), with the aim of testing the effectiveness of the app, in our study, the experimental group was exposed to the narrative, whereas the control condition had no intervention. This approach "enabled us to isolate the unbiased persuasive effect of narrative by comparing it to a zero-effect baseline" (Braddock & Dillard, 2016, p. 448).

To tackle concerns about internal validity, we conducted a pretest with relevant variables in an effort to check that groups were homogeneous (Briz-Ponce, Juanes-Méndez, García-Peñalvo, & Pereira, 2016; Igartua & Frutos, 2017). The research was conducted in two stages. First, the pretest questionnaire was administered. This measured digital personal security skills, online contact risk, coping strategies, and sociodemographic data. The quasi-experiment took place one month later. The procedure was as follows:

[3] Six pairs of classes participated in the quasi-experiment.

We installed the app on 30 rented Samsung Galaxy S5 smartphones running the Android[4] mobile operating system, which we brought to the schools during regular hours. As in previous interventions with apps (e.g., Briz-Ponce et al., 2016), all participants were provided with a mobile device to avoid the following problems: (a) incompatibility—owners of an iPhone, a Windows Phone, or an Android phone running an older version of the operating system could not have taken part otherwise; (b) sampling error (i.e., students who did not own a smartphone could not have participated); (c) time restrictions (i.e., installing the app on the students' devices would have taken too long); and (d) school restrictions (i.e., some institutions might not allow children to bring their mobile phone to school).

The students in the experimental group used the app in the classroom, whereas the control group did not receive any specific intervention and followed the normal class routine. They were simply asked to complete the posttest questionnaire at the beginning or at the end of their class. As in similar interventions dealing with online risks (Vanderhoven et al., 2014) or app interventions (Briz-Ponce et al., 2016), the experimental group used the app during one session. Students were asked to use the app freely and to interact with it. By the end of the session, they also completed the posttest questionnaire, which measured the following variables: digital security skills, coping strategies, mobile application acceptance, identification with the protagonist, narrative transportation, and sociodemographics. In the case of the control group, the questionnaire measured three variables only: digital security skills, coping strategies, and sociodemographic information. A more detailed description of these variables is presented in the Measures section.

Materials: Development of the Mobile Application (CompDig) and Pilot Study

CompDig[5] is a mobile application intended to teach personal security digital skill and active (proactive and communicative) coping strategies to adolescents facing online contact risks. The app has three modules: "My Story," "Test," and "Achievements." In view of the previous arguments, the mobile application design was based on the narrative persuasion theory, and it contains audiovisual narratives. We also considered the constructivist approach, which maintains that activities must simulate real-life situations and also refer to previous knowledge (Sandberg et al., 2011). Accordingly, our narratives and tests refer to common situations that adolescents are likely to have experienced on social media. Finally, and as described next, we also considered the gamification approach by including points and badges to enhance motivation and engagement.

When launching the app (see Figure 1), the users first choose a character: female (Lucía) or male (Hugo). Content is the same in both versions—the protagonist's gender (and their friends) changes. We included a male and a female version of the same character because research shows that there is a significant association between gender of the user and prime character (Woods, Hall, Dautenhahn, & Wolke, 2007). Indeed, chi-square analysis showed that there were gender differences when it came to choosing the character in our study: A total of 91.7% of boys chose the male character, and 100% of the girls chose the female one, $\chi^2(1, N = 118) = 99.582$, $p < .001$.

[4] The Android operating system was chosen because (1) Android devices are more affordable and, (2) according to the Kantar Worldpanel, in 2017, Android was the market leader in Spain, with 92% of the market share.

[5] CompDig is available for free in Google Play.

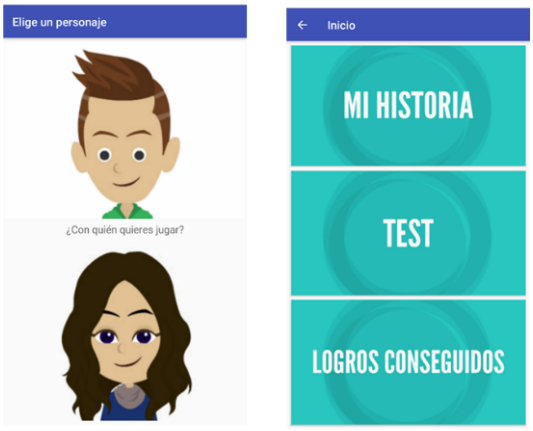

Figure 1. Snapshot of the mobile application: Character selection and menu.

First, and regarding the story module, stories follow a first-person testimonial narrative format because this has been found to be more effective (de Graaf et al., 2012; Kim & Shapiro, 2016). We also considered the importance of the familiarity with the material in the narrative to facilitating narrative transportation (Fitzgerald & Green, 2017). Because adolescents were the target audience of the narratives, the story was set in a high school. Likewise, and to facilitate identification with the characters (Igartua et al., 2019), the main protagonists were all adolescents. Using the GoAnimate platform (see Figure 2), we created four animated videos whose protagonist spoke about his or her use of digital devices while giving advice related to coping strategies and digital skills.

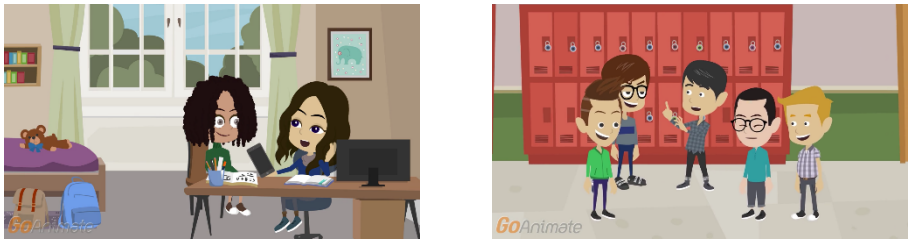

Figure 2. Scenes of the narrative videos from the app.

Second, the test module was developed with gamification and constructivism theories in mind. According to Vanderhoven and colleagues (2014), principles of constructivism can be applied with elements such as active exercises, in which users must choose an option. This module contains tests in which users advise the main character what he or she should do in several online situations. Users received feedback related to their answers and, according to gamification theory, positive reinforcement (i.e., "well done") when they gave the correct answer (Khaleel et al., 2016).

Third, the achieved achievements module was also developed according to gamification principles. Users receive points for answering the tests correctly, and badges for watching the stories and achieving good

marks on the tests (Khaleel et al., 2016). Finally, and based on principles of constructivism, users could choose the order in which to complete the different modules.

A pilot study was carried out to test (1) narrative realism and credibility (six items on a 7-point Likert scale), (2) degree of identification with the protagonist (six items on a 5-point scale), and (3) narrative transportation (four items on a 5-point scale). After reading the story, 16 secondary students (nine boys; *M* = 15.25 years, *SD* = .57) completed the questionnaire. Regarding the realism and credibility of the story, participants considered that "The message was clear and understandable" (*M* = 6.13; *SD* = 1.08), "The story was credible" (*M* = 6.19; *SD* = .65), "The story was interesting" (*M* = 6.13; *SD* = 1.02), "The story about Hugo/Lucía was realistic" (*M* = 6.00; *SD* = 1.21), "The story told by Hugo/Lucía made sense" (*M* = 6.25; *SD* = 1.00), and "The story portrayed situations that could occur in real life" (*M* = 6.69; *SD* = .60). A one sample *t* test was conducted to examine whether the sample mean was statistically different from the scale's mean. Results show that the sample mean is higher than the scale's mean (4): $t(15) = 13.85$, $p < .001$. It was also found that, while reading the story, participants experienced narrative transportation (*M* = 2.96; *SD* = .55), with a sample mean close to the scale's mean (3): $t(15) = -.22$, $p = .825$, and identified with the protagonist (*M* = 3.52; *SD* = .68), with a sample mean higher than the scale's mean (3): $t(15) = 3.04$, $p = .008$.

Measures

Personal Security Skill

This skill was assessed with four items from the Digital Literacy Scale (Rodríguez-de-Dios et al., 2018). Items were measured with a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) (e.g., "I know when I can post pictures and videos of other people online"). This was measured both in the pretest (*M* = 4.28, *SD* = 0.77; Cronbach's α = .66) and the posttest (*M* = 4.45, *SD* = 0.71; α = .73).

Online Contact Risks

This was measured with five items from a scale of online risks (Rodríguez-de-Dios et al., 2018). Participants reported on how often—from 1 (*never*) to 5 (*always*)—they engaged in online activities related to contact with strangers (e.g., "Send personal pictures to people I meet online"). The mean score was calculated (*M* = 1.34, *SD* = 0.45; α = .66).

Coping Strategies

Four types of coping strategies (proactive, communicative, passive, and avoidance) were assessed with 12 items ranging from 1 = *"I did not/would not do this"* to 4 = *"I would probably do this"* (Vandoninck & d'Haenens, 2015).[6] Participants were asked how they (would) respond to online contact risks. These strategies were measured both in the pretest and the posttest:

[6] To improve the reliability, two items were excluded from the original scales: "Delete the message" (proactive) and "Talk with parents" (communication).

- Proactive: pretest (M = 3.22, SD = 0.69; α = .59); posttest [M = 3.55, SD = 0.59; α = .72]; e.g., "Change privacy settings."
- Communicative: pretest (M = 2.11, SD = 0.74; Spearman's rho[7] = .58); posttest (M = 2.54, SD = 0.83; rho = .64); e.g., "Talk with friend(s)."
- Passive: pretest (M = 1.88, SD = 0.77; rho = .38); posttest (M = 1.72, SD = 0.74, rho = .50); e.g., "Hope the problem goes away by itself."
- Avoidance: pretest (M = 2.04, SD = 0.80; α = .72); posttest (M = 1.78, SD = 0.83; α = .82); e.g., "Go offline for a while."

Mobile Application Acceptance

This was assessed using seven items adapted from previous studies (Lund, 2001; Nikou & Economides, 2017). Items (e.g., "I would like to use this app again") were measured in a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The mean score was calculated (M = 4.35, SD = 0.54; α = .78).

Identification With the Protagonist

This was assessed with a shortened version of the Identification with the Protagonist Scale (Igartua & Barrios, 2012). The adapted scale contained six items, and it measured in retrospect the identification with the protagonist (e.g., "I felt as if I were the main character"), with responses ranging from 1 (*not at all*) to 5 (*extremely*). The mean score was calculated (M = 3.66, SD = 0.81 α = .81).

Narrative Transportation

This was assessed with the Transportation Scale–Short Form (Appel, Gnambs, Richter, & Green, 2015). As in previous studies (Riedl, 2010), mental imaginary items designed for a writing narrative were excluded. The scale consisted of four items (e.g., "I wanted to learn how the narrative ended"), ranging from 1 (*not at all*) to 5 (*extremely*). The mean score was calculated (M = 3.03, SD = 0.93; α = .74).

Results

Preliminary Data Analysis: Randomization Check and Equivalence of the Groups

Before analyzing the data, we checked the homogeneity of the two groups with respect to the variables: personal security skills, contact online risks, and coping strategies.

The independent-samples student t test showed that there were no statistically significant differences between the groups in some of the variables considered. However, in other variables, there were

[7] Because the passive and the communicative coping variables only contained two items, Spearman-Brown coefficient was used.

statistically significant differences (see Table 1). Therefore, in the following statistical analysis, we include the pretest score of the dependent variable as a covariate.

Table 1. Homogeneity of the Groups: Experimental and Control.

Variable	Group	*M*	*SD*	*t*	*p*
Personal Security Skills	Experimental group (*n* = 126)	4.11	.84	3.30	.001
	Control group (*n* = 118)	4.44	.66		
Online Contact Risks	Experimental group	1.26	.37	2.56	.011
	Control group	1.40	.51		
Proactive Coping	Experimental group	3.19	.70	.495	.621
	Control group	3.24	.68		
Communicative Coping	Experimental group	2.04	.73	1.371	.172
	Control group	2.17	.75		
Passive Coping	Experimental group	1.86	.74	.44	.658
	Control group	1.91	.81		
Avoidance Coping	Experimental group	2.19	.82	−2.72	.007
	Control group	1.90	.78		

Note. Levene's test was significant ($p < .01$) for online contact risks. We used the values for "Equal variances not assumed."

Chi-square analyses showed that both groups did not differ significantly with regard to gender, $\chi^2(1, N = 245) = .629$, $p = .428$, or grade, $\chi^2(2, N = 245) = .317$, $p = .853$. Similarly, the *t* test indicated no statistically significant differences in age between the experimental group ($M = 13.16$, $SD = 1.00$) and the control group ($M = 13.28$, $SD = 1.02$); $t\ (243) = .885$, $p = .377$.

Research Question and Hypothesis Testing

RQ1: Impact of the Mobile Application on the Development of Digital Skills and Coping Strategies

An analysis of covariance using the pretest as a covariate was conducted for checking the impact of the app (see Table 2).

Table 2. Impact of the App on Personal Security Skill and Intention to Use Coping Strategies.

		Post-test					
Variable	Group	M	SD	*F*	*p*	η_p^2	*d* (Cohen's)
Personal Security Skill	Experimental	4.72	.38	33.9	<.001	.124	.76
	Control	4.24	.80				
Proactive Coping	Experimental	3.69	.53	13.5	<.001	.053	.47
	Control	3.42	.62				
Communicative Coping	Experimental	2.89	.82	48.7	<.001	.168	.89
	Control	2.21	.69				
Passive Coping	Experimental	1.56	.69	9.8	.002	.040	−.41
	Control	1.86	.76				
Avoidance Coping	Experimental	1.45	.66	41.1	<.001	.147	−.83
	Control	2.08	.85				

Results showed that the app was effective; the level of personal security skills and the intention to use active coping strategies were significantly higher in the experimental group than in the control group. Additionally, a paired *t* test was conducted to compare the results of the pretest and posttest in the experimental group (see Table 3). Results revealed significant differences between pretest and posttest: Participants showed a high level of personal security skills and a greater intention to use active coping strategies after using the app.

Table 3. Difference Between Pretest and Posttest Scores of the Experimental Group.

	Pretest		Post-test			
Variable	*M*	*SD*	*M*	*SD*	*t*(118)	*p*
Personal Security Skill	4.12	.84	4.72	.39	−6.751	<.001
Proactive Coping	3.20	.70	3.69	.53	−6.041	<.001
Communicative Coping	2.04	.73	2.89	.82	−8.438	<.001
Passive Coping	1.86	.74	1.57	.69	3.457	.001
Avoidance Coping	2.18	.82	1.45	.66	7.483	<.001

RQ2: Role of Age in the Impact of the App

The PROCESS macro (Model 1) developed by Hayes (2013), with variables in the pretest as covariates, was used for answering RQ2, RQ3, and RQ4.

The interaction effect between the use of the app and age on the level of personal security skill (RQ2a) was not statistically significant ($B = -.01$, $SE = .08$, $p = .892$). Similarly, the interaction effect between the use of the app and age on the intention to use proactive coping strategies (RQ2b) was not statistically significant ($B = -.06$, $SE = .07$, $p = .378$). On the contrary, there was a significant interaction effect between the use of the app and age on the intention to use communicative coping strategies (RQ2c; $B = -.24$, $SE = .09$, $p < .05$). The impact of the app on the intention to use communicative coping strategies

was stronger among the younger students: It had a greater impact on 12-year-olds (B = .98, p < .001) and 13-year-olds (B = .73, p < .001) than on the 14-year-olds (B = .49, p < .01).

RQ3: Role of Gender in the Impact of the App

We also tested the "moderating" effect of gender on the impact of the app. It was found that the interaction effect between the use of the app and the gender on the level of personal security skill (RQ3a; B = −.11, SE = .17, p = .501) and the intention to use proactive (RQ3b; B = −.03, SE = .15, p = .848) and communicative (RQ3c; B = .12, SE = .19, p = .521) coping strategies was not statistically significant.

RQ4: Role of the Frequency of Online Contact Risks in the Impact of the App

Results showed that the frequency of online risks did not moderate the impact of the app on the personal security skill (RQ4a; B = .10, SE = .20, p = .613) and the intention to use proactive (RQ4b; B = .14, SE = .18, p = .435) and communicative (RQ4c; B = .19, SE = .23, p = .418) coping strategies.

Hypotheses 1, 2, and 3: Mobile Application Acceptance, Narrative Transportation, and Identification With Characters Are Predictors of the Impact of the App

To test our hypotheses, we conducted multiple regression analyses using the experimental sample, with mobile application acceptance (H1), narrative transportation (H2), and identification with characters (H3) as independent variables (see Table 4). Variables in the pretest were introduced as covariates. Results of the multicollinearity test, measured based on the tolerance value, indicate no multicollinearity within the independent variables. However, there is a high correlation among the independent variables: identification with the character and narrative transportation (r = .60, p < .001); identification and mobile application acceptance (r = .59, p < .001); and narrative transportation and mobile application acceptance (r = .41, p < .001). Therefore, results should be interpreted with caution.

Table 4. Multiple Linear Regression Analyses for Personal Security Skills and Active Coping Strategies.

	Personal Security Skills	Proactive Coping	Communicative Coping	
	β	*β*	*β*	*Tolerance*
Mobile app acceptance	.311**	.024	−.094	.64
Identification with characters	.023	.413***	.434***	.49
Narrative transportation	−.190^{+}	−.120	.051	.63
Adjusted R^2	.062	.102	.128	

+p < .10. * p < .05. ** p < .01. *** p < .001.

First, and with reference to the impact of those variables on the personal security skill (H1a, H2a, and H3a), mobile application acceptance (H1a) was the only variable that had a statistically significant effect. This regression only explained 5% of the variance.

Regarding these variables' impact on intention to use active coping strategies (H1b, H1c, H2b, H2c, H3b, H3c), results suggest that only identification with characters (H3b and H3c) is positively associated with the intention to use them. This regression model explains 10% of the variance for proactive coping strategies (H3b) and 12% of the variance for communicative coping strategies (H3c).

Therefore, only H1a, H3b, and H3c are confirmed by the data; narrative transportation (H2) is not a predictor of the impact of the mobile application.

Discussion

As part of this study, we designed a mobile application and investigated its impact on the development of digital skills and coping strategies in adolescents. Regarding the impact, results showed that participants in the experimental group had higher levels of personal security skills and showed a greater intention to use active coping strategies (proactive and communicative), and a lower intention to use the passive strategies (passive and avoidance) compared with the control group. Effect sizes, considering Cohen's *d* statistic, were moderate (for communicative coping and personal security skill) to large (for proactive coping). These findings let us conclude that use of our application was effective in improving coping strategies and digital literacy in our test subjects.

Furthermore, our study showed that gender and age do not moderate the impact of interventions on digital safety. Age only predicted the impact of the app on the intention to use communicative coping strategies.

Finally, and with reference to the predictor role of narrative transportation for the impact of the app, contrary to what was hypothesized, results showed that this variable had no significant effect. Levels of narrative transportation were not high, but they were within the range of some previous studies that had significant effects (Mazzocco, Green, Sasota, & Jones, 2010). However, results showed that there was a negative correlation between age and narrative transportation ($r = -.21$, $p = .02$). It could be that older participants may have thought the stories were childish. Moreover, experimental conditions—with students sitting next to each other in their usual classrooms—could have limited the amount of narrative transportation experienced. This is in line with a meta-analysis showing that distraction reduces transportation but has little to no effect on identification (Tukachinsky, 2014).

Thus, and according to previous research (de Graaf et al., 2012; Igartua & Frutos, 2017; Murphy et al., 2013), our results suggest that identification with a character predicts the impact of the app on the intention to use active coping strategies. However, it has no bearing on the impact of the application on the development of the personal security digital skill. Considering that the development of this skill was actually predicted by mobile application acceptance, it might be the case that other elements from the app (such as the content from the test module) influenced this development. The persuasive content of the message transmitted by the protagonist would have only influenced the use of coping strategies. In any case, these variables only explain between 5% and 12% of the variance on the dependent variables. Findings suggest that other potential predictor variables might also explain the impact of the mobile application.

Implications for Research on Narratives and Mobile Interventions

To our knowledge, ours is the first study to have sought to develop and test the impact of a mobile application on the development of digital skills and coping strategies in adolescents faced with online risks. Moreover, it represents one of the first attempts to use traditional narrative persuasion in mobile environments. Results show that this can be a successful combination. Considering that adolescents spend a lot of time on their smartphones, these results open a line of research that deserves further attention.

Furthermore, this study adds to previous evidence showing that identification with a character predicts the effects of narrative persuasion. In this sense, it is important to note that there was a significant association between gender and the character chosen by the adolescents when using the app. This is in line with previous research reporting a significant association between the gender of the user and the prime character (Woods et al., 2007), and it highlights the importance of providing participants with characters of either gender when developing narratives.

Moreover, this study also makes a contribution to research into narrative persuasion on the area of digital safety. Traditionally, studies on narrative persuasion have focused on the power of narratives for health communication (e.g., Kim & Shapiro, 2016) or for reducing social stigma (e.g., Igartua & Frutos, 2017). This research shows that narratives can also be effective for promoting safe and responsible use of digital technology. Furthermore, it also shows that narratives can be effective regardless of an adolescent's individual characteristics (i.e., gender, age, and previous experience with online risks).

Limitations and Future Research

Although the results are promising, this study has also several limitations. First, participants were not randomly assigned to the experimental and control groups, and this may raise concerns regarding the internal validity of the study. Furthermore, experimental conditions may have influenced the results. The participants were sitting next to each other in the classroom and were required to use the mobile application only for a short period. Not all adolescents use mobile apps in the same way, which could also have affected the results. Also, participants were not given the opportunity to use the app in a less controlled setting and on their own smartphone. This may also raise concerns regarding the external validity of the study and the generalizability of the results.

Another limitation is the lack of a long-term follow-up, which would determine whether improvements were maintained for any length of time after the intervention. We only used an immediate posttest, and we did not measure longer term effects of the app. Furthermore, the reliabilities of the scales of coping strategies were not optimal, and results should be interpreted with caution. Last, we only measured perceived digital skills and intentions to resort to coping strategies. We have no way to know whether these skills and strategies were actually put to use by our test subjects in their everyday lives. This also limits the external validity of our findings.

Our intervention was intended to develop coping strategies for facing online risks. Therefore, more research is needed to establish whether these strategies were effective in reducing harm associated with

online risks. Finally, given that use of the mobile application has proved to be effective in developing personal security skills in adolescents, further studies could test the effectiveness of similar interventions in developing other digital skills.

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