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A growth mindset intervention to promote resilience against online peer victimization: A randomized controlled trial

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ABSTRACT

Online peer victimized adolescents are at an increased risk of several behavioral and emotional problems. Most cyberbullying interventions have focused on reducing the frequency of online peer aggressions. Meanwhile, less attention has been given to building resilience in victims to reduce the impact of victimization on their mental health. This study tested the effects of an online growth mindset intervention aimed at building resilience in victims. Eight hundred and fifty-six adolescents (47.10% female) were randomly assigned to the resilience vs. educational control intervention. The adolescents completed measures of online peer victimization, behavioral and emotional problems (online peer aggressions, depression, social anxiety, eating problems, and non-suicidal self-injury), entity theory of personality beliefs, and attitudes toward defending the victims of online peer aggressions at pretest and at three and six months. The resilience intervention reduced the predictive association between online peer victimization and online peer aggression and social anxiety, and it increased the association between online peer victimization and attitude towards defending the victims. The resilience intervention also reduced the entity theory of personality beliefs in all adolescents. These results are promising given that the intervention lasted only approximately 40–45 min.

1. Introduction

Online peer aggressions are a major problem among adolescents. They consist of behaviors of threat, harassment, and embarrassment through electronic means or devices (Chun, Lee, Kim, & Lee, 2020). When these behaviors include as properties the vulnerability of the victims and the repetitiveness of the behaviors they are labeled as cyberbullying (Chun et al., 2020; Smith et al., 2008). According to a scoping review that included 159 studies distributed worldwide, the prevalence of online peer victimization in the last year varied from 1.0 to 61.1% (Brochado, Soares, & Fraga, 2017). Adolescents who are victims of online peer aggressions exhibit an increased risk of several emotional and behavioral problems. For example, findings of several meta-analyses reveal significant relationships between online peer victimization and anxiety, depression, low self-esteem, self-harming behaviors, and suicidal ideation (Fisher, Gardella, & Teurbe-Tolon, 2016; John et al., 2018; Katsaras et al., 2018). A recent meta-analysis of longitudinal studies found cyberbullying victimization as a predictor of internalizing problems, such as anxiety and depression (Marciano, Schulz, & Camerini, 2020). Online peer victimization was also associated with other behavioral problems, such as aggressions and social problems with peers and family members (Fisher et al., 2016). Moreover, the meta-analysis of longitudinal studies conducted by Marciano et al. (2020) showed that victimization significantly predicted perpetration of online aggressive behaviors over time, contributing to the perpetuation of these problematic behaviors and to the bully-victim circle. Beyond the emotional and behavioral problems highlighted in previous meta-analyses, some studies have also found a significant relationship between online peer victimization and eating problems as, for example, body dissatisfaction and unhealthy eating behaviors (Calvete, Orue, & Gámez-Guadix, 2016; Marco, Tormo-Irun, Galán-Escalante, & Gonzalez-García, 2018; Salazar, 2021).

The majority of research on the effectiveness of cyberbullying interventions has focused on potential strategies to reduce or prevent cyberbullying behaviors. For example, programs such as KiVa (Williford et al., 2013), ViSC (Gradinger, Yanagida, Strohmeier, & Spiel, 2015), Cyberprogram 2.0 (Garaigordobil & Martínez-Valderrey, 2015), or the Cyber Friendly School Program (Cross et al., 2016) have found promising results in reducing online peer aggressive behaviors among pre-adolescents and adolescents. Recent meta-analyses indicate that existing

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programs reduce significantly both online peer aggression perpetration and victimization (Gaffney, Farrington, Espelage, & Ttofi, 2019; Ng, Chua, & Shorey, 2022; Polanin et al., 2022). Several of these interventions include strategies to encourage witnesses of online peer aggressions to take an active role in defending the victim (Doane, Ehlke, & Kelley, 2020; Vlaanderen, Bevelander, & Kleemans, 2020) and thereby decrease the likelihood of online peer aggression (Orue, Fernández-González, Machimbarrena, González-Cabrera, & Calvete, 2021; Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). Recently, a quasi-experimental study found that intervention strategies based on emotion and behavioral regulation may be effective in reducing adolescents' aggressive communication, what may be relevant for the design of online peer aggression interventions (Veiga Simão et al., 2021).

In addition, other studies have focused on the effectiveness of interventions intended to improve victims' mental health-related outcomes (Cantone et al., 2015). A recent meta-analysis with 22 studies found a significant but very small effect of antibullying interventions on internalizing symptoms (Guzman-Holst et al., 2022). Some of those studies had analyzed the indirect effects of a bullying program in internalizing symptoms. For example, one of the studies found that the No Trap! Program reduced internalizing symptoms within the group that participated in the program, through the decrease in cybervictimization but not through the decrease in bullying victimization (Palladino, Nocentini, & Menesini, 2019). Another interesting line of study is the one that focuses on analyzing the moderating factors of the intervention effects. For example, Juvonen, Schacter, Sainio, and Salmivalli (2016) evaluated whether baseline bullying victimization moderated the KiVa program effects in depression and self-esteem and they found that the program effects on depression and self-esteem were the strongest for the most victimized students. However, there are fewer programs that were designed not for reducing perpetration and victimization but exclusively to prevent cyberbullying effects in victims. One of such programs is the Increasing Resilience for Cyberbullying (IRCB) program (Chillemi, Abbott, Austin, & Knowles, 2020), which focuses on the value of help-seeking and self-compassion skills. The results of this pilot study showed that those adolescents who received the IRCB program were more likely to use the coping skills of self-compassion and increased their help-seeking attitudes in the event of being a victim of cyberbullying. However, the effects of this intervention in mental health were not evaluated.

Although not specifically focused on improving the mental health of online victimized adolescents by peers, numerous universal preventive interventions have been developed with the aim of ameliorating various emotional and behavioral problems in adolescents. However, some meta-analyses and literature reviews indicate that the average effect of universal preventive interventions on adolescents is small, inconsistent, or nonsignificant in problems such as depressive and anxiety symptoms (e.g., Stice, Burton, Bearman, & Rohde, 2007), self-injurious behaviors (e.g., Fox et al., 2020), and aggressive behavior (e.g., Gaffney et al., 2019). This may be due to some specific characteristics of adolescents that differ from those of other developmental stages. Adolescents are highly motivated to have their autonomy respected and may react defensively to directive intervention programs (Yeager, Dahl, & Dweck, 2018). Another reason many interventions may fail is their long duration, which can lead to demotivation and a lack of attendance (Weisz et al., 2017).

Recently, brief interventions based on new methodologies that are more likely to be accepted by adolescents have been implemented, such as the so-called wise interventions (WIs). WIs are intended to trigger significant changes in relatively stable characteristics of individuals through brief interventions based on strategies derived from research on persuasion and attitude change (for a review, see Walton & Wilson, 2018). A key principle is the influence of the meanings that people make of their personal qualities and social situations on their behavior. WIs attempt to change these meanings in a minimally directive manner. They offer people new information or provide them with well-designed thinking exercises, allowing the people to draw new conclusions for themselves. Hence, WIs generally do not tell adolescents that they "should" adopt a new belief but rather allow them to choose to adopt it for themselves (Walton & Wilson, 2018).

Some WIs have focused on replacing a fixed mindset (or entity theory) with a growth mindset (or incremental theory), including traits such as personality or intelligence. Thus, growth mindset interventions teach the idea that traits are malleable and not fixed (Yeager & Dweck, 2012). In a recent systematic review of the application of WIs for the treatment and prevention of psychopathology in youths, the most promising results were obtained for growth mindset interventions for reducing youth depression (Schleider, Mullarkey, & Chacko, 2020). Specifically, in this systematic review, the authors found seven well-established or probably/possibly efficacious WIs, of which five reduced youth depressive symptoms or suicidal ideation, three reduced general psychological distress, and one each reduced eating or body image problems, anxiety, and substance use.

In this context, the intervention developed by Miu and Yeager (2015) is remarkable, demonstrating efficacy in reducing depression symptoms in community samples (Calvete, Fernández-González et al., 2019; Miu & Yeager, 2015) and symptoms of anxiety and depression in a clinical sample of adolescents (Schleider & Weisz, 2018). The results of this type of intervention for aggressive behavior are also notable, as it reduced both online and offline aggressive peer behavior (Calvete et al., 2020) and cyberdating abuse in adolescents (Fernández-González, Calvete, & Sánchez-Álvarez, 2020). Moreover, growth mindset interventions were found to reduce aggressive peer responses among victims of online peer aggressions (Calvete, Orue, Fernández-González, & Prieto-Fidalgo, 2019; Yeager, Trzesniewski, & Dweck, 2013) and to increase the intention to act in defense of victims of peer aggression in the future (Derr & Morrow, 2020). All previous studies used experimental designs in relatively large samples of adolescents mostly between 12 and 18 years old, with the exception of the study by Derr and Morrow (2020), which was conducted in a sample of 60 undergraduates aged between 18 and 23 years. Despite these overall beneficial effects of growth mindset interventions, there are also studies that have failed to obtain significant results regarding their efficacy. For example, in an experimental study with 222 adolescent girls (mean age around 15 years old) from rural, low-income high schools in the southeastern United States, the intervention reduced depressive symptoms, but no statistically significant results were obtained related to changes in social anxiety and behavioral problems (Schleider, Burnette, Widman, Hoyt, & Prinstein, 2020).

Self-affirmation interventions are another type of WI modality (Steele, 1988). They are based on the idea that, if people's self-image can be reinforced in a domain that is important to them, they should be less likely to process threatening information defensively and, consequently, more likely to change their behavior in accordance with the preventive message (Cohen & Sherman, 2014). In a review by Schleider, Mullarkey, and Chacko (2020), the findings regarding self-affirmation interventions for psychological problems in adolescents were poor. However, a recent experimental study has shown that the combination of both interventions, growth mindset and self-affirmation interventions, was more effective than a growth mindset intervention alone against online risk behaviors, such as online peer aggression and online sexual interaction with adults (Calvete et al., 2021a).

The application of WIs to other psychological problems, such as eating problems and NSSI, is scarce. A growth mindset intervention (Stop Adolescent Violence Everywhere) did not have significant effects on the frequency of NSSI behaviors in a randomized trial with adolescents (Dobias, Schleider, Jans, & Fox, 2021). Regarding eating disorders, Schleider, Mullarkey, and Chacko (2020) found that the results for the few previous WIs were mixed.

As mentioned above, growth mindset interventions contribute to changing the meanings that people give to themselves and to stressors, replacing fixed mindsets with growth mindsets (Walton & Wilson,

2018). Accordingly, numerous studies have found that these interventions reduced beliefs consisting of an entity theory of personality (Calvete, Fernández-González et al., 2019; Yeager et al., 2013). Applied to the context of victimization, this would involve promoting the belief that people change and that past acts of online peer aggression and victimization they may have experienced are not caused by fixed traits that cause these acts to repeat again and again. This would lead to a reduction in feelings of helplessness and less negative impact on the mental health of victims. Moreover, victims could learn that they can change the way in which they cope with online peer rejection and aggression, and so they could implement more adaptative coping skills when facing with victimization.

1.1. Current study

This study aims to evaluate a brief online growth mindset intervention to build resilience in victims of online peer aggression. Resilience was understood as a process that promotes mental health allowing for positive adaptation in spite of the adversity (Shiner & Masten, 2012). In the current study, resilience was indicated through the reduction of the predictive association between online peer victimization and several behavioral and emotional problems in adolescents (social anxiety, depressive symptoms, eating problems, online peer aggressions, and NSSI). This intervention was based on the WIs paradigm and included strategies to change mindsets about online peer victimization and the responses of the victims. As a self-affirmation activity was found to improve the efficacy of a growth mindset intervention on online risk behaviors (Calvete et al., 2021a), we included this component in the intervention. It was expected that adolescents receiving the intervention would experience fewer behavioral and emotional symptoms in the event of online peer victimization.

In addition, because a key component in WIs is the change of meanings that individuals give to circumstances relevant to themselves, we examined whether the intervention produced changes in two relevant cognitive variables: implicit theory about personality malleability and cognitive appraisal of different courses of action when witnessing acts of online peer aggression. Previous studies have found an effect of growth mindset interventions on beliefs about personality malleability (Calvete, Fernández-González et al., 2019; Yeager et al., 2013). Therefore, showing that the intervention developed in this study influences these beliefs would indicate that the intervention is based on this mechanism. At the same time, as stated above, the witnesses of the aggressions play an important role in their perpetuation, and promoting intentions to defend the victims could lead to both a reduction in the aggressions and mitigation of the impact of victimization on the mental health of the victims (Orue et al., 2021; Salmivalli et al., 1996). Moreover, previous research on a growth mindset intervention found that it improved the intention to defend victims in the future (Derr & Morrow, 2020). Therefore, in this study we expected that the intervention would improve the pro-victim attitudes of the adolescents.

Finally, sex and age were examined as moderators of the effects of the intervention. Some previous studies have found that mindset interventions were more effective among younger adolescents (Calvete, Fernandez-Gonzalez et al., 2019; Calvete, Orue, et al., 2019). Moreover, there are important sex differences in several behavioral and emotional problems, with girls displaying higher scores in depressive symptoms (Webb, Sibinga, Musci, Clary, & Mendelson, 2021), eating problems (Lundahl, Wahlstrom, Christ, & Stoltenberg, 2015), and social anxiety (González-Diez et al., 2016) than boys. Grounded on these previous studies, we expected that the intervention would be more effective among girls and younger participants.

2. Method

2.1. Participants

An *a priori* power analysis (G* Power) indicated that a total sample of ~800 participants was required for a small effect size (0.15), with alpha $\alpha = .05$ and power = 90%. The sample consisted of 856 high school students (51.9% boys and 48.1% girls) between 11 and 17 years of age at pretest ($M = 14.55$; $SD = 1.59$). The distribution by grade was as follows: 352 in the first cycle of secondary education (Grades 7 and 8), 260 in the second cycle of secondary education (Grades 9 and 10), and 244 in the last two years of high school (Grades 11 and 12). The professions of the parents, according to the criteria of the National Institute of Statistics of Spain, were classified as follows: scientific and intellectual professionals (39.7%), restaurant and security service workers and vendors (16.8%), accounting and administrative employees (10.0%), technicians and support professionals (8.5%), artisans and skilled workers in the manufacturing and construction industries (6.6%), housewives (4.7%), unemployed (4.7%), directors and managers (3.0%), machinery operators (2.9%), elementary occupations (2.9%), and skilled workers in the agricultural, livestock, forestry, and fishing sectors (0.3%).

2.2. Study design and procedure

The Ethics Committee of the University of Deusto approved this research project. After being informed about the study, adolescents and their parents voluntarily decided whether or not to participate. We carried out a double-blind randomized controlled trial (RCT) with two parallel groups [NCT04509531, clinicaltrials.gov code]. The experimental group received a resilience growth mindset intervention, while the active control group received an alternative educational intervention. Randomization to each condition was performed the day of the intervention at the individual level within each classroom. Recruitment was carried out via educational centers. We initially invited a sample of 20 educational centers. Seven did not respond, and eight declined to participate. The headmasters of five of the centers agreed to participate. From the initial sample of 870 adolescents, only 12 (1.40%) of the parents refused participation. Two participants were not included in the study because they were over 18 years of age. Thus, the final sample was composed of 856 adolescents. A total of 459 participants (mean age = 14.55, $SD = 1.58$, 47.10% female) were allocated to the experimental condition and 397 (mean age = 14.55, $SD = 1.59$, 49.40% female) to the active control condition.

Participants completed both the interventions and study measures in their classroom. Both the interventions and measures used in this study were presented in an automated format via Qualtrics© and therefore did not require the presence of specialized professionals during their application. The pretest measures (Time 1, T1) were taken one week before the intervention (between September–October 2020, depending on school availability). Time 2 (T2) and Time 3 (T3) post-test measurements were taken three and six months after the intervention (between December 2020–January 2021, and between March–April 2021, respectively). Due to COVID-19 pandemic condition, three of the school centers completed the intervention at their schools without the presence of the research assistants. Research assistants with experience in other previous psychological interventions in schools administered both interventions and assessment measures and instructed the teachers in those cases when their presence in the classrooms was no possible. The single session interventions lasted approximately 40 min and were done during normal class time. Fig. 1 (Consort Diagram) displays the flow of participants and attrition rates at each step, for which the main reason was sickness. The percentage of missing data were 10.63% and 9.83%, respectively, at the three-month and the six-month follow-ups. The pattern of missingness was examined. Little's MCAR test was statistically significant, $\chi^2(1173) = 2206$, $p < .001$. There were no statistically significant differences in any pretest variable between adolescents who

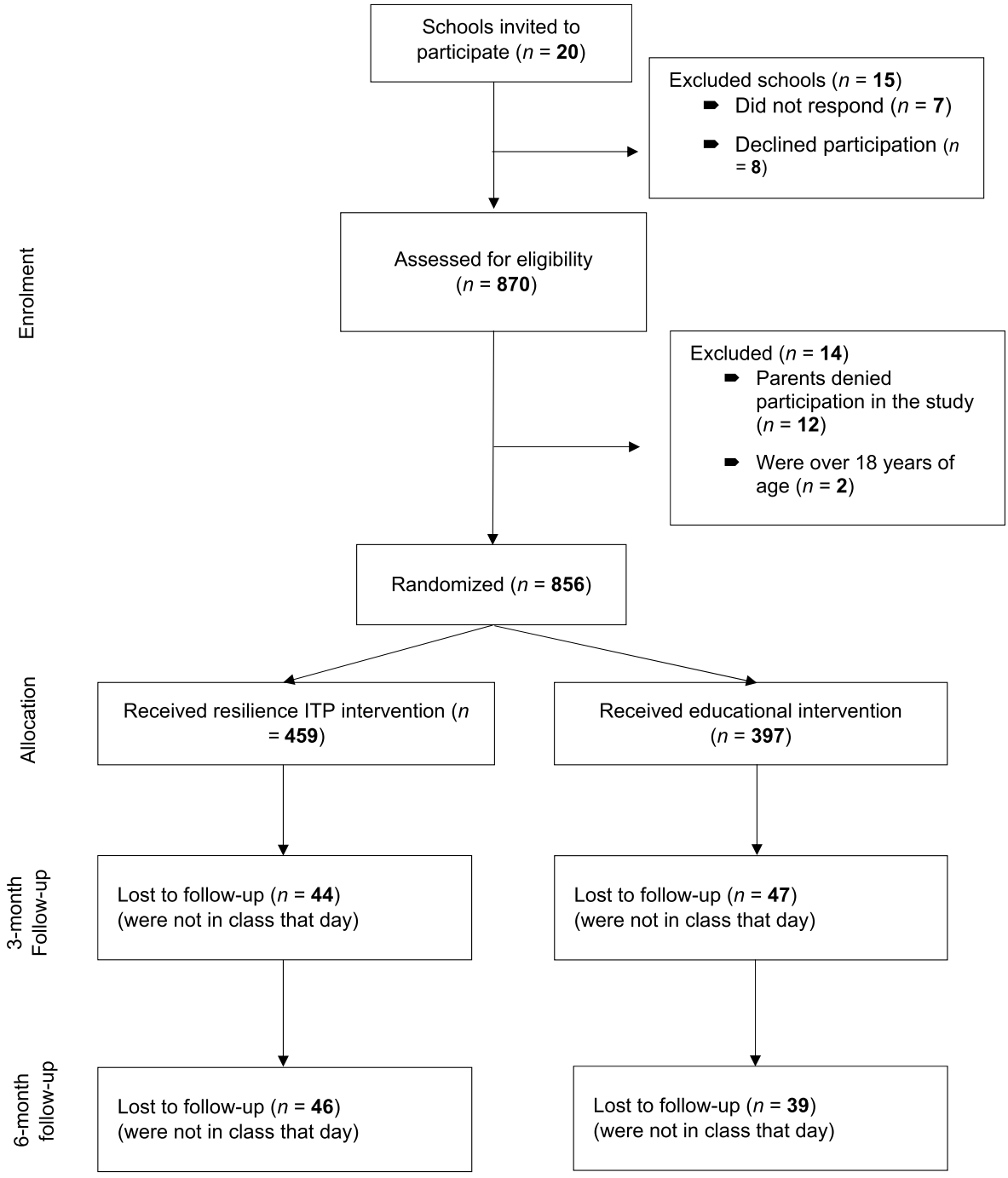

Fig. 1. Consort Diagram.

completed measures in T2 and those who did not ($p > .05$). However, adolescents who did not complete measures in T3 scored significantly higher in age than those who did complete measures in T2 ($M = 15.10$, $SD = 1.30$ vs $M = 14.53$, $SD = 1.59$; $t = 2.14$, $p = .033$, $d = 0.37$) and the percentage of boys was higher among those who did not complete measures in T3 than among those who did complete (69.4% vs 51.1%, χ^2 (1, $N = 856$) = 4.65, $p = .040$). There were no differences in any other variable.

2.3. Measures

Online peer victimization and aggression. We used the self-administrated Cyberbullying Questionnaire (CBQ; Calvete, Orue, Estévez, Villardón, & Padilla, 2010; Gámez-Guadix, Villa-George, & Calvete, 2014) to assess online peer victimization and aggression through nine parallel items (nine items for each scale; e.g., "Posting or sending images of myself that may be humiliating – Posting or sending images of an acquaintance that may be humiliating"). The items were answered on a five-point Likert scale ranging from 0 (*never*) to 4 (*almost every week*) for the last three months. Alpha ordinal coefficients were 0.82, 0.90, and 0.96 at T1, T2, and T3, respectively, for the victimization scale, and 0.84, 0.92, and 0.96 at T1, T2, and T3, respectively, for the perpetration scale.

Social anxiety symptoms. We used the shortened version (Nelemans et al., 2019) of the Social Anxiety Scale for Adolescents (SAS-A;La Greca & Lopez, 1998; Spanish version by Olivares, Ruiz, Hidalgo, &

Piqueras, 2005) to assess social anxiety symptoms. The shortened version consists of 12 items, which were answered on a five-point Likert scale ranging from 1 (*not at all*) to 5 (*all the time*) for the last three months. Some example items are as follows: "I'm afraid that others will not like me" and "I'm afraid to invite others to do things with me because they might say no." In this study, Cronbach's α coefficients were 0.92, 0.93, and 0.94, at T1, T2, and T3, respectively.

Depressive symptoms. We used Rueda-Jaimes et al.'s (2009) shortened version of the Centre for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) to assess depression symptoms. The shortened CES-D consists of 10 items, which were answered on a four-point Likert scale ranging from 0 (*rarely or none of the time*) to 3 *(most or all of the time*) for the last three months. Sample items are "I felt that I could not shake off the blues even with help from my family or friends" and "I enjoyed life." In this study, Cronbach's α coefficients were: 0.90, .0.91, and 0.91 at T1, T2, and T3, respectively.

Non-suicidal self-injury. We used the Spanish version of the Functional Assessment of Self-Mutilation (FASM; Lloyd, Kelley, & Hope, 1997; Spanish version by Calvete, Orue, Aizpuru, & Brotherton, 2015) to measure NSSI. For the present study, we used a list of six representative forms of NSSI and asked the participants to indicate their occurrence during the last three months using a five-point Likert scale ranging from 0 (*0 times*) to 4 (> *11 times*). The version of the FASM we used included six behaviors (e.g., "Biting yourself; e.g., mouth or lip, "Burning your skin with a cigarette or other hot object"). The Spanish version of the FASM has shown good internal consistency in samples of adolescents (Calvete et al., 2015). Cronbach's α coefficients were 0.75, 0.79, and 0.80 at T1, T2, and T3, respectively.

Eating disorder symptoms. We utilized the Eating Attitudes Test (EAT; Garner & Garfinkel, 1979), using the items from the shortened version (EAT-8; Richter, Strauss, Braehler, Altmann, & Berger, 2016) to assess the symptomatology associated with eating disorders through eight items. For this study we used a six-point Likert scale ranging from 1 (*never*) to 6 (*always*) for the last three months. Some example items are the following: "I eat diet foods" or "I am terrified about being overweight." Cronbach's α coefficients were 0.87, 0.89, and 0.90 at T1, T2, and T3, respectively.

Entity theory of personality beliefs inventory. We used eight items from previous studies assessing adolescents' implicit theories of personality adapted to victimization and perpetration situations (Calvete, Fernández-González et al., 2019; Yeager, Trzesniewski, Tirri, Nokelainen, & Dweck, 2011). The items measured the extent to which entity theories are adopted using a six-point agreement Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Some example items are as follows: "Bullies and victims are types of people who really can't be changed" and "Bullies can try acting nice, but deep down they're just bullies." In this study, Cronbach's α coefficient were 0.76, 0.80, and 0.81 at T1, T2, and T3, respectively.

Attitudes towards witnesses' actions. We employed an ad hoc differential semantic measure to assess adolescents' attitudes toward different courses of action when they witness online peer aggression. This type of scale has been previously used with adolescent samples to assess the attitude toward cyberbullying in adolescents (Heirman & Walrave, 2012). The adolescents had to rate different ways of reacting when witnessing online peer aggression through semantic differential items. Some examples of the responses are as follows: "Show support or give some advice to the person they are messing with" and "Forward those pictures and messages to other people." For each given scenario, the participants rated their opinion on a seven-point scale through three differential semantic items (item 1: from *Good to Bad*; item 2: from *Funny to Boring*; item 3: from *Brave to Cowardly)*. As this questionnaire was developed ad hoc for this study, we examined its factor structure with Mplus 8.8 (Muthén & Muthén, 1998-2022). Items were treated as categorical and the robust variance-adjusted weighted least squares estimator (WLSMV) was used. Model fit was evaluated using the comparative fit index (CFI), the Tucker–Lewis index (TLI), the standardized root-mean-square residual (SRMR), and the root-mean-square error of approximation (RMSEA). CFI and TLI values of 0.95 or higher indicate an excellent fit. SRMR and RMSEA values lower than 0.08 indicate a good fit for longitudinal research (Little, 2013). A Bifactor-ESEM model resulted satisfactory: χ^2 [122, $n = 856$] = 76.45, RMSEA = 0.073 [0.057; 0.090], CFI = 0.99, TLI = 0.94, SRMR = 0.026). In this model, all items were allowed to load on both a general factor and the corresponding specific scenario. This model allows the use of a general score of the questionnaire. Items were recoded so that the total score indicates a positive attitude towards defending victims. Alpha coefficients were 0.69, 0.75, and 0.77, respectively, at T1, T2, and T3.

2.4. Interventions

Resilience ITP intervention. The intervention included three parts. In the first part, the adolescents performed a self-affirmation exercise, in which they were presented with a list of 16 values (e.g., sense of humor, creativity, sports ability) and asked to indicate those that were the most important to them. Then, they had to justify this choice by briefly explaining in writing why these values were important. This type of exercise has been widely used in numerous studies (e.g., Cohen & Sherman, 2014).

In the second part, the intervention focused on the idea that people can change. This part is a reduced version of the intervention developed by Miu and Yeager (2015) adapted to online peer aggression situations. Along with scientific information on the possibility of personality change, numerous testimonies are included through videos and written stories of other adolescents who lived through online peer victimization situations, which convey the message that people who behave aggressively against others can stop doing so and that victimization experiences do not have to be perpetuated over time. This second part ends with a writing exercise in which the adolescents have to draft a testimony based on the previous ideas to send to another victimized or rejected adolescent.

In the third part, the adolescents work on the idea that the way people react to stressors can also change. It is explained that scientists have studied how people react to stress and how this is based on connections at the brain level. They are informed that scientists have found effective strategies to improve how people feel when faced with stress, and these strategies are shown. Basically, the intervention shows six ways of coping with stress that are widely used in intervention programs: distraction, relaxation, sport, social support, cognitive restructuring, and gratitude (e.g., Stark, Streusand, Krumholz, & Patel, 2010). The strategies are presented in a subtle way from testimonies of other adolescents through videos and written stories. The last part includes four writing activities: (1) a gratitude exercise focused on the good things one has, (2) identification of a past situation in which the participant felt bad about something that happened with peers, (3) identification of which of the strategies for coping with stress seen in the program could have helped him or her to feel better, and (4) planning how he or she could face similar situations in the future using those strategies. This last point involves intentional implementation (Webb & Sheeran, 2007) in order to strengthen the stress management actions for when they are needed.

Educational intervention. The educational intervention was based on the preventive intervention for online grooming of adolescents developed by Gámez-Guadix and De Santisteban (2018). This intervention aimed at addressing knowledge about and preventive guidelines for the previously mentioned Internet risks. The intervention consisted of three main parts. First, the adolescents were given information about sexting and online grooming through related videos or information about real cases and educative knowledge. Second, they were asked to write down the risks implicated in sexting and online grooming so that they could reflect upon them, thereby being actively involved. Finally, they were asked what they would do in case something like happened to them, and they were given some guidelines for prevention and coping.

2.5. Statistical analyses

We conducted multilevel analyses, using robust maximum likelihood estimation (MLR) with MPLUS-8.8. Missingness was addressed by means of Full Information Maximum Likelihood (FIML), which is a recommended method to deal with missing values when they are not distributed randomly. FIML estimates the parameters using all the available data, including cases without data (Little, Jorgensen, Lang, & Moore, 2013). FIML has been shown to be valid and to yield unbiased estimates (Enders, 2010); moreover, it has been recommended in studies focused on the effects of interventions (Rioux & Little, 2021).

Furthermore, in the sensitivity analyses, we repeated the main analyses using an auxiliary variable. It has been suggested that variables that predict missingness and are not part of the main analytical model should be included as auxiliary variables (Enders, 2010). However, in this study, age and sex, despite being associated with missingness, could not be used as auxiliary variables since they are variables in the model. Given that adolescents in the control group received an educational intervention in which they were given information about sexting and online grooming, we asked the participants to complete measures of sexting and online grooming. We found that the sexting measure was associated with missingness since the participants who failed to answer any of the follow-ups scored higher on sexting. The Sexting Questionnaire (Calvete et al., 2021b) included three items related to sending information, photos, or videos with intimate or sexual content about oneself to one's partner, a friend or acquaintance, or someone who the participant met online but not in person. The response scale has five response options referring to the frequency of sexting in the last year: 0 (never), 1 (1 or 2 times), 2 (3 or 4 times), 3 (5 or 6 times), and 4 (7 or more times). Ordinal alpha was .86. Therefore, all the analyses were repeated with sexting as an auxiliary variable. Following the procedures indicated by Enders (2010), sexting was included in the model and modeled to covary with the rest of the predictor variables and with the residual terms.

Two main models were estimated to test the hypotheses of the study. The first model was conducted for behavioral and emotional problems, and Level 1 consisted of repeated measures and included online peer victimization as a predictor of behavioral and emotional problems. Both the intercepts and the slopes of the association between online peer victimization and behavioral and emotional problems were specified as random. We also included time as a covariate of these problems (codes 0, 1, and 2). Level 2 consisted of person-level predictors and included the intervention (1 = resilience intervention, 0 = control), age, sex, and the intervention x sex and the intervention × age interaction terms as predictors of the intercepts and slopes of the association between online peer victimization and behavioral and emotional problems. Online peer victimization was person-mean centered, whereas age was grand-mean centered. Finally, given that participants were nested in classrooms, Level 3 included the classroom (n = 34) in order to estimate random effects between classrooms.

The second model was conducted to examine the effects of the intervention on the adolescents' entity theory of personality beliefs and attitudes toward defending the victims. The only difference in this model is that it specified the slope for time as random, with the aim of examining the potential effect of the intervention in these variables over time.

3. Results

Table 1 presents the descriptive statistics and correlation coefficients between all the variables. The coefficients between the same variables measured over time were all high or medium, which indicates the stability of these variables. Online peer victimization was significantly associated with all behavioral and emotional symptoms. The percentages of adolescents reporting online peer victimization were 37.7%, 39.3%, and 29.8%, respectively, at T1, T2, and T3. There were no significant differences between the groups in these rates.

3.1. Effects of the resilience intervention on the association between victimization and behavioral and emotional problems

We performed a multilevel longitudinal analysis to examine whether the resilience intervention moderated the predictive association between online peer victimization and behavioral and emotional symptoms. Intraclass correlations for Level 2 ranged from 0.41 (for aggressive online behavior) to 0.74 (for eating problems). Intraclass correlations for Level 3 were lower than 0.10 in all cases and therefore level 3 was dropped from the model. None of the interaction terms were statistically significant, so they were eliminated from the model. However, sex and age variables were left as covariates of the intercept. Table 2 presents the main coefficients of the model. The within-level model indicated that changes in online peer victimization predicted changes in all behavioral and emotional symptoms over time. There were no between-group differences in the behavioral and emotional symptoms, as the coefficients corresponding to the intervention were not statistically significant. However, the intervention moderated the predictive association between online peer victimization and symptoms of social anxiety and peer aggressive online behaviors. There were no significant effects for the rest of the behavioral and emotional symptoms.

Table 2 also shows that female sex was associated with higher levels of all behavioral and emotional symptoms except online peer aggression. Older age was associated with more online peer aggression and less NSSI. Finally, although not shown in Table 2, the within-level model also indicated that changes in symptoms of social anxiety, depression, NSSI, and eating problems covaried with each other over time: social anxiety with eating problems (β = 0.10, SE = 0.01, z = 7.51, p < .001), depressive symptoms (β = 0.05, SE = 0.01, z = 7.79, p < .001), and NSSI (β = 0.04, SE = 0.01, z = 7.55, p < .001); eating problems with depressive symptoms (β = 0.05, SE = 0.01, z = 6.39, p < .001) and NSSI (β = 0.05, SE = 0.01, z = 5.23, p < .001); and depressive symptoms with NSSI (β = 0.04, SE = 0.01, z = 7.55, p < .001). Online peer aggression only significantly covaried with social anxiety (β = 0.003, SE = 0.001, z = 2.44, p = .02).

Post hoc analyses were done to test whether the intervention moderated the time slope, but since there was no significant effect for any behavioral and emotional problem, these paths were omitted from the model.

3.2. Effects of the resilience intervention on entity theory of personality beliefs and attitudes toward defending the victims of online peer aggressions

Finally, we conducted another longitudinal multilevel analysis to examine the effects of the intervention on the adolescents' entity theory of personality beliefs and attitudes toward defending the victims of online peer aggressions. The model included paths from resilience to both the slope of the association between victimization and these outcomes and the time slope. Intraclass correlations for Level 3 were lower than 0.10 for both outcomes (0.02 and 0.04) and this level was dropped from the model. Table 3 displays the coefficients of the model. The interaction between online peer victimization and the intervention was statistically significant for attitudes toward defending the victims of online peer aggression. Namely, the slope of the predictive association between online peer victimization and attitudes toward defending the victims of online peer aggression was higher among adolescents who received the resilience intervention. In fact, it was positive for the resilience group (β = 0.22, SE = 0.02, t = 204, p < .001) and negative for the control group (β = −0.17, SE = 0.01, t = −188, p < .001). There was no effect of the intervention on the time slope. In addition, a statistically significant time × intervention interaction indicated that the entity theory of personality beliefs decreased to a higher degree in the resilience group (β = −0.15, SE = 0.02, t = −156, p < .001) than in the control group: β = −0.01, SE = 0.02, t = 11, p < .001). However, there was no effect of the intervention on the slope between online peer

Table 1
Correlation coefficients between the variables of the study.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1.T1 Online peer victimization	1																							
2.T1 Eating problems	.18**	1																						
3. T1 Online peer aggression	.46**	.06	1																					
4. T1 Social anxiety	.20**	.44**	.08	1																				
5. T1 Depression	.31**	.39**	.06	.51**	1																			
6. T1 NSSI	.17**	.21**	.10	.35**	.39**	1																		
7. T1 ADV	−.11	.05	−.21**	.02	.03	−.06	1																	
8.T1 ETPB	.06	.01	.07	.01	−.01	.08	−.10	1																
9.T2 Online peer victimization	.50**	.09	.29**	.19**	.25**	.16	−.07	.04	1															
10.T2 Eating problems	.13	.70**	.06	.36**	.32**	.17	.07	.06	.20	1														
11. T2 Online peer aggression	.32**	.06	.45**	.05	.06	.07	−.17	.06	.56**	.12	1													
12. T2 Social anxiety	.16*	.29**	.07	.70**	.43**	.21**	.04	.03	.24**	.44**	.13	1												
13. T2 Depression	.26**	.30**	.07	.43**	.70**	.30**	.01	.00	.33**	.42**	.11	.57**	1											
14. T2 NSSI	.18**	.24**	.11	.30**	.31**	.64**	−.04	.10	.25**	.34**	.14	.40**	.44**	1										
15. T2 ADV	−.11	.07	−.14	.07	.03	−.07	.51**	−.07	−.13	.06	−.20	.05	.03	−.03	1									
16. T2 ETPB	.03	.01	.10	−.05	−.02	.03	−.11	.49**	.07	.03	.09	.01	−.02	.09	−.16*	1								
17.T3 Online peer victimization	.30**	.05	.13	.11	.16	.10	−.06	−.07	.41	.15	.27**	.18**	.27**	.19**	−.12	−.02	1							
18.T3 Eating problems	.17*	.68**	.04	.42**	.37**	.18**	.06	.02	.22**	.80**	.08	.42**	.40**	.26**	.09	−.02	.20**	1						
19. T3 Online peer aggression	.21**	−.01	.27**	.01	.07	.08	−.15*	−.01	.26**	.09	.41**	.08	.11	.13	−.13	.04	.63**	.06	1					
20. T3 Social anxiety	.19**	.35**	.03	.70**	.44**	.26**	.03	.02	.22**	.44**	.06	.77**	.53**	.32**	.08	−.02	.20**	.54**	.05	1				
21. T3 Depression	.21**	.28**	.02	.44**	.62**	.26**	.08*	.02	.29**	.37**	.09*	.54**	.75**	.38**	.08*	.04	.28**	.46**	.05	.63**	1			
22. T3 NSSI	.19**	.16*	.08*	.30**	.34**	.57**	−.07	.05	.23**	.26**	.12*	.35**	.41**	.69**	−.02	.06	.33**	.31**	.20**	.40**	.48**	1		
23.T3 ADV	−.08*	.03	−.14*	.06	.06	−.09*	.50**	−.04	−.08*	.03	−.20**	.06	.01	−.05	.65**	−.13*	−.18**	.09*	−.21**	.07	.07	−.07	1	
24. T3 ETPB	.01	.05	.07	.05	.02	.02	−.04	.44*	.05	.05	.07	.05	.02	.09*	−.08*	.48**	.02	−.02	.04	−.02	.01	.04	−.05	1
Mean	1.15	1.66	0.55	1.15	0.88	0.56	5.68	1.68	1.14	1.54	0.61	1.12	0.90	0.52	5.68	1.55	0.96	1.59	0.50	1.11	0.90	0.46	5.64	1.53
SD	2.20	1.17	1.46	0.87	0.63	0.71	0.73	1.01	2.10	1.21	1.45	0.89	0.67	0.72	0.80	1.04	2.84	1.24	1.74	0.92	0.66	0.69	0.74	1.04

Note. *$p < .05$, **$p < .001$. NSSI = Non-Suicidal Self-Injury; ADV = Attitudes toward Defending the Victims; ETPB = Entity Theory of Personality Beliefs.

Table 2
Results of the multilevel model predicting intervention effects on the predictive association between online peer victimization and behavioral and emotional symptoms.

Coefficients	β	*SE*	*z*	*p*	95% Confidence Intervals	
Eating Problems						
Intercept	0.689	0.12	5.85	<.001	0.46	0.92
Sex (1 = female)	0.61	0.07	8.15	<.001	0.46	0.75
Age	0.03	0.02	1.30	.192	−0.02	0.08
Time	−0.03	0.02	−1.6	.105	−0.06	0.01
Intervention (1 = Resilience)	0.08	0.07	1.03	.303	−0.07	0.22
Online peer victimization	0.33	0.15	2.29	.022	0.05	0.62
Online peer victimization × intervention	0.12	0.22	0.52	.601	−0.32	0.55
Online Peer Aggression						
Intercept	0.10	0.02	6.20	<.001	0.07	0.13
Sex (1 = female)	−0.02	0.01	−1.78	.076	−0.03	0.00
Age	0.01	0.00	4.19	<.001	0.01	0.02
Time	0.00	0.00	0.19	.850	−0.00	0.01
Intervention (1 = Resilience)	−0.02	0.01	−1.72	.085	−0.03	0.00
Online peer victimization	0.31	0.04	7.57	<.001	0.23	0.39
Online peer victimization × intervention	−0.12	0.06	−2.07	.039	−0.23	−0.01
Social Anxiety						
Intercept	0.43	0.08	5.04	<.001	0.26	0.59
Sex (1 = female)	0.50	0.05	9.31	<.001	0.40	0.61
Age	0.01	0.02	0.34	.736	−0.03	0.04
Time	−0.02	0.01	−1.85	.064	−0.05	0.00
Intervention (1 = Resilience)	−0.03	0.05	−0.59	.552	−0.14	0.07
Online peer victimization	0.39	0.11	3.48	<.001	0.17	0.62
Online peer victimization × intervention	−0.36	0.16	−2.19	.029	−0.67	−0.04
Depressive Symptoms						
Intercept	0.26	0.06	4.35	<.001	0.14	0.38
Sex (1 = female)	0.42	0.04	11.01	<.001	0.35	0.50
Age	0.01	0.01	0.89	.372	−0.01	0.03
Time	0.01	0.01	0.95	.341	−0.01	0.03
Intervention (1 = Resilience)	−0.01	0.04	−0.04	.969	−0.08	0.07
Online peer victimization	0.24	0.11	2.21	.027	0.03	0.45
Online peer victimization × intervention	−0.01	0.13	−0.08	.939	−0.26	0.25
Non-suicidal Self-injury						
Intercept	0.39	0.07	5.49	<.001	0.25	0.53
Sex (1 = female)	0.13	0.04	2.93	.003	0.04	0.21
Age	−0.05	0.01	−3.90	<.001	−0.08	−0.03
Time	−0.06	0.01	−4.86	<.001	−0.08	−0.03
Intervention (1 = Resilience)	0.01	0.04	0.27	.789	−0.07	0.10
Online peer victimization	0.31	0.11	2.78	.005	0.09	0.53
Online peer victimization × intervention	−0.11	0.16	−0.67	.497	−0.42	0.20

These findings indicated that the slope of the predictive association between online peer victimization and social anxiety was smaller among adolescents who received the resilience intervention (Resilience group: β = 0.04, SE = 0.003, t = 9, p < .001; Control group: β = 0.39, SE = 0.003, t = 90, p < .001). Similar results were found for peer aggressive online behavior (Resilience group: β = 0.19, SE = 0.007, t = 17, p < .001; Control group: β = 0.31, SE = 0.008, t = 21, p < .001).

Table 3
Results of the multilevel model predicting intervention effects on the entity theory of personality beliefs and attitudes toward defending the victims of online peer aggressions.

Coefficients	β	*SE*	*z*	*p*	95% Confidence Intervals	
Entity Theory of Personality Beliefs						
Intercept	2.05	0.11	18.96	<.001	1.84	2.26
Sex (1 = female)	−0.22	0.06	−3.78	<.001	−0.33	−0.10
Age	−0.03	0.02	−1.87	.06	−0.07	0.00
Time	0.01	0.03	0.46	.64	−0.05	0.02
Intervention (1 = Resilience)	−0.09	0.07	−1.23	.22	−0.23	0.05
Online peer victimization	0.13	18	0.72	.47	−0.23	0.49
Online peer victimization × intervention	0.24	0.26	0.94	.348	−0.26	0.74
Intervention × time	−0.13	0.04	−3.18	.001	−0.21	−0.05
Attitudes of the Witnesses of the Online Peer Aggressions						
Intercept	5.20	0.08	68.93	<.001	5.01	5.35
Sex (1 = female)	0.32	0.04	7.56	<.001	0.24	0.41
Age	−0.02	0.01	−1.45	.15	−0.04	0.01
Time	0.01	0.001	0.15	.88	−0.05	0.02
Intervention (1 = Resilience)	−0.09	0.07	−1.23	.204	−0.10	0.10
Online peer victimization	−0.17	0.09	−1.94	.05	−0.34	−0.03
Online peer victimization × intervention	0.39	0.19	2.04	.042	0.02	0.76
Intervention × time	0.01	0.03	0.08	.940	−0.05	0.05

victimization and the entity theory of personality beliefs.

3.3. Sensitivity analyses

The two previous models were re-estimated with the inclusion of the score on the Sexting Questionnaire (Calvete et al., 2021b) as an auxiliary variable. The results were almost identical and the effects of the intervention on social anxiety, online peer aggression, entity theory of personality beliefs, and attitudes of the witnesses of online peer aggressions remained statistically significant. These results are provided as Supplementary Material (S1 and S2).

4. Discussion

The main objective of this study was to test the effects of a resilience-building intervention on adolescents who had experienced online victimization by peers. The program developed within the framework of the WIs paradigm includes strategies to change mindsets or theories about the malleability of some individual characteristics (Miu & Yeager, 2015) in the context of online peer victimization.

The results showed that online peer victimization predicted increases in all behavioral and emotional problems assessed in the study. This confirms results obtained in previous studies (Katsaras et al., 2018; Marciano et al., 2020; Marco et al., 2018), adding longitudinal evidence to the predictive association between online peer victimization and other less studies outcomes such as NSSI and eating problems.

We expected the intervention to buffer the impact of online peer victimization on numerous behavioral and emotional problems. However, the results were modest, as we only found statistically significant effects on social anxiety, online peer aggression, and attitudes toward defending the victims of online peer aggressions. The association over time between online peer victimization and online peer aggression and social anxiety was lower among adolescents who underwent the resilience intervention, whereas the association was higher for attitudes

defending the victims. The results for online peer aggression are consistent with those obtained for other WIs based on similar strategies (Calvete, Orue, et al., 2019; Yeager et al., 2013). For example, using different versions of growth mindset interventions, it was found that adolescents receiving the intervention reacted less aggressively when victimized by peers (Calvete et al., 2021a; Calvete, Orue, et al., 2019). This result is important because cyberbullying is characterized by high reciprocity, so the most common profile of adolescents involved in cyberbullying is as bullies/victims (Marciano et al., 2020). Interventions that serve to reduce the reciprocity of aggressions are therefore a valuable strategy to tackle this problem. The fact that the intervention improved the adolescents' attitudes when they witnessed online peer aggression toward others suggests that this could be a mechanism involved in reducing online peer aggression, given that witnesses' attitudes predict their involvement in future aggressive acts (Orue et al., 2021). In this way, the current intervention joins other recent interventions that have improved children's intentions to help the victims of online peer aggressions (Vlaanderen et al., 2020).

The effect was most notable in the case of social anxiety. The slope of the association between victimization and social anxiety for adolescents under the control condition was medium (0.39), while in adolescents under the resilience condition the slope was almost zero (0.04), supporting the benefit of the intervention in reducing the typical increase in social anxiety following online victimization. Other single-session WIs have also been effective in reducing anxiety. For example, interventions consisting of reappraisal manipulations (Jamieson, Peters, Greenwood, & Altose, 2016) and promoting "stress-is-enhancing" mindsets (Crum, Salovey, & Achor, 2013) have reduced anxiety in various contexts. However, interestingly, another previous WI based on a growth mindset failed to achieve a reduction in social anxiety symptoms (Schleider, Burnette, et al., 2020). It is important to clarify that our study and that of Schleider, Burnette, et al. (2020) differ in both the hypothesis and method used. Whereas their study assessed whether the intervention reduced social anxiety, we assessed whether the intervention reduced the impact of online peer victimization on social anxiety. In fact, in our study there was no significant effect for the time × intervention interaction. That is, the intervention did not have a generalized beneficial effect for all adolescents, only for those who experienced online peer victimization.

Contrary to our hypothesis, there were no significant effects for the other evaluated behavioral and emotional problems (i.e., depression, eating problems, and NSSI). The lack of significant results was especially unexpected for depression, given that numerous previous studies had shown the benefits of WIs based on growth mindsets in reducing depressive symptoms (Calvete, Fernández-González et al., 2019; Miu & Yeager, 2015; Schleider & Weisz, 2018). Moreover, the stress management strategies that were included in the intervention have been widely used in depression programs (e.g., Stark et al., 2010). A tentative explanation may be related to the brief CES-D measure used in this study. Although it showed adequate psychometric properties in terms of reliability (Rueda-Jaimes, López, & Rangel-Martínez-Villalba, 2009), it consisted of only 10 items (i.e., half of the full version). Thus, it is possible that this version did not include key items needed to capture changes in the depressed mood of victimized adolescents.

In any case, the results of this study are consistent with the conclusions of a meta-analysis of single-session interventions for youth psychiatric problems, where highest effect sizes were found for anxiety and conduct problems whereas the results for depression and eating disorders, although promising, were not statistically significant (Schleider & Weisz, 2017). Therefore, it is possible that for some behavioral and emotional problems more sessions or doses of intervention are necessary. For example, studies focused on other modalities of interventions have found that the results of multiple session interventions were better than those of single-session interventions for eating disorders (e.g., Song, Zilverstand, Gui, Li, & Zhou, 2019). Moreover, a meta-analysis of school-based prevention programs for adolescents found that universal anxiety reduction programs with higher doses were more effective (Feiss et al., 2019). In this meta-analysis, the authors concluded that there is a gap in the knowledge regarding the range of necessary doses for preventive interventions in schools. Thus, despite the positive implications of brief interventions (Schleider & Weisz, 2017), additional sessions could be necessary. Furthermore, the intervention should be improved by perhaps including new strategies. For instance, NSSI and eating problems share difficulties in impulse control and it is possible that mindset change may not be sufficient to reduce impulsivity. Future studies should try to improve the intervention by adding strategies such as mindfulness or emotion regulation, which have been successful to increase the capacity for self-control (Canby, Cameron, Calhoun, & Buchanan, 2015; Veiga Simão et al., 2021).

Finally, there were also other interesting secondary results. The resilience intervention reduced the entity theory of personality beliefs in all participants, consistent with the findings of previous growth mindset interventions (Calvete, Fernández-González et al., 2019; Yeager et al., 2013), suggesting that this could be a key component in this type of intervention. Finally, the effects of the intervention were not moderated by sex and age, although there was a greater presence of all behavioral and emotional problems except online peer aggression in girls, consistent with previous research (González-Díez et al., 2017; Lundahl et al., 2015; Webb et al., 2021).

4.1. Strengths and limitations

This study has notable strengths. It employed a double-blind randomized controlled trial with an active control group in a large sample of adolescents (n = 856). The participants came from different high schools, which increased the external validity of the study. Moreover, the methodological design included follow-up evaluations at three and six months after the intervention, which made it possible to explore the impact of the intervention in the medium term. Furthermore, the interventions used in this study are presented in an automated format via Qualtrics and therefore do not require the presence of specialized professionals during their application. This is an advantage that contributes to the low cost in terms of human resources for their implementation. The effect of the resilience intervention was explored on several behavioral and emotional problems (i.e., social anxiety, depressive symptoms, eating problems, online peer aggression, and NSSI), all of which are prevalent and relevant during adolescence.

Despite this single-session intervention was effective for some symptoms, its brief duration design may have also represented a double-edged sword. While it contributes to the low cost of preventive interventions in adolescents, it may also be insufficient to be effective for some specific problems that may require more sessions and/or additional strategies. A second limitation of this study is the exclusive use of self-reports to assess the impact of the intervention as well as the absence of long-term follow-ups (e.g., one or two years after the implementation of the intervention). WIs have the potential to activate recursive cycles that promote cognitive, emotional, and behavioral changes over time through a snowball effect (Kenthirarajah & Walton, 2015; Walton, 2014). Therefore, a long-term follow-up would have been able to test whether the benefits achieved intensified over time or even the appearance of other positive effects. A third limitation was the use of only one control group. Future studies should include additional control conditions such as alternative interventions and wait list control groups without intervention. Importantly, in the meta-analysis of Schleider and Weisz (2017), the intervention effects were much higher when the intervention was compared with no-treatment or waitlist control conditions than when it was compared with active control conditions. Finally, it should be noted that the fact that the study was carried out during the COVID-19 pandemic, a time of increased stress for many adolescents, may have influenced the results.

5. Conclusions

The findings of this study support the benefit of this growth mindset intervention in reducing the typical increase in social anxiety and online peer aggression after being victimized and improving attitudes to defend victims. The high prevalence rates of victimization among adolescents and the adverse effects that this victimization entails call for the implementation of interventions to reduce the effects of these aggressions. This type of short intervention, which can be applied easily and cheaply in schools, can be a useful tool. Future studies should continue to investigate its effects on other problems and in the long term.

Author contributions

EC: Conceptualization, Methodology, Formal analysis, Writing-Reviewing and Editing. **IO**: Writing- Reviewing and Editing. AE: Reviewing and Editing. NC: Data curation, Reviewing and Editing. MM: Reviewing and Editing. **LFG**: Writing- Reviewing and Editing.

Declaration of competing interest

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2022.107373.

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