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Socio-emotional e-competencies, cyberaggression, and cybervictimisation in adolescents: differences according to sex and academic year

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Abstract

The socialisation of adolescent boys and girls takes place primarily online in virtual environments, where cyberbullying is one of the greatest current social dangers faced by that age group. Socio-emotional e-competencies (i.e., competencies that apply specifically to online environments) are a protective factor against cyberaggression and cybervictimisation, and research has shown that the variables of sex and academic year (age) play a relevant role in that interaction. Although such socio-emotional e-competencies have been shown to play an adaptive role in further types of online behaviour, they have not yet been studied specifically in relation to cyberaggression and cybervictimisation. Our study's goal was thus to ascertain whether socio-emotional e-competencies have a predictive value for cyberaggression and cybervictimisation, and whether differences can be observed according to sex or academic year. Participants were 945 Spanish adolescents (56.5% female, 43.5% male) ages 12 to 16 (mean age: 13.80, *DE* = 1.27) enrolled in 13 secondary schools. Data were collected via self-report questionnaires (*European Cyberbullying Intervention Project Questionnaire [ECIP-Q]* and *Socio-Emotional E-Competencies Questionnaire [e-COM]*). We observed differences according to sex and academic year in cyberbullying behaviour and socio-emotional e-competencies. Moreover, significant relationships can be established between socio-emotional e-competencies, on the one hand, and cyberaggression and cybervictimisation, on the other, with differences among groups as revealed by SEM multigroup analysis. The levels of emotional e-regulation in girls and e-self-control of impulsivity in boys across all academic years explain most instances of cybervictimisation and cyberaggression, especially in younger-aged groups. These findings provide a new focus to help prevent cyberbullying.

Keywords: Cyberaggression, Cybervictimisation, Socio-emotional e-competencies, Emotional regulation, Adolescents, Sex, Academic year

1 Background

1.1 Roles of cyberbullying: cyberaggression and cybervictimisation

The online environment has become a fundamental medium for socialisation during adolescence. Young people use social media and apps as a way of developing their identity, thereby fulfilling their need to belong to a group, cultivate friendships, and build communication skills (Valkenburg et al., 2022). Although online communication and social networks can serve as a useful platform for finding friendships and meeting new people, they can also lead to exclusion, intimidation, and aggression.

Cyberbullying, in particular, can become a problem of substantial magnitude. As a research subject, it has only recently started to appear in the literature. Moreover, there is still no universally accepted definition of cyberbullying. In a systematic review of the concept across 24 studies, Peter and Petermann (2018) proposed to define cyberbullying as the use of information and communication technologies with the purpose of repeatedly and deliberately harming, harassing, hurting, and/or embarrassing someone. This definition was similar to previous ones, which are widely accepted in the literature (Tokunaga, 2010).

Several research teams have affirmed that cyberbullying can have more devastating effects than its physical counterpart, bullying. Cyberaggression can occur at any moment of the day (Vismara et al., 2022; Bautista-Alcaine & Vicente-Sánchez 2020), it can be maintained over time, and it can spread to a large audience; moreover, the aggressor can remain anonymous, difficult to identify (Chamizo-Nieto et al., 2024). In fact, findings throughout the scientific literature have warned of the serious negative impact cyberbullying can have on adolescents on a psychological, social, physical, and academic level. On the one hand, cyberbullies themselves suffer from anxiety, low self-esteem and depression (Strohmeier & Gradinger, 2022); some cyberbullies even have suicidal ideations (Andrade et al., 2021). On the other hand, regarding cybervictims, a systematic revision of the literature carried out by Evangelio et al. (2022) highlighted a series of effects of cyberbullying on their mental health: anxiety, depression, nervousness, irritability, and increased feelings of solitude and frustration.

The substantial prevalence of cyberbullying and cybervictimisation is undisputed: a recent meta-analysis of 26 international studies yielded a global prevalence of 18% for cybervictimisation and 11% for cyberaggression (Huang et al., 2024). These percentages differed according to region and culture, as well as due to varying measurement criteria and tools (Henares-Montiel et al., 2022). Researchers have also examined the prevalence of cyberbullying and cybervictimisation according to sex and academic year. There seems to be greater evidence indicating that boys are more at risk of becoming cyberaggressors (Bae, 2021; Piazuelo-Rodríguez et al., 2024; Sorrentino et al., 2019), whereas girls are at more risk of becoming cybervictims (Gao et al., 2021; Kowalski et al., 2019). Along these same lines, a transnational study across 42 countries indicated that the mean prevalence of cybervictimisation reported by girls as victims around the age of 13 was greater than boys of the same age. However, in all age groups between 11 and 15, the prevalence of reported instances of cybervictimisation was greater in boys than in girls, increasing with age (Craig et al., 2020). A large-scale study in Spain by Andrade et al., 2021 estimated that the rate of cyberaggression was 7.9% and the rate of cybervictimisation was 10.7% across all years of obligatory secondary education (12 to 16 years old).

Girls were more often victims (12.7% vs 8.7%), whereas boys were more often aggressors (8.4% vs 7.3%) or victim-aggressors (13.8% vs 9.6%). On the other hand, cybervictimisation was somewhat more pronounced (10.8%) in the first two academic years of obligatory secondary education (1º—2º ESO, i.e., ages 12 to 14) as compared with the last two obligatory years 3º—4º ESO (10.6% in 3º—4º ESO, i.e., ages 14 to 16). The measured rate of cyberaggression grew from 6.5% in 1º—2º ESO (ages 12 to 14) to a more elevated rate of 9.2% in 3º—4º ESO (ages 14 to 16). The factors of sex and academic high school year should thus be taken into account, particularly since the majority of interactions among adolescents take place at school, where they are grouped into academic years. Moreover, these differences could be associated with boys' and girls' divergent approaches to the use of social networks (Twenge & Martin, 2020) and with their differing motivations for participating in cyberbullying (Wong et al., 2018), apart from further factors.

1.2 Socio-emotional e-competencies

Online communication has its own idiosyncratic characteristics: anonymity, a greater degree of disinhibition, and a lack of non-verbal communication signals (Wright et al., 2019; Yang et al., 2021). Online communication also generates new communication modes and elements, such as emoticons, memes, stickers, and viral challenges. In view of all these special traits, online communication might require specific competencies in order to ensure that social relationships remain positive and optimal while protecting users from exposure to risks such as cyberbullying (Martín Martínez & Castiblanco Carrasco, 2023).

Thus, socio-emotional e-competencies can be described as a series of abilities that allow an individual to manage their emotions in specific online situations, with the purpose of establishing optimal relationships with their peers (Cebollero-Salinas, 2022a). Socio-emotional e-competencies can be enumerated as follows: emotional e-awareness (the capacity of identifying and comprehending one's own emotions in a virtual context), e-regulation of emotions (the capacity of generating adequate responses to a context by identifying one's own emotional states which have been generated by specific characteristics of online communication); e-self-control of impulsivity (the competency to mitigate or inhibit one's own spontaneous responses to stimuli, social demands, and information encountered on the Internet); emotional e-independence (the capacity to feel emotional strong in online social relationships without depending on the number of likes, the number of followers, or one's online reputation, etc.); and social e-competency (the capacity to cultivate and maintain good relationships in a virtual environment, exhibiting pro-social behaviour). Research has shown that socio-emotional e-competencies predict online behaviours such as cybergossip, phubbing, and media multitasking in adolescents ages 12 to 16 (Cebollero-Salinas, 2022b): emotional e-independence is an exclusive competency that protects girls in the two academic years 3º—4º ESO (ages 14 to 16), whereas emotional e-regulation and e-self-control of impulsivity are competencies that protect members of both sexes and pertaining to all academic years from 1º to 4º ESO, i.e. from ages 12 to 16 (Cebollero-Salinas, 2022b); not only have these emotional e-competencies proved to be relevant, particularly in adolescence, but differences according to sex and age (academic year) were also evident.

For instance, when cybergossip, a predictor of cyberaggression and cybervictimisation in 12-to-16-year-old adolescents, was examined in detail (Cebollero-Salinas, 2022c; Falla et al., 2021; Romera et al., 2021), researchers found that socio-emotional e-competencies were related differently to that behaviour according to sex and academic year. In all academic years (1º—4º ESO, ages 12 to 16), cybergossip was inversely predicted by e-motional e-regulation in girls and by e-self-control of impulsivity in boys. The same inversely predictive quality was likewise exclusively shared by emotional e-independence in girls and boys in the two higher academic years (3º—4º ESO, ages 14 to 16) (Cebollero-Salinas, 2024). However, no study has analysed the relationship between those e-competencies and cyberaggression and/or cybervictimisation.

Other research teams suggested that certain offline socio-emotional competencies, such as conscience and emotional regulation, display significant relationships with socio-emotional e-competencies in 10-to-14-year-old adolescents, as opposed to emotional e-independence and e-self-control of impulsivity, which have to be specifically developed in an online environment (González-Gómez et al., 2024). Further research teams demonstrated the relevance of the above-mentioned offline socio-emotional competencies for the prevention of cybervictimisation and cyberaggression (Marín-López et al., 2020; Ran et al., 2023; Zych et al., 2018). This was confirmed in another study, which showed that greater levels of emotional comprehension and emotional regulation inversely predict the probability of becoming a cybervictim or a cyberaggressor (Martínez-Monteagudo et al., 2019). A study by Rey et al. (2018) showed that deficiencies in emotional regulation differentially explain instances of cybervictimisation experienced by adolescent girls.

Given that socio-emotional competencies are protective factors against cyberaggression and cybervictimisation (Marín-López et al., 2020; Martínez-Monteagudo et al., 2019; Ran et al., 2023; Zych et al., 2018) and given that they partially transfer to the virtual environment as socio-emotional e-competencies (González-Gómez et al., 2024), and, moreover, given that the latter are adaptive online competencies differentially related to cyberaggression and cybervictimisation according to sex and academic year (Cebollero-Salinas, 2022b; Cebollero-Salinas, 2024), one could hypothesise that socio-emotional e-competencies could be significantly related to and aid and in preventing cyberaggression and cybervictimisation. Proving that hypothesis would open up new lines of prevention against those risks. This is the basis on which we posit this study's objectives and hypothesis.

1.3 Objectives, hypothesis, and study model

The above-mentioned studies suggested that socio-emotional competencies may be relevant to the prevention of cyberbullying. However, we noted the inexistence of studies that would analyse cyberbullying in the milieu in which it actually takes place: the online environment. We also noted a lack of studies on the differential aspects of sex and academic year in the influence exerted by socio-emotional e-competencies on the roles of cyberaggressor and cybervictim. To address this gap, and given the urgency of efficiently tackling the problem of cyberbullying, our study's objectives were the following: to analyse, in a sample of 12-to-16-year-old Spanish adolescents, the predictive value of socio-emotional e-competencies in the two roles involved in

cyberbullying: cyberaggression and cybervictimisation, while examining differences in function of sex and academic year. In practice, we found that it is of utter importance to understand how the behaviours of cyberaggression and cybervictimisation emerge in the online environment, particularly given the grave consequences such behaviours can entail.

In order to address those objectives, we postulated a structural equation model, considering that all socio-emotional e-competencies (emotional e-awareness, emotional e-regulation, e-self-control of impulsivity, emotional e-independence, and social e-competency) would be significantly related to the condition of being a cybervictim or a cyberaggressor. The simplified model is depicted in Fig. 1.

Our research hypotheses were the following:

H1. We expected to find that the dimensions of socio-emotional e-competencies would predict the roles of cyberbullying, cyberaggression, and cybervictimisation in adolescence, given that offline socio-emotional competencies are protective factors against cyberaggression and cybervictimisation (Marín-López et al., 2020; Martínez-Monteagudo et al., 2019; Ran et al., 2023; Zych et al., 2018). Such competencies partially transfer to online environments in the guise of socio-emotional e-competencies (González-Gómez et al., 2024), and their inversely predictive relationship with online behaviours similar to cyberaggression and cybervictimisation has already been noted (Cebollero-Salinas, 2022b; Cebollero-Salinas, 2024).

H2. We expected to find differences in function of sex and academic year in the prediction of socio-emotional e-competencies and of the roles of cyberaggressor and cybervictim, given that previous studies had shown that socio-emotional

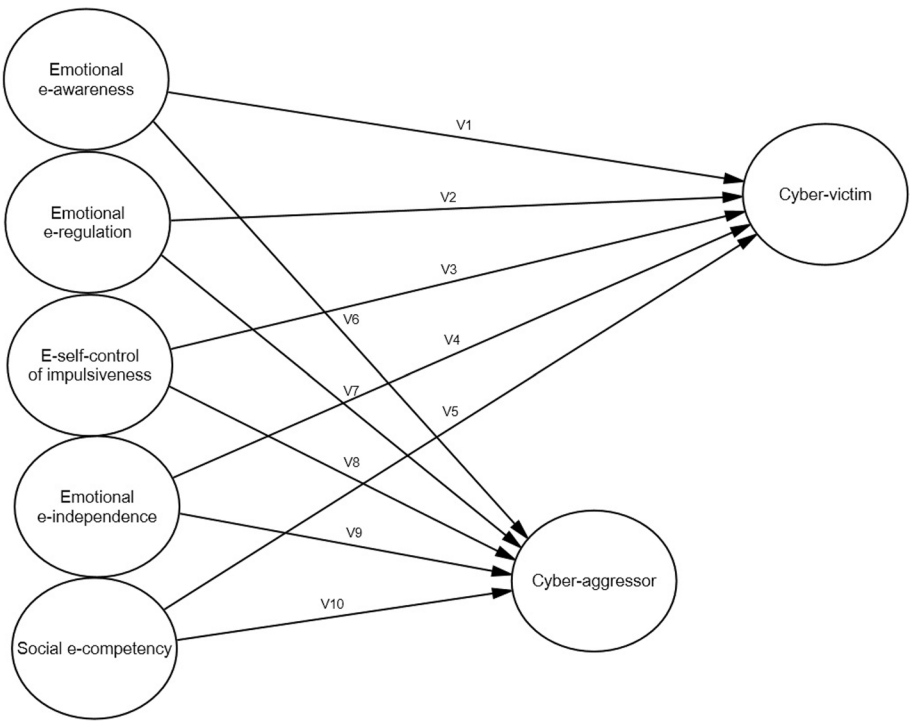

Fig. 1 Study model diagram

e-competencies were differentially related, in function of sex and academic year, with other online behaviours related to cyberaggression (Cebollero-Salinas, 2022b; Cebollero-Salinas, 2024).

2 Methods

2.1 Participants

Information was collected from students enrolled in 13 centres of secondary education (in Spain: 1st-4th grades of ESO, e.g., *Educación Secundaria Obligatoria*, "Compulsory Secondary Education", comprising ages 12 to 16) in the Autonomous Community of Aragon (Spain). The sampling procedure was probabilistic by quota, according to sex, according to the number of students in each province of the Autonomous Community of Aragon, and, especially, in function of each age group, thereby creating representative sampling units divided into urban and rural municipalities, and proportionally distributed among public and private schools. Each of the thirteen schools comprised one sampling unit. We chose to focus our study on the four years of obligatory secondary education (ESO) for the following reason: this is the only portion of secondary education that all Spanish students are obliged to attend by law. After fourth year of ESO, certain students can choose to continue preparing for university in two more academic years, or they can choose to pursue other types of training and professional education outside of a university context. Thus, once the four years of ESO are over, the class groups formed in the first year tend to change considerably, as many students tend to switch to another education centre depending on their professional choices.

Thanks to the procedure described above, we obtained data from 945 students enrolled in 1st to 4th secondary academic year. Distribution by sex was equitable (56.5% girls and 43.5% boys), with an average age of 13.80 ($SD = 1.27$) and a well-balanced distribution across academic years (24.7% of students were in first year of ESO, 24.9% in second, 22.0% in third, and 28.5% in fourth year). Those four academic years differ in terms of age [1st year = 12.29(0.501), 2nd year = 13.16 (0.511), 3rd year = 14.30 (0.556), and 4th year = 15.28(0.548)]. Moreover, age and academic year are highly correlated (r = 0.919). The percentage of boys and girls in the different academic years did not differ statistically (Chi-square = 2.537, gl = 3, $p = 0.469$); neither did the mean age of the boys and girls ($F_{1,943} = 2.194$, $p = 0.139$).

2.2 Instruments

Socio-emotional e-competencies questionnaire (e-COM) (Cebollero-Salinas, 2022a). This questionnaire evaluates socio-emotional competencies in an online environment. It comprises 25 items with responses on an 11-point Likert scale ranging from 0 (totally disagree) to 10 (totally agree).

The questionnaire has five subscales:

- emotional e-awareness. Quantifies the ability to identify and understand one's own emotions in a virtual context, as in, for example: "When I am on social media (reading comments, watching videos, exploring people's profiles, etc.), I can put a name on what I feel" (5 items; *Rho* = 0.755).

- emotional e-regulation. Evaluates the capacity to generate appropriate responses to a context by identifying one's emotional states generated by the specific characteristics of communication on the Internet, as, for example: "Before making a joke about someone on social media, I am capable of imagining how they are going to feel" (5 items; *Rho* = 0.818).
- e-self-control of impulsiveness. Quantifies the competency to inhibit spontaneous responses in the face of stimuli, social requirements, and information appearing on the Internet, for example: "I cannot avoid clicking on attractive links that appear in my feed" (5 items; *Rho* = 0.755).
- Emotional e-independence. Evaluates the ability to feel emotionally intense in virtual social relations without depending on one's reputation and virtual status negotiation. For example: "If people don't react to me on social media, I feel as if they did not regard me as part of the group" (5 items; *Rho* = 0.866).
- social e-competency. Quantifies the competency to maintain good relationships in a virtual environment, as well as pro-social conduct, as in, for example: "On social media (Instagram, WhatsApp, etc.) I pay attention to the needs of others" (5 items; Rho = 0.805).

The e-COM questionnaire has been validated on a sample of 888 Spanish adolescents, ages 12 to 16. It has been submitted to EFA and CFA, displaying an adequate fit ($\chi^2 = 519.441$, g.l. = 265, $p < 0.001$; χ^2/g.l. = 1.960; CFI = 0.940, TLI = 0.932, RMSEA = 0.043), as well as in the entire sample ($\chi^2 = 624.572$, g.l. = 265, $p < 0.001$; χ^2/g.l. = 2.357; CFI = 0.954, TLI = 0.948, RMSEA = 0.039).

European Cyberbullying Intervention Project Questionnaire (ECIP-Q), (Del Rey et al., 2012), Spanish version (Ortega-Ruiz et al., 2016). This questionnaire evaluates cybervictimisation and cyberaggression behaviour in adolescents, with 11 items per role. For our study, we picked 4 items from each role, chosen to represent the most habitual behaviours ("I have insulted someone / I have been insulted; I have threatened someone / I have been threatened; I have spread rumours / rumours have been spread about me; I have excluded someone on social media and/or videogames / I have been excluded on social media and/or videogames") (Álvarez-García et al., 2017; Rey et al., 2018; Whittaker & Kowalski, 2015). Answers reflecting activity in the last months were provided by respondents on a 5-point Likert-type scale ranging from 0 (never), 1 (yes, one or two times), 2 (yes, one or two times per month), 3 (yes, about once a week), to 4 (yes, more than once a week). Cronbach's Alpha of the original 11-item scales was 0.80 for cybervictimisation and. 88 for cyberaggression. In our study, with four items selected from the scale, *Rho* was 0.742 for cybervictimisation and 0.765 for cyberaggression.

2.3 Procedure

After obtaining consent from the directive board of each high school, we obtained informed consent from the families, explaining the study's objectives and the voluntary basis of the student's participation. An access web platform was uploaded, and the participants filled out the questionnaires online in the presence of a research team member. The duration of the assessment was 20 min during class time. The project was evaluated

and approved by the Research Ethics Committee of (anonymised) Community, thereby ensuring that all ethical standards were respected.

2.3.1 Statistical procedure

Analysis of results was carried out in two phases. In a first phase, we applied descriptive analysis of the means of the scales that had been used, differentiating by sex and academic year, to conduct an initial exploration of results and test whether there were differences between boys and girls. To calculate the effect size of the differences among groups, we used eta square (η^2): following the recommendations given by Cohen (1992), we considered 0.01 to be a small effect, 06. as a medium effect, and 0.14 as large.

In a second phase, we tested the hypothetical model of causal structure by applying SEM (Byrne, 2012; Schreiber et al., 2006), which, along with measurement models, adds the possibility of establishing relationships among variables by defining exogenous variables as independent variables, and endogenous variables as dependent ones. Moreover, structural equation modelling (SEM) allowed us to study factorial invariance to ascertain whether the relationships among variables were the same in different groups.

In our model, socio-emotional e-competencies were considered exogenous variables, whereas cyberaggression and cybervictimization were considered endogenous variables (or criterion variables in the regression equations). The model designed according to our hypothesis is represented in Fig. 1. Endogenous and exogenous variables are latent variables obtained from the items of the analysed scales. In all cases, the scores achieved on the items were sufficient for them to be maintained as indicators of the variables, and an indicator grouped with its value was retained with the construct validity value (Rho) provided in the scale description section. That validity score was taken from the CFA regression weights; its values were considered satisfactory when they lay above 0.7 (Hair et al., 1998).

We compared the regression weights of boys and girls in two age groups represented by the first two and the last two academic years, a useful strategy to prove our hypothesis. Our SEM model was tested with M-Plus (Muthén & Muthén, 1998–2017). We used the MLR estimation method, which remains unaffected by data that do not comply with the norm and is thereby more flexible in making comparisons among models. We started by constructing the scales' factorial scores. Once the factorial structure of the variables was confirmed, we obtained correlations among factorial scores of all variables for the total sample and for each of the four groups, after which we compared them via Fisher's Z transformation of the correlation coefficient.

We then tested the SEM model by establishing comparisons among groups, which gave rise to successive models. The first model included all the relationships postulated in Fig. 1. In Models 2 and 3, certain non-statistically-significant weights in certain groups were fixed at zero. In Model 4, with resulting relationships that were equal for several groups, we tested equality of regression weights.

In order to analyse the models' goodness of fit, we used the usual indices reported by M-PLUS: the chi-square index and the normalised chi-square index ($\chi 2$ / DF), the RMSEA, the TLI and the CFI (Byrne, 2012). When dealing with nested models, we compared them by calculating $\Delta\chi^2$ with the correction proposed by (Satorra &

Bentler, 2010) through the Satorra-Bentler Scaled Chi-Square statistic (TRd) and the AIC index (Byrne, 2012).

3 Results

3.1 Descriptive analyses

First, the self-informed data provided by the participants revealed the presence of cybervictimisation and cyberaggression behaviours. As can be ascertained in Table 1, behaviours such as being insulted or being the object of taunts were reported with different frequencies by 51.3% of all participants. Other behaviours were less common, such as being the object of rumours (35%), or being excluded from social networks, or from games (31.1%). Being the object of threats is a more dangerous behaviour and was confirmed by 22.1% of participants (Table 1). Most of those who affirmed that they had received threats stated that it occurred sporadically, but 8 to 11% of participants were the object of threats on a weekly or weekly/monthly basis. The sum of these items made up the total cybervictimisation score.

A lower proportion of students admitted to having displayed cyberaggressive behaviour. The most frequent ones (in parallel to the cybervictimization figures) were: proffering insults and taunts (27.6%), followed by ignoring someone on social media or excluding them from games (23.9%), spreading rumours (14.3%) or issuing threats (9.7%) (Table 1). As above, participants indicated that they exhibited these behaviours rather seldom, although between 3 and 8% of them did so repeatedly on a weekly or monthly basis. The sum of these items made up the cyberaggression total.

Table 1 Frequency of cybervictimisation and cyberaggression ($n = 945$)

		No, never	Yes, one or two times	Yes, once or twice a month	Yes, about once a week	Yes, more than once a week
V1. I have been told bad words or insults on the Internet	CIBVI1	48.7	39.5	6.6	2.9	2.4
V2. I have been threatened through the Internet	CIBVI2	77.9	17.1	3.3	1.1	.6
V3. They have spread rumours about me on the Internet	CIBVI3	65.0	26.3	5.0	1.9	1.8
V4. I have been excluded or ignored from a social network or video game	CIBVI4	69.9	21.7	5.5	1.7	1.2
A1. I have said bad words or insults on the Internet	CIBAI1	62.4	28.6	5.7	1.9	1.4
A2. I have threatened someone through the Internet	CIBAI2	90.3	6.6	2.2	.4	.5
A3. I have spread rumours about someone on the Internet	CIBAI3	85.7	10.5	2.1	1.3	.4
A4. I have excluded or ignored someone from a social network or video game	CIBAI4	76.1	18.1	3.7	1.1	1.1

Table 2 Descriptive analysis and ANOVA of cyberaggression, cybervictimisation, and socioemotional e-competencies, in function of sex and academic year

		n	*M*	*SD*	*F*	*p*	η^2
Cybervicti	Girls in 1st/2nd year	272	2.68	3.551	3.297[a]	.020	0.011
	Boys in 1st/2nd year	196	3.62	5.076			
	Girls in 3rd/4th year	262	3.58	3.979			
	Boys in 3rd/4th year	215	3.82	5.099			
Cyberaggressor	Girls in 1st/2nd year	272	1.86	3.141	3.215[a]	.022	0.011
	Boys in 1st/2nd year	196	2.66	5.579			
	Girls in 3rd/4th year	262	2.69	3.992			
	Boys in 3rd/4th year	215	3.09	4.969			
Emotional e-awareness	Girls in 1st/2nd year	272	31.61	10.50	3.065	.027	0.01
	Boys in 1st/2nd year	196	33.46	10.84			
	Girls in 3rd/4th year	262	32.55	10.69			
	Boys in 3rd/4th year	215	34.44	10.89			
Emotional e-regulation	Girls in 1st/2nd year	272	38.15	9.41	5.277	.001	0.02
	Boys in 1st/2nd year	196	36.93	8.85			
	Girls in 3rd/4th year	262	37.49	9.42			
	Boys in 3rd/4th year	215	34.83	10.37			
E-self-control of impulsiveness	Girls in 1st/2nd year	272	32.45	10.03	0.263	.852	0.001
	Boys in 1st/2nd year	196	32.82	11.27			
	Girls in 3rd/4th year	262	31.95	10.62			
	Boys in 3rd/4th year	215	32.30	10.36			
Emotional e-independence	Girls in 1st/2nd year	272	38.02	10.92	3.285	.020	0.010
	Boys in 1st/2nd year	196	36.63	11.60			
	Girls in 3rd/4th year	262	34.90	12.59			
	Boys in 3rd/4th year	215	36.90	11.23			
Social e-competency	Girls in 1st/2nd year	272	31.75	10.14	5.844	.001	0.018
	Boys in 1st/2nd year	196	30.62	10.25			
	Girls in 3rd/4th year	262	33.12	9.05			
	Boys in 3rd/4th year	215	29.46	10.51			

[a] Brown-Forsite

3.2 Differences in terms of sex and academic year in relation to socio-emotional e-competencies and cyberaggression/cybervictimisation

In order to compare these behaviours and socio-emotional e-competencies across different groups, we took the direct total scores of the cyberbullying and socio-emotional e-competency scales as a point of departure. Results are shown in Table 2. In the case of cybervictimisation and cyberaggression, girls in the younger age group (1st two years of secondary education) were those who scored the lowest. These differences were statistically significant in the post hoc comparisons with the groups of boys and girls that scored higher on cybervictimisation ($p = 0.016$ and $p = 0.039$) and with the boys in cyberaggression ($p = 0.012$). Boys generally scored higher than girls on cyberaggression [2.88 (5.26) vs 2.27(3.60); Brown-Forsite = 4.125; $p = 0.043$], and also presented a greater degree of variance; they also scored higher on cybervictimisation [girls 3.13 (3.79) vs boys 3.73 (5.08); Brown-Forsite = 4.005; $p = 0.046$]. Cybervictimisation and cyberaggression increased in both sexes in parallel with the progressive advancement of academic years.

In the area of socio-emotional e-competencies, we observed differences among the four groups in all dimensions, except for e-self-control of impulsivity. Differences in social e-competency stood out particularly, with higher scores for girls (32.42 vs. 30.01, $F_{1.983} = 13.341$, $p < 0.001$, $\eta^2 = 0.018$), particularly those in the two upper academic years (33.12). Results in the dimension of emotional e-independence had a smaller effect size, but the result was nevertheless relevant, as it displayed a statistically significant interaction between sex and academic year ($F_{1.983} = 4.956$, $p = 0.026$). Thus, boys had similar scores in both two-year groups (1st and 2nd vs 3rd and 4th), but girls, who still had high scores in 1st and 2nd year (38.02), even higher than the boys' mean (36.77), attained the lowest scores in 3rd and 4th year of secondary education (34.90), now lying below the boys' scores. Moreover, emotional e-regulation and e-self-control of impulsivity decreased with progressive academic years in both boys and girls.

We calculated the correlations among the variables' factorial scores; results are displayed in Table 3. There was a high correlation between the self-informed behaviours of cybervictimization and cyberaggression, with high values. However, comparison among groups showed that these behaviours were slightly lower in girls of the older age group, i.e., 3rd and 4th year ($r = 0.596$) than the other groups ($Z = 5.38$, $p < 0.001$ versus girls in 1st and 2nd year). Regarding cybervictimisation and its relationship with socio-emotional e-competencies, there were medium-sized negative relationships with e-self-control of impulsiveness as well as with emotional e-independence. In other words, cybervictimisation was associated with lower scores in those e-competencies, as well as in emotional e-regulation. In the first case, this correlation attained the highest score values in boys of the lower age group ($r = -0.516$), which was higher than the other groups ($Z = 1.95$, $p = 0.05$, with the girls in the lower age group); in the case of emotional e-regulation, the relationship was only significant for girls.

Table 3 Correlations among "behaviours" and socio-emotional e-competencies

	Girls 1º–2º ESO	Boys 1º–2º ESO	Girls 3º–4º ESO	Boys 3º–4º ESO	Total
Cybervictimisation					
Cyberaggressor	.821***	.853***	0.596***	.987***	.812***
Socio-emotional e-competencies and cybervictimisation					
Emotional e-awareness	.102	.095	.041	.136	.123**
Emotional e-regulation	-.247**	-.138	-.208*	-.140	-.192***
E-self-control of impulsiveness	-.368***	-.516***	-.207*	-.340***	-.319***
Emotional e-independence	-.386***	-.399***	-.208*	-.253*	-.264***
Social e-competency	.206**	.266***	.049	.155	.164***
Socio-emotional e-competencies and cyberaggression					
Emotional e-awareness	.092	-.088	-.033	.100	.034
Emotional e-regulation	-.330***	-.219*	-.318***	-.182*	-.260***
E-self-control of impulsiveness	-.530***	-.407***	-.227**	-.453***	-.386***
Emotional e-independence	-.378***	-.243**	-.249**	-.172	-.243***
Social e-competency	.105	.035	-.142*	.025	-.006

* $p < .05$; ** $p < .01$; *** $p < .01$

In the case of emotional e-independence, the strongest relationships could be observed in the two younger groups of boys and girls, and the scores were lower in the upper-year groups.

Social e-competency was also slightly related to cybervictimization in the groups of younger boys and girls. This relationship was positive: in other words, the younger boys and girls who reported more online victimisation also scored higher on levels of social e-competency. There was no relationship with emotional e-awareness.

Regarding cyberaggression, Table 3 once more shows the importance of e-self-control of impulsiveness, with medium-sized relationships in all groups except for the older girls ($r = -0.227$ vs. $r = -0.407/-0.530$, $Z = 2.1$, $p = 0.03$). The importance of emotional e-regulation and emotional e-independence is also evident therein, with slightly lower values. In all cases, these relationships were negative, indicating that e-competencies were associated with lower levels of cyberaggression. Emotional e-awareness and social e-competency did not display relationships with cyberaggression, except for a minimal relationship of the latter with social e-competency in older girls ($r = -0.142$).

3.3 Predictive value of the dimensions of socio-emotional e-competencies regarding cyberaggression and cybervictimisation

Per this study's objective, we tested the model displayed in Fig. 1. In Table 4, we present the results of goodness of fit of the models applied to the four groups. We tested a first model without restrictions on any of the regression weights between the model's exogenous and endogenous variables (Fig. 1). This first model had good indicators of fit, but it also contained non-significant weights, as can be ascertained in Table 5: we fixed the latter at zero in Model 2, concretely V7 and V8 in the group of boys in 3rd and 4th year, which had still been statistically significant in Model 1. Once again, certain non-significant weights appeared: we once more fixed these at zero in Model 3. Lastly, we compared whether there were differences in regression weights among the groups in cases where more than one group had statistically significant relationships (V2 and V7 in the two girls' groups and V8 in the boys' and girls' groups of 1st and 2nd year). A comparison among models is shown in Table 4. In accordance with comparisons according to the chi-squared value, there were no differences among models: for example, Model 1 vs. Model 2 ($TRd = 7.078$, $\Delta d.f. = 6$ $p = 0.313$) or Model 3 vs. Model 4 ($TRd = 5.761$, $\Delta d.f. = 4$ $p = 1.000$). On the other hand, the data of the AIC index showed that Model 4 is the one with the best fit. It would also be the most parsimonious model, as it did not

Table 4 The goodness of fit of the SEM models and invariance analysis

Model	χ^2	DF	*p*	χ^2/DF	CFI	TLI	RMSEA	SRMR	Akaike (AIC)
Model 1	3163.104	2067	.000	1.530	0.894	0.892	0.048	0.068	117,622.750
Model 2	3153.256	2073	.000	1.528	0.896	0.894	0.047	0.070	117,592.652
Model 3	3154.665	2075	.000	1.520	0.896	0.894	0.047	0.071	117,589.803
Model 4	3159.533	2079	.000	1.520	0.896	0.894	0.047	0.071	117,587.370

Model 1: Without restrictions on weights among groups

Model 2: Non-significant regression weights among groups in M1 fixed at zero

Model 3: Non-significant regression weights among groups in M2 fixed at zero

Model 4: Regression weights among the same groups in M3 fixed as equal (V2, V7, and V8)

Table 5 SEM model according to invariance groups

	Victim	Girls 1st-2nd year	Boys 1st-2nd year	Girls 3rd-4th year	Boys 3rd-4th year
		Cyber-victim- Model 1			
V1	Emotional e-awareness	.054	-.070	.096	.189
V2	Emotional e-regulation	-.235**	-.001	-.239*	-.185
V3	E-self-control of impulsiveness	-.182	-.408***	-.046	-.235
V4	Emotional e-independence	-.232**	-.127	-.173	-.104
V5	Social e-competency	.140	.159	.122	.035
		Cyber-aggressor- Model 1			
V6	Emotional e-awareness	.100	-.172*	.104	.228*
V7	Emotional e-regulation	-.272***	-.018	-.295**	-.222*
V8	E-self-control of impulsiveness	-.415***	-.448***	-.093	-.442***
V9	Emotional e-independence	-.141*	.028	-.150	.042
V10	Social e-competency	-.024	.003	-.089	-.153
		Cyber-victim- Model 4			
V1	Emotional e-awareness	.000	.000	.000	.000
V2	Emotional e-regulation	-.189**	.000	-.173**	.000
V3	E-self-control of impulsiveness	.000	-.457***	.000	.000
V4	Emotional e-independence	-.356***	.000	.000	.000
V5	Social e-competency	.000	.000	.000	.000
		Cyber-aggressor – Model 4			
V6	Emotional e-awareness	.000	-.161***	.000	.000
V7	Emotional e-regulation	-.284***	.000	-.268***	.000
V8	E-self-control of impulsiveness	-.374***	-.303***	.000	-.307***
V9	Emotional e-independence	-.158**	.000	.000	.000
V10	Social e-competency	.000	.000	.000	.000
		% of variance explained			
	Cyber-victim	19.20%	20.8%	3.0%	0
	Cyber-aggressor	34.8%	9.8%	7.20%	9.40%

* $p < .05$; ** $p < .01$; *** $p < .01$

incorporate non-significant regression weights and assumes equality among groups in the three postulated cases.

Globally, the model explained a high proportion of the variance of cyberaggression in the younger group of girls (34.8%) and of cybervictimisation in the younger group of boys (20.80%) and girls (19.2%). In the other cases, the percentages of variance explained by the model lay between 3.0% and 9.8% (Table 5), except in the case of cybervictimisation of older boys, in which no variable entered the regression equation. We also ascertained that not all e-competencies had the same weight in explaining cybervictimization and cyberaggression behaviours, as already evident in the correlation table. Thus, emotional e-regulation was key in the case of girls for predicting cybervictimization ($\beta = -0.189$ y $\beta = -0.173$) and cyberaggression ($\beta = -0.284$ y $\beta = -0.268$) with negative weights in all cases. E-self-control of impulsiveness appeared as a protective factor against cybervictimisation in younger boys ($\beta = -0.457$), as well as against cyberaggression, both in the younger group (12–14 years old) ($\beta = -0.303$) and in the older group (15–16 years old) ($\beta = -0.307$), as well as against aggression in the younger girls ($\beta = -0.374$). Emotional e-awareness also slightly contributed toward explaining cyberaggression in younger boys

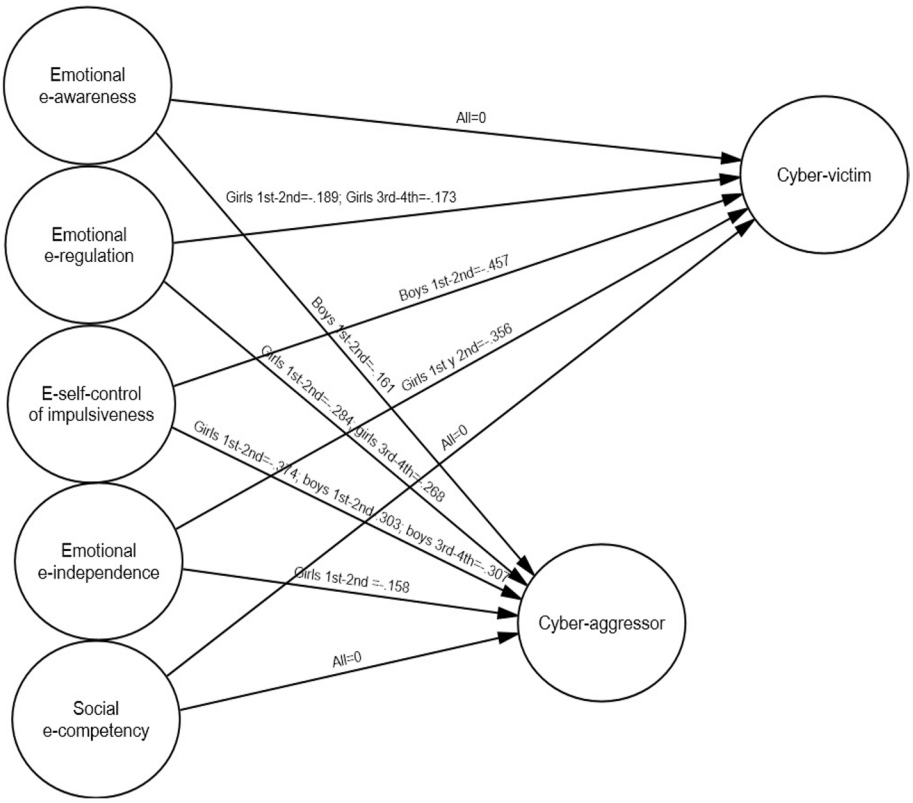

Fig. 2 Diagram of the study model: results

(β = −0.162). Emotional e-independence was negatively related to cybervictimisation and cyberaggression in the younger girls (1st and 2nd year; β = −0.356 y β = −0.158). These results are represented in Fig. 2.

4 Discussion

This study's objectives were to analyse the potential of socio-economic e-competencies in predicting cyberaggression and cybervictimisation in a sample of 12-to-16-year-old Spanish adolescents, differentiating those relationships among variables according to sex and academic year. Previous literature had analysed such conducts by evaluating them in face-to-face situations without studying the specificity of such competencies in the environment where cyberbullying occurs. Our study thus contributes to a more profound understanding of the mechanisms underlying these risk behaviours in adolescents.

To achieve this, we postulated two hypotheses. The first one (H1) was partially confirmed: in our sample, all socio-emotional e-competencies, except social e-competency, predicted cyberaggression and/or cybervictimisation. All this could indicate that socio-emotional e-competencies can provide specific information to help researchers better understand the phenomenon of cyberbullying in adolescence, as suggested by certain authors (Martín Martínez & Castiblanco Carrasco, 2023). This result also aligns with previous studies that reached similar conclusions in the analysis of other online behaviours such as cybergossip, phubbing, and media multitasking (Cebollero-Salinas, 2022b). In our current study, three socio-emotional e-competencies (emotional e-regulation,

e-self-control of impulsivity, and emotional e-independence) were shown to function as protective factors against cyberaggression and cybervictimisation. In other words, if an adolescent makes comments about an influencer without regulating their own emotions or if an adolescent responds impulsively to a notification that makes them feel aggressed or makes them feel excluded from a group on social networks, these can be situations that require the development of those three e-competencies to help the adolescent prevent the perpetration or the suffering of an act of cyberbullying. Moreover, we find it significant that most relationships between socio-emotional e-competencies, on the one hand, and cyberaggression and cybervictimisation, on the other, were shown to be of greater magnitude and intensity in our study than similar relationships analysed in previous studies associating socio-emotional competencies in face-to-face situations (Marín-López et al., 2020; Martínez-Monteagudo et al., 2019). These results could be due to the fact that socio-emotional e-competencies are providing information that is more precisely adjusted to the phenomenon under study, especially since we only featured the most common cyberaggression and cybervictimisation behaviours, and scoring was factorial.

Regarding our second hypothesis (H2) postulating that socio-emotional e-competencies predict cybervictimisation in function of sex and academic year, it was partially confirmed, for which there are several reasons. Three of the five socio-emotional e-competencies were predictive of cyberaggression and cybervictimisation, with differences according to sex and/or academic year. Emotional e-regulation predicts whether girls suffer from cyberbullying, regardless of academic year, whereas e-self-control of impulsivity explains cyberaggression in boys in all academic years as well as cybervictimisation of boys in 1st to 2nd year. In girls, however, the latter competency only explains cyberaggression in 1st to 2nd year. To summarise, the competency of emotional e-regulation predicts cyberaggression and cybervictimisation exclusively in girls, whereas e-self-control of impulsivity tends to fulfil a predictive capacity almost exclusively in boys only. These results seem to suggest that these two socio-emotional e-competencies (i.e., emotional e-regulation and e-self-control of impulsivity) might be playing a key role in the prevention of those two cyberbullying roles. This, in turn, would bring our results in line with previous studies that showed the predictive role of socio-emotional e-competencies in further online behaviours related to cyberbullying, such as cybergossip (Cebollero-Salinas, 2024; Romera et al., 2021). Moreover, this is plausible, considering that acting and reacting online (on the Internet, in social media, etc.) is associated with a greater amount of information input, entertainment options and instant gratification potential; this, in turn, can lead users to interact more intensely than in face-to-face situations, to make comments about others more often, and to compare themselves with others more frequently (Falla et al. 2021; Romera et al., 2021). Certain authors have found significant relationships between aggressivity and the different forms of impulsivity (Bresin, 2019; Khoury-Kassabri et al., 2020), as well as between emotional regulation in face-to-face environments and cyberbullying (Kokkinos & Voulgaridou, 2017; Martínez-Monteagudo et al., 2019; Rey et al., 2018). As our results show, e-self-control of impulsivity is particularly relevant in boys. This might be due to boys' greater tendency to use cyberaggression to exert vengeance on someone (Wong et al., 2018), as well as their increased tendency to apply a more direct style of online violence (Álvarez-García

et al., 2017). An example for such a lack of e-self-control of impulsivity would be the case of an adolescent reposting messages and comments left by third parties without verifying the information or without paying heed to the rules of netiquette (Cebollero-Salinas, 2022d). On the other hand, emotional e-regulation seems to be more relevant in girls, who tend to become cyberaggressors through disinhibition (Wong et al., 2018). It is possible that adolescent girls who possess greater emotional e-regulation competencies may be able to channel their negative feelings, viz., their anger, thanks to strategies of positive confrontation. Regarding the predictive capacity of emotional e-regulation for cybervictimisation in girls, one possible explanation is that girls tend to show and comment on a greater amount of personal information on social media, with greater frequency and more pronounced emotional intensity (Bailen et al., 2019). Therefore, without adequate emotional e-regulation strategies, stressful virtual situations could easily lead girls to lose their self-respect, thereby leading them to become the object of cybervictimisation. It is likewise plausible that boys, who are more impulsive, will be more prone to become victims when trying to escape feelings of loneliness (Estévez et al., 2018).

Our results indicate that the relationship between emotional e-regulation, viz. e-motional e-independence, on the one hand, and cyberaggression/cybervictimisation on the other is stronger in girls, particularly girls ages 12 to 14 (1st and 2nd academic year in our study). In other words, the manner in which 12-to-14-year-old girls regulate their online emotions when confronted with a meme or manage their emotional e-independence when they might feel rejected by commentaries they read on social networks could have a greater influence on girls' tendency to suffer or inflict cyberbullying than would be the case in boys. Previous studies suggest that in these academic years, when peers start gaining major importance in building one's identity, adolescents could be more prone to becoming the objects of cybervictimisation (Onditi et al., 2024). The fact that these associations are more pronounced in girls is plausible, as girls use social networks more frequently with the purpose of cultivating and maintaining friendships (Twenge & Martin, 2020). This, in turn, could give rise to more pronounced tendencies toward social comparison (Rosenthal-von der Pütten et al., 2019) and envy (Yin et al., 2021), thereby providing a motivation for cyberbullying.

Our results also suggest that social e-competency is positively associated with the role of cybervictim in boys and girls in the first two academic years featured in our study (1st and 2nd year of ESO; ages 12 to 14). Adolescents who display an elevated level of online social awareness and are more competent in maintaining good social relationships could interact with others online more frequently, thus increasing their risk of becoming the object of criticism. Previous studies likewise suggest this (Kırcaburun et al., 2019; Onditi et al., 2024). Moreover, our measurement of social e-competency contained an elevated level of empathy: adolescents such as these could be more frequently attempting to support peers who are being aggressed, and they, in turn, would tend to be attacked with a similar type of treatment. This is plausible, given that the lack of face-to-face non-verbal communication on the Internet, combined with the asynchronous nature of online communication, imply that cyberbullying perpetrators may not feel the need to assume responsibility for their actions. This, in turn, tends to increase adolescents' levels of online disinhibition, thereby increasing the amount of cyberbullying instances perpetrated by adolescents on the whole (Wright et al., 2019; Yang et al., 2021).

In our study, we found that younger girls (1st and 2nd years of ESO, i.e., ages 12 to 14) display lower victimisation levels than the boys; however, their cybervictimisation scores increase in greater proportion than those of boys, which is in line with previous studies which showed that girls are the most frequent victims of cybervictimisation (Gao et al., 2021; Kowalski et al., 2019); moreover, the two cyberbullying roles tend to become more frequent in subsequent academic years. The same tendency is found in other European countries as well as on different continents (Craig et al., 2020; Henares-Montiel et al., 2022; Smahel et al., 2020). Therefore, it would be advisable to intensify the prevention of cyberbullying and active intervention from the beginning of adolescence.

It is interesting to note the high percentage in which socio-emotional e-competencies explain cyberbullying, especially in cyberaggression perpetrated by girls in the first two academic years featured in our study (1st and 2nd year of ESO) and in the cybervictimisation of boys in those same academic years. This might imply that these variables could be crucial in early adolescence. This aligns with previous studies (Gónzalez-Gómez et al., 2024; Leduc et al., 2018; Palermiti et al., 2017). In our sample, e-self-control of impulsivity and emotional e-regulation decrease from 1st to 4th year of Obligatory Secondary Education in both sexes; thus, it would probably be convenient to include those competencies as part of the curriculum from early ages. On the other hand, our observation that emotional factors do not lose their explanatory power in the two higher academic years could also suggest that, as adolescence advances, a greater amount of personal changes occur, implying the involvement of further variables such as family supervision and parental phubbing (Elboj et al., 2023), the problematic use of the Internet, (Cebollero-Salinas, 2022c), peer support, and social pressure (Gao et al., 2021; Piazuelo-Rodríguez et al., 2024), among others. However, once the four years of Obligatory Secondary Education (ESO) are over, students tend to switch schools to go on pursuing several different further education possibilities; they are no longer in the same group as before, and the amount of cyberbullying would thus tend to decrease.

Although our data provide evidence regarding the differentiating role played by sex and academic year in the socio-emotional e-competencies gender involved in cyberaggression and cybervictimisation, this study has several limitations that will have to be addressed in future research. On the one hand, despite using a structural equation model that establishes causal relationships, our study's transversal nature limits those relationships' conceptual theoretical potential. A contrary hypothesis could be postulated, namely, that the stability of cyberaggression and cybervictimisation behaviours could influence the development of e-competencies. Future longitudinal studies could help obtain such information. On the other hand, the self-report tools used in our study can be the object of social desirability; thus, it would be convenient also to use qualitative tools to complete these results. A further limitation is that our sample was not random; furthermore, only certain academic years of adolescence were analysed. Thus, it would be necessary to replicate this study but randomising the sample, extending the number of academic years under study and incorporating further genders apart from boys and girls. Moreover, to confirm our results, it would be advisable to carry out similar studies in other countries, incorporating further related variables, such as peer support and social pressure (Piazuelo-Rodríguez et al., 2024), netiquette (Cebollero-Salinas, 2022d) and family supervision (Elboj et al., 2023). Despite these limitations, our results

point toward an interesting line of research, as they indicate that the situation of cyberaggression among adolescents could be explained by the manner in which they manage their socio-emotional life on the Internet. To prevent cyberbullying, it would be particularly interesting to study the manner in which they value themselves online, regulate their emotions and their impulsivity when they respond, and the way in which they comment and gather information on the Internet.

5 Conclusion

This study's results have important implications for educational practice. Whether in face-to-face or virtual environments, harmonious coexistence tends to represent a great challenge for human beings worldwide (Cebollero-Salinas, 2022e). Educational interventions need to be continually carried out and updated to reduce the occurrence of cyberbullying incidences (Barlett, 2023); thus, our results regarding the protective role of socio-emotional e-competencies on the environment in which cyberbullying occurs could open up a new line of research. In this sense, it would be important for students to have the opportunity to learn these socio-emotional e-competencies, including specific modules incorporated into existing emotional education programmes (Divecha & Brackett, 2020; Schoeps et al., 2018). Another manner of incorporating socio-emotional e-competencies in school would consist in using collective intelligence apps, which have fostered beneficial results (Cebollero-Salinas, 2022f). The literature indicates that it is advisable to include the adolescents' families in this kind of training (Ansary, 2020; Alcaine & Sánchez, 2020; Elboj et al., 2023; Kowalski et al., 2019) as well as their teachers (Lan & Pan, 2022). Moreover, prior to adolescence, digital alphabetisation programmes could already be applied to achieve effective, positive mentoring and accompaniment of children and adolescents on the Internet with the purpose of preventing aggressive behaviour (Martín Martínez & Castiblanco Carrasco, 2023).

In conclusion, this study provides evidence of the importance of capacitating adolescents to cope with their online emotions via socio-emotional e-competencies, taking into account certain specific nuances according to sex. This could provide a new focus to help us continue to progress in the prevention of cyberaggression and cybervictimisation.

Authors' contributions
A.C-S: conceptualization, investigation, methodology, writing—original draft, writing—review & editing. S. O.: methodology, formal analysis, visualization, supervision. J. C.-E.: resources, writing—review & editing, supervisión.

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Data availability
Data will be made available on reasonable request.

Declarations

Ethics approval and consent to participate
The project was evaluated and approved by the Research Ethics Committee of Aragón Community, thereby ensuring that all ethical standards were respected. Informed consent was obtained from all individual participants and legal guardians included in the study.

Consent for publication
Informed consent was obtained from all individual participants included in the study.

Competing interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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