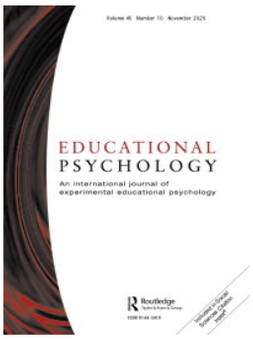

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Cyberbullying probability, not frequency, predicts mental health: a gendered investigation of individual, familial, and school-level predictors

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ABSTRACT

This study distinguishes between the probability and frequency of cyberbullying to examine its malleable predictors, mental health impacts, and gender differences among primary school children. We analysed data from 1031 students (49.75% male) and their parents across 19 primary schools in Hong Kong, employing a two-part model that distinguishes between the probability and frequency of cyberbullying experiences. The findings reveal that the probability of experiencing cyberbullying, rather than its frequency, was a significant predictor of poorer mental health in children. Higher digital literacy (DL), lower academic stress, and less frequent online activity were linked to reduced cyberbullying involvement for both boys and girls. Better family functioning was associated with lower rates of perpetration and victimisation among girls only. These findings offer a nuanced perspective on how individual, familial, and digital factors distinctly shape cyberbullying experiences and their mental health outcomes across genders in primary school students.

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KEYWORDS
Cyberbullying; primary school students; mental health; two-part model; gender difference

Introduction

Cyberbullying is commonly defined as deliberate, repeated aggression perpetrated by an individual or group *via* electronic communication against a target who cannot easily defend themselves (Smith et al., 2008). This mirrors the core features of traditional bullying – intentional harm, repetition, and power imbalance – while situating

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the behaviour in digital contexts. Extensive research links cyberbullying to adverse psychological outcomes, including depression, anxiety, and reduced self-esteem (Kowalski & Limber, 2013; Van Geel et al., 2014). In severe cases, it can contribute to suicidal ideation among young people, underscoring its status as a pressing public health concern (Kwan et al., 2020).

In efforts to reduce its prevalence and mitigate its negative effects, previous review studies have identified malleable factors that may influence its occurrence, including individual-level factors such as age and online behaviour, and family-level factors such as parent–child relationships (Guo, 2016; Zhu et al., 2021). Despite these insights, key gaps remain in the literature, which limits the design of effective interventions.

First, quantitative studies often treat cyberbullying as binary variable (experienced or not), ignoring the cumulative effect of repeated incidents on mental health. This approach is problematic as allostatic load theory suggests that repeated exposure to stressors, like cyberbullying, potentially compounding negative psychological effects (Carlson & Chamberlain, 2005). This limited approach also hinders the analysis of factors affecting both the probability and frequency of cyberbullying, which might be influenced differently (Chicote-Beato et al., 2024). For example, the probability of cyberbullying might be influenced by broad factors such as age and time spent online, while the frequency of cyberbullying could be more directly shaped by the quality of peer relationships or the level of parental monitoring.

Second, while internet use among younger children is rising, research mainly targets adolescents, leaving primary school cyberbullying underexplored (Tao et al., 2022; Zhu et al., 2021). The role of bystanders, who outnumber victims and perpetrators, is also underrepresented despite its potential impact on mental health (Guo, 2016; Zhu et al., 2021). Although gender differences in cyberbullying are known, further research is needed to explore whether gender moderates the relationships between individual/family factors and cyberbullying outcomes (Schell-Busey et al., 2023).

This study examines the malleable predictors of cyberbullying and its impact on mental health among primary school children, with a focus on gender differences. By examining both the probability and frequency of cyberbullying experiences, the research seeks to inform the design of targeted, gender-sensitive early intervention.

Theoretical frameworks

This study draws on two theoretical frameworks to investigate the relationships between cyberbullying, mental health, and malleable factors among primary school children.

First, the allostatic load theory (McEwen & Stellar, 1993) offers a foundational framework for understanding how stressors such as cyberbullying may contribute to psychological outcomes. Allostatic load theory posits that the body's stress response system adjusts to ongoing or repeated challenges, but when these stressors accumulate and exceed an individual's coping capacity – referred to as allostatic load – they can lead to long-term emotional and physiological dysregulation. In the context of cyberbullying, this framework highlights that both the occurrence of the incident and the repeated occurrence of incidents may negatively affect well-being. This study adopts a two-part modelling approach that aligns with this theoretical perspective

by distinguishing between the probability of experiencing cyberbullying and the frequency of such experiences among those exposed. This analytical strategy enables us to examine whether the associations between cyberbullying and well-being differ by probability and frequency, and to explore whether various malleable factors relate differently to each dimension of cyberbullying involvement.

Second, a gender-sensitive perspective is incorporated, informed by theories of gender socialisation and differential susceptibility (Carter, 2014; Ellis et al., 2011). These frameworks posit that boys and girls exhibit divergent psychological responses to social environments due to disparities in emotional development, social expectations, and parental interactions. Additionally, the differing prevalence rates of various roles of cyberbullying (e.g., higher rates of male perpetrators) and the distinct psychological consequences experienced (e.g., greater psychological distress among females) suggest the need to account for gender differences in both influencing factors and the mental health outcomes of cyberbullying (e.g., Connell et al., 2014; Scheithauer et al., 2006).

Literature review

Impacts of cyberbullying on well-being among younger children

The negative psychological outcomes of cyberbullying are well-established, including links to depression, anxiety, stress, loneliness, and diminished self-esteem (Molero et al., 2022; Zhang et al., 2021; Zhu et al., 2021). However, much of this research has focused on adolescents, leaving a critical gap in our understanding of younger children's experiences (DePaolis & Williford, 2019; Evangelio et al., 2022; Ey et al., 2015).

This gap is particularly pressing given the increasing use of digital devices by young children. As the average age of internet access continues to decrease (Flores Buils et al., 2020), younger children are increasingly engaging with digital devices, leading to a rise in cyberbullying incidents within this demographic (Holfeld & Leadbeater, 2015; Kwan et al., 2020; Smahel et al., 2020; Tao et al., 2022; Zhu et al., 2021, p. 202). While some studies suggest a peak in cyberbullying prevalence among adolescents aged 12–15 (Ševčíková & Šmahel, 2009; Williams & Guerra, 2007), others have found that primary school students report higher frequencies of cyberbullying victimisation compared to their secondary school counterparts (Aizenkot & Kashy-Rosenbaum, 2021).

Importantly, early intervention during primary school is key. Longitudinal studies have shown that the effects of cyberbullying can persist over time (Wang et al., 2022), and early patterns of digital behaviour often set the stage for later online risks. Addressing cyberbullying at this formative stage may reduce long-term psychological harm and improve emotional regulation, peer relationships, and digital competence.

The overlooked role of bystanders in cyberbullying

While much attention has been given to cyberbullying victims and perpetrators, bystanders – who often witness incidents but may not intervene – are an understudied group (Chicote-Beato et al., 2024; Rudnicki et al., 2023). These children can also suffer mental health consequences, including anxiety and social stress (Doumas & Midgett, 2021; Tao et al., 2022). Including bystanders in both research and intervention designs

can offer a fuller picture of how cyberbullying affects classroom dynamics and well-being.

Malleable individual-level factors and internalising symptoms

A growing body of work has explored risk and protective factors related to cyberbullying. At the individual level, online behaviour, emotional distress, and coping styles play central roles. For instance, students experiencing internalising symptoms, such as academic stress or anxiety, may engage in more digital interactions as a form of escapism or to seek emotional support. This increased engagement can result in increased exposure to cyber risks (Mackenzie et al., 2023). Furthermore, increased online activity has been associated with a higher likelihood of cyberbullying because those who spend more time online are more exposed to online risks (Livingstone & Haddon, 2009; Zhu et al., 2021).

In addition, digital literacy (DL) has emerged as a significant protective factor in this regard. DL signifies the capacity to access, critically evaluate, create, and communicate digital content while adeptly managing risks such as privacy violations or misinformation (Carretero et al., 2017). Students with higher DL are more likely to recognise and avoid unsafe online environments and are better equipped to respond constructively to digital conflicts (Sonck & De Haan, 2013; Vandoninck et al., 2010, 2013; Vissenberg et al., 2022).

Family-level influences on cyberbullying

Within the family context, parents are pivotal to cyberbullying prevention. A warm, supportive parent–child relationship is widely recognised as a strong protective factor. However, the effectiveness of parental monitoring is less straightforward. While some studies link supervision of children's online activities to lower involvement in cyberbullying (Mesch, 2018; Pieschl & Porsch, 2017), whereas others find no significant effect (Lin, 2016). These discrepancies likely reflect heterogeneity in monitoring practices and in youths' perceptions of them, namely, whether oversight is experienced as supportive rather than controlling or restrictive (Baldry et al., 2019). This complexity underscores the need for further research on the nuanced pathways through which parental involvement shapes young people's digital experiences.

Gender differences in relationships between cyberbullying and influencing factors and well-being

Gender differences in cyberbullying have been extensively studied in past research. Females are more likely to be victims, while males are more frequently identified as perpetrators (see a review by Zhu et al., 2021). Individual factors such as narcissism and self-esteem have been associated to a higher likelihood of engaging in cyberbullying among males compared to females (Fan et al., 2019). Additionally, cultural influences play a critical role; in certain cultural contexts, such as some Asian societies, aggressive behaviours like cyberbullying may be more socially accepted among males (Chang, 2021). Furthermore, girls are likely to report higher levels of emotional distress related to cyberbullying victimisation than boys (DePaolis & Williford, 2019;

Svensson et al., 2022; Tao et al., 2024). Therefore, it is crucial to adopt gender-sensitive methodologies in both research and intervention development.

Skewed distribution and the need for a two-part model

A methodological challenge in cyberbullying research is the zero-inflated distribution of experiences: most students report no involvement, while a small minority report varying levels of perpetration, victimisation, or bystanding. This discrepancy can be attributed to the relatively low incidence of cyberbullying incidents within school-aged populations (Brochado et al., 2017), which can obscure significant variations in the severity or intensity experienced by affected individuals. For example, prevalence rates among primary school students range from 8% to 45%, typically below 20%.

Consequently, a substantial body of research has characterised cyberbullying as a binary variable, i.e. an indicator of its occurrence or non-occurrence. However, this approach has overlooked the critical variations in the frequency of such experiences. This study draws on the tenets of allostatic load theory (McEwen & Stellar, 1993), which emphasises cumulative stress and adaptive thresholds. This study adopts a two-part model to distinguish between the probability of exposure to cyberbullying and the frequency of such experiences when they occur. This differentiation is crucial for understanding how cyberbullying relates to students' well-being and for identifying effective intervention targets. Specifically, it enables researchers and educators to identify not only the factors that reduce the likelihood of cyberbullying occurring, but also those that may influence how intensely it unfolds once it begins.

The two-part model approach has been proposed and applied in empirical studies to handle zero-inflated data (e.g. Wasserman et al., 2017). Specifically, this approach conceptualises certain events – such as cyberbullying incidents in this study – as a dual process: one binary (e.g. whether cyberbullying was experienced) and one continuous (the frequency of cyberbullying if it occurs). This allows researchers to examine different predictors (i.e. factors influencing cyberbullying) for both the probability of occurrence and the frequency of the experience simultaneously. The approach is theoretically appealing and provides richer insights than models that predict only the probability of a binary outcome (Olsen & Schafer, 2001).

This study

This study examines mental health outcomes and malleable factors of cyberbullying among primary school students, employing a gender lens. By utilising a two-part modelling approach, it explores both the probability and frequency of cyberbullying, offering a more nuanced understanding of these relationships. We aim to answer two research questions as below. A conceptual framework is presented in Figure 1.

RQ1: What are the associations between the probability and frequency of cyberbullying experiences (as perpetrators, victims, and bystanders) and mental health outcomes (e.g. subjective well-being) among primary school boys and girls?

RQ2: What are the associations of malleable factors, including DL, academic stress, and online activity at the individual-level, and parental monitoring and

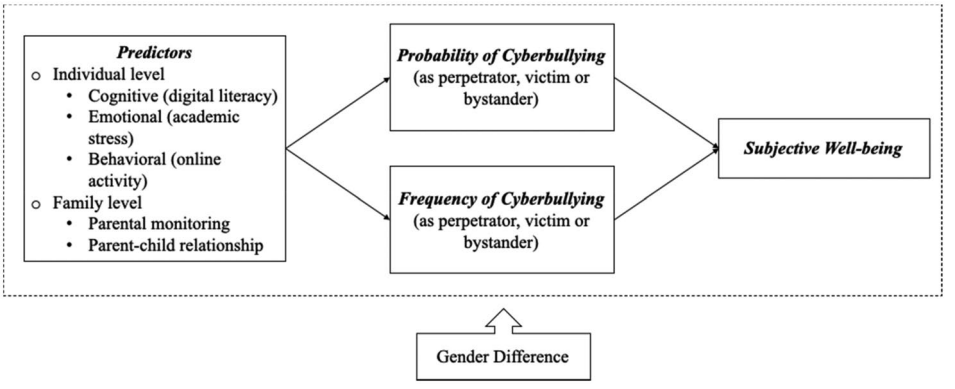

Figure 1. Conceptual framework.

parent–child relationship at family-level, with the probability and frequency of cyberbullying experiences as perpetrators, victims, and bystanders, among primary school boys and girls?

Method

Sample

This study analysed 1031 responses from students and their respective parents across 19 primary schools in Hong Kong. The student participants ranged from Grade 3 to Grade 6, comprising 502 boys and 507 girls. Among the parent respondents, 73% were mothers, 15% were fathers, only 1% were other types of guardians and the remaining 11% were missing. All project details and data-collection procedures underwent review and received approval from University of Hong Kong's Human Research Ethics Committee. Demographic information of all participants is presented in Table 1.

Procedure

Data were collected using online survey. Students provided self-reports on their experiences of cyberbullying (as perpetrators, victims, and bystanders) in the past 6 months, their frequency of online activity, academic stress, subjective well-being, and demographic details. The survey also incorporated a validated performance assessment test to measure students' DL. Parents reported their perceptions of the parent–child relationship, parental monitoring practices, and family socioeconomic status (SES).

Measurements

Student level measurements

Digital literacy (DL). Student completed the 10-item DL assessment (DLA-short), a performance-based measure distilled from the validated long form (DLA-L) and aligned with the DigComp 2.1 framework (Carretero et al., 2017; Pan et al., 2025).

Table 1. Demographic information of student and parent samples.

Parent sample	*n*	%
Gender		
Mother	753	73.0
Father	152	15.0
Other guardians	15	1.0
Missing	111	11.0
Age (years old)		
19–25	1	<1.0
26–35	91	9.0
36–45	598	58.0
46–55	217	21.0
56 and above	13	1.0
Missing	111	11.0
Educational level		
Junior secondary or below	154	15.0
Senior secondary/associate's degree	493	48.0
Bachelor	171	17.0
Master or above	91	9.0
Missing	122	12.0
Student sample	***n***	**%**
Grade		
3	262	25.0
4	355	34.0
5	326	32.0
6	88	9.0
Gender		
Male	513	49.75
Female	518	50.25

The DLA-L has demonstrated robust psychometric properties, supporting a reliable unidimensional digital-literacy score in a sample of 4,016 students from 18 primary and 14 secondary schools in Hong Kong (Jin et al., 2020; Pan et al., 2025). The short form was constructed by selecting items that jointly optimised discrimination, difficulty, and content coverage. Items are multiple-choice with one to three keyed responses; scoring is dichotomous at the item level (1 = fully correct; 0 = otherwise), with item scores summed to produce the total digital-literacy score. The reliability of Estimated a Posteriori (EAP) scores for DLA-short was 0.77.

Subjective well-being. We assessed the subjective well-being using the 15-item Well-Being Profile – Short (WB-Pro-Short). Items (e.g. 'I feel free to make my own choices') were rated on a 9-point Likert scale (1 = completely disagree, 9 = completely agree). Following the developers' recommendations (Marsh et al., 2020), we computed a mean composite across the 15 items (range = 1–9) to index adolescents' overall well-being, with higher values indicating greater well-being. The reliability α of this scale was 0.98.

Cyberbullying experience. Students provided self-reports on their experiences of cyberbullying – whether as perpetrators, victims, or bystanders – over the past 6 months using a five-point scale (0 = never, 1 = 1 or 2 times, 2 = 3 or 4 times, 3 = 5 or 6 times, 4 = 7 or more times). Items were adapted from two widely used instruments: the Cyber-Aggression Questionnaire for Adolescents (CYBA; Álvarez-García et al., 2016) and the Cybervictimisation Questionnaire (CYVIC; Álvarez-García et al., 2017). Each role (perpetrator, victim, and bystander) was assessed using five items. Example items include Perpetrators: 'I have sent or forwarded a

hurtful message electronically to someone'. Victims: 'I have received a hurtful message from someone online'. Bystanders: 'I have seen somebody receive a hurtful message online'. The scale demonstrated a reliability of 0.94, 0.94, and 0.93 for subscales measuring the experience of being a perpetrator, a victim, and a bystander, respectively. Appendix Table A1 shows the specific items, while Appendix Table A2 shows how often our participants have experienced cyberbullying.

Online activity. The frequency of students' online activities was measured using four items on a five-point scale (1 = not at all, 2 = About once a week, 3 = 2–3 times a week, 4 = 4–5 times a week, 5 = More than 5 times a week). This measure was adapted from Authors (2022). An example item is: 'Chat with friends using Snapchat/WeChat/WhatsApp/QQ/Facebook, etc'. A higher scale score on this scale indicates a higher level of online activities. The reliability α of this scale was 0.72.

Academic stress. Six items measured the extent of students perceived academic stress (e.g. 'I cannot concentrate on my learning in the classroom') on a 5-point scale (1 = Strongly disagree, 5 = Strongly agree). This measure was adapted from Authors (2022). A higher score indicates a higher level of academic stress. The reliability α of this scale was 0.90.

Family level measurements

Parent–child relationship. We assessed the parent–child relationship with seven items adapted from the positive relationship subscale of the Child–Parent Relationship Scale (Driscoll & Pianta, 2011). An example item is 'I share a warm relationship with my child'. Responses were recorded on a 5-point scale (1 = definitely does not apply, 5 = definitely applies). Higher scores reflect greater parent–child closeness. Internal consistency was excellent (Cronbach's α = 0.90).

Parental monitoring practices. Parental monitoring of children's online behaviour was measured with three items (e.g. 'I monitor my child's apps/websites/YouTube channels'.) rated from 1 (never) to 5 (always). Higher scores indicate more frequent monitoring. Reliability was acceptable (Cronbach's α = 0.80).

Family socioeconomic status (SES). Following PISA conventions (OECD, 2017), the SES index was estimated using an item response theory model applied to six household-resource items (e.g., presence of a desk/personal room/quiet study space; number of books at home). The books item used five ordered categories ranging from '0–10 books' to 'more than 200 books'. Expected a posteriori (EAP) reliability for the SES scores was 0.81.

Data analysis

Preliminary data analysis

Students' DL was scaled with a unidimensional two-parameter logistic (2PL) IRT model estimated by maximum likelihood (ML). Individual DL proficiencies were obtained *via*

EAP scoring, with higher values indicating greater overall DL; score precision was summarised using EAP reliability (Adams, 2005). Family SES was likewise scaled within an IRT framework using ML, with higher scores reflecting higher SES. In addition, a confirmatory factor analysis (CFA) was conducted to evaluate the latent constructs of academic stress, online activity participation, parent–child relationship, and parental monitoring, using robust maximum likelihood (MLR).

Model fit was assessed with the comparative fit index (CFI) and root mean square error of approximation (RMSEA), using thresholds of RMSEA < 0.06 and CFI > 0.95 for a good model-data fit, and CFI > 0.90 and RMSEA < 0.08 as minimum standards (Kline, 2016; Maydeu-Olivares, 2013; Sharma et al., 2005).

Two-part model

A two-part model was used to assess three roles of students' cyberbullying experiences (Olsen & Schafer, 2001). This method is ideal for handling semicontinuous variables, which often show skewed distributions with many observations at a single value, usually zero. Unlike left-censored or truncated variables, semicontinuous variables consider zeros as meaningful data points rather than indicators of negative or missing responses.

Let Y_{ij} denote a semicontinuous response for participant i for variable j. Following Olsen and Schafer (2001), semicontinuous responses are modelled using a pair of correlated random-effect models: one for the logit probability of a nonzero response, $U_{ij} = 1$ (see Equation 1) and another for the mean of the continuous responses given that nonzero responses occur $E(V_{ij} \mid U_{ij} = 1)$ (see Equation 2).

$$U_{ij} = \begin{cases} 1 \; if \; Y_{ij} \neq 0 \\ 0 \; if \; Y_{ij} = 0 \end{cases} \tag{1}$$

$$V_{ij} = \begin{cases} g\left(Y_{ij}\right) if \; Y_{ij} \neq 0 \\ irrelevant \; if \; Y_{ij} = 0 \end{cases} \tag{2}$$

where g is a monotone increasing function that will make V_{ij} approximately Gaussian.

The analysis adopts a two-part approach. Part 1 codes a binary indicator to capture the presence of the behaviour (any use). Part 2 models the level of use as a continuous outcome among users only. When the binary indicator equals zero, the continuous frequency variable is undefined and set to missing by design.

This two-part modelling approach can be extended to include a factor model, resulting in a two-part factor model. This approach is well-suited to situations where multiple items exhibit a preponderance of zeros and the remaining observations are highly skewed (Kim & Muthén, 2009, p. 20).

In this study, we applied a two-part factor model to measure students' cyberbullying experiences, as the data were positively skewed with zeros representing no experience of cyberbullying. This model included two latent variables: the probability of cyberbullying, which captures the probability of experiencing one type of cyberbullying, and the frequency of cyberbullying, which reflects the frequency level of cyberbullying experienced when nonzero responses occur.

Multiple-group structural equation modelling (MG-SEM)

The relationships among the variables of interest were examined using a multiple-group structural equation modelling (MG-SEM) approach, with gender serving as the grouping variable, as illustrated in Figure 1. The male group was designated as the reference group, with its latent factors standardised to have a mean of 0 and a variance of 1 to establish the scale. We conducted three separate MG-SEMs, each focusing on one type of cyberbullying experience. This approach enabled us to analyse and report the standardised coefficients for each type of experience independently, thereby facilitating meaningful comparisons across the three roles of cyberbullying experiences.

We utilised the *lavaan* package (Rosseel, 2012) to perform CFA analysis in the R programming environment. The two-part model and MG-SEM were applied using *Mplus* 8.1 (Muthén & Muthén, 2017).

Results

Preliminary results

Figure 2 shows the highly skewed distribution of cyberbullying indicators. Table 2 presents the descriptive analysis among measured variables. The probability and frequency of cyberbullying exhibited a strong correlation ($rs > 0.70$, $p < 0.05$), indicating that students who once experienced cyberbullying incidents were likely to experience more. To avoid multicollinearity in the MG-SEM, we focused on correlations between cyberbullying metrics and well-being rather than treating both as predictors.

MG-SEM results

Table 3 presents the model fits and Table 4 presents the MG-SEM analysis results. In examining the relationship between cyberbullying and well-being, distinct gender patterns emerge. For boys, the probability of experiencing all three roles of cyberbullying was significantly negatively correlated with well-being ($r_{Pprep\_wb\_boy} = -0.13, r_{Pvic\_wb\_boy} = -0.18, r_{Pby\_wb\_boy} = -0.12, ps < 0.05$). In contrast, for girls,

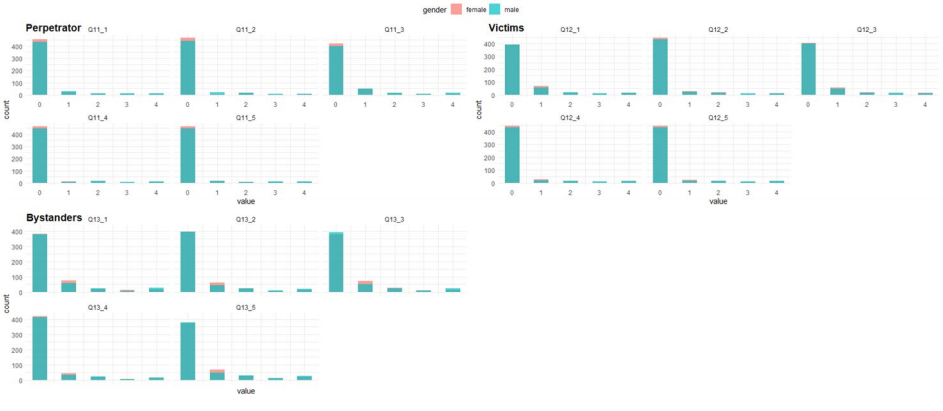

Figure 2. Distribution of cyberbullying experiences indicators.

Table 2. Means (M), standard deviations (SD), and correlations for measured variables.

	1	2	3	4	5	6	7	8	9	10	11	12	*M(SD)*
1. Probability of perpetrators	1												0.107(0.072)
2. Probability of victims	0.870	1											0.151(0.107)
3. Probability of bystanders	0.776	0.874	1										0.2099(0.110)
4. Frequency of perpetrators	0.855	0.820	0.785	1									2.251(0.744)
5. Frequency of victims	0.818	0.872	0.804	0.956	1								2.612(.997)
6. Frequency of bystanders	0.756	0.814	0.846	0.912	0.942	1							2.272(1.109)
7. Online activities	0.290	0.334	0.303	0.373	0.386	0.346	1						2.990(1.052)
8. Academic stress	0.260	0.299	0.231	0.268	0.234	0.199	0.184	1					2.516(1.117)
9. SES	−0.103	−0.027	0.015	0.011	−0.015	−0.012	0.002	−0.136	1				0.165(0.795)
10. DL	−0.238	−0.133	0.010	−0.086	−0.017	0.007	0.025	−0.358	0.199	1			−0.218(0.910)
11. Wellbeing	−0.147	−0.162	−0.072	−0.112	−0.094	−0.129	0.067	−0.147	0.195	0.107	1		6.416(1.539)
12. Parent–child relationship	−0.131	−0.132	−0.064	−0.065	−0.070	−0.043	−0.080	−0.128	0.038	0.006	0.100	1	4.329(0.581)
13. Parental monitory	−0.035	−0.098	−0.067	−0.092	−0.142	−0.100	−0.091	0.014	0.099	0.063	0.051	*0.151*	3.386(0.866)

SES: family socioeconomic status; DL:= digital literacy.
SES, DL, and wellbeing were manifest variables, and all the others are latent variables. Underlined, italicised numbers = non-significant correlation.

Table 3. Model fit summary.

		CFI	RMSEA	95% CI of RMSEA	Reliability ω
Student-level factors					
Academic worries		0.99	0.07	(0.04, 0.09)	0.93
Online activities		1.00	<0.00	(0.00, 0.07)	0.78
Digital literacy		0.96	0.02	[0.00, 0.02]	0.70
Wellbeing		NA[a]	NA[a]	NA[a]	0.98
Cyberbullying experience	Perpetrators	1.00	0.02	[0.00, 0.06]	0.95
	Victims	1.00	0.04	[0.01, 0.06]	0.95
	Bystanders	1.00	0.02	[0.00, 0.06]	0.95
Family-level factors					
Socio-economic status (SES)		NA[b]	0.02	NA[b]	0.81
Parent–child relationship		0.97	0.08	[0.07, 0.09]	0.92
Parental monitoring practice		1.00	<0.00	0	0.82

[a]Model fit indices are not available for well-being scale scores.
[b]Fit indices cannot be calculated because of few degrees of freedom.

Table 4. Results of MG-SEM.

	Perpetrator β (SE) (β_{Pprep})		Victim β (SE) (β_{Pvic})		Bystander β (SE) (β_{Pby})	
Probability	Boy ($n=502$)	Girl ($n=507$)	Boy ($n=502$)	Girl ($n=507$)	Boy ($n=502$)	Girl ($n=507$)
DL(β_{DL_P})	−0.25 (0.06)**	−0.29 (0.07)**	−0.14 (0.07)*	−0.21 (0.07)**	−0.02 (0.07)	−0.02 (0.06)
ONACT (β_{ONACT_P})	0.21 (0.07)**	0.23 (0.07)**	0.28 (0.07)**	0.16 (0.06)**	0.30 (0.07)**	0.20 (0.06)**
PM(β_{PM_P})	0.06 (0.07)	0.15 (0.07)*	0.04 (0.07)	−0.06 (0.06)	−0.01 (0.08)	−0.00 (0.07)
PCR(β_{PCR_P})	−0.12 (0.09)	−0.16 (0.08)*	−0.12 (0.08)	−0.10 (0.08)	0.02 (0.09)	−0.13 (0.07)
SES(β_{SES_P})	−0.01 (0.07)	−0.09 (0.06)	0.07 (0.07)	−0.05 (0.06)	0.08 (0.07)	−0.03 (0.06)
AS(β_{AS_P})	0.17 (0.06)**	0.22 (0.06)**	0.20 (0.06)**	0.25 (0.06)**	0.18 (0.06)**	0.20 (0.06)**
Well-being (r_{P_WB})	−0.13 (0.06)*	−0.09 (0.07)	−0.18 (0.05)**	−0.12 (0.06)*	−0.12 (0.05)*	−0.02 (0.06)
	Perpetrator β (SE) (β_{Fprep})		Victim β (SE) (β_{Fvic})		Bystander β (SE) (β_{Fby})	
Frequency	Boy ($n=502$)	Girl ($n=507$)	Boy ($n=502$)	Girl ($n=507$)	Boy ($n=502$)	Girl ($n=507$)
DL(β_{DL_F})	−0.19 (0.10)	−0.42 (0.07)**	−0.15 (0.09)	−0.15 (0.09)	−0.16 (0.08)	−0.03 (0.07)
ONACT (β_{ONACT_F})	0.38 (0.11)**	0.27 (0.08)**	0.43 (0.09)**	0.17 (0.10)	0.48 (0.08)**	0.16 (0.07)*
PM(β_{PM_F})	0.17 (0.11)	0.02 (0.09)	0.04 (0.11)	−0.08 (0.11)	−0.01 (0.10)	−0.09 (0.10)
PCR(β_{PCR_F})	−0.13 (0.14)	−0.11 (0.09)	0.00 (0.12)	−0.09 (0.11)	−0.01 (0.11)	−0.11 (0.09)
SES(β_{SES_F})	0.08 (0.08)	0.00 (0.09)	0.05 (0.08)	−0.01 (0.08)	−0.02 (0.07)	0.02 (0.07)
AS(β_{AS_F})	0.19 (0.12)	0.21 (0.09)*	0.12 (0.10)	0.32 (0.09)**	0.08 (0.09)	0.25 (0.07)**
Well-being (r_{F_WB})	−0.01 (0.10)	−0.10 (0.12)	−0.03 (0.08)	−0.08 (0.09)	−0.12 (0.09)	−0.02 (0.10)

DL: digital literacy; ONACT: online activity; PM: parental monitoring; PCR: parent–child relationship; SES: socio-economic status; AS: academic stress; Pperp: Perpetrator probably, DL_P = impacts of DL on probability of certain role of cyberbullying; Iperp = Perpetrator frequency, DL_I = impacts of DL on frequency of certain role of cyberbullying; SE = standard error. *$p < .05$, **$p < 01$.

only the probability of being a victim was significantly negatively correlated well-being ($(r_{Pvic\_wb\_girl} = -0.12, p < 0.05$). The frequency of cyberbullying was not significantly negatively associated with well-being for either gender, indicating that while cyberbullying experiences harm students' well-being, the increasing frequency of these experiences might not necessarily lead to additional harm.

Regarding the relationships between influencing factors and cyberbullying experiences, DL was significantly negatively associated with the probability of being a perpetrator or a victim for all students

($\beta_{DL\_Pperp\_boy} = -0.25, \beta_{DL\_Pperp\_girl} = -0.29, \beta_{DL\_Pvic\_boy} = -0.14, \beta_{DL\_Pvic\_girl} = -0.21, ps < 0.05$), and it also significantly reduced the frequency of these experiences for girls ($\beta_{DL\_Fperp\_girl} = 0.42, p < 0.01$). Academic stress was linked to a significantly higher probability of experiencing all roles of cyberbullying for both genders ($\beta_{AS\_Pperp\_boy} = 0.17, \beta_{AS\_Pperp\_girl} = 0.22, \beta_{AS\_Pvic\_boy} = 0.20, \beta_{AS\_Pvic\_girl} = 0.25, \beta_{AS\_Pby\_boy} = 0.18$, $\beta_{AS\_Pby\_girl} = 0.20$, $ps < 0.05$), and was also associated with increased frequency for girls ($\beta_{AS\_Fperp\_girl} = 0.21, \beta_{AS\_Fvic\_girl} = 0.32, \beta_{AS\_Fby\_girl} = 0.25, ps < 0.05$), reflecting their heightened emotional vulnerability. Increased online activity was associated with a higher probability and frequency of perpetration and bystander roles for both genders. For victims, more online activity was significantly positively associated with the probability of being a victim for both genders, though it was linked to increased frequency only for boys.

Finally, family influence was observed only in the perpetrator experiences of girls: parental monitoring was associated with an increased probability of being a perpetrator ($\beta_{PM\_Pperp\_girl} = 0.15, p < 0.01$), while a positive parent–child relationship was linked to a decreased probability of engaging in perpetration ($\beta_{PCR\_Pperp\_girl} = -0.16, p < 0.01$).

Discussion

This study explores the mental health outcomes and the malleable factors associated with cyberbullying (probability and frequency) with a specific emphasis on gender differences among primary school students. Findings of this study indicated that the probability plays a more important role than the frequency of cyberbullying on individual's subjective well-being. Gendered differences also emerged in the role of several malleable factors, offering insights for more targeted and developmentally appropriate interventions.

Cyberbullying and well-being

While cyberbullying is consistently linked to poor mental health in youth (Kowalski et al., 2019; Zhu et al., 2021), our findings offer a new insight: the probability of experiencing cyberbullying has a more consistent association with mental health than the frequency of those experiences. This suggests that the psychological stress of potential exposure is a powerful factor in itself. This finding can be interpreted through the lens of allostatic load theory, which suggests that, while individual stressors are negatively related to mental health, the accumulation of stressors does not have a proportionally negative impact on mental health as long as it remains within an individual's coping capacity (Carlson & Chamberlain, 2005). Our results support this, as the frequency of incidents (a measure of accumulated stress) was not the primary predictor of poor outcomes.

However, the theory also predicts that once stressors overwhelm one's coping capacity, long-term emotional difficulties arise. This is an effect we did not observe. The discrepancy may be due to two reasons. First, our focus on young children means their exposure may not have reached a critical tipping point, given that cyberbullying is less prevalent among younger children than among adolescents (Zhu et al., 2021). Second, our measure of frequency did not account for the severity of incidents. A single, highly severe event could cause far more distress than multiple mild ones (Kwan et al., 2020), a factor that frequency alone cannot capture. Future studies are

suggested to measure the possibility, frequency and intensity of events in both children and adolescents to better understand the relation between cumulative stress and mental health outcomes.

Gender patterns also emerged: for boys, the probability of all three roles of cyberbullying was significantly linked to lower well-being, while for girls, only the probability of victimisation was associated with decreased well-being, with the effect being stronger in boys (see Table 4).

Our findings echo previous evidence that female students are more susceptible to victimisation than their male counterparts (Sampasa-Kanyinga et al., 2020). This increased vulnerability may be attributed to the relational nature of cyberbullying, which often involves behaviours like rumour spreading, social exclusion, and manipulation of relationships (Mehari & Farrell, 2018). Traditional social dynamics have conditioned girls to place a high value on social networks and interpersonal connections, making them especially susceptible to these forms of aggression (Sampasa-Kanyinga et al., 2020). Furthermore, when faced with cyberbullying, girls are more likely to internalise their distress, manifesting as anxiety, depression, and low self-esteem, whereas boys are likelier to externalise it through anger or aggression (Romero-Reignier, 2022; Tao et al., 2024).

Our study further adds nuance to this literature by examining not only victimisation, but also the roles of perpetrator and bystander. We found that, in boys, both perpetration and bystander experiences were significantly associated with mental health outcomes, a pattern not observed in girls. Two mechanisms may explain these gender differences. First, while victimisation is a passive experience, perpetration and bystander roles are more proactive. Boys experiencing mental health difficulties may be more prone to externalising behaviours, increasing the likelihood of engaging in cyberbullying perpetration or exposing themselves to risky online environments, which in turn raises the chances of witnessing cyberbullying (Romero-Reignier, 2022). On the other hand, girls, who are more likely to internalise distress, may be less inclined to become perpetrators. Second, girls who do act as perpetrators or bystanders might be buffered from negative psychological effects by higher emotional intelligence (e.g. using blaming others as an emotion regulation strategy; Tao et al., 2024) and by stronger peer support networks that help reduce feelings of guilt and negative self-perception (Hellfeldt et al., 2019).

Notably, while this study modelled cyberbullying roles (victim, perpetrator, bystander) as distinct constructs, the strong correlations among these roles suggest a substantial degree of overlap, particularly among students who act as both victims and perpetrators, or as victims and bystanders. Prior research has shown that occupying multiple roles in peer aggression is associated with more severe psychosocial difficulties than involvement in a single role (Cross et al., 2015; Ttofi et al., 2011). For instance, youth who both perpetrate and experience cyberbullying often report higher levels of emotional distress, social problems, and externalising behaviours compared to their single-role peers. Additionally, witnessing peer victimisation may have unique psychological impacts, distinct from being directly involved (Lan, Law, et al., 2022; Lan, Pan, et al., 2022). These findings suggest that comparisons across roles in our study should be interpreted with caution, as overlapping role experiences may obscure clear distinctions in their associations with well-being. Future studies could employ latent class analysis or person-centred approaches to better account for role overlap and its implications.

Malleable factors of cyberbullying by gender

DL is a protective factor

DL emerged as a protective factor against the probability of both cyberbullying victimisation and perpetration, regardless of gender. This finding aligns with previous studies showing that higher DL is associated with safer digital behaviour and reduced involvement in online risks (Tao et al., 2022). The measurement of DL in this study reflects a broad range of competencies – including information evaluation, communication, safety, content creation, and problem-solving – all of which help students navigate online spaces more critically and responsibly (Carretero et al., 2017). For example, communication skills can help them engage respectfully in online discussions and avoid misunderstandings. Online safety competencies can ensure that students can protect their personal information and recognise potential cyber threats, such as phishing emails.

For girls, higher DL was linked to lower frequency of cyberbullying experiences, suggesting a buffering effect even when exposure occurs. This is aligning with studies showing that girls with high DL showed greater cybersecurity awareness than boys (Siddiq & Scherer, 2019). Thus, interventions aimed at building DL may be particularly effective for girls, as DL was found to negatively predict both the likelihood and frequency of their engagement in cyberbullying.

Online activity positively related to cyberbullying

Increased online activity was generally associated with a higher probability and frequency of cyberbullying, consistent with prior findings (Kowalski et al., 2019). Greater digital engagement naturally increases the number of social encounters – and therefore the potential for both positive and negative interactions.

A gendered nuance was observed in the frequency of victimisation: it was significantly linked to online activity for boys, but not for girls. This may relate to differences in online behaviour. Boys are more likely to engage in competitive gaming environments, while girls are more active on social networking platforms (OECD, 2015; Zhu et al., 2021). Although both environments carry risk, the social dynamics and aggressiveness of gaming may expose boys to more intense forms of cyber aggression. Future research should investigate platform-specific patterns of behaviour to better understand how digital contexts influence cyberbullying exposure and severity.

Academic stress as a gendered risk factor

Our study found that academic stress was positively associated with both the probability and frequency of cyberbullying experiences, especially for girls. This expands on past literature showing that stress is a precursor to risky digital behaviours (Evangelio et al., 2022; Garaigordobil & Machimbarrena, 2019; Martínez-Monteagudo et al., 2020). Girls tend to report higher levels of school-related anxiety and are more likely to seek emotional support through online communication (Mackenzie et al., 2023). Paradoxically, while such coping strategies are adaptive in theory, they may also expose girls to negative peer dynamics, particularly in emotionally charged platforms or group chats in the online environment.

Family influence: relationship and monitoring

Parental monitoring was positively associated with the possibility of girls becoming cyberbullying perpetrators in this study. Research on the effects of parental monitoring on children's cyberbullying experiences has produced mixed findings, largely influenced by the specific type of monitoring employed. Overly controlling parental monitoring can sometimes serve as a risk factor for cyberbullying (Brighi et al., 2019; Lin, 2016), as it may prioritise parental authority over child autonomy. This approach can strain parent–child relationships, potentially increasing the likelihood of cyberbullying incidents (Elsaesser et al., 2017). Conversely, open and collaborative parental strategies, such as explaining the rationale behind rules, co-using digital technologies, and modelling appropriate online behaviour, have been shown to reduce the probability of cyberbullying incidents (Benrazavi et al., 2015).

In this study, parental monitoring was operationalised as a measure of controlling children's digital use and was identified as a significant risk factor specifically for girls. This finding highlights the potential adverse effects of restrictive mediation strategies. This aligns with research indicating that restrictive or authoritarian monitoring can provoke reactance or concealment, thereby increasing risky behaviours (Brighi et al., 2019; Lin, 2016; Mesch, 2009).

Emerging evidence supports a balanced model of parental monitoring in which proportionate control is paired with open communication. Such an approach allows children to navigate diverse online activities safely and fosters trust and positive parent–child relations (Livingstone et al., 2015, 2017), emphasising protection and empowerment in the digital age.

Limitations

We note several limitations. The cross-sectional design does not permit causal inference about identified malleable factors, and the mechanisms underlying their association with cyberbullying are uncertain. Longitudinal designs are necessary to delineate causal pathways. Second, we did not include school- or community-level variables, which may also shape cyberbullying experiences; future research should incorporate these broader ecological factors. Third, although the two-part model distinguished between the probability and frequency of cyberbullying, we could not assess the subjective severity of incidents – a factor highlighted by allostatic load theory as critical for understanding stress responses. Finally, reliance on self-reported measures may introduce bias, particularly for sensitive issues like perpetration, and the frequency scale's upper-bound truncation may limit data precision. Future studies should consider using multi-informant approaches and behavioural data to enhance validity.

Contribution and implication

This study makes three key theoretical contributions. First, it disentangles the probability and frequency of cyberbullying, showing their distinct impacts on well-being. This differentiation helps address zero-inflated data and guides the development of targeted interventions by identifying which factors influence the likelihood or

frequency of cyberbullying. Second, the study highlights gender-specific factors affecting cyberbullying experiences, essential for designing precise interventions. Third, most prior research has focused on adolescents. By shifting attention to primary school-aged children, our study emphasises the importance of early prevention and developmental sensitivity in both measurement and intervention.

The findings offer practical insights for designing targeted anti-cyberbullying programs. Prevention should focus on reducing the probability of incidents. For girls, improving DL and reducing academic stress are key, while for boys, promoting balanced online behaviour and digital self-regulation is critical. Additionally, fostering healthy family dynamics – especially for girls – can lower perpetration risk, suggesting that parent-focused initiatives should be integral to these efforts. For example, parental strategies involving co-use and evaluative mediation (S. Livingstone et al., 2015, 2017) have been shown to be more effective than restrictive controls in shaping responsible digital behaviours. Similarly, school-based interventions that emphasise digital citizenship, empathy-building, and peer support (Elsaesser et al., 2017; Lan, Law, et al., 2022) may be especially impactful. Addressing these gender-specific and contextually malleable factors can make anti-cyberbullying programs more effective in reducing online aggression among primary school students.

Conclusion

This research advances our understanding of cyberbullying by showing that the probability of an incident, rather than its frequency, has a stronger negative link to a child's well-being. This is especially true for boys, who are more vulnerable across perpetrator, victim, and bystander roles. Additionally, this study identifies actionable factors, showing DL is a key protective skill, while academic stress and controlling parenting are significant risks, especially for girls. This evidence calls for a shift towards targeted, gender-sensitive interventions. To be effective, prevention must focus on the specific factors that increase the likelihood of cyberbullying and be tailored to the developmental needs of young students.

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References

Adams, R. J. (2005). Reliability as a measurement design effect. *Studies in Educational Evaluation*, *31*(2–3), 162–172. https://doi.org/10.1016/j.stueduc.2005.05.008

Aizenkot, D., & Kashy-Rosenbaum, G. (2021). The effectiveness of safe surfing intervention program in reducing WhatsApp cyberbullying and improving classroom climate and student sense of class belonging in elementary school. *The Journal of Early Adolescence*, *41*(4), 550–576. https://doi.org/10.1177/0272431620931203

Álvarez-García, D., Barreiro-Collazo, A., Núñez, J. C., & Dobarro, A. (2016). Validity and reliability of the cyber-aggression questionnaire for adolescents (CYBA). *The European Journal of Psychology Applied to Legal Context*, *8*(2), 69–77. https://doi.org/10.1016/j.ejpal.2016.02.003

Álvarez-García, D., Núñez, J. C., Barreiro-Collazo, A., & García, T. (2017). Validation of the xyber-victimization questionnaire (CYVIC) for adolescents. *Computers in Human Behavior*, *70*, 270–281. https://doi.org/10.1016/j.chb.2017.01.007

Baldry, A. C., Sorrentino, A., & Farrington, D. P. (2019). Cyberbullying and cybervictimization versus parental supervision, monitoring and control of adolescents' online activities. *Children and Youth Services Review*, *96*, 302–307. https://doi.org/10.1016/j.childyouth.2018.11.058

Benrazavi, R., Teimouri, M., & Griffiths, M. D. (2015). Utility of parental mediation model on youth's problematic online gaming. *International Journal of Mental Health and Addiction*, *13*(6), 712–727. https://doi.org/10.1007/s11469-015-9561-2

Brighi, A., Menin, D., Skrzypiec, G., & Guarini, A. (2019). Young, bullying, and connected: Common pathways to cyberbullying and problematic internet use in adolescence. *Frontiers in Psychology*, *10*, 1467. https://doi.org/10.3389/fpsyg.2019.01467

Brochado, S., Soares, S., & Fraga, S. (2017). A scoping review on studies of cyberbullying prevalence among adolescents. *Trauma, Violence & Abuse*, *18*(5), 523–531. https://doi.org/10.1177/1524838016641668

Carlson, E. D., & Chamberlain, R. M. (2005). Allostatic load and health disparities: A theoretical orientation. *Research in Nursing & Health*, *28*(4), 306–315. https://doi.org/10.1002/nur.20084

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/38842

Carter, M. (2014). Gender socialization and identity theory. *Social Sciences*, *3*(2), 242–263. https://doi.org/10.3390/socsci3020242

Chicote-Beato, M., González-Víllora, S., Bodoque-Osma, A. R., & Navarro, R. (2024). Cyberbullying intervention and prevention programmes in Primary Education (6 to 12 years): A systematic review. *Aggression and Violent Behavior*, *77*, 101938. https://doi.org/10.1016/j.avb.2024.101938

Connell, N. M., Schell-Busey, N. M., Pearce, A. N., & Negro, P. (2014). Badgrlz? Exploring sex differences in cyberbullying behaviors. *Youth Violence and Juvenile Justice*, *12*(3), 209–228. https://doi.org/10.1177/1541204013503889

Cross, D., Barnes, A., Papageorgiou, A., Hadwen, K., Hearn, L., & Lester, L. (2015). A social–ecological framework for understanding and reducing cyberbullying behaviours. *Aggression and Violent Behavior*, *23*, 109–117. https://doi.org/10.1016/j.avb.2015.05.016

DePaolis, K. J., & Williford, A. (2019). Pathways from cyberbullying victimization to negative health outcomes among elementary school students: A longitudinal investigation. *Journal of Child and Family Studies*, *28*(9), 2390–2403. https://doi.org/10.1007/s10826-018-1104-6

Doumas, D. M., & Midgett, A. (2021). The association between witnessing cyberbullying and depressive symptoms and social anxiety among elementary school students. *Psychology in the Schools*, *58*(3), 622–637. https://doi.org/10.1002/pits.22467

Driscoll, K., & Pianta, R. C. (2011). Mothers' and fathers' perceptions of conflict and closeness in parent-child relationships during early childhood. *Journal of Early Childhood and Infant Psychology*, *7*, 1–24.

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary–neurodevelopmental theory. *Development and Psychopathology*, *23*(1), 7–28. https://doi.org/10.1017/S0954579410000611

Elsaesser, C., Russell, B., Ohannessian, C. M., & Patton, D. (2017). Parenting in a digital age: A review of parents' role in preventing adolescent cyberbullying. *Aggression and Violent Behavior*, *35*, 62–72. https://doi.org/10.1016/j.avb.2017.06.004

Evangelio, C., Rodríguez-González, P., Fernández-Río, J., & Gonzalez-Villora, S. (2022). Cyberbullying in elementary and middle school students: A systematic review. *Computers & Education*, *176*, 104356. https://doi.org/10.1016/j.compedu.2021.104356

Ey, L. A., Taddeo, C., & Spears, B. (2015). Cyberbullying and primary-school aged children: The psychological literature and the challenge for sociology. *Societies*, *5*(2), 492–514. https://doi.org/10.3390/soc5020492

Fan, C. Y., Chu, X. W., Zhang, M., & Zhou, Z. K. (2019). Are narcissists more likely to be involved in cyberbullying? Examining the mediating role of self-esteem. *Journal of Interpersonal Violence*, *34*(15), 3127–3150. https://doi.org/10.1177/08862605166665

Flores Buils, R., Caballer Miedes, A., & Romero Oliver, M. (2020). Effect of a cyberbullying prevention program integrated in the primary education curriculum. *Revista de Psicodidáctica (English Ed.)*, *25*(1), 23–29. https://doi.org/10.1016/j.psicoe.2019.08.004

Garaigordobil, M., & Machimbarrena, J. M. (2019). Victimization and perpetration of bullying/cyberbullying: Connections with emotional and behavioral problems and childhood stress. *Psychosocial Intervention*, *28*(2), 67–73. https://doi.org/10.5093/pi2019a3

Guo, S. (2016). A meta-analysis of the predictors of cyberbullying perpetration and victimization: Cyberbullying perpetration and victimization. *Psychology in the Schools*, *53*(4), 432–453. https://doi.org/10.1002/pits.21914

Hellfeldt, K., López-Romero, L., & Andershed, H. (2020). Cyberbullying and psychological well-being in young adolescence: The potential protective mediation effects of social support from family, friends, and teachers. *International Journal of Environmental Research and Public Health*, *17*(1), 45. https://doi.org/10.3390/ijerph17010045

Holfeld, B., & Leadbeater, B. J. (2015). The nature and frequency of cyber bullying behaviors and victimization experiences in young Canadian children. *Canadian Journal of School Psychology*, *30*(2), 116–135. https://doi.org/10.1177/0829573514556853

Jin, K. Y., Reichert, F., Cagasan, L. P., De La Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. *Computers & Education*, *157*, 103968. https://doi.org/10.1016/j.compedu.2020.103968

Kim, Y., & Muthén, B. O. (2009). Two-part factor mixture modeling: Application to an aggressive behavior measurement instrument. *Structural Equation Modeling: A Multidisciplinary Journal*, *16*(4), 602–624. https://doi.org/10.1080/10705510903203516

Kline, R. B. (2016). *Principles and practice of structural equation modeling*. Guilford Press.

Kowalski, R. M., & Limber, S. P. (2013). Psychological, physical, and academic correlates of cyberbullying and traditional bullying. *The Journal of Adolescent Health*, *53*(1), S13–S20. https://doi.org/10.1016/j.jadohealth.2012.09.018

Kowalski, R. M., Limber, S. P., & McCord, A. (2019). A developmental approach to cyberbullying: Prevalence and protective factors. *Aggression and Violent Behavior*, *45*, 20–32. https://doi.org/10.1016/j.avb.2018.02.009

Kwan, I., Dickson, K., Richardson, M., MacDowall, W., Burchett, H., Stansfield, C., Brunton, G., Sutcliffe, K., & Thomas, J. (2020). Cyberbullying and children and young people's mental health: A systematic map of systematic reviews. *Cyberpsychology, Behavior and Social Networking*, *23*(2), 72–82. https://doi.org/10.1089/cyber.2019.0370

Lan, M., Law, N., & Pan, Q. (2022). Effectiveness of anti-cyberbullying educational programs: A socio-ecologically grounded systematic review and meta-analysis. *Computers in Human Behavior*, *130*, 107200. https://doi.org/10.1016/j.chb.2022.107200

Lan, M., Pan, Q., Tan, C. Y., & Law, N. W. Y. (2022). Understanding protective and risk factors affecting adolescents' well-being during the COVID-19 pandemic. *NPJ Science of Learning*, *7*(1), 32. https://doi.org/10.1038/s41539-022-00149-4

Lin, M. T. (2016). *Risk factors associated with cyberbullying victimization and perpetration among Taiwanese children*. The University of Texas. https://digitalcommons.library.tmc.edu/dissertations/AAI10126751

Livingstone, S. M., & Haddon, L. (Eds.). (2009). *Kids online [electronic resource]: Opportunities and risks for children*. Policy Press.

Livingstone, S., Mascheroni, G., & Staksrud, E. (2015). *Developing a framework for researching children's online risks and opportunities in Europe* [Monograph]. EU Kids Online, The London School of Economics and Political Science. http://www.lse.ac.uk/media@lse/research/EUKidsOnline/Home.aspx

Livingstone, S., Ólafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2017). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation: Maximizing opportunities and minimizing risks. *Journal of Communication*, *67*(1), 82–105. https://doi.org/10.1111/jcom.12277

Mackenzie, E., McMaugh, A., Van Bergen, P., & Parada, R. H. (2023). Adolescent girls' academic support-seeking, depression, and anxiety: The mediating role of digital support-seeking. *Australian Journal of Psychology*, *75*(1), 2170279. https://doi.org/10.1080/00049530.2023.2170279

Marsh, H. W., Huppert, F. A., Donald, J. N., Horwood, M. S., & Sahdra, B. K. (2020). The well-being profile (WB-Pro): Creating a theoretically based multidimensional measure of well-being to advance theory, research, policy, and practice. *Psychological Assessment*, *32*(3), 294–313. https://doi.org/10.1037/pas0000787

Martínez-Monteagudo, M. C., Delgado, B., Díaz-Herrero, Á., & García-Fernández, J. M. (2020). Relationship between suicidal thinking, anxiety, depression and stress in university students who are victims of cyberbullying. *Psychiatry Research*, *286*, 112856. https://doi.org/10.1016/j.psychres.2020.112856

Maydeu-Olivares, A. (2013). Goodness-of-fit assessment of item response theory models. *Measurement: Interdisciplinary Research & Perspective*, *11*(3), 71–101. https://doi.org/10.1080/15366367.2013.831680

McEwen, B. S., & Stellar, E. (1993). Stress and the individual: Mechanisms leading to disease. *Archives of Internal Medicine*, *153*(18), 2093–2101. https://doi.org/10.1001/archinte.1993.00410180039004

Mehari, K. R., & Farrell, A. D. (2018). Where does cyberbullying fit? A comparison of competing models of adolescent aggression. *Psychology of Violence*, *8*(1), 31–42. https://doi.org/10.1037/vio0000081

Mesch, G. S. (2009). Parental ediation, online activities, and cyberbullying. *Cyberpsychology & Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, *12*(4), 387–393. https://doi.org/10.1089/cpb.2009.0068

Mesch, G. S. (2018). Parent–child connections on social networking sites and cyberbullying. *Youth & Society*, *50*(8), 1145–1162. https://doi.org/10.1177/0044118X16659685

Molero, M. M., Martos, Á., Barragán, A. B., Pérez-Fuentes, M. C., & Gázquez, J. J. (2022). Anxiety and depression from cybervictimization in adolescents: A metaanalysis and meta-regression study. *The European Journal of Psychology Applied to Legal Context*, *14*(1), 42–50. https://doi.org/10.5093/ejpalc2022a5

Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide* (8th ed.). (Version 8.1) [Computer software]. Muthén & Muthén.

OECD. (2015). *PISA 2015 results (volume III): Students' well-being | en*. OECD. https://www.oecd.org/education/pisa-2015-results-volume-iii-9789264273856-en.htm

OECD. (2017). *PISA 2015 technical report*. OECD. http://www.oecd.org/pisa/sitedocument/PISA-2015-technical-report-final.pdf

Olsen, M. K., & Schafer, J. L. (2001). A two-part random-effects model for semicontinuous longitudinal data. *Journal of the American Statistical Association*, *96*(454), 730–745. https://doi.org/10.1198/016214501753168389

Pan, Q., Reichert, F., Liang, Q., De La Torre, J., & Law, N. (2025). Measuring digital literacy across ages and over time: Development and validation of a performance-based assessment. *Education and Information Technologies*. https://doi.org/10.1007/s10639-025-13592-8

Pieschl, S., & Porsch, T. (2017). The complex relationship between cyberbullying and trust. *International Journal of Developmental Science: Biopsychosocial Mechanisms of Change, Human Development, and Psychopathology - Perspectives from Psychology, Neuroscience, and Genetics*, *11*(1–2), 9–17. https://doi.org/10.3233/DEV-160208

Reignier, V. L. R., Gascó, V. J. P., & Gerónimo, E. M. (2022). The influence of self-esteem and (cyber) bullying on adolescents' well-being: A question of gender? *Revista de Psicología Clínica Con Niños y Adolescentes*, *9*(1), 8.

Rosseel, Y. (2012). lavaan: An *R* package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Rudnicki, K., Vandebosch, H., Voué, P., & Poels, K. (2023). Systematic review of determinants and consequences of bystander interventions in online hate and cyberbullying among adults. *Behaviour & Information Technology*, *42*(5), 527–544. https://doi.org/10.1080/0144929X.2022.2027013

Sampasa-Kanyinga, H., Lalande, K., & Colman, I. (2020). Cyberbullying victimisation and internalising and externalising problems among adolescents: The moderating role of parent–child relationship and child's sex. *Epidemiology and Psychiatric Sciences*, *29*, e8. https://doi.org/10.1017/S2045796018000653

Scheithauer, H., Hayer, T., Petermann, F., & Jugert, G. (2006). Physical, verbal, and relational forms of bullying among German students: Age trends, gender differences, and correlates. *Aggressive Behavior*, *32*(3), 261–275. https://doi.org/10.1002/ab.20128

Schell-Busey, N., Connell, N. M., & Walding, S. (2023). Examining gender differences in a social norms prevention program for cyberbullying. *International Journal of Bullying Prevention*. https://doi.org/10.1007/s42380-023-00196-4

Ševčíková, A., & Šmahel, D. (2009). Online harassment and cyberbullying in the Czech Republic: comparison across age groups. *Zeitschrift Für Psychologie / Journal of Psychology*, *217*(4), 227–229. https://doi.org/10.1027/0044-3409.217.4.227

Sharma, S., Mukherjee, S., Kumar, A., & Dillon, W. R. (2005). A simulation study to investigate the use of cutoff values for assessing model fit in covariance structure models. *Journal of Business Research*, *58*(7), 935–943. https://doi.org/10.1016/j.jbusres.2003.10.007

Siddiq, F., & Scherer, R. (2019). Is there a gender gap? A meta-analysis of the gender differences in students' ICT literacy. *Educational Research Review*, *27*, 205–217. https://doi.org/10.1016/j.edurev.2019.03.007

Smahel, D., Machackova, H., Mascheroni, G., Dedkova, L., Staksrud, E., Ólafsson, K., Livingstone, S., & Hasebrink, U. (2020). *EU kids online 2020: Survey results from 19 countries*. (EU Kids Online). London School of Economics and Political Science. https://www.lse.ac.uk/media-and-communications/research/research-projects/eu-kids-online/eu-kids-online-2020/home.aspx

Smith, P. K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: Its nature and impact in secondary school pupils. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *49*(4), 376–385. https://doi.org/10.1111/j.1469-7610.2007.01846.x

Sonck, N., & De Haan, J. (2013). How the internet skills of European 11- To 16-year-olds mediate between online risk and harm. *Journal of Children and Media*, *7*(1), 79–95. https://doi.org/10.1080/17482798.2012.739783

Svensson, R., Johnson, B., & Olsson, A. (2022). Does gender matter? The association between different digital media activities and adolescent well-being. *BMC Public Health*, *22*(1), 273. https://doi.org/10.1186/s12889-022-12670-7

Tao, S., Lan, M., Tan, C. Y., Liang, Q., Pan, Q., & Law, N. W. Y. (2024). Adolescents' cyberbullying experience and subjective well-being: Sex difference in the moderating role of cognitive-emotional regulation strategy. *Computers in Human Behavior*, *153*, 108122. https://doi.org/10.1016/j.chb.2023.108122

Tao, S., Reichert, F., Law, N., & Rao, N. (2022). Digital technology use and cyberbullying among primary school children: Digital literacy and parental mediation as moderators. *Cyberpsychology, Behavior and Social Networking*, *25*(9), 571–579. https://doi.org/10.1089/cyber.2022.0012

Ttofi, M. M., Farrington, D. P., Lösel, F., & Loeber, R. (2011). Do the victims of school bullies tend to become depressed later in life? A systematic review and meta-analysis of longitudinal studies. *Journal of Aggression, Conflict and Peace Research*, *3*(2), 63–73. https://doi.org/10.1108/17596591111132873

Van Geel, M., Vedder, P., & Tanilon, J. (2014). Relationship between peer victimization, cyberbullying, and suicide in children and adolescents: A meta-analysis. *JAMA Pediatrics*, *168*(5), 435–442. https://doi.org/10.1001/jamapediatrics.2013.4143

d'Haenens, L., Vandoninck, S., & Donoso, V. (2013). How to cope and build online resilience? EU Kids Online, London School of Economics and Political Science. http://eprints.lse.ac.uk/48115/

Vandoninck, S., D'Haenens, L., & Donoso, V. (2010). Digital literacy of flemish youth: How do they handle online content risks? *Communications*, *35*(4), 397–416. https://doi.org/10.1515/comm.2010.021

Vissenberg, J., d'Haenens, L., & Livingstone, S. (2022). Digital literacy and online resilience as facilitators of young people's well-being: A systematic review. *European Psychologist*, *27*(2), 76–85. https://doi.org/10.1027/1016-9040/a000478

Wang, M., Huebner, E. S., Liu, Y., & Tian, L. (2022). Longitudinal relations between traditional bullying victimization and cyberbullying perpetration in elementary school students: Deviant peer affiliation as a mediator. *Psychology of Violence*, *12*(5), 361–370. https://doi.org/10.1037/vio0000433

Wasserman, A. M., Crockett, L. J., & Hoffman, L. (2017). Reward seeking and cognitive control: Using the dual systems model to predict adolescent sexual behavior. *Journal of Research on Adolescence*, *27*(4), 907–913. https://doi.org/10.1111/jora.12321

Williams, K. R., & Guerra, N. G. (2007). Prevalence and predictors of internet bullying. *The Journal of Adolescent Health*, *41*(6), S14–S21. https://doi.org/10.1016/j.jadohealth.2007.08.018

Zhang, D., Huebner, E. S., & Tian, L. (2021). Neuroticism and cyberbullying among elementary school students: A latent growth curve modeling approach. *Personality and Individual Differences*, *171*, 110472. https://doi.org/10.1016/j.paid.2020.110472

Zhu, C., Huang, S., Evans, R., & Zhang, W. (2021). Cyberbullying among adolescents and children: A comprehensive review of the global situation, risk factors, and preventive measures. *Frontiers in Public Health*, *9*, 634909. https://doi.org/10.3389/fpubh.2021.634909

Appendix

Table A1. Measures for cyberbullying experience.

Cyberbullying perpetration	Q11		How often have you done the following in the past 6 months?
	Q11	1	I have sent or forwarded a hurtful message electronically to someone
	Q11	2	I have posted or texted a hurtful comment about a photo/video of somebody online
	Q11	3	I have removed or refused another person on some chat groups (e.g. Messenger, Whatsapp), without him/her doing anything and only for being who he/she was.
	Q11	4	I have pushed another person to do things that he/she did not want to do (whether or not he/she finally agreed to do it) by threatening to share intimate conversations or images of him/her.
	Q11	5	I have posted rumours about someone on a social network.
Cyberbullying victimisation	Q12		How often have you encountered the following situations in the past 6 months?
	Q12	1	I have received a hurtful message from someone online
	Q12	2	I have seen hurtful comments about a photo/video of me online
	Q12	3	I was kicked out or not accepted on some chat groups (e.g. Messenger, Whatsapp), without having done anything, just for being me.
	Q12	4	I have been pressured to do things that I didn't want to do (whether or not I finally agreed to do) and threatened to spread my intimate conversations or images.
	Q12	5	There have been false rumours about me on some social network.
Cyberbullying bystander	Q13		How often have you seen someone encounter the following situations in the past 6 months?
	Q13	1	I have seen somebody received a hurtful message online
	Q13	2	I have seen hurtful comments about a photo/video of others online
	Q13	3	I have seen someone being kicked out or not accepted on some chat groups (e.g. Messenger, Whatsapp), without having done anything, just for being who he/she was.
	Q13	4	I have seen someone being pressured to do things that the he/she didn't want to do (whether or not he/she finally agreed to do) and being threatened to spread the intimate conversations or images of him/her.
	Q13	5	I have seen false rumours about another person on some social network.

Answer options: 1 = Never, 2 = 1 or 2 times, 3 = 3 or 4 times, 4 = 5 or 6 times, 5 = 7 or more times. The scale has been changed to 0–4 in the data analysis process.

Table A2. Frequency table of items of cyberbullying experience scale.

	Answer options							Answer Options					
Female	1	2	3	4	5	Missing	Male	1	2	3	4	5	Missing
Q11_1	456	22	8	6	8	7	Q11_1	432	29	11	11	11	8
Q11_2	468	5	16	2	9	7	Q11_2	441	20	17	8	8	8
Q11_3	422	49	14	6	9	7	Q11_3	398	52	16	10	18	8
Q11_4	463	14	12	5	6	7	Q11_4	448	8	18	9	11	8
Q11_5	462	17	7	6	8	7	Q11_5	446	15	10	11	12	8
Q12_1	391	69	16	8	16	7	Q12_1	393	55	20	10	16	8
Q12_2	443	26	18	3	10	7	Q12_2	432	24	17	11	10	8
Q12_3	402	56	20	6	16	7	Q12_3	401	49	17	16	11	8
Q12_4	445	27	14	3	11	7	Q12_4	432	19	16	13	14	8
Q12_5	444	22	14	8	12	7	Q12_5	434	16	15	12	17	8
Q13_1	382	73	18	12	15	7	Q13_1	380	59	23	7	25	8
Q13_2	397	60	24	5	14	7	Q13_2	398	44	24	8	20	8
Q13_3	381	72	26	9	12	7	Q13_3	392	49	22	8	23	8
Q13_4	422	42	18	7	11	7	Q13_4	415	33	24	7	15	8
Q13_5	376	69	26	9	20	7	Q13_5	379	48	28	13	26	8