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Moral disengagement as mediator and guilt as moderator between cyber moral literacy and cyberbullying among late adolescents

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The rapid growth of internet usage has led to increased cyberbullying among adolescents, with varying rates reported across countries. This study aimed to investigate the impact of cyber moral literacy on cyberbullying among late adolescents, examining both the mediating role of moral disengagement and the moderating effect of quilt on the relationship between cyber moral literacy and cyberbullying. Data were collected from 7837 late adolescent students (aged 18-21 years) at four universities in Sichuan Province, China. Scales measuring cyber moral literacy, cyberbullying, moral disengagement, and guilt were employed. Structural Equation Modeling was used to test hypothesized relationships. Cyber moral literacy showed a strong negative association with cyberbullying. The relationship between cyber moral literacy and cyberbullying was partially mediated by moral disengagement. Additionally, guilt moderated the direct relationship between cyber moral literacy and cyberbullying, with this negative relationship being stronger among individuals with high guilt compared to those with low guilt. The study highlights the complex interplay of moral, cognitive, and emotional factors in adolescent online behavior. The findings suggest that enhancing cyber moral literacy could be particularly effective in reducing cyberbullying, especially among individuals who experience higher levels of guilt. Additionally, addressing moral disengagement mechanisms could help strengthen the preventive effect of cyber moral literacy on cyberbullying. These insights contribute to our understanding of creating a more harmonious online environment for late adolescents.

Keywords Cyber moral literacy, Moral disengagement, Cyberbullying, Guilt, Mediating and moderating effects

The rapid proliferation of internet use has led to unprecedented connectivity. By 2022, China's internet population reached 1.051 billion, with individuals aged 10–29 accounting for 30.5% of the total¹. This digital revolution has brought both opportunities and challenges, particularly for adolescents who have grown up as "digital natives". Cyberbullying, defined as an aggressive act carried out repeatedly through electronic means², has become a significant concern. Studies across various countries have reported alarming rates of cyberbullying incidents. In a study of Malaysian young adults aged 17–30, Balakrishnan et al.³ reported that over a six-month period, 35% had engaged in cyberbullying behaviors, 44% had experienced cyberbullying victimization, and 70% had witnessed cyberbullying incidents. Maurya et al.⁴ documented a three-year increase in cyberbullying victimization rates among Indian adolescents and young adults, with rates rising from 3.8 to 6.4% for females and from 1.9 to 5.6% for males. In Canada, nearly 54% of adolescents have been victims of bullying, with more than a quarter experiencing cyberbullying⁵. A study in China's Shanxi Province revealed that 17.4% of adolescents

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reported experiencing cyberbullying⁶. In the United States, 19% of regular internet-using students reported involvement in cyberbullying in the past year⁷, while in the UK, 8% of individuals reported being bullied online⁸.

While extensive research has been conducted on cyberbullying among younger adolescents, there is a notable gap in understanding these dynamics among late adolescents, particularly in higher education settings. The tragic case of Tyler Clementi, a Rutgers University freshman who died by suicide after experiencing cyberbullying⁹, underscores the critical need for research in this area. Previous studies have explored various factors influencing cyberbullying, including prosocial behavior¹⁰, family functions¹¹, moral disengagement¹², exposure to violent online games¹³, loneliness¹⁴, and childhood abuse experiences¹⁵. However, there is limited research on the mechanisms by which cyber moral literacy impacts cyberbullying, particularly among late adolescents.

This study aims to address this gap by examining the relationship between cyber moral literacy and cyberbullying among late adolescents, with a focus on the mediating role of moral disengagement and the moderating effect of guilt. The inclusion of these mediating and moderating variables is crucial for several reasons. Examining moral disengagement as a mediator can help elucidate the mental mechanisms and thought processes through which individuals with varying levels of cyber moral literacy may justify or rationalize cyberbullying behaviors. These mechanisms include cognitive restructuring of harmful conduct, minimizing one's role in causing harm, disregarding or distorting the consequences of actions, and dehumanizing the victim. Understanding these processes can potentially provide insights into specific psychological intervention points to reduce cyberbullying. Investigating guilt as a moderator allows us to understand how emotional responses may alter the relationship between cyber moral literacy and cyberbullying, shedding light on individual differences in susceptibility to engaging in cyberbullying behavior. The combination of these variables provides a more comprehensive model of cyberbullying behavior, accounting for cognitive (moral disengagement), emotional (guilt), and knowledge-based (cyber moral literacy) factors. Specifically, we propose the following research questions:

- (1) How does cyber moral literacy influence cyberbullying behaviors among late adolescents?
- (2) To what extent does moral disengagement mediate the relationship between cyber moral literacy and cyberbullying?
- (3) How does guilt moderate the relationship between cyber moral literacy and cyberbullying?

To address these research questions and provide a comprehensive understanding of the mechanisms underlying cyberbullying among late adolescents, we draw upon several theoretical frameworks. These include theories of moral development, cognitive processing, and emotional regulation. In the following section, we present our theoretical framework and develop hypotheses based on the existing literature. We begin by examining the relationship between cyber moral literacy and cyberbullying, then explore the potential mediating role of moral disengagement, and finally consider how guilt might moderate these relationships.

Theoretical framework and hypotheses

Cyber moral literacy and cyberbullying

Cyberbullying is defined as the act of using digital platforms to maliciously target, harm, intimidate, or humiliate others through electronic media¹⁶. It shares roots with traditional bullying, often stemming from a lack of virtues such as care, self-discipline, sympathy, humility, and trust¹⁷. Research suggests that individuals who violate moral norms and values are at higher risk of engaging in aggressive behavior¹⁸. Cyber moral literacy encompasses moral values, norms, and behavioral standards in the online environment, including privacy protection, respect for intellectual property, and information accuracy and reliability¹⁹. The compromised cyber moral literacy among adolescents can lead to cyber moral misconduct, including cyberbullying. An individual's character plays a significant role in deciding whether to engage in harmful online behaviors, with those less cyber morally literate being more likely to participate in cyberbullying²⁰.

Studies have shown that attitude is a crucial predictor of cyberbullying behavior, with correlations found between students' attitudes towards school violence, subconscious norms, behavioral control, and their criminal intentions²⁰. Some researchers advocate for strengthening students' moral awareness, reasoning, and courage to influence their moral behavioral intentions and reduce the likelihood of cyberbullying²¹. Based on these insights, we propose our first hypothesis:

H1: Adolescent cyber moral literacy has a significant negative influence on cyberbullying.

The mediating role of moral disengagement

Moral disengagement is a cognitive process where individuals employ mechanisms to absolve themselves of moral responsibility for unethical behavior, making their actions seem justifiable²². Individuals with higher cyber moral literacy are more likely to empathize with others and less likely to activate self-justification mechanisms that could harm others²³, thus reducing the likelihood of moral disengagement.

Conversely, individuals lacking concern for traditional morals may act outside moral standards and rules²⁴, a characteristic feature of moral disengagement. This suggests a correlation between cyber moral literacy and moral disengagement.

Moral disengagement operates as a series of cognitive strategies that selectively "turn off" one's moral agency, enabling inappropriate behavior that would normally be avoided²⁵. The activation of moral disengagement systems results in a failure of personal moral self-regulation and cognitive reconstruction of cyberbullying behavior, allowing individuals to violate their moral standards without feelings of guilt or remorse²⁶. Research has found that students involved in cyberbullying scored higher in moral disengagement compared to those who were not²⁷. Integrating these perspectives, we formulate our second hypothesis:

H2: Moral disengagement mediates the effects of adolescents' cyber moral literacy on cyberbullying, with cyber moral literacy negatively impacting moral disengagement, and moral disengagement positively impacting cyberbullying.

The moderating role of guilt

Guilt is a self-conscious emotion arising when individuals realize their behavior violates recognized moral norms or causes harm to others²⁸. It is closely related to empathy, compassion²⁹, sadness, and regret³⁰, and plays a crucial role in behavioral repair processes^{31,32}. When individuals violate personal or societal moral standards, feelings of guilt influence unethical behavior through a contemplative approach³³. Guilt serves as a strong emotion of adaptive moral self-direction, prompting critical appraisal and reflection on specific behaviors and their consequences^{29,34}. It motivates individuals to adopt moral behavior patterns, take responsibility, and implement remedial measures after violations³⁵.

Guilt tendencies can be categorized into evaluative assessments of negative behaviors and restorative tendencies³⁶, with repair primarily involving the tendency to revoke or change inappropriate behavior. This process assists individuals in self-forgiveness on a moral level³⁷, thereby potentially strengthening the impact of moral literacy on inappropriate behavior.

Based on these considerations, we propose our third hypothesis:

H3: Guilt moderates the impact of cyber moral literacy on cyberbullying.

Hypothesis model

Building on the previously discussed theoretical frameworks, we developed a hypothetical model for this study. We propose that cyber moral literacy is a negative predictor of cyberbullying, moral disengagement mediates the effect of cyber moral literacy on cyberbullying, while guilt acts as a moderator of the influence of cyber moral literacy on cyberbullying. Figure 1 illustrates the hypothesis model.

Methodology Research participants

This study employed convenience sampling, targeting late adolescent students (aged 18–21 years) from four universities in Sichuan Province, China. A total of 7837 valid responses were collected (61.8% female; M age = 20.00, SD = 0.68) from January 19, 2024 to February 1, 2024. The survey was conducted by instructors through online meetings. First, instructors explained the study's purpose, and then students who volunteered to participate completed the online informed consent. Instructors then distributed QR codes for accessing the questionnaire. The survey took approximately 15 min to complete and included demographic information and four scales measuring the study variables. No incentives were offered for participation. Ethical approval was obtained from the Institutional Review Board (IRB) of Yibin University (IRB reference: 20231123003). All study procedures were conducted in accordance with institutional ethical guidelines, and informed consent was obtained from all participants.

Measures

Cyber moral literacy

Cyber moral literacy was assessed using the scale developed by Lau and Yuen³⁸. This instrument comprises 10 items across three dimensions: unauthorized actions (four items), internet stickiness (two items), and plagiarism (four items). Following confirmatory factor analysis (CFA), the two items from the internet stickiness dimension were not included in subsequent analyses addressing the research questions due to unsatisfactory psychometric properties (see note under Table 1). The unauthorized actions dimension evaluates unethical behaviors related to unauthorized access or use of digital resources, while the plagiarism dimension assesses unethical behaviors associated with the misappropriation or improper attribution of others' digital work. Participants responded on



Fig. 1. Hypothetical model illustrating the relationships between cyber moral literacy, moral disengagement, guilt, and cyberbullying.

Pathway	Estimate	S.E.	CR	AVE	Cronbach'a			
Unauthorized ^a	<	Cyber moral literacy	0.87		0.91	0.67	0.96	
Plagiarism ^a	<	Cyber moral literacy	moral literacy 0.77 0.02		0.96	0.90	0.90	
Cyberbullying item 6	<	Cyberbullying	0.94					
Cyberbullying item 5	<	Cyberbullying	0.94	0.006				
Cyberbullying item 4	<	Cyberbullying	0.95 0.006		0.98 0.88	0.00	0.09	
Cyberbullying item 3	<	Cyberbullying 0.95 0		0.006		0.98		
Cyberbullying item 2	<	Cyberbullying	0.95 0.006		1			
Cyberbullying item 1	<	Cyberbullying	0.90	0.007	0.007			
Attribution of Blame	<	Moral disengagement	0.76		0.86	0.67	0.85	
Dehumanization ^a	<	Moral disengagement	0.87	0.012	0.90	0.76	0.90	
Distortion of Consequences ^a	<	Moral disengagement	0.90	0.011	0.95	0.86	0.94	
Diffusion of Responsibility ^a	<	Moral disengagement	0.72	0.014	0.93	0.81	0.92	
Displacement of Responsibility ^a	<	Moral disengagement	0.84	0.012	0.88	0.71	0.87	
Advantageous Comparison ^a	<	Moral disengagement	0.90	0.011	0.92	0.8	0.92	
Euphemistic Labeling ^a	<	Moral disengagement	0.90	0.011	0.87	0.7	0.85	
Moral Justification ^a	<	Moral disengagement	0.76	0.013	0.93	0.8	0.92	
Guilt item 3	<	Guilt	0.87					
Guilt item 2	<	Guilt	0.95	0.009	0.93	0.82	0.92	
Guilt item 1	<	Guilt	0.91 0.00		1			

Table 1. Standardized factor loadings, convergent validity, and reliability of study constructs. ^aThe indicators of the latent variables are represented by mean subscale scores; items from the internet stickiness subscale were excluded from subsequent analyses due to cross-loading issues identified during factor analysis. *CR* construct reliability, *AVE* average variance extracted.

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a five-point Likert-type scale ranging from 1 (never) to 5 (often), with higher mean scores indicating lower levels of cyber moral literacy. The scale demonstrated excellent internal consistency in the present study, with an overall Cronbach's alpha coefficient of 0.93. The individual dimensions also exhibited high reliability: unauthorized actions (α =0.92) and plagiarism (α =0.92).

Moral disengagement

Moral disengagement was measured using the 24-item scale developed by Detert et al.³⁹. This scale assesses eight different mechanisms of moral disengagement: moral justification, euphemistic labeling, advantageous comparison, displacement of responsibility, diffusion of responsibility, distortion of consequences, attribution of blame, and dehumanization. Each mechanism is represented by three items. An example item is "If someone is forced to do something, they should not be blamed." Responses were recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher average scores indicating higher levels of moral disengagement. The scale showed excellent internal consistency in this study, with an overall Cronbach's α of 0.97. The individual dimensions' α values ranged from 0.85 to 0.92, indicating high reliability across all subscales.

Cyberbullying

Cyberbullying was assessed using the cyberbullying dimension from the scale developed by Xie et al.⁴⁰. While the original scale included both cyberbullying and cyber victimization dimensions, this study used only the six-item cyberbullying dimension. This dimension measures the extent to which participants engage in cyberbullying behaviors. An example item is "Sending or forwarding hurtful messages electronically." Responses were recorded on a five-point Likert scale ranging from 0 (never) to 4 (daily), with higher average scores indicating higher levels of cyberbullying behavior. In this study, the cyberbullying scale demonstrated excellent internal consistency, with a Cronbach's α of 0.98.

Guilt

Guilt was measured using an adapted version of the scale developed by Thornberg et al.⁴¹. The original scale was unidimensional, and for this study, it was adapted to include three items specifically related to guilt emotions in bullying behavior. An example item is "If the person being ridiculed starts crying, I would feel uneasy." Participants responded on a seven-point Likert scale ranging from 1 (disagree) to 7 (agree), with higher mean scores indicating greater feelings of guilt. Factor loadings for the items in this study ranged from 0.88 to 0.95, indicating good construct validity. The scale demonstrated good reliability, with a Cronbach's α of 0.93.

Data analysis

Data analysis was conducted using SPSS 22.0 and Amos⁴² 21.0. The analytical process consisted of several stages. First, we performed CFA⁴³ using Amos to assess the measurement model. This step involved evaluating model fit indices, convergent validity, and discriminant validity of the constructs. We then proceeded with structural

equation modeling (SEM) in Amos to test our hypothesized relationships. This included examining the direct effect of cyber moral literacy on cyberbullying, as well as the mediating role of moral disengagement in this relationship. To test the moderating effect of guilt, we employed multi-group analysis in Amos. This approach allowed us to compare the structural model across different levels of guilt, providing insights into how the relationships between variables might change depending on the level of guilt experienced. Throughout the analysis, we adhered to common guidelines for assessing model fit, including examining the Chi-square statistic, comparative fit index (CFI), normed fit index (NFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). This comprehensive analytical strategy enabled us to rigorously test our hypotheses and evaluate the overall fit of our proposed model.

Research results Measurement model

The measurement model (refer to Fig. 2) was validated using CFA with maximum likelihood estimation. Overall fit indices indicated a good fit between the model and the data. The chi-square/degrees of freedom ratio $(\chi^2/df=41.02)$ was slightly higher than the recommended standard of less than 5, which is likely attributable to the large sample size. Other fit indices demonstrated acceptable to good fit: RMSEA=0.071 (\leq 0.08 indicating acceptable fit), SRMR=0.047 (\leq 0.08 indicating good fit), CFI=0.968, and NFI=0.967 (both exceeding the >0.9 threshold for good fit). Despite the elevated chi-square value, which is sensitive to large sample sizes, the overall pattern of fit indices suggested that the measurement model for all constructs in this study achieved an acceptable fit^{44,45}.

Convergent validity and reliability were assessed using several criteria, as presented in Table 1. All item standardized factor loadings ranged from 0.72 to 0.95, exceeding the recommended threshold of 0.5 and achieving statistical significance⁴⁶. Construct reliability (CR) and average variance extracted (AVE) for cyber moral literacy, cyberbullying, moral disengagement, and guilt all met the established criteria (CR>0.7 and AVE>0.5), providing strong evidence of convergent validity⁴⁷. Internal consistency was further supported by Cronbach's a values ranging from 0.85 to 0.98 across these dimensions⁴⁸.



Fig. 2. Confirmatory factor analysis model of study constructs. F1= "Cyber moral literacy"; F2= "Cyberbullying"; F3= "Moral disengagement"; F4= "Guilt".

Variables	A	В	С	D	E	F	G	Н	I	J	К	L
A. Plagiarism	0.95											
B. Unauthorized	0.67***	0.82										
C. Cyberbullying	-0.65***	-0.76***	0.94									
D. Moral justification	-0.53***	-0.43***	0.52***	0.90								
E. Euphemistic labeling	-0.62***	- 0.57***	0.69***	0.78***	0.90							
F. Advantageous comparison	-0.58***	- 0.65***	0.76***	0.66***	0.86***	0.90						
G. Displacement of responsibility	-0.52***	-0.48***	0.57***	0.68***	0.75***	0.75***	0.84					
H. Diffusion of responsibility	-0.45***	-0.35***	0.42***	0.59***	0.61***	0.56***	0.72***	0.90				
I. Distortion of consequences	-0.54***	- 0.59***	0.69***	0.61***	0.78***	0.84***	0.72***	0.66***	0.93			
J. Dehumanization	-0.52***	-0.51***	0.59***	0.63***	0.73***	0.73***	0.73***	0.67***	0.83***	0.87		
K. Attribution of blame	-0.46***	-0.43***	0.50***	0.59***	0.64***	0.63***	0.64***	0.59***	0.68***	0.82***	0.82	
L. Guilt	-0.01	0.10***	-0.10***	0.05*	-0.03	0.08^{**}	0.06**	0.13***	-0.05^{**}	0.02	0.06**	0.91

Table 2. Correlations among latent variables and square roots of average variance extracted. Diagonal elements represent the square root of the average variance extracted (AVE). p < 0.05, p < 0.01, p < 0.01.



Fig. 3. Structural model of direct effect of cyber moral literacy on cyberbullying. F1= "Cyber Moral Literacy"; F2= "Cyberbullying".

Discriminant validity was evaluated by comparing the correlations among constructs with the square root of the AVE for each construct. As shown in Table 2, the square roots of the AVEs for all constructs exceeded the inter-construct correlation coefficients, satisfying the criterion for discriminant validity⁴⁹. This indicates that each construct in the model is distinctly different from the others, further supporting the validity of the measurement model.

Given that the study relied on self-report data, which can be susceptible to common method bias, several preventive measures were taken. Reverse scoring methods were employed in the survey design to mitigate potential common method variance. Additionally, a one-factor CFA was conducted to test for common method bias. The results of this analysis (χ^2/df =293.65, RMSEA=0.186, RMR=0.702, CFI=0.399 and NFI=0.398) showed a significant deviation from the original model, suggesting that common method bias did not substantially influence the data⁵⁰.

In sum, the measurement model demonstrated good psychometric properties, with evidence supporting its reliability, convergent validity, and discriminant validity. The potential influence of common method bias was assessed and found to be minimal, further strengthening confidence in the measurement model's robustness.

Direct effect of cyber moral literacy on cyberbullying

To test Hypothesis 1, which proposed a direct negative relationship between cyber moral literacy and cyberbullying, we examined a structural model with cyber moral literacy as the predictor and cyberbullying as the outcome variable (Fig. 3). This model demonstrated acceptable fit with the sample data, despite an elevated χ^2 /df ratio (40.74, χ^2 =774.05, p < 0.001) due to the large sample size (*N*=7837). Other fit indices indicated good model fit: RMSEA = 0.071, SRMR = 0.021, CFI = 0.991, and NFI = 0.991.

The analysis revealed a strong, negative relationship between cyber moral literacy and cyberbullying ($\gamma = -0.86$, p < 0.001). Moreover, cyber moral literacy explained a substantial 75% of the variance in cyberbullying ($R^2 = 0.75$). These results provide strong support for Hypothesis 1, demonstrating that higher levels of cyber moral literacy are associated with lower levels of cyberbullying behavior among late adolescents.

Mediating role of moral disengagement

To test Hypothesis 2, which proposed that moral disengagement mediates the relationship between cyber moral literacy and cyberbullying, we examined a structural model incorporating moral disengagement as a mediator (Fig. 4). This model demonstrated good fit with the data: $\chi^2 = 4747.99 (p < 0.001)$, $\chi^2/df = 49.098$ (elevated due to



Fig. 4. Mediation effect of moral disengagement in the relationship between cyber moral literacy and cyberbullying. F1 = "Cyber moral literacy"; F2= "Cyberbullying"; F3= "Moral disengagement". *PL* plagiarism, *UN* unauthorized, *MJ* moral justification, *EL* euphemistic labeling, *AC* advantageous comparison, *DIS* displacement of responsibility, *DIF* diffusion of responsibility, *DOC* distortion of consequences, *DE* dehumanization, *AOB* attribution of blame.

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		95% confidence interval					
		BC/PC					
	Estimate	<i>p</i> value	BC	РС			
Indirect effect							
Cyber moral literacy \rightarrow moral disengagement \rightarrow cyberbullying	-0.155	0.001/0.001	-0.201~-0.102	-202~-0.104			
Direct effect							
Cyber moral literacy \rightarrow cyberbullying	-0.716	0.001/0.001	-0.786~-0.647	$-0.785 \sim -0.647$			
Total effect							
Cyber moral literacy \rightarrow cyberbullying	-0.871	0.001/0.001	-0.896~-0.845	$-0.895 \sim -0.844$			

Table 3. Bootstrapped estimates of direct, indirect, and total effects in mediation analysis. *BC* bias corrected, *PC* percentile method.

the large sample size, N = 7837), RMSEA = 0.079, SRMR = 0.041, CFI = 0.970, and NFI = 0.969. The standardized regression coefficients in the structural model ranged from 0.71 to 0.95.

In this mediation model, cyber moral literacy showed a strong negative association with moral disengagement ($\gamma = -0.75$, p < 0.001), while moral disengagement demonstrated a positive association with cyberbullying ($\gamma = 0.20$, p < 0.001). To assess the mediation effect, we compared the direct effect of cyber moral literacy on cyberbullying in models with and without the mediator. Without moral disengagement (Fig. 3), the effect of cyber moral literacy on cyberbullying was -0.86 (t = -80.55, p < 0.001). When moral disengagement was included as a mediator (Fig. 4), this direct effect decreased to -0.72 (t = -58.70, p < 0.001), suggesting partial mediation.

Further analysis of total, direct, and indirect effects using a bootstrap approach (Table 3) revealed significant effects across all pathways. The indirect effect of cyber moral literacy on cyberbullying through moral disengagement was -0.155 (95% CI [-0.201, -0.102] for bias-corrected and [-0.202, -0.104] for percentile method, p = 0.001). The direct effect of cyber moral literacy on cyberbullying remained substantial at -0.716 (95% CI [-0.786, -0.647] for bias-corrected and [-0.785, -0.647] for percentile method, p = 0.001). The total effect of cyber moral literacy on cyberbullying was -0.871 (95% CI [-0.896, -0.845] for bias-corrected and [-0.895, -0.844] for percentile method, p = 0.001).

These results indicate that moral disengagement partially mediates the association between cyber moral literacy and cyberbullying, supporting Hypothesis 2. The significant indirect effect (-0.155) suggests that a portion of the influence of cyber moral literacy on cyberbullying operates through moral disengagement. However, the larger direct effect (-0.716) indicates that cyber moral literacy also has a substantial direct influence on cyberbullying, independent of moral disengagement.

Indices	Criterion	Full sample	Low group of guilt	High group of guilt
χ^2/df	<5.000	49.098	20.754	29.942
RMSEA	< 0.080	0.079	0.077	0.080
SRMR	< 0.080	0.041	0.030	0.047
NFI	>0.900	0.969	0.970	0.953
CFI	>0.900	0.970	0.976	0.963

Table 4. Model fit statistics across different levels of guilt.

Moderation effect of guilt

To test Hypothesis 3, which proposed that guilt moderates the relationship between cyber moral literacy and cyberbullying, we employed multi-group analysis. The guilt variable was dichotomized using K-means cluster analysis, resulting in low (n=3341) and high (n=4496) guilt groups. The effectiveness of this grouping was confirmed through discriminant analysis, which yielded a 100% hit rate, and an independent samples *t*-test (t = -112.037, p < 0.001), demonstrating significant differences between the groups.

Multi-group structural equation modeling (SEM) was performed to evaluate model fit across high and low guilt groups (Table 4). While the χ^2 /df ratios were elevated due to the large sample size, all other fit indices met conventional threshold criteria. A chi-square difference test was conducted to assess the moderating effect, revealing a significant difference ($\Delta\chi^2 = 72.853$) between the constrained and unconstrained models, which exceeded the critical value of 3.84 (df = 1, p < 0.001). These findings demonstrate significant variation in path coefficients between high and low guilt groups, providing empirical support for guilt as a moderator in the relationship between cyber moral literacy and cyberbullying behavior.

Analysis of path coefficients demonstrated that cyber moral literacy significantly predicted cyberbullying in both low ($\beta = -0.650$, p < 0.001) and high ($\beta = -0.840$, p < 0.001) guilt groups. The stronger coefficient in the high guilt group ($\Delta\beta=0.190$) suggests that guilt amplifies the negative effect of cyber moral literacy on cyberbullying, supporting Hypothesis 3. These findings indicate that the inverse relationship between cyber moral literacy and cyberbullying is more pronounced for individuals experiencing higher levels of guilt.

Discussion

This study primarily investigated the impact of cyber moral literacy on cyberbullying, examining moral disengagement as a mediator in this relationship, and exploring guilt's moderating role in this pathway.

Results demonstrate a significant inverse relationship between cyber moral literacy and cyberbullying behaviors among late adolescents (aged 18–21). Higher levels of cyber moral literacy corresponded with lower levels of cyberbullying behavior. This relationship may be attributed to adolescents' lack of understanding of online moral norms, potentially leading to deviant behaviors in cyberspace²⁷. Moral emotions play a crucial role in cyberbullying¹⁸, with individuals adhering to moral norms and possessing correct moral values being less likely to engage in cyberbullying⁵². This aligns with the need for tailored moral education programs or innovative cyber moral leadership models to address negative behaviors in cyberspace⁵³. The anonymity characteristic of cyberbullying, unlike traditional bullying, reduces the perceived cost of immoral behavior, potentially leading to decreased self-control and increased cyberbullying behaviors among adolescents⁵⁴.

The results demonstrate that moral disengagement serves as a partial mediator in the relationship between cyber moral literacy and cyberbullying among late adolescents. Specifically, cyber moral literacy exerts both a direct effect on cyberbullying and an indirect effect through moral disengagement. This partial mediation operates through two key mechanisms. First, individuals with lower cyber moral literacy show a higher propensity for moral disengagement, as demonstrated by their reduced adherence to traditional moral standards²⁴. Second, the unique characteristics of online environments facilitate moral disengagement by creating psychological distance between perpetrators and victims⁵². This psychological distance, combined with the reduced ability to perceive the immediate consequences of one's actions online⁵⁶, increases the likelihood of engaging in cyberbullying behaviors. These findings align with and extend previous research establishing strong associations between moral disengagement and cyberbullying^{57,58}, while specifically highlighting the role of cyber moral literacy in this process.

The study revealed that guilt moderates the association between cyber moral literacy and cyberbullying. Students with stronger feelings of guilt demonstrated a more pronounced inhibitory effect on cyberbullying compared to those with weaker feelings of guilt. As the level of cyber moral literacy increased, students with higher guilt showed a more marked effect in inhibiting cyberbullying. Guilt, as a moral emotion, enables individuals to anticipate the harmful outcomes of moral transgressions³⁵, facilitating behavior change for more positive outcomes. When experiencing guilt, individuals are motivated to compensate for harm caused to others or groups. If direct compensation is not possible, they may seek various ways to alleviate their guilt, aiming to restore moral identity, self-values, interpersonal relationships, and positive emotional factors^{28,35}. The process of guilt generation reinforces the pathway of moral literacy's influence on harmful behavior.

In contrast, individuals with low levels of guilt may be less responsive to moral knowledge and principles, as they are less likely to experience emotional consequences from moral violations⁵². This diminished emotional responsiveness to moral transgressions may weaken the connection between understanding moral principles (cyber moral literacy) and actual behavior (cyberbullying), potentially explaining the less pronounced effect of cyber moral literacy on cyberbullying behavior among individuals with low guilt.

Although this study has revealed the impacts of adolescents' cyber moral literacy, moral disengagement, and guilt on cyberbullying, several potential variables warrant further investigation, particularly moral courage^{59–61} in the context of internet norms. Recent research has demonstrated that moral courage plays a crucial role in improving the online environment by enabling individuals to speak up against norm violations⁵⁹. Individuals with higher moral courage are more likely to overcome fear and actively intervene when witnessing online misconduct, thereby helping to establish and maintain positive internet norms. This aspect is particularly relevant to our study's focus on moral disengagement, as research has shown that moral courage can counteract moral disengagement mechanisms⁶⁰.

Beyond moral courage, other factors could influence adolescents' cyber moral behaviors. Psychological resilience may affect how adolescents cope with and respond to online pressures and negative experiences⁶², while home Internet rules set by parents could shape adolescents' understanding of appropriate online behavior and establish boundaries for digital interactions⁶³. Future research should examine how moral courage interacts with our model's variables (cyber moral literacy, moral disengagement, and guilt) in fostering a more ethical online environment. Understanding these relationships could inform interventions that both enhance moral awareness and empower adolescents to actively intervene against cyberbullying, thereby contributing to more positive internet norms.

This study offers significant theoretical and practical implications. From a theoretical perspective, our findings expand current understanding of the complex relationships among cyber moral literacy, moral disengagement, guilt, and cyberbullying in adolescents. By establishing moral disengagement as a mediating mechanism and guilt as a moderating factor, we contribute to theoretical frameworks that explain the psychological processes underlying cyberbullying behavior. These findings enrich existing models in adolescent cyber behavior and moral psychology, providing a more comprehensive understanding of how these psychological factors interact to influence cyberbullying outcomes.

From a practical standpoint, our findings have important implications for multiple stakeholders. For educators and school administrators, the results underscore the critical importance of developing comprehensive cyber ethics education programs that enhance students' moral literacy in online environments. Given the mediating role of moral disengagement, interventions should specifically target mechanisms that lead to moral disengagement, helping students maintain ethical awareness in digital spaces. The moderating effect of guilt suggests that fostering appropriate emotional responses to harmful online behavior could serve as an effective deterrent to cyberbullying. Mental health professionals can utilize these insights to develop more targeted and effective interventions for both perpetrators and victims of cyberbullying, focusing on strengthening moral awareness, reducing moral disengagement tendencies, and developing healthy emotional regulation skills. These findings can inform the design of prevention programs and therapeutic approaches aimed at creating safer and more positive online environments for adolescents.

Limitations

This study has several limitations that should be addressed in future research. First, the use of convenience sampling, limited to late adolescent students from four undergraduate institutions in Sichuan Province, restricts the generalizability of our findings. Future studies should employ more diverse sampling strategies across multiple provinces to enhance external validity. Second, while our study focused on cyber moral literacy, moral disengagement, and guilt as factors influencing cyberbullying, numerous other potential variables were not considered. Subsequent research could expand the scope of variables examined to provide a more comprehensive understanding of cyberbullying determinants. Third, the reliance on self-reported data may have introduced biases related to social desirability and recall accuracy. To mitigate these limitations, future investigations could employ mixed-method approaches, incorporating interviews and observational techniques alongside surveys. This methodological triangulation would yield richer, more objective data, particularly beneficial for process analysis and result interpretation. Finally, a key limitation of this study is the use of cross-sectional data to examine mediation effects, which Maxwell and Cole⁶⁴ note can be problematic. While our statistical analyses were methodologically sound, cross-sectional data captures relationships at only one time point, limiting our ability to draw causal inferences and understand the temporal dynamics between variables. Future research employing longitudinal designs would enable more robust examination of the causal mechanisms and temporal relationships among these variables.

Conclusion

In the contemporary digital landscape, adolescents navigate an environment characterized by rapid information dissemination, necessitating the development of appropriate cyber moral concepts. These moral literacies are crucial not only for individual behavior but also for maintaining harmony and order within the entire online community. The present study yielded several significant findings: (1) cyber moral literacy demonstrated a strong negative association with cyberbullying; (2) moral disengagement partially mediated the relationship between cyber moral literacy and cyberbullying; (3) guilt moderated the association between cyber moral literacy and cyberbullying. These results underscore the complex interplay of moral, cognitive, and emotional factors in adolescent online behavior.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Y.X.S: Conceptualization, Writing - original draft. C.H.C: Data curation, Formal analysis. Writing - review & editing. Z.J.T.: Resources, Validation; Visualization. F.M.H: Resources, Investigation, Methodology. X.B.Z.: Data curation, Formal analysis. I.H.C.: Conceptualization, Writing - original draft, Supervision. All authors reviewed the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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