Original Article

Psychometric Properties and Measurement Invariance of the Chinese Version of the Internet Moral Literacy Scale

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Abstract

Introduction: With the rapid rise of the Internet, it has become an indispensable part of adolescents' learning and lives. To promote sustainable development of the Internet, fostering good Internet moral literacy among adolescents is particularly important. Given the current absence of a Chinese version of the Internet Moral Literacy Scale suitable for adolescents, this study translated and conducted two studies on the scale developed by Lau and Yuen. **Methods:** In Study 1, item analysis and factor validity analysis of the scale were conducted with 343 adolescents from China. In Study 2, a large-scale cross-sectional survey was conducted to analyze descriptive statistics, factor validity, measurement invariance across genders, difference analysis, and concurrent validity of the scale. The study 2 involved 7837 Chinese adolescents. **Results:** The results from study 1 showed that most items met the specified criteria. However, one item exhibited higher internal consistency than the overall Cronbach's alpha value when removed. Exploratory factor analysis indicated a more suitable two-dimensional model, with one item showing cross-loading issues. Study 2 revealed that the Internet Moral Literacy Scale had good internal reliability, and the two-factor structure exhibited excellent factor validity. In addition, significant gender differences in Internet moral literacy levels were identified, with males scoring lower than females. A significant negative correlation was found between Internet moral literacy and both cyberbullying ($r = -0.87$, $P < 0.001$) and moral disengagement ($r = -0.75$, $P < 0.001$). **Conclusion:** Chinese version of the Internet Moral Literacy Scale has good psychometric properties.

Keywords: *Cyberbullying, Internet moral literacy, moral disengagement, reliability and validity*

Introduction

The advent and proliferation of various social media platforms have marked every corner of the Internet, allowing users worldwide to exist in a hidden and independent manner on these platforms.[1] According to Statista data as of the first quarter of 2023, monthly active users of various online platforms range from 556 million to 2.958 billion. Facebook, founded in 2004, leads with approximately 2.98 billion monthly active users, making it the most used online social networking site.[2] In addition, Statista reported that in 2019, over 41.6 million mobile messages and 2.1 million snaps were sent globally every minute on the Internet. In China, as per the 50th "Statistical Report on Internet Development in China," as of June 2022, there are 1.051 billion netizens with an Internet penetration rate of 74.4%. Adolescents aged 10–29 years constitute 30.5% of netizens, approximately 321 million people.[3] Given this rapid development of the Internet, the application of online platforms and the maintenance of Internet order have become increasingly significant.[4]

Martin Luther King Jr. once said, "One should be more concerned with inner moral principles, not just obeying external laws." Internet morality transcends national, international, or transnational legal jurisdictions, forming a normative mode in the global space. In the context of global space, traditional legal frameworks may be insufficient in addressing the unique challenges of the digital domain, but Internet moral literacy can play a significant role.[5] Therefore, beyond the norms of Internet law, improving Internet moral literacy becomes crucial. Johnson, in his book, mentions that discussing morality implies a focus on human behavior.[6] Morality is a standard to examine human conduct and shape societal behavior, guiding the thinking process of the doer.[7] Just as moral norms are required to regulate people's behavior in real society, similar

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norms are needed in online social interactions to restrain netizens' behavior.[8]

Internet moral literacy refers to moral values, standards, and behavioral norms manifested in an online environment, encompassing aspects such as privacy protection, respect for intellectual property rights, and accuracy and reliability of information.[9] It represents the manifestation of values in online behavior, and thus, analyzing online behavior can be used to assess an individual's Internet moral literacy.[10] To this end, Lau and Yuen developed a simple and effective tool, the Internet Moral Literacy Scale, consisting of ten items representing immoral behaviors.[11] Compared to other tools developed for assessing Internet moral literacy, such as immoral activities,[12] Internet moral codes,[13] unethical behaviors,[14] moral judgments,[15] and Internet moral literacy,[8,16] Lau and Yuen's scale has several advantages.

First, compared to other scales, Lau and Yuen's scale has fewer items, making it more suitable for longitudinal and large-scale sample studies, ensuring a high response efficiency from participants.[11] For instance, Freestone and Mitchell's scale on immoral activities included 23 items;[12] McMahon and Cohen's moral judgment scale had 20 items.[15] Both these scales have a higher number of items compared to the Internet Moral Literacy Scale.

Second, the Internet Moral Literacy Scale exhibits good internal consistency, with clearer dimensions of Internet moral literacy measurement, including Unauthorized Acts (UNAC), Internet Stickiness (INST), and Plagiarize.[11] By contrast, Bei's study analyzed the current situation of adolescent Internet literacy, considering Internet moral literacy as one dimension of Internet literacy.[8] Zheng and Liu's study on the development and validation of the Adolescent Internet Literacy Scale treated Internet moral literacy as a single dimension.[16] However, these studies did not present evidence of internal consistency reliability or factor validity for these items.

Moreover, the item design of the Internet moral literacy scale is more widely applicable for measuring adolescents' level of Internet moral literacy.[11] For example, one of the items states, "For homework assigned by the teacher, I sometimes copy from the Internet without citing the source." In comparison, Freestone and Mitchell's scale, such as "buying and selling organs on the Internet," is clearly not relevant to adolescents' life contexts.[12] Masrom *et al.*'s scale items included statements like "not considering the social consequences of the program you are writing or the system you are designing," limiting the study to computer science students.[13] Khazanchi's research on unethical behavior reflected in this study were mainly focused on scenarios such as "programmers serving new employers with old programs," and "professors publishing papers without crediting contributing graduate students," which are not suitable for a wide application in measuring adolescents' Internet immoral behavior.[14]

In summary, based on the advantages of Lau and Yuen's Internet Moral Literacy Scale compared to other scales, it is quite suitable for measuring adolescents' Internet moral literacy. Since there is no Chinese version of this scale to date, the purpose of this study is to translate it and explore its psychometric properties. In addition, to our knowledge, no study on gender differences in Internet moral literacy has tested whether the scale's measurement model exhibits equivalent characteristics in male and female groups.[11,14,15] Therefore, this study not only measures the internal reliability and factor structure of the Internet Moral Literacy Scale but also performs measurement invariance tests across genders.

In this study, in addition to testing the factor validity of the Internet Moral Literacy Scale, we will also examine the association between Chinese adolescents' Internet moral literacy and cyberbullying, moral disengagement, using the latter two as criterion variables to test the concurrent validity of the translated scale. Cyberbullying involves intentional malicious acts using digital technology and social media to harm, threaten, or humiliate individuals.[17] When explaining the occurrence of cyberbullying behavior, morality is an important factor to consider.[18] The virtual nature of the Internet obscures external human characteristics, making it easy for adolescents to relax their moral constraints,[19] leading to cyberbullying. In Canada, the Digital and Media Literacy Centre, in collaboration with the Canadian government and the Teachers' Union, developed a cyber literacy education program for cyberbullying, named "Cyberbullying: Encouraging Ethical Online Behavior,"[20] aimed at curbing the occurrence of cyberbullying through the promotion of Internet moral literacy. The above studies collectively indicate a clear correlation between Internet moral literacy and cyberbullying.

Similarly, there is an association between adolescents' Internet moral literacy and moral disengagement. Moral disengagement is a cognitive mechanism that moralizes behaviors considered immoral through a self-regulation process, explaining the internal psychological process behind immoral behavior decisions.[21] Bandura *et al.* divided moral disengagement into eight cognitive mechanisms, including moral justification, euphemistic labeling, advantageous comparison, displacement of responsibility, diffusion of responsibility, distortion of consequences, dehumanization, and attribution of blame.[21] Individuals with high Internet moral literacy are more attentive to others' suffering and have stronger moral sensitivity, imposing higher moral demands on themselves, thereby not resorting to moral justification, euphemistic labeling, and other psychological mechanisms for moral disengagement.[22] In addition, individuals with higher Internet moral literacy usually possess a high level of moral identity,[23] guiding self-regulation and promoting the visualization of moral action standards, thus reducing the execution of moral disengagement mechanisms.

To evaluate the psychometric properties of the Internet Moral Literacy Scale, two different studies were conducted in this research. The first study involved a pilot test, performing item analysis and exploratory factor analysis; the second study expanded the participant pool to include adolescents from four undergraduate colleges, systematically assessing the psychometric properties of the Internet Moral Literacy Scale and the correlation between Internet moral literacy and criterion variables such as moral disengagement and cyberbullying.

Study 1

Methods

Participants

A convenience sampling strategy was employed to select participants from four distinct universities located in Sichuan Province, China. In this process, collaboration was sought with the student affairs departments of these institutions. These offices facilitated the distribution of the survey by providing the online survey hyperlink to their respective staff members, who subsequently forwarded it to class counselors. This method ensured a wider and more efficient dissemination of the survey. It is noteworthy that participation in the survey was both anonymous and voluntary, adhering to ethical research standards. The survey successfully garnered responses from a total of 343 students across the mentioned universities. Among these, 165 were males, accounting for 48.1% of the sample, aged between 18 and 21 years. This sample group falls into the late adolescent category, with an average age of M = 18.79, standard deviation (SD) =0.815. Students from three academic years participated, with the 1st-year students being the most represented at 155 individuals, or 45.2% of the sample. A majority of the participants, 231 (67.3%), hailed from rural areas, and 242 (70.6%) were not only children.

Measures

Internet moral literacy scale

This scale measures immoral behavior on the Internet and was developed by Lau and Yuen. It comprises three dimensions: UNAC, INST, and Plagiarism, each containing 4, 2, and 4 items respectively, totaling 10 items. Responses are recorded on a 5-point Likert scale ranging from 1 (never) to 5 (often). The scores of each dimension are summed to obtain the overall score, with higher scores indicating lower Internet moral literacy. The English version of the scale has demonstrated good reliability and validity.[11] In this study, the Internet Moral Literacy Scale showed good internal consistency among all participants, with a total Cronbach's α of 0.847 and Cronbach's α for each dimension being 0.923, 0.799, and 0.913, respectively.

Research procedure

This study utilized the back-translation[24] method for the revision of the Chinese version of the Internet Moral Literacy Scale. The initial translation from English to Chinese was executed by two Ph.D. holders in education management, both of whom had studied in the United Kingdom. To ensure linguistic accuracy, this Chinese translation was subsequently reviewed and refined by two teachers with expertise in English. The revised English version was then back-translated into Chinese, resulting in the initial draft of the scale's Chinese version. The finalization of this draft involved critical examination and discussion by a professor of psychology and a professor specializing in education management. Their collaborative effort ensured the precision and contextual appropriateness of the finalized Chinese version of the Internet Moral Literacy Scale.

The preliminary testing of the Internet Moral Literacy Scale was carried out during class meetings, supervised by class advisors. Each testing session involved about 30 students and was conducted as part of the class meeting agenda without offering any incentives. Before the survey, advisors explained the questionnaire's basics and distributed QR codes via tools like QQ and WeChat once the participants understood the contents. The advisors monitored the students while they completed the survey, allowing them to leave the classroom only after finishing.

Participants completed questionnaires including (i) demographic information and (ii) the Internet Moral Literacy Scale. The survey took approximately 15 min to complete, and a total of 343 valid questionnaires were collected.

Statistical analysis

The study used SPSS version 22.0 for statistical analysis, comprising item analysis and factor validity analysis. The item analysis included independent sample *t*-tests for extreme group analysis, Pearson correlation to understand the correlation of items with the total score, and reliability analysis to compare Cronbach's α after item deletion with overall reliability. Factor validity was examined through exploratory factor analysis to clarify the factor structure and item dimensions.

Results

Item analysis

The item analysis of the Internet Moral Literacy Scale revealed that the scale met the set standards in terms of judgment value comparison, item-total correlation, and corrected item-total correlation, as shown in Table 1. However, the internal consistency coefficient for the item "Immediately going online upon waking up during holidays" in the INST dimension was higher than the overall Cronbach's α value after item deletion. The necessity of item deletion will be further examined in Study 2.

Factor validity

Through exploratory factor analysis, the Bartlett's Test of Sphericity yielded a KMO value of 0.879, $\chi^2 = 3018.991$, df = 45, $P < 0.001$, indicating that the sample was suitable for factor analysis. This study employed the principal axis factor method, incorporating an optimal oblique (promax) rotation, and adhered to the criterion of eigenvalues >1 for factor extraction. This analytical approach yielded two distinct factors. Further validation of this factor structure was obtained through the analysis of the scree plot, which also supported the extraction of two factors [Figure 1]. Subsequently, it was determined that the two-dimensional model consisted of two constructs: "Unauthorized Acts," encompassing four items, and "Plagiarism," comprising six items [Table 2]. However, the item "Using pirated software" showed cross-loading issues, as the factor loadings on both factors were close. In addition, the item "Immediately going online upon waking up during holidays" in the INST dimension had a negative factor loading, and its removal had previously been shown to increase the internal consistency coefficient above the overall Cronbach's α value in the item analysis. Study 2 will further investigate whether to retain these two items.

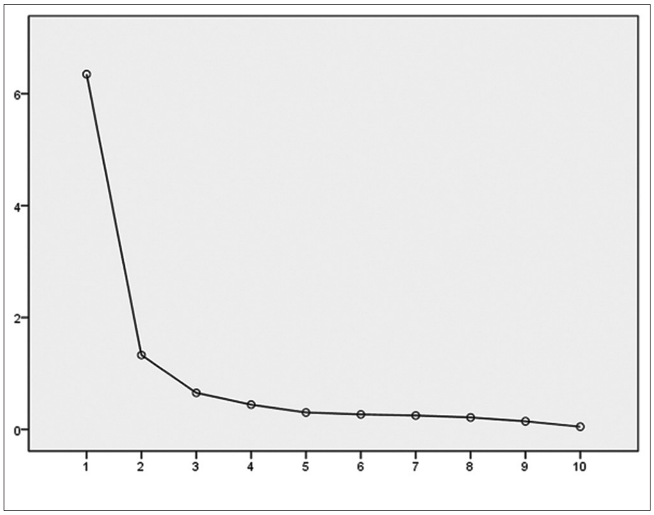

Figure 1: Scree plot of the exploratory factor analysis

To prevent overestimation of the number of factors, Study 2 will compare and analyze the single-dimension model, bi-dimensional model, bi-dimensional model with item deletion, and the original tri-dimensional model of the scale to determine the optimal model structure of the Internet Moral Literacy Scale.

Study 2

Method

Participant

In July 2023, Study 2 was conducted as a large-scale cross-sectional study employing convenience sampling. This approach was used to gather data from four undergraduate institutions in Sichuan Province, China. Collaboration was sought with the student affairs offices of these institutions, which facilitated the distribution of the survey by sending the links to their staff members, who in turn forwarded them to class counselors. This process resulted in a substantial response, with a total of 7837 students completing the survey. Among them, 2994 were males, accounting for 38.2% of the sample, with ages ranging from 18 to 21 years. This group represents late adolescence, with an average age of M = 20, SD = 0.683. Students from three academic years participated, with 2nd-year students being the most numerous, totaling 4339, or 55.4% of the sample. A majority, 5597 (71.4%), came from rural areas, and 5672 (72.4%) were not only children.

Table 1: Item analysis results for the 343-Sample Internet Moral Literacy Scale

Selection standardized	Mean (SD)	Skewness (Kurtosis)	Extreme group comparison: Value of a decision) (CR) (≥3.0)	Relevance testing			The number of indicators not reached
				Correlation of question items to total score (≥0.400)	Corrected items correlate to the total score (≥0.400)	Cronbach's alpha (if the item is deleted) (<0.847)	
UN1-1	4.76 (0.70)	−3.12 (9.66)	16.262***	0.894***	0.858	0.804	0
UN1-2	4.76 (0.69)	−3.15 (9.90)	15.891***	0.882***	0.84	0.805	0
UN1-3	4.70 (0.75)	−2.73 (7.37)	19.106***	0.838***	0.781	0.81	0
UN1-4	4.42 (0.90)	−1.60 (2.21)	14.740***	0.701***	0.605	0.827	0
IN2-1	4.06 (1.06)	−0.93 (0.09)	10.345***	0.558***	0.428	0.844	0
IN2-2	3.80 (1.21)	−0.69 (−0.56)	4.085***	0.352***	-0.49	0.923	1
PL3-1	4.47 (0.85)	−1.70 (2.76)	17.871***	0.818***	0.76	0.814	0
PL3-2	4.36 (0.92)	−1.45 (1.75)	17.870***	0.778***	0.71	0.818	0
PL3-3	4.26 (0.92)	−1.21 (1.14)	15.518***	0.758***	0.678	0.821	0
PL3-4	4.48 (0.85)	−1.72 (2.72)	19.202***	0.810***	0.749	0.814	0

$P<0.05$, $P<0.01$, ***$P<0.001$. $n=343$. UN: Unauthorized, IN: Internet stickiness, PL: Plagiarism, SD: Standard deviation, CR: Composite reliability

Table 2: Validity analysis results for the 343-Sample Internet Moral Literacy Scale

Subscale	Item	Factor loading	Square loading behind the rotating shaft		Cronbach's α
			Eigen value	Explanatory variable %	
Unauthorized	UN1-1	0.953	5.659	56.586	0.923
	UN1-2	0.943			
	UN1-3	0.903			
	UN1-4	0.669			
Plagiarize	PL3-2	0.845	1.159	68.181	0.610
	PL3-3	0.824			
	PL3-1	0.796			
	PL3-4	0.775			
	IN2-1	0.692			
	IN2-2	−0.677			

Overall reliability of the scale: 0.847. UN: Unauthorized, IN: Internet sticky, PL: Plagiarism

Ethical consideration

Ethical approval was obtained in advance from the Institutional Review Board (IRB) of Yibin University (IRB references: 20231123002).

Measures

Internet Moral Literacy Scale

This scale, the same as used in the preliminary study, measures immoral behavior on the Internet. The scale exhibited good internal consistency among all participants, with a total Cronbach's α of 0.925, and the Cronbach's α for each dimension being 0.920, 0.806, and 0.919.

Cyberbullying scale

Developed by Xie *et al.*,[25] this scale measures cyberbullying behavior. It consists of 12 items, 6 each for cyberbullying and victimization. This study employed the cyberbullying construct sub-scale, which includes six items (e.g. Posting or retweeting comments online that embarrass or are mean to others; sending or forwarding photos or videos that someone does not want others to see or that are embarrassing). Respondents rate each item on a 5-point Likert scale from 0 (never) to 4 (daily). Higher average total scores indicate higher levels of cyberbullying. The scale has demonstrated good reliability and validity.[25] In this study, the Cyberbullying Scale showed good internal consistency, with a Cronbach's α of 0.978.

Moral disengagement scale

This questionnaire, developed by Detert *et al*.,[26] measures the extent of moral disengagement. It consists of 24 items (e.g., Its okay to fight to protect your friends; telling a friend the answer to a test is just a way to help them out.), covering eight dimensions: moral justification, euphemistic labeling, advantageous comparison, displacement of responsibility, diffusion of responsibility, distortion of consequences, attribution of blame, and dehumanization. The items are rated on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater moral disengagement. The scale has shown good reliability and validity.[26] In this study, the Moral Disengagement Scale exhibited good internal consistency, with an overall Cronbach's α of 0.971 and the Cronbach's α for each dimension being 0.846, 0.897, 0.944, 0.923, 0.873, 0.915, 0.854, and 0.923.

Research procedure

The formal survey was supported by the student affairs offices of the participating schools, with class advisors conducting the survey online. Advisors explained the questionnaire and distributed QR codes in class groups, urging students to answer seriously to understand the indicators of adolescent participation in online activities. The questionnaires filled by participants included: (i) demographic information; (ii) Internet Moral Literacy Scale; (iii) Cyberbullying Scale; and (iv) Moral Disengagement Scale. The survey took approximately 15 min, after which participants exited the online meeting room.

Statistical analysis

The study employed SPSS 22.0 and Amos 21.0 for statistical analysis, including: Descriptive analysis and Pearson correlation to understand the levels and correlations of Internet moral literacy, moral disengagement, and cyberbullying.

Factor validity testing: regarding factor validity testing, the confirmatory factor analysis (CFA) utilized the maximum likelihood estimation method, confirming the normal distribution of data among participants. The CFA aimed to compare three distinct models: the three-dimensional model, a modified bidimensional model, and the original three-dimensional model. To assess the factorial validity, we employed several indices: the comparative fit index (CFI), the nonnormed fit index (NNFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Following the guidelines set by Hu and Bentler,[27] a well-fitted model was defined as having a CFI and NNFI value >0.95, an RMSEA value <0.08, and an SRMR value <0.08. Convergent validity was established when the dimensions' composite reliability (CR) exceeded 0.6, and the average variance extracted (AVE) was >0.5.[28]

Measurement invariance across genders

Multi-group CFA was used to test differences in factor structure, factor loadings, observed variable intercepts, and observed variable residuals between male and female groups. According to Chen, the following changes in ΔCFI, ΔRMSEA, and ΔSRMR support measurement invariance of the constrained model: ΔCFI >−0.01, ΔRMSEA < 0.015, and ΔSRMR < 0.03 (for factor loadings) or < 0.01 (for item intercepts and construct covariances).[29]

Independent samples *t*-test: After completing the measurement invariance tests, the study proceeded to examine gender differences in Internet.

SEM analysis was used to explore the correlation between Internet moral literacy and criterion variables such as cyberbullying and moral disengagement, testing the concurrent validity of the Internet moral literacy scale.

Results

Descriptive statistical analysis

Statistical descriptive analyses of the means and SDs for each variable and presents the correlations between Internet moral literacy, cyberbullying, and moral disengagement. The analysis show that: the average score of Internet moral literacy was 44.06, above the mid-value of 25, suggesting that adolescents' overall Internet moral literacy is above average. The mean score for moral disengagement was 39.63, below the mid-value of 60, indicating below-average levels of moral disengagement among adolescents. The average score for cyberbullying was 7.93, below the mid-value of 15, signifying that overall cyberbullying among adolescents is below average. All variables reached a significant level, with correlation coefficients of the observed variables ranging between .368 and .866.

Psychometric properties

Factor validity

Using AMOS 21.0, the study analyzed the fit of the single-dimension model, bi-dimensional model, bi-dimensional model with item deletion, and the original tri-dimensional model. The results, as shown in Table 3, indicated that the single-dimension model had poor fit: CFI = 0.718, NNFI = 0.718, RMSEA = 0.275, SRMR = 0.150, failing to meet the fit index evaluation criteria. Study 1 had already identified issues with the bi-dimensional model, specifically the item "Using pirated software" showing small differences in factor values and "Immediately going online upon waking up during holidays" increasing internal consistency when removed. Therefore, two versions of the bi-dimensional model were compared: one with and one without these items. The analysis revealed that the RMSEA and SRMR were relatively high in the un-deleted bi-dimensional model. After deleting these two items, five items were grouped under the dimension "Plagiarism" and three under "Unauthorized Acts." The structural model analysis of this revised bi-dimensional model showed good fit: CFI = 0.984, NNFI = 0.984, RMSEA = 0.081, and SRMR = 0.033. The original tri-dimensional model showed high factor loadings for the UNAC dimension with two items reaching 0.97, and a high RMSEA, as detailed in Table 3.

The convergent validity of the revised bi-dimensional model was then evaluated. As shown in Table 4, the CR and AVE for the Plagiarism dimension were 0.909 and 0.669, respectively, and for the UNAC dimension, they were 0.963 and 0.898. Both dimensions met the standard criteria, and the standardized factor loadings of the observed variables were over 0.500 and significant in the *t*-tests, supporting the convergent validity of the revised bi-dimensional model.

Measurement invariance across genders

Gender-based measurement invariance was tested using AMOS 21.0. A multi-group CFA tested the measurement invariance of the revised bi-dimensional model of the Chinese version of the Internet Moral Literacy Scale between male and female groups. The measurement invariance included configural invariance models, weak invariance models, strong invariance models, and strict invariance models, examining differences in factor structure, factor loadings, observed variable intercepts, and residuals across groups. The fit indices of the multi-group measurement invariance models are presented in Table 5. Comparison revealed that the ΔCFI, ΔRMSEA, and ΔSRMR from Model M3 did not meet the criteria compared to Model M2, indicating that the scale only achieved weak invariance across genders.

Table 3: Testing the factor structure of the Internet Moral Literacy Scale

Modeling	χ^2 (df)	CFI	NNFI	RMSEA	SRMR
One-dimensional model	20796.044 (35)	0.718	0.718	0.275	0.150
Two-dimensional model (undeleted question)	5842.438 (34)	0.921	0.921	0.148	0.08
Two-dimensional model (postdeletion)	1003.329 (19)	0.984	0.984	0.081	0.033
Three-dimensional model	3448.666 (32)	0.954	0.953	0.117	0.072

CFI: Comparative fit index, NNFI: Nonnormal fit index, RMSEA: Root mean square error of approximation, SRMR: Standardized root mean square residuals

Table 4: Convergent validity

Pathway			Standardized factor loadings	SE	*P*	CR	AVE
IN_1	←	PL	0.614			0.909	0.669
PLAG_1	←	PL	0.849	0.019	<0.001		
PLAG_4	←	PL	0.886	0.019	<0.001		
PLAG_2	←	PL	0.865	0.020	<0.001		
PLAG_3	←	PL	0.844	0.020	<0.001		
UNAC_3	←	UN	0.893			0.963	0.898
UNAC_2	←	UN	0.973	0.007	<0.001		
UNAC_1	←	UN	0.974	0.007	<0.001		

Source: Compiled in this study. SE: Standard error, IN: Internet stickiness, PLAG: Plagiarize, UNAC: Unauthorized act, CR: Composite reliability, AVE: Average variance extracted, UN: Unauthorized, PL: Plagiarism

Table 5: Fit indices of gender measurement invariance models (*n*=7837)

Model	χ^2 (df)	*P*	CFI	RMSEA	SRMR	△CFI	△SRMR	△RMSEA
M1	957.590 (38)	0.000	0.985	0.056	0.025			
M2	1022.589 (44)	0.000	0.984	0.053	0.026	−0.001	0.001	−0.003
M3	2005.769 (47)	0.000	0.968	0.073	0.093	−0.016	0.067	0.020
M4	4500.761 (55)	0.000	0.927	0.102	0.096	−0.041	0.003	0.029

M1: Configural invariance models, M2: Weak invariance models, M3: Strong invariance models, M4: Strict invariance models, CFI: Comparative fit index, RMSEA: Root mean square error of approximation, SRMR: Standardized root mean square residual

An independent samples *t*-test were shown: revealed significant gender differences in Internet moral literacy levels, t (4781.45) = −10.265, $P < 0.001$, d = 0.31. Males (M = 42.96, SD = 8.34) scored lower in Internet moral literacy than females (M = 44.74, SD = 3.25). However, due to the lack of metric invariance of the Chinese version of the scale across genders, caution is advised when interpreting these gender differences.

Association between Internet moral literacy, cyberbullying, and moral disengagement

Using cyberbullying and moral disengagement as criterion variables, the study tested the impact of the bi-dimensional model of Internet moral literacy on these variables. As illustrated in Figure 2, there was a significant negative correlation between Internet moral literacy and cyberbullying ($\gamma = -0.87$, $P < 0.001$), and between Internet moral literacy and moral disengagement ($\gamma = -0.75$, $P < 0.001$). This confirmed the second research objective of the study: using cyberbullying and moral disengagement as criterion variables, the results demonstrated significant negative correlations between Internet moral literacy and these variables.

Discussion

Due to the lack of tools for assessing Internet moral literacy in China, this study conducted a large-scale cross-sectional survey to translate and systematically evaluate the psychometric properties of Internet moral literacy among adolescents, and its correlations with cyberbullying and moral disengagement. The study evaluated the factor structure of Internet moral literacy, finding that a bi-dimensional model, including Plagiarism and UNAC dimensions, was more suitable. It was observed that two items from the original scale were not suitable for the mainland Chinese adolescent population: "Immediately going online upon waking up during holidays" and "Using pirated software." Regarding gender-based measurement invariance, the study found that the bi-dimensional model did not exhibit measurement invariance between male and female groups. Furthermore, the study tested the criterion validity of Internet moral literacy with cyberbullying and moral disengagement as criterion validity, finding significant negative correlations, supporting the concurrent validity of the scale. These results will be further discussed in relation to related findings.

The results indicated that the Internet Moral Literacy Scale exhibited good internal reliability and factor validity, consistent with Lau and Yuen's findings.[11] Although the concept of Internet morality is abstract, the scale was designed considering the practical application of moral principles and ethical standards in the online environment. The item construction relied on a broad theoretical foundation to accurately reflect Internet moral literacy across different dimensions. This encourages future researchers to continue exploring and utilizing this tool to gain a more comprehensive understanding of adolescents' Internet moral literacy and provide more effective tools and mechanisms for Internet moral education.

The results clearly showed that higher levels of Internet moral literacy among adolescents are associated with a lower likelihood of engaging in cyberbullying. This phenomenon may partly stem from adolescents' insufficient understanding of Internet moral relationships and ethical norms. The virtual nature of the Internet can obscure the

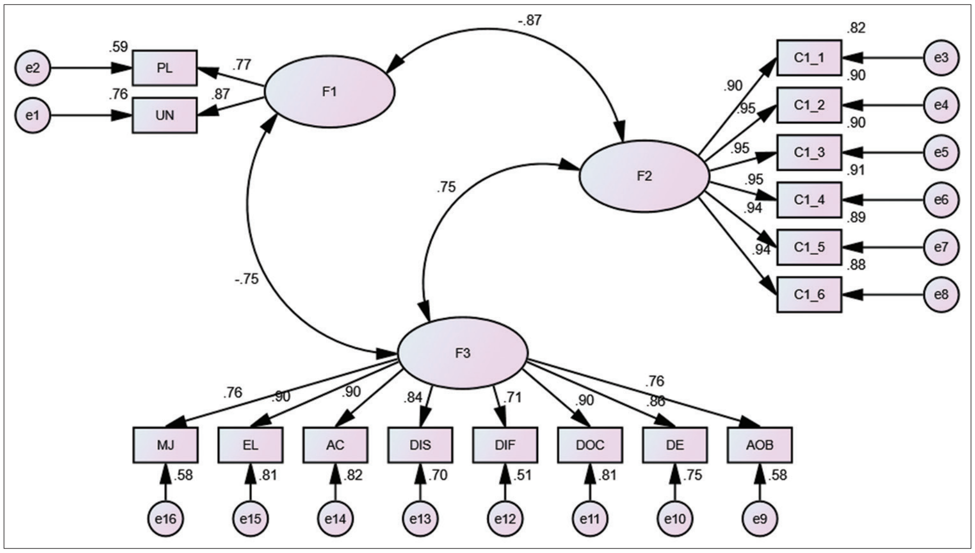

Figure 2: Correlations between Internet moral literacy, cyberbullying, and moral disengagement. Note: F1: Internet moral literacy, F2: Cyberbullying, F3: Moral disengagement, PL: Plagiarism, UN: Unauthorized, MJ: Moral justification, EL: Euphemistic labeling, AC: Advantageous comparison, DIS: Displacement of responsibility, DIF: Diffusion of responsibility, DOC: Distortion of consequences, DE: Dehumanization, AOB: Attribution of blame

external characteristics of individuals, making it easier for adolescents to relax their self-imposed moral constraints, leading to cyberbullying behaviors. This aligns with findings from studies by Perren *et al.*, and Li and Yan.[18,19] High levels of Internet moral literacy, typically combined with a broad knowledge and information literacy, allow adolescents to consciously avoid engaging in cyberbullying behaviors, reflecting the importance of Internet moral literacy education. In addition, individuals with high literacy levels are usually better at self-management and emotional control, helping them avoid impulsive and malicious online behaviors. They are more likely to handle conflicts and dissatisfaction rationally rather than venting emotions through cyberbullying.

The study found a negative correlation between adolescents' Internet moral literacy and moral disengagement, indicating that adolescents with lower Internet moral literacy are more likely to exhibit moral disengagement. This is consistent with studies by Wu and Zeng *et al.*[22,30] Adolescents with higher levels of Internet moral literacy are generally more capable of moral reflection and self-control,[31] meaning they are more likely to consider the impact of their actions on others and society and have the ability to restrain themselves, thereby adhering to moral standards during cognitive processes. In terms of emotional intelligence development, adolescents developing Internet moral literacy might simultaneously cultivate emotional intelligence, including empathy and understanding others' feelings, making them less likely to activate moral disengagement mechanisms.[30]

The study also conducted separate descriptive statistical analyses of the overall Internet Moral Literacy Scale and individual items to understand the current issues in Internet moral literacy among Chinese adolescents. The results revealed significant gender differences in Internet moral literacy levels, with males scoring lower than females, consistent with Lau and Yuen's findings.[11] However, due to the lack of measurement invariance of the bi-dimensional model between male and female groups, caution is advised when interpreting these gender differences. Individual item analysis showed that a significant proportion of students admitted to "copying content or images from the Internet for assignments without citing sources" (41%) and "submitting assignments using online translators" (48.6%), indicating a clear lack of ability among adolescents to use the Internet correctly for knowledge acquisition. This calls for further enhancement of education regarding learning attitudes, civil beliefs, and academic purposes. "The high percentage of students feeling uneasy when unable to access the Internet" (54.2%) suggests a high dependency on the Internet among adolescents, warranting further investigation into what attracts adolescents to the Internet and how to establish a healthy relationship between adolescents and the Internet. Overall, improving Internet moral literacy levels cannot be separated from the development of Internet moral education, which should not only guide students to use the Internet correctly and adhere to online moral rules but also enhance their ability to effectively learn through the Internet.

This study contributes in three main ways. First, it utilized a large-scale cross-sectional survey, which is rare in studies focused on Internet morality. Second, the scarcity of research data on the Internet Moral Literacy Scale both in China and internationally, with Chinese research on Internet moral literacy largely based on qualitative studies and few quantitative studies addressing the scale's internal consistency and structural model data, this scale not only aids research on Internet moral literacy in China but also provides baseline data for international research on the subject. Third, the multi-level analysis results showing significant negative correlations between Internet moral literacy and both cyberbullying and moral disengagement provide informational support for future research in Internet moral literacy.

This study boasts a considerable advantage in its extensive sample size and diverse analytical approaches. However, it is not without its limitations. Primarily, the research employed a convenience sampling strategy. As a result, despite the breadth of the cross-sectional sample, the extrapolation of the findings may be somewhat constrained. To augment the external validity, future investigations might benefit from employing more rigorous sampling techniques, facilitating a more encompassing data collection process. Furthermore, the current study's focus on college-aged adolescents uniquely positions it for a methodical examination of the psychometric properties of the Internet Moral Literacy Scale. Nevertheless, subsequent research could further enrich this field of study by exploring variations in online moral literacy across different age demographics.

Conclusion

The Internet has become a primary channel for production, dissemination, and acquisition of information in today's society, with adolescents, as the new force of the Internet, active in every corner of the online world. Their level of Internet moral literacy directly determines the quality of the online order and influences their healthy growth in Internet society. Against this backdrop, an effective tool for assessing adolescents' level of Internet moral literacy is especially necessary. This study found that the Internet Moral Literacy Scale has good psychometric properties; there is a significant negative correlation between Internet moral literacy and both cyberbullying and moral disengagement; and there are significant gender differences in Internet moral literacy levels, with males scoring lower than females. Moreover, the analysis of the original score data of Internet moral literacy revealed that further enhancement is needed in the education of adolescents' learning attitudes, civil beliefs, academic purposes, and their dependency on the Internet. Identifying the aspects of the Internet that attract adolescents is a question worth further exploration.

Authors' contributions

Ya-Xing Sun: Concept and design of study or acquisition of data or analysis and interpretation of data, drafting the article; I-Hua Chen: Revising it critically for important intellectual content.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Conflicts of interest

There are no conflicts of interest.

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