Enhancing academic self-efficacy on decreasing adolescents' unmonitored internet usage and depressive mood

Shiling Huang [a,$], Xian Li [a,1], Shih-Han Chen [a], Zhiwei Fang [a], Chun-Yang Lee [b,**], Yi-Chen Chiang [a,*]

[a] *State Key Laboratory of Vaccines for Infectious Diseases, Xiang An Biomedicine Laboratory, State Key Laboratory of Molecular Vaccinology and Molecular Diagnostics, National Innovation Platform for Industry-Education Integration in Vaccine Research, School of Public Health, Xiamen, China*
[b] *School of International Business, Xiamen University Tan Kah Kee College, Zhangzhou, China*

ARTICLE INFO

ABSTRACT

Unmonitored internet use and depression are difficulties that adolescents experience. Efforts to promote healthy adolescent development tend to focus on reducing these two risk outcomes. Therefore, the purpose of this study was to examine how three important school-related factors (teachers, peers, and academics) affect adolescents' levels of unmonitored internet use and depression. For this study, a cross-sectional data analysis was conducted. The sample included 9297 students who participated in two waves of the China Education Panel Survey (CEPS). Structural equation modeling (SEM) was performed using LISREL 8.80 to analyze the data. Monte Carlo resampling was then performed using R to confirm the significance of the mediating effects. Teacher criticism and negative peers can increase unmonitored internet use and depression in adolescents, while academic stress can exacerbate depression. In contrast, teacher praise and positive peers can reduce those risk outcomes. Academic self-efficacy serves as a key mediator of the impacts of teachers, peers, and academics on adolescents' levels of unmonitored internet use and depression. We advocate that schools should establish a positive school climate, provide teacher feedback training and design physical activity programs to improve academic self-efficacy, thereby reducing the risk of unmonitored internet use and depression among adolescents, effectively preventing possible subsequent internet addiction and promoting the mental health of adolescents.

1. Introduction

Due to technological advancements, the internet has become a significant source of learning that is commonly utilized in schools, and the use and popularity of the internet has gained significant momentum among adolescents [1]. Reportedly, 66.6 % of the global population uses the internet for approximately 7 h per day [2]. In 2021, the penetration rate of the internet among Chinese minors was 96.8 % [3]. Proper internet usage is helpful, but unmonitored internet use is commonly correlated with specific unfavorable outcomes

---

* Corresponding author.
** Corresponding author.
E-mail addresses: 1335532712@qq.com (S. Huang), 2712472487@qq.com (X. Li), leecy@xujc.com (C.-Y. Lee), jyj@xmu.edu.cn (Y.-C. Chiang).
[1] Co-first authors: Xian Li.
[$] First author: Shiling Huang.

and may cause problematic internet use [4]. Digital games in virtual environments tend to cause adolescents to spend large amounts of their time aimlessly and unproductively on the internet [5]. Increased time spent using the internet can increase the risk of internet addiction [6]. These results show that unmonitored internet use by adolescents is an important risk factor for internet addiction. Therefore, it is very important to take precautions against unmonitored internet use to enable adolescents to experience healthy growth and development.

Depression is another difficulty experienced by adolescents worldwide, and the global prevalence rate of depression among adolescents below the age of 18 years has been reported to be 8–20 % [7]. Depressive symptoms are associated with a variety of negative outcomes among adolescents, such as conduct problems [8] and suicidal ideation or adolescent suicide [9]. Excessive internet use is also often observed in depressed adolescents, and vice versa [10,11]. The unmonitored internet use and depressed moods experienced by adolescents during adolescence may have common causes. To enable adolescents to navigate adolescence more effectively, this study explores the common influences of unmonitored internet use and depressed moods in adolescents and thus provides a practical reference for preventing possible subsequent internet addiction and promoting adolescent mental health.

Adolescence, which marks the passage from childhood to adulthood, is a crucial period in a person's life because it is characterized by rapid and unexpected changes in physiology, psychology, and behavior [12]. Notably, family factors tend to be more important during childhood [13], while school-related factors become more important in adolescence [14]. As they age, children grow increasingly independent from their families [15] and more connected to their schools. In China, adolescent students spend nearly 70 % of their time in school [16]. During this period, the focus of adolescents shifts from the family to the school [17], which is an important setting for adolescent socialization and has an extraordinary impact on both the short- and long-term development of adolescents [18]. On the one hand, this influence is exercised by significant others in the school environment, namely, peers and teachers, who play important roles in adolescents' behavioral development and emotions [19]. Another source of influence is the stress faced at school; for Chinese students, academic stress is nearly at its highest level during adolescence [20]. Academic stress has been shown to be strongly associated with the development of behavioral problems and negative emotions on the part of adolescents [21]. As school is an important part of adolescents' behavioral changes and emotional development, this study explores possible predictors of unmonitored internet use and depression in adolescents by examining three important school-related factors (teachers, peers, and academic stress) and provides a school-level discussion concerning ways of effectively preventing unmonitored internet use among adolescents' and enhance adolescents' mental health.

1.1. School-related factors affecting unmonitored internet use and depression among adolescents

Teacher feedback is considered to be one of the most influential factors with regard to students [22]. Teacher feedback is defined as the information offered by teachers in response to students' performance and understanding of the material [23]. Positive teacher feedback, namely, teacher praise, refers to situations in which teachers commend students for their positive learning attitudes, performance, or work, whereas negative teacher feedback, also known as teacher criticism, is a negative reaction on the part of the teacher to a student's attitude, performance, or behavior through the expression of disapproval, disgust, or rejection [24]. Research has found that teacher praise reduces inappropriate and problematic student behavior [25] and helps improve depression [26]. Conversely, teacher criticism leads to an increase in defiant and disobedient behavior, which may be reinforced when teachers reprimand students for such problematic behaviors [27]. Students are vulnerable to negative feedback [28], and teacher criticism can exacerbate student depression [26]. These points all seem to be understandable since according to labeling theory, the evaluations of socially meaningful others influence how we see ourselves and how we act in the future [29]; this point is especially applicable to students, for whom teachers' perceptions are even more important [30]. We speculate that teacher praise and criticism affect students' levels of unmonitored internet use and depression.

During adolescence, students may have the most intense social interactions with their friends and peers, and parental influence begins to decline, while peer influence becomes greater and has a decisive effect on adolescent behavior [31]. Peer effects are often grouped into the categories of positive and negative peer influence [32]. Researchers have reported that misbehavior is more contagious in adolescence than in childhood or emerging adulthood [33]. Peer time spent on electronic screen media has a significant positive effect on the time that students spend on electronic screen media [31], and peer internet overuse is positively associated with students' problematic internet use [34]. In contrast, students have been found to benefit from high-ability peers who act as role models for the average student [35]. Positive peer influence can predict lower levels of problematic behaviors [36] in adolescence, and having more positive friends increases students' motivation to learn [37]. Although peer effects research has focused more on behavior, peers also influence adolescents' mental health. Research has suggested that both negative and positive peers impact mental health, with negative peers likely to have a greater impact [38]. Based on the research on peer effects mentioned above, we conjecture that adolescents' unmonitored internet use and depressed moods are influenced by both negative and positive peers.

A variety of forms of pressure or stress experienced by adolescents can cause negative emotions and lead to problematic behaviors [39]. Since higher education is considered to be the most important way in which teenagers can succeed, the pressure resulting from their studies is the most prominent and common source of stress for teenagers [40]. Academic stress is related to internet addiction [41] and negative emotions such as depression and anxiety among adolescents [40]. Particularly in a Chinese culture, in which context educational achievement is associated with economic success and social status [42], Chinese parents have high educational expectations for their children, and as a result, Chinese students may experience greater academic stress [43]. We think that Chinese students' academic stress may be strongly associated with depression and unmonitored internet use.

1.2. Academic self-efficacy may be a mediator of unmonitored internet use and depression among adolescents

Self-efficacy refers to judgments concerning how well one can perform in response to a pending event [44]. It is a multidimensional construct that varies according to the demands in question [45], and therefore, it must be evaluated at a level that is specific to the outcome domain [46]. For adolescents, academic self-efficacy is more important than generalized self-efficacy because academic study is the most important task for adolescents [47]. Academic self-efficacy refers to an individual's beliefs regarding his or her own capabilities to complete instructional tasks and achieve learning aims in the educational process [48]. When human behavior is regulated by anticipations of cognitive goals, one's evaluation of one's own self-worth evaluation influences one's goal setting. Theoretically, perceived self-efficacy affects performance accomplishments both directly and indirectly due to its effects on self-goals [49]. Academic self-efficacy has been associated with problematic internet use [50] and depressive symptoms [51]. In academic institutions, adolescents experience multiple school-related stressors, such as academic performance, testing, peer competition and conflict, and teacher-student relations [52]. Academic stress is the strongest predictor of academic self-efficacy, and high levels of stress may reduce the self-efficacy assessments of students [46]. However, positive academic self-efficacy cannot be achieved without a positive schooling outcome [53]. One goal of education is to instill a sense of competence in learning and achievement [54], which is reflected in young people's mastery of academic knowledge and the internalized belief that one can affect one's own academic mastery [55]. Previous studies have reported that instead of highlighting weaknesses in students' performance, teachers' verbal encouragement and affirmation or strategies can enhance students' perceived self-efficacy more effectively [56]. Especially for students who experience a lower degree of social support, a caring and supporting teacher-student relationship is indispensable to the task of sustaining hope and encouraging students engage in academic self-regulatory and social behavior [57]. In classroom groups, regarding others as social references may lead to one-sided behavior that bases one's self-efficacy on competition with others in terms of abilities. Students in such high-stress situations are more likely to engage in avoidance behaviors and exhibit lower self-efficacy when facing setbacks [58]. Accordingly, we suggest that academic self-efficacy may be a mediating factor with regard to the ability of teacher, peer, and academic stress to influence unmonitored internet use and depression among adolescents.

1.3. The present study

Since school is the place where adolescents spend most of their time [18], the people and things present in school greatly influence students' behavior and emotions. To find predictors that influence adolescents' depression and unmonitored internet use, this study uses a nationally representative, school-based, large-scale survey to explore the influences of teachers, peers, and academic pressure. The hypothetical model is shown in Fig. 1, and the following hypotheses are proposed.

Hypothesis 1. (H1): In terms of teacher feedback, teacher praise reduces adolescents' levels of unmonitored internet use and depression, whereas teacher criticism exacerbates both outcomes.

Hypothesis 2. (H2): Positive peers have positive influences on adolescents, thus reducing the likelihood of unmonitored internet use and depression. However, peers who engage in the same unmonitored internet use behavior can increase this likelihood.
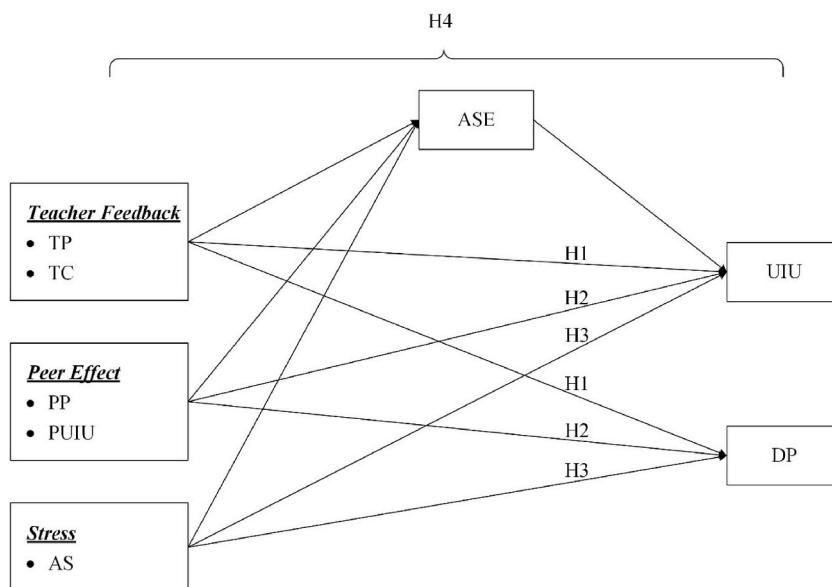

Fig. 1. Hypothesized model.
Note. TP, Teacher praise; TC, Teacher criticism; PP, Positive peers; PUIU, Peer unmonitored internet use; AS, Academic stress; ASE, Academic self-efficacy; UIU, Unmonitored internet use; DP, Depression.

Hypothesis 3. (H3): The greater the academic stress that students face, the higher their levels of unmonitored internet use and depression.

Hypothesis 4. (H4): Academic self-efficacy has a mediating effect on adolescents' levels of unmonitored internet use and depression.

2. Materials and methods

2.1. Study design and participants

Data was derived from the China Education Panel Survey (CEPS). The CEPS was a nationally representative large-scale follow-up survey project designed and implemented by the National Survey Research Center at Renmin University of China and was approved by the Institutional Review Board at Renmin University of China (Project No.: 61662993). The survey employed a multistage stratified probability proportional to size (PPS) sampling method. First, the CEPS randomly selected 28 county-level units (counties, districts, and municipalities) covering 31 provinces nationwide as survey points. Second, four junior high schools were randomly selected from each county. Then, two classes in grade 7 and two classes in grade 9 were randomly selected from each school. Finally, all students in these classes were used as the research sample. All grade 7 students included in the baseline survey were interviewed once again during the second wave (when the students were in grade 8), and successful follow-up was completed with a total of 9449 eighth-grade students, for a follow-up rate of 92 %. The main reasons for the failure to follow-up included transfer to other schools, dropping out of school, and other reasons. More details concerning the sampling, questionnaires, and other issues are available at http://ceps. ruc.edu.cn/English/Home.htm.

We referenced these two waves of CEPS data in this study. After excluding observations featuring missing or abnormal information concerning key variables, the total valid sample size including successful follow-up for the completion of two waves of surveys was 9297. The main characteristics of the participants are shown in Table 1. The participants included 47.92 % girls and 52.08 % boys; most families (73.18 %) exhibited a medium economic status, and most parents (79.97 %) had received primary and secondary school education.

Table 1
Descriptive statistics for variables of the sample (n = 9297).

Variables	n[a]	%	Mean	SD
Control variables				
Sex				
Girl (0)	4455	47.92		
Boy (1)	4842	52.08		
Family financial condition				
Poor	1947	21.00		
Moderate	6786	73.18		
Rich	540	5.82		
Father's/mother's highest education level				
≤Junior high school degree	4659	50.22		
≤Senior high school degree	2760	29.75		
≤Bachelor degree	1694	18.26		
≥Master degree	164	1.77		
Independent variables				
Teacher Praise [1–4]			2.50	0.77
Teacher Criticism [1–4]			1.50	0.66
Positive Peers [1–3]			2.48	0.51
Peer Unmonitored Internet Use				
None of them	8200	89.82		
One or two of them	749	8.20		
Most of them	180	1.97		
Academic Stress [1–4]			2.44	0.66
Mediating variables				
Academic self-efficacy [1–4]			3.19	0.69
Dependent variables				
Unmonitored Internet Use				
Never	8134	87.49		
Seldom	699	7.52		
Sometimes	264	2.84		
Often	106	1.14		
Always	94	1.01		
Depression [1–5]			2.16	0.91

[ ]: The range of a single item.
[a] The total number < n = 9297 due to missing.

2.2. Measures

In this study, sex, family financial condition and father's/mother's highest level of education were used as control variables. The following items and scales were used in this study.

2.2.1. Unmonitored internet use

Internet cafes provide a place in which adolescents can avoid parental supervision and surf the internet at will [59], and adolescents with greater access to internet cafes are more likely to become addicted to the internet [60]. This study used the frequency of adolescents' visits to internet cafes to represent their unmonitored internet use; previous studies have used a similar measurement tool [61]. Unmonitored internet use was measured in Wave 2 (8th grade) through the following question: "How often did you go to net bars or video arcades during the past year?" This item was scored on a 5-point scale with responses ranging from 1 (never) to 5 (always).

2.2.2. Depression

Based on a short version of the Center for Epidemiologic Studies Depression Scale, depression was measured in Wave 2 based on the respondents' level of agreement with the following phrases: "(1) Feeling blue; (2) being too depressed to focus on anything; (3) being unhappy; (4) not enjoying life; (5) having no passion to do anything; (6) being sad or sorrowful". The values ranged from 1 (never) to 5 (always), and this measure has exhibited good reliability in previous studies of Chinese adolescents [62]. Cronbach's α of this measure in the present sample was 0.92. We observed that Item 4 (not enjoying life) and Item 5 (having no passion to do anything) share significant similarities in terms of their nature, function, and form. Therefore, we decided to make their error terms correlated [63]. We conducted confirmatory factor analysis (CFA) to investigate the instruments used to measure depression, and the goodness-of-fit indexes TLI, IFI, and CFI were all >0.95, while SRMR = 0.038, RMSEA = 0.094, and CN > 200, thus indicating that the validity of the measure was good.

2.2.3. Teacher feedback

Teacher feedback includes both positive and negative feedback; researchers have defined positive feedback as the expression of support, encouragement, or appreciation and negative feedback as the expression of disapproval [64]. We therefore used teacher praise and teacher criticism to represent teacher feedback. The CEPS uses four self-assessment items to examine students' perceived teacher praise [65], including "My mathematics/Chinese/English teacher always praises me" and "My homeroom teacher always praises me" during Wave 1 (7th grade). The Cronbach's α for this measure was 0.86. Teacher criticism was assessed using two questions in Wave 1: "My parents always receive criticism about me from my teacher" and "My homeroom teacher always criticizes me". These items were scored on a 4-point scale with responses ranging from 1 (strongly disagree) to 4 (strongly agree). We conducted confirmatory factor analysis (CFA) to investigate the instruments used to measure teacher praise and teacher criticism, and the goodness-of-fit indexes TLI, IFI, and CFI were all >0.95, while SRMR = 0.010, RMSEA = 0.015, and CN > 200, thus indicating that the validity of the measure was good.

2.2.4. Peer effects

The peer effect comprised two variables, "positive peer effect" and "peers' unmonitored internet use". Based on the Friendship Quality Scale (FQS) [66] and peer relationship measurement [67], "positive peer effect" was represented by three observed variables in the CEPS, a measure that has shown good reliability in previous studies [68,69]. Adolescents were asked the following question in Wave 1 to measure the number of positive peers (Cronbach's α = 0.79): "How many of your best friends match the following descriptions? (1) Doing well in academic performance; (2) studying hard; and (3) expecting to go to college." Peers' unmonitored internet use was measured using the following question in Wave 1: "How many of your best friends always go to net bars or video arcades?" This question had 3 possible responses: "none of them", "one or two of them" and "most of them". We conducted confirmatory factor analysis (CFA) to investigate the instruments used to measure peer effects, i.e., on two factors ("positive peer effect" and "peers' unmonitored internet use"), and the goodness-of-fit indexes TLI, IFI, and CFI were all >0.95, while SRMR = 0.015, RMSEA = 0.045, and CN > 200, thus indicating that the validity of the measure was good.

2.2.5. Academic stress

Academic stress is largely the result of task overload, the difficulty and amount of material that the student is required to learn, and the need to perform well [70]. In China, Chinese, mathematics, and English are the core subjects that junior high school students study. Students' mastery of these three subjects largely determines their academic performance. Therefore, this study used students' perceived difficulty of these core subjects to represent students' academic stress, an approach that has been verified in previous studies [71]. Students were asked whether they experienced difficulties when taking courses in mathematics, Chinese, and English in Wave 1. The relevant items were scored on a 4-point scale with answers ranging from 1 (very difficult) to 4 (not difficult at all). During the data analysis, we reverse scored these three items. The higher the score was, the more academic stress the respondent experienced.

2.2.6. Academic self-efficacy

The academic self-efficacy scale was adapted from the Aggressiveness Scale [72], which a previous study verified to be applicable to the CEPS survey [73]. Academic self-efficacy was measured in Wave 2 using questions such as the following: "(1) I would try my best to go to school even if I were not feeling very well or if I had other reasons to stay home; (2) I would try my best to finish even homework I disliked; (3) I would try my best to finish my homework even if it would take me quite a long time; (4) I would persist in my

interests and hobbies." Possible answers to these questions ranged from 1 (strongly disagree) to 4 (strongly agree), and the Cronbach's α for this measure was 0.80.

CFA was performed to investigate academic stress and academic self-efficacy. The results revealed that TLI = 0.98, IFI = 0.98, CFI = 0.98, SRMR = 0.025, RMSEA = 0.053, and CN > 200, thus suggesting that the validity of this measure was acceptable.

2.3. Statistical analysis

Data were analyzed using SAS 9.4, LISREL 8.8 and R statistical software. First, a descriptive analysis was conducted in SAS 9.4, and the frequency and percentage of categorical variables and the mean and standard deviation of continuous variables were calculated. Then, we used structural equation modeling (SEM) via the maximum likelihood (ML) method to explore the mediating effects of academic self-efficacy (Fig. 1). The root-mean-squared error of approximation (RMSEA), the nonnormed fit index (NNFI), the comparative fit index (CFI), the incremental fit index (IFI), the adjusted goodness-of-fit index (AGFI) and the critical N (CN) were used to evaluate model fit [74]. If RMSEA ≤0.05, NNFI, CFI, IFI, and AGFI are all greater than 0.90 and CN > 200, then the model exhibits a good fit. We then performed Monte Carlo simulations using R statistical software to confirm the significance of the estimated mediating effects [75]. The Monte Carlo simulations were based on parameter estimates, associated asymptotic variance and covariance matrices. The simulations were repeated 20,000 times to construct 95 % confidence intervals for the indirect effects (http://quantpsy.org/medmc/medmc.htm).

3. Results

3.1. Descriptive analysis

The average values of the individual items used to measure teacher praise, teacher criticism, positive peer and academic stress were 2.50 (SD = 0.77), 1.50 (SD = 0.66), 2.48 (SD = 0.51), and 2.44 (SD = 0.66), respectively; 8.20 % of the students reported that one or two of their best friends always went to internet cafes, while 1.97 % reported that most of their friends did so. The average value of the individual item used to measure academic self-efficacy was 3.19 (SD = 0.69). The average value of the individual item to measure depression was 2.16 (SD = 0.91), and 1.14 % of participants reported that they often went to internet cafes, while 1.01 % reported that they always did so.

3.2. Mediation analysis

Based on the hypothesized model, we first used a structural model to investigate whether academic self-efficacy mediates the effects of unmonitored internet use and depression. Among the paths included in the initial model, two paths were found to have t values less than 1.96. Therefore, TP→UIA and AS→UIA were omitted from the final model since they exhibited the smallest and most nonsignificant t values. The final model exhibited moderate fit indexes: RMSEA = 0.059, NNFI = 0.92, CFI = 0.94, IFI = 0.94, AGFI = 0.93, and CN = 338.35 (Table 2). The final model is shown in Fig. 2.

The results of the SEM showed that teacher criticism, positive peers and unmonitored peer internet use have positive, direct, and significant relationships with students' unmonitored internet use (β = 0.09, p < 0.001; β = −0.06, p < 0.001; β = 0.22, p < 0.001). Furthermore, teacher praise, teacher criticism, positive peers, peers' unmonitored internet use and academic stress were directly and positively related to depression (β = −0.04, p < 0.01; β = 0.13, p < 0.001; β = −0.02, p < 0.05; β = 0.03, p < 0.001; β = 0.18, p < 0.001). Thus, H1, H2 and H3 were partially supported.

The relationships among teacher feedback, peer effects, academic stress levels, unmonitored internet use levels and depression levels were mediated by academic self-efficacy (H4). That is, if students receive higher levels of praise from teachers or have higher numbers of positive friends, they tend to have higher levels of academic self-efficacy and subsequently lower levels of unmonitored internet use and depression. However, if students receive higher levels of teacher criticism, have higher numbers of friends with unmonitored internet use, or face higher levels of academic stress, they tend to have less academic self-efficacy and may have higher levels of unmonitored internet use and depression (Fig. 2 and Table 3). In addition, we used Monte Carlo simulations to test for indirect effects. The results indicated that the 95 % confidence interval for the indirect effect of academic self-efficacy did not include zero (Table 4). Therefore, H4, which focuses on this mediating effect, was supported.

Table 2
Measures of goodness-of-fit for the unmonitored internet use and depression model of adolescents.

	RMSEA	NNFI	CFI	IFI	AGFI	CN
Initial model	0.059	0.92	0.94	0.94	0.93	336.13
Delete SEX→ASE	0.059	0.92	0.94	0.94	0.93	337.11
Delete AS→UIU	0.059	0.92	0.94	0.94	0.93	337.68
Delete TP→UIU[a]	0.059	0.92	0.94	0.94	0.93	338.35

Note. ASE, Academic self-efficacy; AS, Academic stress; UIU, Unmonitored internet use; TP, Teacher praise.
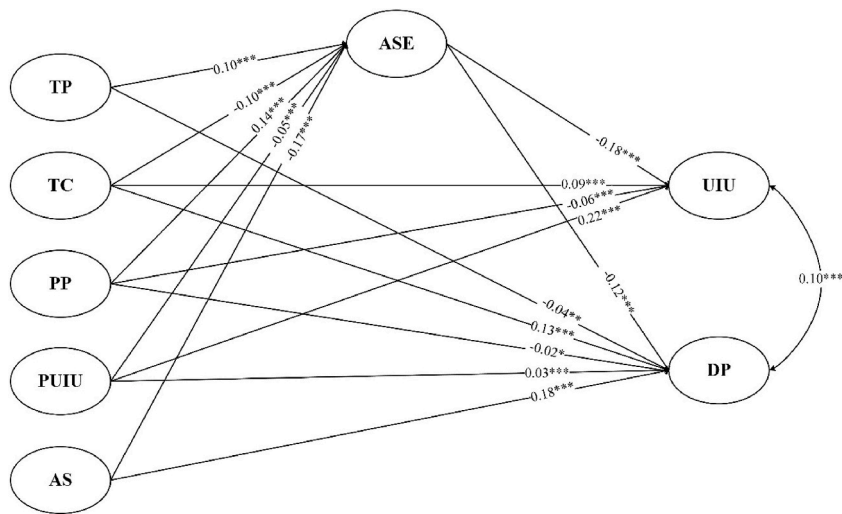[a] The goodness-of-fit of the Final model.

Fig. 2. Model diagram of the mediating effect of academic self-efficacy on unmonitored internet use and depression among adolescents.
Note. In this model, sex, family financial condition, father's/mother's highest education level are taken as control variables. TP, Teacher praise; TC, Teacher criticism; PP, Positive peers; PUIU, Peer unmonitored internet use; AS, Academic stress; ASE, Academic self-efficacy; UIU, Unmonitored internet use; DP, Depression.
$*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Table 3
Direct and indirect effects of academic self-efficacy on unmonitored internet use and depression among adolescents.

Variables	Unmonitored Internet Use			Depression		
	Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Independent variables						
Teacher Praise		−0.02***	−0.02***	−0.04***	−0.01***	−0.05***
Teacher Criticism	0.09**	0.02***	0.11***	0.13***	0.01***	0.14***
Positive Peers	−0.06***	−0.02***	−0.09***	−0.02***	−0.02***	−0.04***
Peer Unmonitored Internet Use	0.22***	0.01***	0.23***	0.03***	0.01***	0.04***
Academic Stress		0.03***	0.03***	0.18***	0.02***	0.21***
Mediating variables						
Academic Self-Efficacy	−0.18***		−0.18***	−0.12***		−0.12***

Note. $**p < 0.01$, $***p < 0.001$.

Table 4
Tests of indirect effects of the hypothesized model by Monte Carlo method.

Path	95 % Confidence Interval	
TP→ASE→UIU	[-0.024,	−0.016]
TC→ASE→UIU	[0.011,	0.021]
PP→ASE→UIU	[-0.025,	−0.018]
PUIU→ASE→UIU	[0.011,	0.015]
AS→ASE→UIU	[0.022,	0.036]
TP→ASE→DP	[-0.017,	−0.010]
TC→ASE→DP	[0.007,	0.015]
PP→ASE→DP	[-0.018,	−0.011]
PUIU→ASE→DP	[0.006,	0.010]
AS→ASE→DP	[0.014,	0.025]

Note. TP, Teacher praise; TC, Teacher criticism; PP, Positive peers; PUIU, Peer unmonitored internet use; AS, Academic stress; ASE, Academic self-efficacy; UIU, Unmonitored internet use; DP, Depression.

4. Discussion

This study focused on the effects of three important school-related factors (teachers, peers, and academics) on adolescents' levels of unmonitored internet use and depression. As expected, teacher criticism and negative peers had a direct and significant positive

association with unmonitored internet use and depression in adolescents, and academic stress also exacerbated depression. Teacher praise and positive peers could alleviate adolescent depression, and positive peers could also reduce unmonitored internet use. Academic self-efficacy plays an important mediating role in these relationships. Notably, the negative impacts of teacher criticism, negative peers and academic stress are greatly outweighed by the positive impacts of teacher praise and positive peers (Table 3). These differences are understandable, as previous psychophysiological research has shown that people are more responsive to criticism than to praise and require greater regulation to cope with negative (as opposed to positive) feedback [76]. According to social learning theory, adolescents imitate and reinforce the negative behaviors of their peers and gradually develop a positive attitude toward such negative behaviors [77]. Many studies have found that negative peers are more likely to promote changes in adolescent beliefs and behaviors than positive peers [78]. These findings suggest that when creating a positive school environment, special attention should be given to the task of preventing the possible negative effects of teacher criticism, negative peers, and academic pressure on adolescents since those factors may have greater and more direct effects.

As mentioned in previous studies, the influence of family factors decreases with age, in which context some school influences can be observed and require attention [79]. School-related factors become more important in adolescence [14], and teachers serve as role models for students' behaviors during this time [80]. In Chinese culture, students tend to evaluate themselves based on the judgments of authorities, such as teachers [81]. In the Chinese context, Confucianism emphasizes unconditional respect for teachers [82]. A Western philosophy of teaching might be as follows: "Love your subject and convey that love; all else is secondary." [83]. Obviously, teacher criticism is contrary to this guideline. Previous studies have emphasized that excessive teacher criticism hinders students' sense of security and self-esteem and increases their depression and antisocial behaviors [26]. Specifically, teacher criticism usually indicates that the teacher's expectations are not met, which can easily lead to student depression [51]. Simultaneously, teacher criticism can exacerbate misbehavior because students who are at risk of behavioral problems are more sensitive to reprimands [84]. Criticism tends to convince such students that they are not good students; therefore, they can go in and out of internet cafes without fear. Teacher praise can increase students' self-identity and reinforce their beliefs [85]. However, it is usually easier to weaken students' self-efficacy through negative evaluations than to enhance their self-efficacy through praise [86]. Therefore, teachers should be cautious in their use of criticism.

Becoming part of a peer group is a major experience associated with adolescence [87]. Adolescents tend to imitate the behavior of their peers and participate in the same activities [88]; this behavior choice may be the result of peer pressure or the desire to avoid potential social sanctions or social isolation [89]. Adolescents tend to engage in more unmonitored internet use if they have more peers who are doing so. However, the network norms of such a peer group are different from those of the school, and this difference may be rejected by other students, thus making it difficult to achieve high levels of recognition [90] and leading to high levels of depression. Adolescents' values are not yet stable, and they assess themselves by observing their peers. Observing high academic achievement on the part of peers can increase adolescents' academic self-efficacy, causing them to believe that they can accomplish the same tasks and become equally good students. However, if peer failure is observed, academic self-efficacy decreases [91].

The effects of academic stress on internet addiction and depression have been repeatedly demonstrated [40,41]. The present study also found positive associations adolescents' levels of academic stress, levels of unmonitored internet use and depression. Specifically, we found that this positive effect of academic stress was mediated by academic self-efficacy. In Asia, academic stress is a significant source of daily stress for adolescents because students have high expectations for academic success [92]. Excessive academic stress can affect adolescents' academic self-efficacy judgments [47] and thus reduce their academic self-efficacy. This finding is consistent with social cognitive theory, according to which stress is negatively related to self-efficacy [93]. Previous research also supports the negative association between academic stress and academic self-efficacy [94]. However, low academic self-efficacy increases the risk of depression in adolescents [95]. Adolescents with low academic self-efficacy perceive that they cannot meet the relevant standards while nevertheless believing that they should do so [96]. This difference between aspirations and perceived ability can lead to feelings of depression. In addition, academic self-efficacy has a significant negative relationship with behaviors that trigger internet addiction [50], and this study demonstrates that high academic self-efficacy can reduce unmonitored internet use behaviors among adolescents. High academic self-efficacy can help students set realistic goals, create encouraging thought patterns, cope with stress and negative emotions, become more resistant to difficulties, and maintain their motivation [97].

School-based interventions are an effective strategy for improving adolescents' behaviors and moods [98]. The findings reported in this paper inform schools of ways of reducing unmonitored internet use and depression levels among adolescents with the goal of reducing their risk of internet addiction and promoting students' mental health. At the teacher level, schools can provide teachers with training related to effective praise and criticism. Research has shown that teachers' use of task-specific and constructive feedback can have a positive impact on student behavior [99] and that praise for specific behaviors is more effective than general praise [100]. However, teachers should be particularly cautious when providing negative feedback, such as criticism, to students with depressive tendencies and problematic behaviors. At the student level, students should be encouraged to develop positive relationships or taught to choose more positive school members with whom to interact [101]. In a positive environment, adolescents may develop appropriate norms and attitudes about internet use and reduce their own internet use, and a positive climate is conducive to such a reduction in negative feelings [102].

In addition, physical activity is known to be an important way of preventing and treating internet addiction [103], in which context exercise can replace a great deal of the internet experience and significantly reduce the amount of time spent online and the severity of internet addiction [104]. Physical activity also has psychological benefits, such as reducing the risk of adolescent depression and promoting adolescent mental health [105]. Physical activity has also been identified as an effective strategy to increase adolescents' academic self-efficacy [106]. Therefore, schools can increase students' number of hours of physical activity on the one hand and can train more physical education teachers on the other hand with the goal of developing physical activity programs/interventions that

emphasize a sense of accomplishment and hedonism and that feature achievable and realistic goals, thus increasing individual academic self-efficacy. High academic self-efficacy helps adolescents resist the negative effects of teacher criticism, negative peers, and academic stress, thereby reducing their risk of unmonitored internet use and depression.

To test the robustness of the model in further detail, we set the random seed number to 200 and 800 and randomly selected 10 % and 20 % of the original samples for model validation. The results are shown in Fig. 3. Compared to the full-sample path diagram shown in Fig. 2, when the number of the random seed is 200 and the sampling proportion is 10 % (Fig. 3A), we find that the difference lies in the reduction of the direct paths PP→UIA, PP→DP, AS→UIA and AS→DP; when the number of the random seed is 200 and the sampling proportion is 20 % (Fig. 3B), the difference lies in the reduction of the direct paths PP→DP and PUIA→DP; when the number of the random seed is 800 and the sampling proportion is 10 % (Fig. 3C), the difference lies in the reduction of the direct paths TP→DP, TC→DP, and PP→DP and the indirect path PUIA→ASE; and when the number of the random seed is 800 and the sampling proportion is 20 % (Fig. 3D), the difference lies in the reduction of the direct paths TP→DP and TC→UIA. These results indicate that, with the exception of some direct paths, the important path direction and significance of the small-sample tested model do not differ significantly from those of the full-sample model, thus indicating the relative robustness and reliability of the model used in this study.

5. Limitations

This study is not without certain limitations. First, this study is based on a Chinese survey that focused on the specific context of
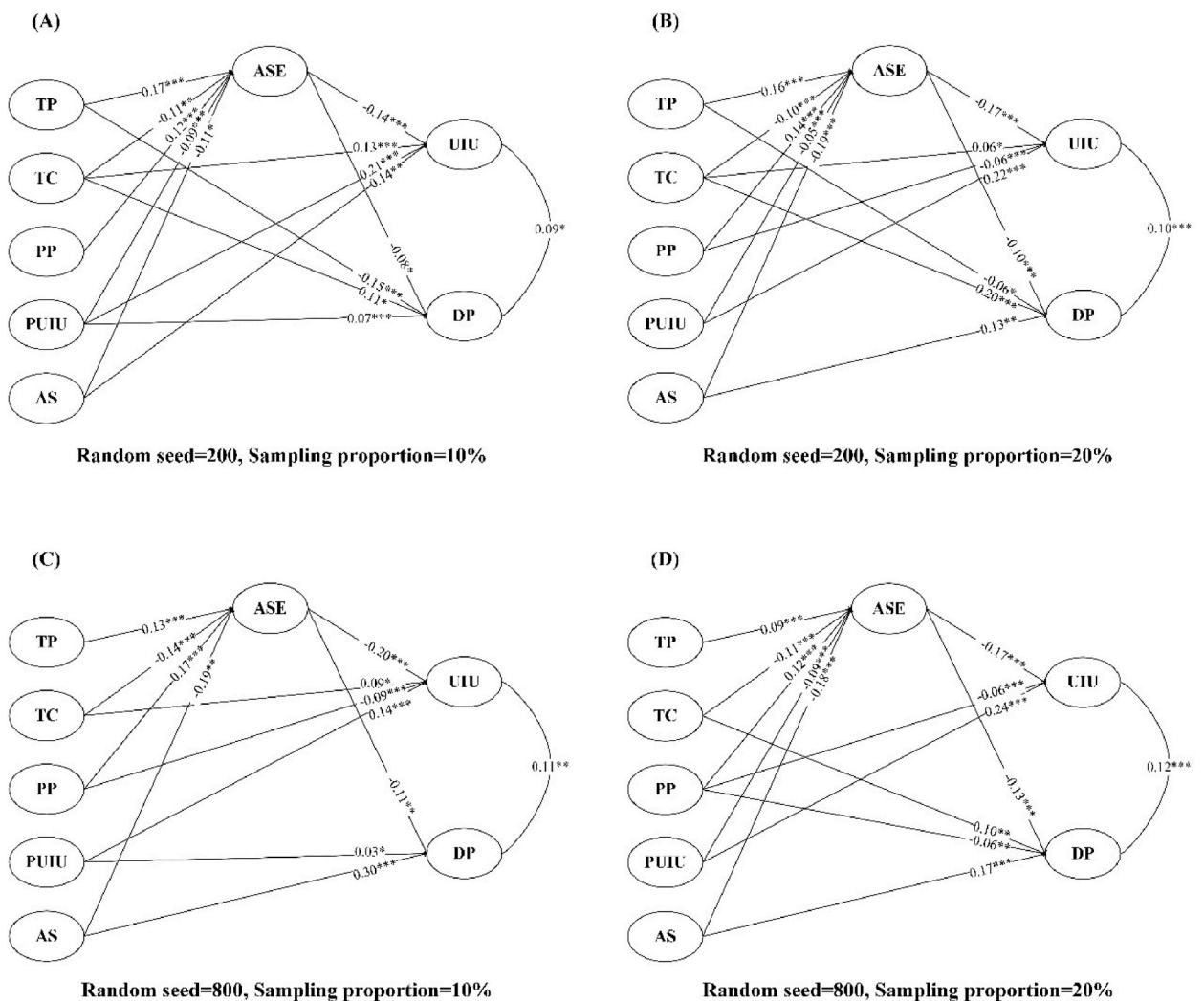

Fig. 3. Robustness check.
Note. TP, Teacher praise; TC, Teacher criticism; PP, Positive peers; PUIU, Peer unmonitored internet use; AS, Academic stress; ASE, Academic self-efficacy; UIU, Unmonitored internet use; DP, Depression.
*p < 0.05, **p < 0.01, ***p < 0.001.

Chinese culture, and the generalizability of these results to other countries must take this limitation into account. As CEPS is a large follow-up survey, due to considerations of follow-up success and time to fill in the responses, the survey team of experts, through numerous adjustments, could only include the most critical topics to measure the variables, some of which had only one question, such as unmonitored internet access, which is indeed a limitation of this study. The CEPS focused on the frequency with which students use the internet and did not examine the purposes for which they do so or the specific types of internet use, although most youths use the internet for entertainment-related purposes [107]. In the future, more dimensions should be used to measure adolescents' unmonitored internet use behavior. Additionally, this study focused on school-level influences, and in the future, we could consider adding more influences, such as sports, which have been found to be important in previous studies [103,105]; accordingly, we advocate increasing physical activity at the school level. Finally, the indirect effect of academic self-efficacy is small. However, the significance of this indirect effect remains high based on a large-scale sample survey, thus indicating that our estimate is very accurate and that academic self-efficacy is thus a critical mediating factor.

6. Conclusion

This study demonstrated the ability of teacher criticism, peer unmonitored internet use, and academic stress to exacerbate two risk outcomes as well as the ability of teacher praise and positive peers to mitigate unmonitored internet use and depression levels among adolescents. Academic self-efficacy plays an important mediating role in these effects. We advocate that schools should create a positive school climate, establish appropriate online norms, and provide teacher feedback training to ensure that students can receive more appropriate feedback. Additionally, physical activity programs should be designed to increase academic self-efficacy. These multifaceted measures should reduce the risk of unmonitored internet use and depression among adolescents and thus promote the healthy growth of young people.

Ethics statement

Procedures were approved by the Institutional Review Board at Renmin University of China (Project No.: 61662993). All procedures were performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Written informed consent was obtained from parents and participants before the baseline survey.

Funding

Data availability statement

These data were derived from the following resources available in the public domain: China Education Panel Survey (CEPS) (http://ceps.ruc.edu.cn/English/Home.htm). The data of this study in excel format was included in the supplementary material.

CRediT authorship contribution statement

Shiling Huang: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Xian Li:** Writing – review & editing, Methodology, Formal analysis, Conceptualization. **Shih-Han Chen:** Writing – review & editing, Writing – original draft. **Zhiwei Fang:** Writing – review & editing, Writing – original draft. **Chun-Yang Lee:** Writing – review & editing, Supervision, Project administration, Data curation, Conceptualization. **Yi-Chen Chiang:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

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

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e23286.

References

[1] R. López-Bueno, A. Koyanagi, G.F. López-Sánchez, J. Firth, L. Smith, Association between age of first exposure and heavy internet use in a representative sample of 317,443 adolescents from 52 countries, Eur. Child Adolesc. Psychiatry. 32 (2023) 395–403, https://doi.org/10.1007/s00787-021-01869-5.

[2] WE ARE SOCIAL, DIGITAL 2021: THE LATEST INSIGHTS INTO THE 'STATE OF DIGITAL, 2021. https://wearesocial.com/uk/blog/2021/01/digital-2021-the-latest-insights-into-the-state-of-digital/.

[3] China Internet Network Information Center, The Research Report on the Internet Use of Chinese Minors 2021, 2022. https://qnzz.youth.cn/qckc/202211/t20221130_14166885.htm.

[4] L. Cerniglia, F. Zoratto, S. Cimino, G. Laviola, M. Ammaniti, W. Adriani, Internet Addiction in adolescence: neurobiological, psychosocial and clinical issues, Neurosci. Biobehav. Rev. 76 (2017) 174–184, https://doi.org/10.1016/j.neubiorev.2016.12.024.

[5] E. McDool, P. Powell, J. Roberts, K. Taylor, The internet and children's psychological wellbeing, J. Health Econ. 69 (2020), 102274, https://doi.org/10.1016/j.jhealeco.2019.102274.

[6] Y. Karaer, D. Akdemir, Parenting styles, perceived social support and emotion regulation in adolescents with internet addiction, Compr, Psychiatry 92 (2019) 22–27, https://doi.org/10.1016/j.comppsych.2019.03.003.

[7] K. Naicker, N.L. Galambos, Y. Zeng, A. Senthilselvan, I. Colman, Social, demographic, and health outcomes in the 10 Years following adolescent depression, J. Adolesc. Health 52 (2013) 533–538, https://doi.org/10.1016/j.jadohealth.2012.12.016.

[8] M.-T. Wang, S. Kenny, Longitudinal links between fathers' and mothers' harsh verbal discipline and adolescents' conduct problems and depressive symptoms, Child Dev. 85 (2014) 908–923, https://doi.org/10.1111/cdev.12143.

[9] D.M. Fergusson, J.M. Boden, L.J. Horwood, Recurrence of major depression in adolescence and early adulthood, and later mental health, educational and economic outcomes, Br. J. Psychiatry 191 (2007) 335–342, https://doi.org/10.1192/bjp.bp.107.036079.

[10] B. Bozoglan, V. Demirer, I. Sahin, Problematic Internet use: functions of use, cognitive absorption, and depression, Comput. Hum. Behav. 37 (2014) 117–123, https://doi.org/10.1016/j.chb.2014.04.042.

[11] J.-Y. Yen, H.-C. Lin, W.-P. Chou, T.-L. Liu, C.-H. Ko, Associations among resilience, stress, depression, and internet gaming disorder in young adults, Int. J. Environ. Res. Publ. Health 16 (2019) 3181, https://doi.org/10.3390/ijerph16173181.

[12] P. Heaven, Adolescent Health, Psychology Press, 2002, https://doi.org/10.4324/9780203137161, 0 ed.

[13] J. Oberuč, L. Zapletal, Family as one of the most important factors in a child's upbringing, Acta Technol. Dubnicae. 7 (2017) 105–112, https://doi.org/10.1515/atd-2017-0018.

[14] G. Tomé, M. Matos, C. Simões, J.A. Diniz, I. Camacho, How can peer group influence the behavior of adolescents: explanatory model, Glob. J. Health Sci. 4 (2012) p26, https://doi.org/10.5539/gjhs.v4n2p26.

[15] S. Elías Alvarado, Delayed disadvantage: neighborhood context and child development, Soc. Forces 94 (2016) 1847–1877, https://doi.org/10.1093/sf/sow020.

[16] K.H. Xiang, Investigations and reflections on the learning behavior status of primary and secondary school students: an example from hubei province, Educ. Res. Exp. (2017) 85–91.

[17] S.L. Hofferth, J.F. Sandberg, How American children spend their time, J. Marriage Fam. 63 (2001) 295–308, https://doi.org/10.1111/j.1741-3737.2001.00295.x.

[18] R.M. Lerner (Ed.), Handbook of Child Psychology and Developmental Science, John Wiley & Sons, Inc., Hoboken, NJ, USA, 2015, https://doi.org/10.1002/9781118963418.

[19] E.P. Smith, M. Faulk, M.A. Sizer, Exploring the meso-system: the roles of community, family, and peers in adolescent delinquency and positive youth development, Youth Soc. 48 (2016) 318–343, https://doi.org/10.1177/0044118X13491581.

[20] H. Li, P.W. Liu, J. Zhang, Estimating returns to education using twins in urban China, J. Dev. Econ. 97 (2012) 494–504, https://doi.org/10.1016/j.jdeveco.2011.05.009.

[21] S. Jun, E. Choi, Academic stress and Internet addiction from general strain theory framework, Comput. Hum. Behav. 49 (2015) 282–287, https://doi.org/10.1016/j.chb.2015.03.001.

[22] J. Hattie, Visible Learning for Teachers: Maximizing mpact on Learning, Routledge, London ; New York, 2012.

[23] J. Hattie, H. Timperley, The power of feedback, Rev. Educ. Res. 77 (2007) 81–112, https://doi.org/10.3102/003465430298487.

[24] Y. Skipper, K. Douglas, The influence of teacher feedback on children's perceptions of student-teacher relationships, Br. J. Educ. Psychol. 85 (2015) 276–288, https://doi.org/10.1111/bjep.12070.

[25] K.S. Sutherland, D.P. Oswald, The relationship between teacher and student behavior in classrooms for students with emotional and behavioral disorders: transactional processes, J. Child Fam. Stud. 14 (2005) 1–14, https://doi.org/10.1007/s10826-005-1106-z.

[26] M. Smith, R. Calam, C. Bolton, Psychological factors linked to self-reported depression symptoms in late adolescence, Behav. Cogn. Psychother. 37 (2009) 73, https://doi.org/10.1017/S1352465808004724.

[27] R.A. Gable, P.H. Hester, M.L. Rock, K.G. Hughes, Back to basics: rules, praise, ignoring, and reprimands revisited, Interv. Sch. Clin. 44 (2009) 195–205, https://doi.org/10.1177/1053451208328831.

[28] A.M. Thompson, W. Wiedermann, K.C. Herman, W.M. Reinke, Effect of daily teacher feedback on subsequent motivation and mental health outcomes in fifth grade students: a person-centered analysis, Prev. Sci. 22 (2021) 775–785, https://doi.org/10.1007/s11121-020-01097-4.

[29] M. Rotenberg, Self-labelling: a missing link in the 'societal reaction' theory of deviance, Sociol. Rev. 22 (1974) 335–354, https://doi.org/10.1111/j.1467-954X.1974.tb00257.x.

[30] J. Dobbs, D.H. Arnold, Relationship between preschool teachers' reports of children's behavior and their behavior toward those children, Sch. Psychol. Q. 24 (2009) 95–105, https://doi.org/10.1037/a0016157.

[31] J.-O. Escardíbul, T. Mora, A. Villarroya, Peer effects on youth screen media consumption in Catalonia (Spain), J. Cult. Econ. 37 (2013) 185–201, https://doi.org/10.1007/s10824-012-9177-3.

[32] G.D. Walters, Positive parents and negative peers: assessing the nature and order of caregiver and friend effects in predicting early delinquency, Youth Violence Juv. Justice 18 (2020) 96–114, https://doi.org/10.1177/1541204019831751.

[33] V. Lorant, M. Tranmer, Peer, school, and country variations in adolescents' health behaviour: a multilevel analysis of binary response variables in six European cities, Soc. Netw. 59 (2019) 31–40, https://doi.org/10.1016/j.socnet.2019.05.004.

[34] J. Jia, W. Tong, J. Zhang, F. Liu, X. Fang, Trajectory of problematic internet use across the college years: the role of peer internet overuse behavior and peer attitude toward internet overuse, J. Adolesc. 86 (2021) 64–76, https://doi.org/10.1016/j.adolescence.2020.12.006.

[35] M.A. Burke, T.R. Sass, Classroom peer effects and student achievement, J. Labor Econ. 31 (2013) 51–82, https://doi.org/10.1086/666653.

[36] C. Coyle, J. Bramham, N. Dundon, M. Moynihan, A. Carr, Exploring the positive impact of peers on adolescent substance misuse, J. Child Adolesc. Subst. Abuse 25 (2016) 134–143, https://doi.org/10.1080/1067828X.2014.896761.

[37] V. Lavy, E. Sand, The effect of social networks on students' academic and non-cognitive behavioural outcomes: evidence from conditional random assignment of friends in school, Econ. J. 129 (2019) 439–480, https://doi.org/10.1111/ecoj.12582.

[38] L. Kiessling, J. Norris, The long-run effects of peers on mental health, Econ. J. (2022), https://doi.org/10.1093/ej/ueac039 ueac039.

[39] R. Agnew, Foundation for a general strain theory of crime and delinquency, Criminology 30 (1992) 47–88, https://doi.org/10.1111/j.1745-9125.1992.tb01093.x.

[40] P. Jayanthi, M. Thirunavukarasu, R. Rajkumar, Academic stress and depression among adolescents: a cross-sectional study, Indian Pediatr. 52 (2015) 217–219, https://doi.org/10.1007/s13312-015-0609-y.

[41] J.G. Snodgrass, M.G. Lacy, H.J.F. Dengah, S. Eisenhauer, G. Batchelder, R.J. Cookson, A vacation from your mind: problematic online gaming is a stress response, Comput. Hum. Behav. 38 (2014) 248–260, https://doi.org/10.1016/j.chb.2014.06.004.

[42] T. Hesketh, Q.J. Ding, Anxiety and depression in adolescents in urban and rural China, Psychol. Rep. 96 (2005) 435–444, https://doi.org/10.2466/pr0.96.2.435-444.

[43] W. Shen, A tangled web: the reciprocal relationship between depression and educational outcomes in China, Soc. Sci. Res. 85 (2020), 102353, https://doi.org/10.1016/j.ssresearch.2019.102353.

[44] A. Bandura, Self-efficacy mechanism in human agency, Am. Psychol. 37 (1982) 122–147, https://doi.org/10.1037/0003-066X.37.2.122.

[45] B.J. Zimmerman, Self-efficacy: an essential motive to learn, Contemp. Educ. Psychol. 25 (2000) 82–91, https://doi.org/10.1006/ceps.1999.1016.

[46] F. Pajares, Self-efficacy beliefs in academic settings, Rev. Educ. Res. 66 (1996) 543–578, https://doi.org/10.3102/00346543066004543.

[47] A. Zajacova, S.M. Lynch, T.J. Espenshade, Self-efficacy, stress, and academic success in college, Res. High. Educ. 46 (2005) 677–706, https://doi.org/10.1007/s11162-004-4139-z.

[48] B.J. Zimmerman, Self-efficacy and educational development, in: A. Bandura (Ed.), Self-Effic. Chang. Soc., first ed., Cambridge University Press, 1995, pp. 202–231, https://doi.org/10.1017/CBO9780511527692.009.

[49] B.J. Zimmerman, A. Bandura, M. Martinez-Pons, Self-motivation for academic attainment: the role of self-efficacy beliefs and personal goal setting, Am. Educ. Res. J. 29 (1992) 663–676, https://doi.org/10.3102/00028312029003663.

[50] H. Odaci, Academic self-efficacy and academic procrastination as predictors of problematic internet use in university students, Comput. Educ. 57 (2011) 1109–1113, https://doi.org/10.1016/j.compedu.2011.01.005.

[51] P. Steca, J.R.Z. Abela, D. Monzani, A. Greco, N.A. Hazel, B.L. Hankin, Cognitive vulnerability to depressive symptoms in children: the protective role of self-efficacy beliefs in a multi-wave longitudinal study, J. Abnorm. Child Psychol. 42 (2014) 137–148, https://doi.org/10.1007/s10802-013-9765-5.

[52] J.P. Fanshawe, P.C. Burnett, Students' and teachers' perceptions of adolescents' problems and coping strategies, J. Psychol. Couns. Sch. 9 (1999) 93–108, https://doi.org/10.1017/S1037291100003022.

[53] J.C.Y. Chan, S. Lam, Effects of different evaluative feedback on students' self-efficacy in learning, Instr. Sci. 38 (2010) 37–58, https://doi.org/10.1007/s11251-008-9077-2.

[54] R.W. White, Ego and Reality in Psychoanalytic Theory, Psychological Issues, 1963.

[55] E.A. Skinner, M. Chapman, Resolution of a developmental paradox: how can perceived internality increase, decrease, and remain the same across middle childhood? Dev. Psychol. 23 (1987) 44–48, https://doi.org/10.1037/0012-1649.23.1.44.

[56] D.H. Schunk, B.J. Zimmerman, Influencing children's self-efficacy and self-regulation of reading and writing through modeling, Read. Writ. Q. 23 (2007) 7–25, https://doi.org/10.1080/10573560600837578.

[57] K.R. Wentzel, Teacher-student relationships and adolescent competence at school, in: Interpers. Relatsh. Educ., SensePublishers, Rotterdam, 2012, pp. 19–35, https://doi.org/10.1007/978-94-6091-939-8_2.

[58] C. Ames, Classrooms: goals, structures, and student motivation, J. Educ. Psychol. 84 (1992) 261–271, https://doi.org/10.1037/0022-0663.84.3.261.

[59] F. Liu, It is not merely about life on the screen: urban Chinese youth and the Internet café, J. Youth Stud. 12 (2009) 167–184, https://doi.org/10.1080/13676260802590386.

[60] J.A. Ryu, K. Kim, An analysis of ecological variables affecting adolescent internet addiction, korea, J. Youth Couns 12 (2004) 65–80.

[61] X. Li, C.-Y. Lee, Y.-J. Lin, M. Chu, X. Qin, S. Zhang, S. Zhang, Y.-C. Chiang, Moderating effects of teachers' praise/criticism on the bullying of vulnerable students among teenagers, Curr. Psychol. (2022), https://doi.org/10.1007/s12144-022-03032-y.

[62] S. Jiang, L. Dong, The effects of teacher discrimination on depression among migrant adolescents: mediated by school engagement and moderated by poverty status, J. Affect. Disord. 275 (2020) 260–267, https://doi.org/10.1016/j.jad.2020.07.029.

[63] D.W. Gerbing, J.C. Anderson, On the meaning of within-factor correlated measurement errors, J. Consum. Res. 11 (1984) 572, https://doi.org/10.1086/208993.

[64] M. Losada, E. Heaphy, The role of positivity and connectivity in the performance of business teams: a nonlinear dynamics model, Am. Behav. Sci. 47 (2004) 740–765, https://doi.org/10.1177/0002764203260208.

[65] S. Jiang, C. Li, X. Fang, Socioeconomic status and children's mental health: understanding the mediating effect of social relations in Mainland China, J. Community Psychol. 46 (2018) 213–223, https://doi.org/10.1002/jcop.21934.

[66] W.M. Bukowski, B. Hoza, M. Boivin, Measuring friendship quality during pre- and early adolescence: the development and psychometric properties of the friendship qualities scale, J. Soc. Pers. Relatsh. 11 (1994) 471–484, https://doi.org/10.1177/0265407594113011.

[67] M. Berchiatti, L. Badenes-Ribera, A. Ferrer, C. Longobardi, F. Giovanna Maria Gastaldi, School adjustment in children who stutter: the quality of the student-teacher relationship, peer relationships, and children's academic and behavioral competence, Child. Youth Serv. Rev. 116 (2020), 105226, https://doi.org/10.1016/j.childyouth.2020.105226.

[68] L. Zhao, W. Zhao, Impacts of family environment on adolescents' academic achievement: the role of peer interaction quality and educational expectation gap, Front. Psychol. 13 (2022), 911959, https://doi.org/10.3389/fpsyg.2022.911959.

[69] C. Huang, C. Li, F. Zhao, J. Zhu, S. Wang, J. Yang, G. Sun, Parental, teacher and peer effects on the social behaviors of Chinese adolescents: a structural equation modeling analysis, Brain Sci. 13 (2023) 191, https://doi.org/10.3390/brainsci13020191.

[70] S. Xu, The influence and mechanism of leisure-time activity on teenagers' academic achievement—an empirical research based on CEPS data, J Educ Sci Hunan Norm. Univ. 21 (2022) 25–38, https://doi.org/10.19503/j.cnki.1671-6124.2022.04.004.

[71] H. Xue, H. Sun, Study on the effect of academic burden on the health of junior high school students in China——based on China education tracking survey (CEPS) data analysis, Contemp. Educ. Sci. (2022) 86–95.

[72] G.W. Cai, H.Q. Wu, Enterprising, fairness and social trust, Bus. Manag. J (2016) 62–72, https://doi.org/10.19616/j.cnki.bmj.2016.01.007.

[73] X. Ye, Q. Wang, Y. Pan, The impact of head teacher praise and criticism on adolescent non-cognitive skills: evidence from China, Front. Psychol. 13 (2023), 1021032, https://doi.org/10.3389/fpsyg.2022.1021032.

[74] Y. Rosseel, Lavaan : an R package for structural equation modeling, J. Stat. Softw. 48 (2012), https://doi.org/10.18637/jss.v048.i02.

[75] J.P. Selig, K.J. Preacher, Monte Carlo Method for Assessing Mediation: an Interactive Tool for Creating Confidence Intervals for Indirect Effects, 2008.

[76] M.-A. Vanderhasselt, J. Remue, K.K. Ng, S.C. Mueller, R. De Raedt, The regulation of positive and negative social feedback: a psychophysiological study, Cogn. Affect. Behav. Neurosci. 15 (2015) 553–563, https://doi.org/10.3758/s13415-015-0345-8.

[77] I.N. Defoe, J.S. Dubas, M.A.G. Van Aken, The relative roles of peer and parent predictors in minor adolescent delinquency: exploring gender and adolescent phase differences, Front. Public Health 6 (2018) 242, https://doi.org/10.3389/fpubh.2018.00242.

[78] A.D. Farrell, E.L. Thompson, K.R. Mehari, Dimensions of peer influences and their relationship to adolescents' aggression, other problem behaviors and prosocial behavior, J. Youth Adolesc. 46 (2017) 1351–1369, https://doi.org/10.1007/s10964-016-0601-4.

[79] S. Mollborn, E. Lawrence, Family, peer, and school influences on children's developing health lifestyles, J. Health Soc. Behav. 59 (2018) 133–150, https://doi.org/10.1177/0022146517750637.

[80] F.H.K. Wanders, A.B. Dijkstra, R. Maslowski, I. Van Der Veen, E. Amnå, The role of teachers, parents, and friends in developing adolescents' societal interest, Scand. J. Educ. Res. 65 (2021) 736–751, https://doi.org/10.1080/00313831.2020.1754901.

[81] A. Bandura (Ed.), Self-Efficacy in Changing Societies, first ed., Cambridge University Press, 1995 https://doi.org/10.1017/CBO9780511527692.

[82] K. Ting, A multilevel perspective on student ratings of instruction: lessons from the Chinese experience, Res. High. Educ. 41 (2000) 637–661, https://doi.org/10.1023/A:1007075516271.

[83] M.V. Covington, L.M.V. Hoene, D.J. Voge, Life beyond Grades: Designing College Courses to Promote Intrinsic Motivation, first ed., Cambridge University Press, 2017 https://doi.org/10.1017/9781139032896.

[84] K.R. Downs, P. Caldarella, R.A.A. Larsen, C.T. Charlton, H.P. Wills, D.M. Kamps, J.H. Wehby, Teacher praise and reprimands: the differential response of students at risk of emotional and behavioral disorders, J. Posit. Behav. Interv. 21 (2019) 135–147, https://doi.org/10.1177/1098300718800824.

[85] K.S. Sutherland, T. Lewis-Palmer, J. Stichter, P.L. Morgan, Examining the influence of teacher behavior and classroom context on the behavioral and academic outcomes for students with emotional or behavioral disorders, J. Spec. Educ. 41 (2008) 223–233, https://doi.org/10.1177/0022466907310372.

[86] A. Bandura, Social foundations of thought and action, in: Health Psychol. Read., SAGE Publications Ltd, 1 Oliver's Yard, 55 City Road, London EC1Y 1SP United Kingdom, 2002, pp. 94–106, https://doi.org/10.4135/9781446221129.n6.

[87] C.C. Voorhees, D. Murray, G. Welk, A. Birnbaum, K.M. Ribisl, C.C. Johnson, K.A. Pfeiffer, B. Saksvig, J.B. Jobe, The role of peer social network factors and physical activity in adolescent girls, Am. J. Health Behav. 29 (2005) 183–190, https://doi.org/10.5993/AJHB.29.2.9.

[88] G.D. Walters, Positive peers—the neglected stepchildren of social influence theories of crime, J. Abnorm. Child Psychol. 48 (2020) 719–732, https://doi.org/10.1007/s10802-020-00630-x.

[89] B.G. Simons-Morton, T. Farhat, Recent findings on peer group influences on adolescent smoking, J. Prim. Prev. 31 (2010) 191–208, https://doi.org/10.1007/s10935-010-0220-x.

[90] C.-Y. Liu, F.-Y. Kuo, A study of internet addiction through the lens of the interpersonal theory, Cyberpsychol. Behav. 10 (2007) 799–804, https://doi.org/10.1089/cpb.2007.9951.

[91] D.H. Schunk, J.L. Meece, Self-efficacy development in adolescence, in: F. Pajares, T. Urdan (Eds.), Self-Effic. Beliefs Adolesc., Information Age Publishing, Greenwich, 2006, pp. 71–96.

[92] R.P. Ang, V.S. Huan, Relationship between academic stress and suicidal ideation: testing for depression as a mediator using multiple regression, Child Psychiatry Hum. Dev. 37 (2006) 133–143, https://doi.org/10.1007/s10578-006-0023-8.

[93] A. Bandura, W.H. Freeman, R. Lightsey, Self-efficacy: the exercise of control, J. Cogn. Psychother. 13 (1999) 158–166, https://doi.org/10.1891/0889-8391.13.2.158.

[94] L. Ye, A. Posada, Y. Liu, The moderating effects of gender on the relationship between academic stress and academic self-efficacy, Int. J. Stress Manag. 25 (2018) 56–61, https://doi.org/10.1037/str0000089.

[95] W.D. Scott, E. Dearing, A longitudinal study of self-efficacy and depressive symptoms in youth of a North American Plains tribe, Dev. Psychopathol. 24 (2012) 607–622, https://doi.org/10.1017/S0954579412000193.

[96] A. Bandura, C. Pastorelli, C. Barbaranelli, G.V. Caprara, Self-efficacy pathways to childhood depression, J. Pers. Soc. Psychol. 76 (1999) 258–269, https://doi.org/10.1037/0022-3514.76.2.258.

[97] A. Bandura, Social cognitive theory: an agentic perspective, Annu. Rev. Psychol. 52 (2001) 1–26, https://doi.org/10.1146/annurev.psych.52.1.1.

[98] A.L. Calear, S.M. McCallum, H. Christensen, A.J. Mackinnon, A. Nicolopoulos, J.L. Brewer, A. Werner-Seidler, A.R. Morse, D. Kazan, L.M. Farrer, L. Kampel, P.J. Batterham, The Sources of Strength Australia project: a cluster randomised controlled trial of a peer-connectedness school-based program to promote help-seeking in adolescents, J. Affect. Disord. 299 (2022) 435–443, https://doi.org/10.1016/j.jad.2021.12.043.

[99] K.S. Sutherland, J.H. Wehby, S.R. Copeland, Effect of varying rates of behavior-specific praise on the on-task behavior of students with EBD, J. Emot. Behav. Disord. 8 (2000) 2–8, https://doi.org/10.1177/106342660000800101.

[100] M.T. Floress, M.M. Beaudoin, R.S. Bernas, Exploring secondary teachers' actual and perceived praise and reprimand use, J. Posit. Behav. Interv. 24 (2022) 46–57, https://doi.org/10.1177/10983007211000381.

[101] J. VanLone, J. Freeman, T. LaSalle, L. Gordon, T. Polk, J. Rocha Neves, A practical guide to improving school climate in high schools, Interv. Sch. Clin. 55 (2019) 39–45, https://doi.org/10.1177/1053451219832988.

[102] B. Zhai, D. Li, X. Li, Y. Liu, J. Zhang, W. Sun, Y. Wang, Perceived school climate and problematic internet use among adolescents: mediating roles of school belonging and depressive symptoms, Addict. Beyond Behav. 110 (2020), 106501, https://doi.org/10.1016/j.addbeh.2020.106501.

[103] J.S. Hong, S.M. Kim, K.D. Kang, D.H. Han, J.S. Kim, H. Hwang, K.J. Min, T.Y. Choi, Y.S. Lee, Effect of physical exercise intervention on mood and frontal alpha asymmetry in internet gaming disorder, Ment, Health Phys. Act. 18 (2020), 100318, https://doi.org/10.1016/j.mhpa.2020.100318.

[104] Ç.V. Koçak, How does regular exercise affect internet addiction level in university students? Phys. Educ. Stud. 23 (2018) 186–190, https://doi.org/10.15561/20755279.2019.0404.

[105] S.J.H. Biddle, M. Asare, Physical activity and mental health in children and adolescents: a review of reviews, Br. J. Sports Med. 45 (2011) 886–895, https://doi.org/10.1136/bjsports-2011-090185.

[106] K. Bertills, M. Granlund, Ö. Dahlström, L. Augustine, Relationships between physical education (PE) teaching and student self-efficacy, aptitude to participate in PE and functional skills: with a special focus on students with disabilities, Phys. Educ. Sport Pedagogy. 23 (2018) 387–401, https://doi.org/10.1080/17408989.2018.1441394.

[107] L. Zhao, Y. Lu, W. Huang, Q. Wang, Internet inequality: the relationship between high school students' Internet use in different locations and their Internet self-efficacy, Comput. Educ. 55 (2010) 1405–1423, https://doi.org/10.1016/j.compedu.2010.05.010.