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# The relationship between parental phubbing and social anxiety in emerging adulthood students: a serial mediation model

Jinlin Li<sup>1</sup>, Fanggui Tang<sup>1</sup>, Huazhan Yin<sup>2</sup> and Shaolei Liu<sup>1\*</sup>

## Abstract

**Background** Emerging adulthood is a critical period for the establishment of personal intimacy, and emerging adulthood students are vulnerable groups with social anxiety. Some studies have explored the mechanism of social anxiety. However, most of these studies are limited to analysis from a single individual or family dimension perspective, without considering its mechanism from a comprehensive perspective. Based on the cognitive behavioral framework of social anxiety, this study investigated the influence of parental phubbing on social anxiety in emerging adulthood students, and the mediating role of shyness and fear of negative evaluation.

**Method** This study surveyed 5173 emerging adulthood students from two colleges in China to explore the mediating effect of shyness and fear of negative evaluation between parental phubbing and social anxiety. Correlations between variables were analysed using Pearson correlation analysis, and mediation analyses were performed using Hayes' PROCESS macro software (model 6).

**Result** (1) The results of the correlation analysis showed that parental phubbing was significantly positively correlated with shyness, fear of negative evaluation and social anxiety. (2) After controlling for sociodemographic variables, parental phubbing can not only indirectly aggravate social anxiety through the separate mediation of shyness and fear of negative evaluation, but also through the serial mediation of shyness and fear of negative evaluation. Specifically, these mediating effects account for 27.12%, 8.40%, and 10.30% of the total effect.

**Conclusion** Parental phubbing positively and directly affects the social anxiety of emerging adulthood students, and a higher level of shyness and fear of negative evaluation further aggravate social anxiety. These findings provide not only empirical support for the cognitive behavioral framework of social anxiety, but also have practical implications for the intervention of social anxiety in emerging adulthood students.

**Keywords** Emerging adulthood, Serial mediation model, Parental phubbing, Social anxiety, Shyness, Fear of negative evaluation

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## Introduction

Social anxiety refers to an individual's excessive concern or fearful emotional response and avoidance behaviour towards one or more interpersonal situations [1], which often occurs during adolescence and early adulthood [2]. A cross-country survey indicates that more than one-third (36%) of emerging adulthood individuals meet the threshold criteria for suffering from social anxiety disorder (SAD) [3]. Emerging adulthood students, aged 18–25 years, according to Erikson's Psychosocial Development Theory, this period is a critical period for establishing intimate relationships, and its core task is to establish healthy interpersonal relationships with others and learn to share life and emotions [4]. In this critical period, individuals gradually separated from their family of origin, entered the track of independent life, and tried to adapt to the diversified living environment and cultural background. Volatility, extremes, and vulnerability are the hallmarks of this period of development, and new living environments and social partners make social anxiety a serious mental health problem for people at this stage [5]. An epidemiological survey in the United States shows that the prevalence of social anxiety among emerging adulthood students in the United States is about 3.4% [6]. One study from China found that 23.7% of emerging adulthood students had symptoms of social anxiety [7]. In addition, numerous studies have shown that social anxiety can impair an individual's interpersonal communication and academic performance, reduce people's quality of life, and increase suicide risk [8–10]. Therefore, it is urgent and necessary to explore the risk factors and potential mechanisms of social anxiety in emerging adulthood students.

The cognitive behavioral framework of social anxiety holds that, influenced by family factors, the interpersonal attitudes and behaviors that individuals learn from parent-child interactions during childhood are internalized into their coping patterns. These patterns will become the template for their future social interactions and directly affect their social interaction attitudes and behaviors [11, 12]. At the same time, in this era of information explosion, digital media such as smartphones and computers are reshaping human lifestyle and growth trajectory in an unprecedented depth [13, 14]. Given this situation, the “phubbing” behavior displayed by parents when using these digital devices, and the potential impact and correlation effect on the healthy growth of children, has become an important issue that cannot be ignored.

Some studies have explored the mechanism of social anxiety. However, most of these studies are limited to analysis from a single individual or family dimension perspective, without considering its mechanism from a comprehensive perspective [15–17]. In the context of the intrusion of electronic products into people's lives, this

study closely follows the characteristics of The Times. It explores from a comprehensive perspective how electronic products affect people's social anxiety through family factors (parental phubbing), and the role of individual factors (shyness and fear of negative evaluation) in this process. The aim is to understand the underlying mechanism of social anxiety development and provide a theoretical basis for its prevention and intervention, to improve the mental health level of emerging students.

## Parental phubbing and social anxiety

Parental phubbing refers to the behavior of parents who, during daily interactions, education, and communication with their children, are distracted by and frequently use their mobile phones, resulting in the neglect of their children [18]. According to family systems theory, parental phubbing may be a significant influencing factor in individuals developing social anxiety [19]. As the earliest environment where individuals connect with the outside world, the family is the most direct microenvironment influencing individuals [20]. Parental phubbing conveys a clear message to children: Parents value smartphones more than their children. In such cases, children may experience intense feelings of neglect or even rejection. This kind of parental rejection will bring destructive emotions to children, make them more prone to internal emotional problems such as social anxiety and external behavioral problems during development, and reduce their social interaction motivation and social interaction ability [21, 22].

The displacement hypothesis also helps explain the causes of social anxiety. The displacement hypothesis suggests that parental time on mobile devices may replace time typically spent interacting with their children. Weak online relationships replace strong offline relationships, negatively impacting parent-child relationships and causing children to lose interest in interacting with their parents and others [23]. Studies have shown that parental phubbing is closely related to social anxiety in children [24]. Based on existing theories and research bases, we propose the following hypotheses:

**Hypothesis 1** Parental phubbing can significantly and positively predict social anxiety among emerging adulthood students.

## Mediating role of shyness

Shyness is a temperament trait that manifests as discomfort, excessive restraint, and sensitivity in unfamiliar social environments and when perceiving social evaluations [25]. On the one hand, parenting style can predict shyness. Parental rejection positively predicts children's shyness, while parental emotional warmth negatively predicts shyness [26]. Parental phubbing is a typical negative

parenting style, which is likely to lead to shyness in children. Relevant studies have shown a significant positive correlation between the degree of rejection of children in the family and their shyness [27]. On the other hand, numerous studies have shown that there is a significant positive correlation between shyness and social anxiety [28–30]. Some scholars believe that there is a hypothesis about the relationship between shyness and social anxiety, that is, putting them on a continuum or range, and social anxiety can be conceptualized as “extreme shyness” [31].

At the same time, the cognitive behavioral framework of social anxiety suggests that, influenced by how they communicate with their parents during childhood, children imitate interpersonal attitudes and behaviors learned from parent-child interactions and internalize them into coping patterns [11, 12]. This pattern will serve as a template for individuals’ social interactions in adulthood, directly affecting their peer interactions and outcomes. Parental neglect, indifference, or refusal to communicate may make their children feel “what I’m doing is not good enough for others,” causing their children to be shy when interacting with their peers, affecting their future willingness and ability to socialize [32]. Therefore, we proposed the following hypothesis:

**Hypothesis 2** Shyness acts as an independent mediator between parental phubbing and social anxiety.

#### Mediating role of fear of negative evaluation

Fear of negative evaluation refers to an individual’s apprehension of others’ evaluations, distress over negative feedback, and anticipation of possible negative assessments from others [33]. On the one hand, parental phubbing is closely related to the fear of negative evaluation. Some research shows that poor communication between parents and children is an important factor leading to children’s fear of negative evaluation [34]. On the other hand, fear of negative evaluation can lead to social anxiety, and people who fear negative evaluation tend to have fewer friends and actively avoid social activities [35]. Studies have shown that high fear of negative evaluation can lead individuals to engage in problem behaviors such as avoidance of social interactions, poor interpersonal attraction, and low communication skills [36]. The cognitive behavioural framework of social anxiety suggests that fear of negative evaluation is a core feature of social anxiety [37]. The attentional bias towards negative information is critical to maintaining the anxious state of socially anxious individuals [38, 39]. For individuals with social anxiety, the most dangerous stimulus comes from the surrounding audience, and the most dreaded outcome is a negative evaluation from them [40, 41]. Thus, we proposed the third hypothesis:

**Hypothesis 3** Fear of negative evaluation acts as an independent mediator between parental phubbing and social anxiety.

#### Serial mediation role of shyness and fear of negative evaluation

As mentioned above, different parenting styles may affect children’s personality and temperament, and shyness is a typical temperament characteristic [25]. As a negative parenting style, parental phubbing may lead to children’s shyness, which is supported by empirical studies [42, 43]. At the same time, whether in real life or imaginary situations, shy individuals tend to be overly sensitive to other people’s evaluation when interacting with others, and worry too much about the possible negative review [26]. This excessive fear of negative evaluation can lead to social anxiety and alleviate this anxiety by actively avoiding social situations [44].

Therefore, the more apathetic and neglectful parents are to their children, the more likely children are to develop shyness. Shy individuals, when interacting with others or imagining interacting with others, tend to worry excessively about the possible negative evaluation of others. This kind of worry will cause individuals to have anxiety, and actively avoid social interaction to relieve anxiety, and eventually lead to the formation of social anxiety. At the same time, with the development of society, smartphones, tablets, and other electronic devices are increasingly invading people’s lives, reshaping people’s lifestyles while facilitating people’s lives; it is bound to cause many negative impacts on people. How parents’ excessive attention to electronics affects their children’s personality traits (shyness, fear of negative judgment) and, thus, their children’s social behavior and willingness (social anxiety) is a fascinating topic. Therefore, we propose the following hypothesis:

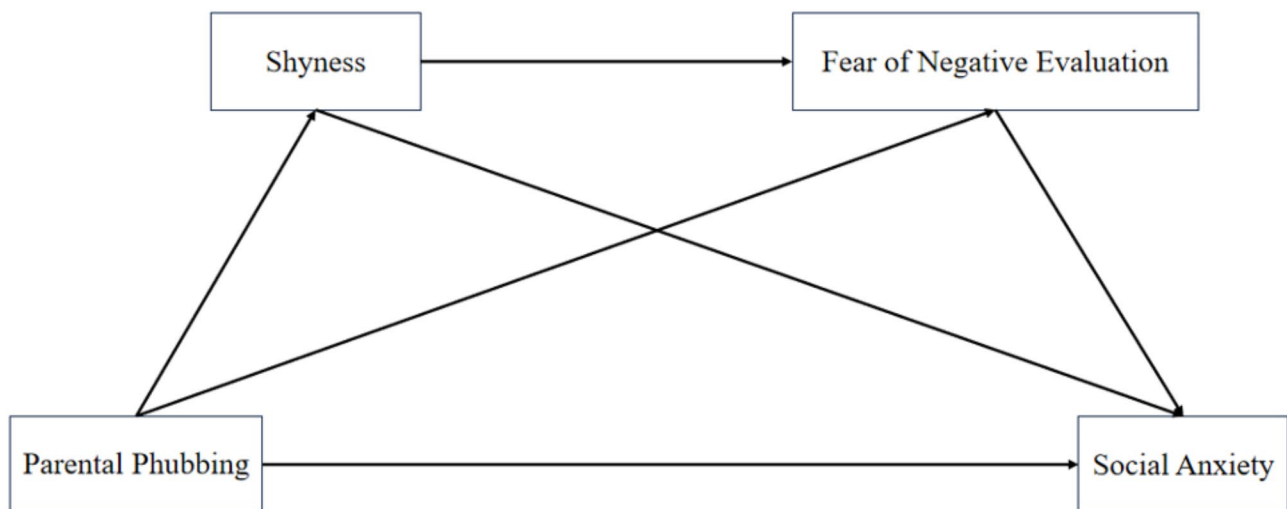
**Hypothesis 4** Parental phubbing indirectly aggravates social anxiety through the serial mediation of shyness and fear of negative evaluation.

Combined with the four hypotheses proposed above, we construct a serial mediation model with parental phubbing as the independent variable, social anxiety as the dependent variable, and Shyness and Fear of negative evaluation as mediation variables. Figure 1 shows our proposed serial mediation model of the relationship between parental phubbing and social anxiety.

## Method

### Participant

This survey was conducted from September 2023 to April 2024 in two Universities in Hengyang, Hunan, China. Convenience sampling was used to recruit participants who met the following criteria: (1) emerging adulthood



**Fig. 1** The proposed serial mediation model

students aged 18 to 25 years; (2) voluntary participation in this study; (3) able to comprehend and complete the questionnaires relevant to this study. Before participating in the survey, all participants were informed of the purpose and content of the study, and they participated voluntarily and could withdraw from the study at any time. A mental health education center teacher was the experimenter, and four students responsible for distributing the questionnaires underwent unified training with standardized instructions.

The surveys were conducted during class breaks, and participants completed the questionnaires anonymously and in silence, either by scanning the QR code to access an online version or by filling out a paper questionnaire. In order to ensure the validity of the data, we limited the number of people who filled in the online questionnaire; each ID could only be filled in once, and the online questionnaire with a short answering time was excluded. A total of 5500 college students agreed to participate and completed their questionnaire. Of them, 327 questionnaires with critical information omission or logical errors were excluded, resulting in 5173 valid questionnaires being obtained, suggesting an efficiency rate of 94.1%.

The Research Ethics Committee of Hengyang Normal University approved the research. Before the survey, detailed instructions were given on this study's purposes, nature of confidentiality, and voluntary nature.

## Measurements

### Parental phubbing

The Chinese version of the Parents Phubbing Scale (PPS) assessed parental phubbing among emerging adulthood students [45, 46]. This scale consists of 13 items, each rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate higher levels of parental phubbing. Research has demonstrated that

the Chinese version of the PPS possesses good reliability and validity, serving as an effective measurement tool for assessing parental phubbing in Chinese emerging adulthood students [46, 47]. In this study, the Cronbach's  $\alpha$  of the PPS was 0.88.

### Shyness

The level of shyness among emerging adulthood students was assessed using the Chinese version of the Shyness Scale [48, 49]. This scale consists of 13 items, each rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate higher levels of Shyness. Research has shown that the Chinese version of the Shyness Scale possesses good reliability and validity, making it an effective measurement tool for assessing shyness levels in Chinese emerging adulthood students [49]. In this study, the Cronbach's  $\alpha$  of the Shyness Scale was 0.90.

### Fear of negative evaluation

The Chinese version of the Brief Fear of Negative Evaluation Scale (BFNES) was utilized to assess the fear of negative evaluation among emerging adulthood students [50, 51]. This scale comprises 12 items, each rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicate greater levels of fear of negative evaluation. Research has shown that the Chinese version of the BFNES possesses good reliability and validity, making it an effective measurement tool for assessing fear of negative evaluation in Chinese emerging adulthood students [52, 53]. In this study, the Cronbach's  $\alpha$  of the BFNES was 0.79.

### Social anxiety

The Chinese version of the Liebowitz Social Anxiety Scale (LSAS) was utilized to assess social anxiety among

emerging adulthood students [54, 55]. This scale comprises two dimensions, social interaction, and performance, consisting of a total of 24 items. Each item is rated on a 4-point scale ranging from 0 (none/never) to 3 (severe/consistently). Higher scores indicate greater levels of social anxiety. Research has indicated that the Chinese version of the LSAS possesses good reliability and validity, serving as an effective measurement tool for assessing social anxiety in Chinese emerging adulthood students [55, 56]. In this study, the Cronbach's  $\alpha$  of the LSAS was 0.97.

Data analysis

IBM SPSS 26.0 was used to conduct common method bias tests (Harman's single-factor test), descriptive statistics (mean, standard deviation, etc.), and correlation analysis (Pearson correlation) [57, 58]. The mediation effect was analyzed using Model 6 of the SPSS PROCESS macro developed by Hayes [59]. In this model, sex, age, grade, source of the students, and being only-child or not were included as covariates. A bias-corrected test with a 95% confidence interval was conducted using the Bootstrap method.

Results

Testing for common method bias

The Harman single-factor test method was used to conduct a common method bias test on the research data. The results showed that there were 12 factors with eigenvalues greater than 1, and the variance explained by the first factor was 34.80%, which is less than the critical criterion of 40% [57]. This indicates no significant common method bias in the research data.

Testing for multicollinearity

Testing for multicollinearity and collinearity diagnostics showed that the VIF for parental phubbing, Shyness, and Fear of negative evaluation was 1.507, 1.867, and 1.741, respectively, below the threshold of 5 [58]. The multicollinearity may not affect our estimates.

Preliminary analyses

Means, standard deviations (SD), and Pearson correlations for the study variables are presented in Table 1. The results indicate that parental phubbing is significantly

positively correlated with shyness, fear of negative evaluation, and social anxiety ( $r=0.545, p<0.001$ ;  $r=0.496, p<0.001$ ;  $r=0.663, p<0.001$ ). Shyness is significantly positively correlated with fear of negative evaluation and social anxiety ( $r=0.626, p<0.001$ ;  $r=0.679, p<0.001$ ). Fear of negative evaluation is significantly positively correlated with social anxiety ( $r=0.627, p<0.001$ ).

Testing serial mediation model

This study conducted a 95% confidence interval Bootstrap mediation effect test with a sample size of 5000, controlling for sex, age, grade, source of the students, and being only-child or not. The indirect effects of shyness and fear of negative evaluation in the relationship between parental phubbing and social anxiety were analyzed. If the confidence interval did not include 0, it indicated that the indirect effect was significant. The model is shown in Fig. 2. The results indicated that parental phubbing could predict shyness ( $\beta=0.541, p<0.001$ ), fear of negative evaluation ( $\beta=0.223, p<0.001$ ), and social anxiety ( $\beta=0.351, p<0.001$ ). Shyness positively predicted fear of negative evaluation ( $\beta=0.506, p<0.001$ ) and social anxiety ( $\beta=0.325, p<0.001$ ), and fear of negative evaluation positively predicted social anxiety ( $\beta=0.244, p<0.001$ ). Specific analysis results are shown in Table 2.

\*\*\*  $p<0.001$ .

Bootstrap test of mediating effect

Based on model fitting, the Bootstrap method (with 5000 repetitions) was further employed to examine the mediating and serial mediating effects between parental phubbing and social anxiety among emerging adulthood students. The results (see Table 3) indicated that the mediating effect of shyness between parental phubbing and social anxiety was 0.176, with a 95% confidence interval excluding 0, suggesting a significant mediating effect accounting for 27.12% of the total effect. The mediating effect of fear of negative evaluation between parental phubbing and social anxiety was 0.054, with a 95% confidence interval excluding 0, indicating a significant mediating effect accounting for 8.40% of the total effect. The serial mediating effect of shyness and fear of negative evaluation between parental phubbing and social anxiety was 0.067, with a 95% confidence interval excluding 0,

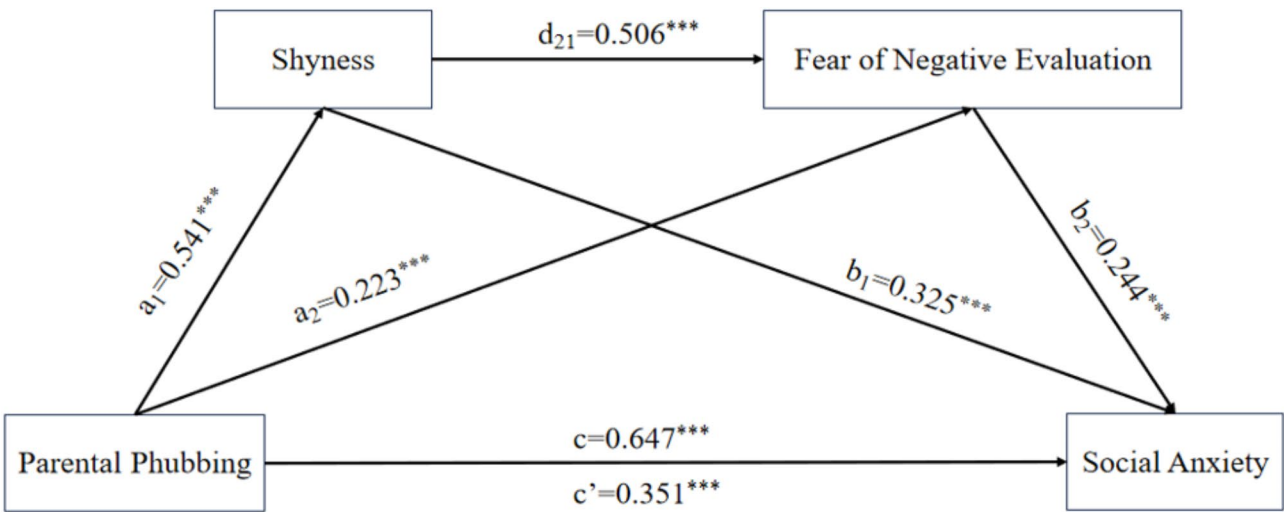
Table 1 Means, standard deviations, and correlations of study variables (N=5173)

Variable	M	SD	1	2	3	4
1. Parental phubbing	24.606	7.013	1			
2. Shyness	37.649	8.523	0.545***	1		
3. Fear of negative evaluation	35.554	3.525	0.496***	0.626***	1	
4. Social anxiety	50.077	26.372	0.663***	0.679***	0.627***	1

Note: M, mean; SD, standard deviation

\*\*\*  $p<0.001$





**Fig. 2** The serial mediation model of Shyness and Fear of negative evaluation in the relationship between parental phubbing and social anxiety. Effects were reported as standardize values

**Table 2** Regression-based results in the serial mediation analysis (N=5173)

Criterion	Predictor variable	R	R <sup>2</sup>	F	β	t	95% CI
Shyness	Parental phubbing	0.546	0.298	437.958***	0.541	45.960***	(0.518,0.564)
Fear of Negative Evaluation	Parental phubbing	0.653	0.426	639.614***	0.223	17.690***	(0.199,0.248)
	Shyness				0.506	40.264***	(0.482,0.531)
Social anxiety	parental phubbing	0.792	0.627	1241.210***	0.351	33.451***	(0.330,0.371)
	Shyness				0.325	27.943***	(0.302,0.348)
	Fear of Negative Evaluation				0.244	21.720***	(0.222,0.266)

Note: CI= confidence interval; sex, age, grade, source of the students, and being only-child or not as covariates  
\*\*\*  $p < 0.001$

**Table 3** Parental phubbing and social anxiety in the mediation effect analysis (N= 5173)

effect	β	se	bootstrapping 95% CI	
total effects	0.647	0.010	(0.627,0.668)	100.00%
direct effect	0.351	0.011	(0.330,0.371)	54.17%
total indirect effect	0.297	0.011	(0.276,0.318)	45.84%
Indirect(X-M1-Y)	0.176	0.009	(0.159,0.193)	27.12%
Indirect(X-M2-Y)	0.054	0.005	(0.046,0.064)	8.40%
Indirect(X-M1-M2-Y)	0.067	0.004	(0.058,0.076)	10.30%

indicating a significant serial mediating effect accounting for 10.30% of the total effect.

Discussion

In this study, we use a serial mediation model to explain our research hypothesis. The results suggest that parental phubbing can not only directly predict social anxiety, but also influence social anxiety through shyness and fear of negative evaluation. The higher the level of parental phubbing, the greater the probability of shyness, and shyness further promotes fear of negative evaluation, thus increasing the risk of social anxiety. This further clarifies the underlying mechanism of social anxiety development and provides a new reference for the prevention

and intervention of social anxiety in emerging adulthood students.

The impact of parental phubbing on social anxiety

This study demonstrates a direct link between parental phubbing and social anxiety, and the results support hypothesis 1. A study has found that parents who focus too much on mobile phones, tablets and other electronic devices while raising their children can hurt their children’s mental health [60]. When parents often interrupt or neglect communication with their children because they are distracted or addicted to their phones, the quality of parent-child communication and relationships is reduced [61]. According to family systems theory, children learn social skills through interaction with their

parents. However, parent phubbing leads to insufficient parent-child communication, depriving the child of the opportunity to exercise social skills and making the child feel anxious about social interaction. To alleviate this unpleasant feeling, they use avoidance of social interactions and anxiety as a maladaptive coping strategy [62]. In addition, the cognitive behavioral framework of social anxiety states that patterns of communication and interaction between parents and children play a crucial role in children's development. This mode of communication and interaction constitutes the prototype of children's psychological response and behavior pattern imitation in interpersonal communication. Suppose parents are too neglectful, indifferent, or rejecting. In that case, children will reduce their desire to communicate with their parents and internalize their parents' behaviors into their patterns of social interaction behavior. These unhealthy social patterns are bound to lead to social failure as they grow up and, to a large extent, increase the likelihood of their social anxiety [63].

In conclusion, this study further examines the importance of parents in children's social development. It enriches the explanations of family system theory and cognitive behavioral models for the causes of social anxiety. This also suggests that in educational practice, parents should reduce excessive attention to mobile phones and other electronic products, improve the frequency and quality of communication between parents and children, and enhance the equal and harmonious atmosphere between parents and children. Parents should let their children receive education in a good family atmosphere to promote their social communication ability and mental health level.

#### **Mediation effect of shyness**

This study shows that shyness significantly mediates the relationship between parental phubbing and social anxiety in emerging adulthood students. Hypothesis 2 is verified, and the mediating role of shyness between parental phubbing and social anxiety is close to 30%. These findings echo previous research showing that shyness plays a mediating role in parental phubbing and social anxiety [64]. Some research suggests that receiving good parenting in early childhood may alter shy children's ability to adjust and adapt to social situations. Poor parenting style was strongly associated with more excellent social withdrawal behavior and negative psychosomatic responses in children in their new environment [65, 66]. It may increase the risk of children developing social anxiety when they grow up [67]. According to the cognitive behavioral framework of social anxiety, individuals will imitate the interpersonal attitudes and behaviors of others and internalize them into their future social interaction coping patterns [11]. Frequent parental phubbing

may cause children to experience emotional alienation and insecurity in the family. Therefore, these children may imitate their parents' psychological attitudes and behaviors in social interactions, gradually develop shy personality traits, begin to avoid social situations, and eventually lead to social anxiety. The study further validates this theory and adds to the evidence that parental phubbing enhances social anxiety in emerging adulthood students through shyness.

#### **Mediating effect of fear of negative evaluation**

This study shows that fear of negative evaluation significantly mediates the relationship between parental phubbing and social anxiety. The results confirm hypothesis 3, that is, the higher the degree of parental phubbing experienced by emerging adulthood students, the more likely it is to form a fear of negative evaluation, thus increasing the probability of their social anxiety. The mediating effect of negative evaluation fear between parental phubbing and social anxiety was 8.40%. A similar relationship has been shown in previous studies. In daily contact with children, parents' frequent use of mobile phones will reduce parent-child communication quality, weaken family functions, and increase the risk of children developing problem behaviors such as fear of negative evaluation [68]. At the same time, some studies have shown that a typical feature of socially anxious individuals is concern about evaluating others in social situations, especially negative evaluations [69, 70]. Conversely, positive parenting reduces individuals' fear of negative evaluation. It enables them to apply communication skills learned from family interactions to real-life situations, reducing anxiety levels during social interactions [71, 72]. In other words, fear of negative evaluation is an important behavioral mechanism between parental phubbing and social anxiety, and the results of this study further provide theoretical support for this conclusion.

#### **Serial mediating effect of shyness and fear of negative evaluation**

We found that shyness and fear of negative evaluation mediate the relationship between parental phubbing and social anxiety through a serial mediation model, which explains more than 10% of the total effect. The results support hypothesis 4. In other words, we found that if the emerging adulthood students experienced more parental phubbing, they were more likely to develop incredible shyness, and the fear of negative evaluation would increase accordingly. Such high fear of negative evaluation further increased the occurrence of social anxiety, which further explained the mechanism of parental phubbing affecting social anxiety. Additionally, this study confirms the close relationship between shyness and fear of negative evaluation, suggesting that shyness may lead

to anxiety about the negative evaluation of others. These findings are consistent with previous research. Recent studies have shown that low-shyness individuals experience more parental acceptance and warmth during parenting.

In contrast, high-shyness individuals experience more parental neglect, indifference and rejection [73–75], while great-shyness individuals are more sensitive to unfamiliar social environments and often worry about negative evaluation from others [76–78]. This high fear of negative evaluation will cause individuals to avoid social situations further and fear possible social interactions, resulting in social anxiety. Our study adds to the research on the mechanism of the relationship between shyness and fear of negative evaluation in parental phubbing and social anxiety.

At the same time, this study also verified the cognitive behavior framework of social anxiety. In other words, the experience formed in the early social interaction with parents will naturally transfer to the interpersonal relationship with others, affect the individual's attitude towards interpersonal communication, and thus affect the individual's social interaction behavior [79]. Parents' neglect, indifference and rejection in the daily contact with children, education and communication process will affect children's attitude and cognition of interpersonal relationships, resulting in discomfort, excessive restraint and sensitivity in unfamiliar social environments and perception of social evaluation, and even anxiety or fear when communicating with real or imagined others, and eventually form social anxiety.

### Research significance and limitation

To our knowledge, this study is the first to investigate the relationship between parental phubbing, shyness, fear of negative evaluation, and social anxiety in emerging adulthood students. This study successfully integrated family factors (parental phubbing) and individual factors (shyness, fear of negative evaluation) to consider the generation mechanism of social anxiety, providing a theoretical basis for intervening in emerging adulthood students' social anxiety from family and individual perspectives, and providing a direction for mental health education for emerging adulthood students.

The present study also had some limitations. Firstly, this study employed a cross-sectional research design, and it failed to exclude reverse causality. Further cohort studies are needed to validate the results of this paper. Secondly, due to the limitation of research funds and time, this survey was only conducted in two universities in Hunan Province. Further studies in more heterogeneous and national populations are needed to confirm our findings, and caution should be exercised in extrapolating the results of this study. Finally, this study adopts

the method of online and offline convenient sampling for data collection. Although confounding variables were added to the data analysis to mitigate the effect of convenience sampling on the study results, this effect cannot be eliminated. Future studies could use more rigorous random sampling methods and consider including samples from different regions to improve the reliability of the results.

### Conclusion

Our study mainly confirmed the following four results: (1) Parental phubbing is positively correlated with social anxiety in emerging adulthood students; (2) Shyness plays a mediating role between parental phubbing and social anxiety; (3) Fear of negative evaluation plays a mediating role between parental phubbing and social anxiety; (4) Parental phubbing indirectly raises the level of social anxiety of emerging adulthood students through the serial mediation model of shyness and fear of negative evaluation. Our findings further fill the research gap on the potential influencing factors of emerging students' social anxiety from a comprehensive perspective. In addition, this finding provides a new perspective for the intervention of social anxiety; that is, through the intervention of personal factors (shyness, fear of negative evaluation), we can reduce the influence of family factors (parental phubbing) on social anxiety. In the context of the widespread penetration of modern electronic products into daily life, this study aims to explore how electronic products affect the social anxiety of emerging adulthood students through the medium of family environment, and to analyze the mediating role of personal traits (shyness and fear of negative evaluation) in this influencing mechanism. These findings provide a novel theoretical framework for understanding and intervening in social anxiety. Specifically, this study points out that, on the one hand, if parents can reduce their excessive dependence on electronic products, improve the frequency and quality of communication with their children, and create a more equal and harmonious parent-child relationship atmosphere, it will promote the development of students' social skills and improve their mental health. On the other hand, encouraging students to participate actively in social activities and reducing their shyness and fear of negative evaluation in interpersonal communication can also effectively improve their social ability and mental health.

### Abbreviations

QR	Quick response code
ID	Identity document
PPS	Parents phubbing scales
BFNES	Brief fear of negative evaluation scale
LSAS	Liebowitz social anxiety scale
SPSS	Statistical product and service solutions
VIF	Variance inflation factor



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## Author contributions

Shaolei Liu, Jinlin Li, Fanggui Tang and Huazhan Yin designed and interpreted the study. Shaolei Liu collected the data for the study and wrote the first draft of the manuscript. Jinlin Li was responsible for revising and proofreading the manuscript. All authors contributed to the article and approved the submitted version.

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## Data availability

No datasets were generated or analysed during the current study.

## Declarations

### Ethical approval and consent to participate

This study was conducted by the 1964 Helsinki Declaration and its later amendments. The Ethics Institutional Review Board of Hengyang Normal University approved the study. The participants provided their written informed consent to participate in this study.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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