


Maternal Phubbing and Problematic Media Use in Preschoolers: The Independent and Interactive Moderating Role of Children's Negative Affectivity and Effortful Control

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Purpose: Given that mother plays the main nurturing role in a family unit and their unique influence on children's development, the current study aimed to examine the influence of maternal phubbing on children's problematic media use and the independent and interactive moderating role of children's negative affectivity and effortful control.

Methods: Participants were 1986 children aged 3 to 6 years in Shanghai, China. Their mothers were asked to complete a series of questionnaires including parental phubbing scale, problematic media use measure, and child behavior questionnaire. To investigate the moderating influence of children's negative affectivity and effortful control, hierarchical linear regression analyses were conducted using SPSS 24.0. Simple slopes analyses and the Johnson–Neyman technique were further used to depict moderation effects.

Results: Maternal phubbing was associated with higher levels of problematic media use in preschool children ($\beta = 0.18$, $p < .001$, $[0.14, 0.22]$). Children's negative affectivity acts as a risk factor, exacerbating the adverse effects of maternal phubbing on children's problematic media use ($\beta = 0.05$, $t = 2.69$, $p < 0.05$), whereas children's effortful control acts as a protective factor, buffering the link between maternal phubbing and children's problematic media use ($\beta = -0.10$, $t = -5.00$, $p < 0.001$).

Conclusion: These results suggest that interventions seeking to promote appropriate digital development in preschoolers should take the child's temperament into account and be complemented by active parental mediation and involvement.

Keywords: maternal phubbing, problematic media use, negative affectivity, effortful control, preschoolers

Introduction

The rapid advancement of digital technology has facilitated the widespread use of digital media devices among children, resulting in a substantial increase in children's screen time.¹ Notably, there is a growing trend of digital media usage starting at increasingly young ages.² As digital media has become an integral part of daily life, researchers have expressed concerns regarding the risks associated with children's excessive exposure to it.^{3,4} Studies have consistently demonstrated that such overexposure during early childhood is associated with various physiological and psychological problems, including impaired vision and sleep problems,^{5–7} as well as academic, social-emotional, and behavioral problems.^{8–11} Similarly, the adverse effects of problematic internet and smartphone use, such as lower self-esteem,^{12,13} depression, anxiety,^{14,15} and reduced prosocial behavior,¹⁶ have also been observed in adolescents. These findings highlight the pervasive influence of digital media on various age groups.

It is particularly essential to examine problematic media use (PMU) in young children, as early childhood is marked by rapid development and heightened receptivity to their environment and experiences, making it an important stage for

establishing healthy habits. Without proper intervention, such maladaptive media use would escalate into maladjustment and academic difficulties that could compromise children's day-to-day social and school functioning in the future.¹⁷ Given the prevalence of PMU among preschoolers and its adverse consequences on their subsequent development, it is necessary to investigate the causes of PMU in this age group, rectify inappropriate digital media usage patterns in a timely manner, and ensure the optimal well-being and development of children.

The development of social digitization shapes a transcendent parenting paradigm, digital parenting, implying the important influence of family dynamics (eg, SES and parent-related factors) on children's PMU.¹⁸ Compared to children from high income families, children who are raised in families with lower income display more media use for entertainment.¹⁹ Furthermore, less educated parents tend to be inconsistent in their ability to regulate children's media use, which could increase children's PMU, such as engaging in extensive media use or accessing inappropriate content.¹⁹ One another potential precursor to children's PMU is their caregivers' excessive daily use of mobile devices. By the end of June 2023, the proportion of individuals using smartphones to access the Internet reached a remarkable 99.6%.²⁰ There is a growing dependence on mobile phones at the expense of interpersonal relationships.²¹ To maximize effective communication, individuals nowadays often prioritize indirect virtual interactions over direct face-to-face conversations, inadvertently limiting the enriched information conveyed through verbal and body language.²² This phenomenon gives rise to a common social behavior known as "phubbing". In the family system, parental phubbing exerts a notable influence on children's PMU.^{23,24} For instance, Zhou et al found that parental phubbing significantly predicts increases in children's Internet gaming addiction.²⁵ While negative mobile phone practice by parents is generally recognized as a risk factor for children's PMU,^{26,27} it's important to acknowledge that children vary in their sensitivity to environmental risks.²⁸ It is possible that children's temperament might modify the negative impact of parental phubbing on their PMU. However, little is known about whether the magnitude and direction of the correlation between parental phubbing and PMU would change when considering temperament as a moderator variable. Additionally, existing empirical studies on PMU have mainly focused on adolescents, with little attention devoted to preschoolers.^{23,29,30} Therefore, this study aims to explore the underlying mechanisms through which maternal phubbing influences PMU among preschool-aged children. Maternal phubbing, akin to social exclusion,³¹ can hinder mothers' sensitive responses to children's need for companionship.³² During early childhood, the mother often plays a central role as the primary caregiver, particularly in meeting children's emotional needs.³³ Given this influential caregiving role and the heightened emotional bond with the child, our study focuses on maternal phubbing as it is anticipated to have a more significant impact on the social development of young children compared to paternal phubbing. This investigation not only expands current literature on media usage and children's characteristics but also provides practical insights for preventing and intervening in PMU among preschoolers within the digital era.

Maternal Phubbing and Children's Problematic Media Use

Maternal phubbing refers to mothers using mobile phones during parent-child interactions, which can make children feel ignored or rejected.³⁴ A model detailing potential consequences of being phubbed, drawn from Vanden Abeele's attention-arousal-attribution framework of the social consequences of being phubbed,³⁵ assumes three temporally consecutive stages.²⁷ In the initial reflexive stage, children experience immediate emotional and cognitive reactions, including negative affect arousal and fundamental needs dissatisfaction.²⁷ This is followed by the reflective stage, during which children adopt (mal)adaptive coping strategies. Finally, the resignation stage entails long-term interpersonal and intrapersonal consequence on individual health.²⁷ According to this model, parental phubbing leads to children's negative affect arousal in the reflexive stage, which, in turn, promotes children to engage in increased digital media use as a maladaptive coping strategy to escape from the negative emotions triggered by parental phubbing and fulfill their emotional needs in the digital environment in the reflective stage.^{27,35} This stage involves more deliberate and conscious processing of the phubbing behavior. In support of this theory, parental phubbing has been found to be correlated with negative emotions such as loneliness, which further results in PMU among adolescents.^{23,36} Furthermore, the social learning theory suggests that children who frequently experience parental phubbing will imitate and replicate these behaviors through observational learning, leading to the intergenerational transmission of media use behaviors.³⁷

Problematic media use (PMU) refers to the excessive use of various digital media, such as mobile phones, television and tablets, which significantly interferes with individual psychosocial functioning.^{9,17} Over the past few years, there has been a growing concern surrounding maladaptive media use among children and adolescents. Preschool children, unlike adolescents, heavily rely on their parents for access to digital devices.⁹ From this perspective, it becomes clear that parents' media use beliefs and practices can have a notable impact on preschoolers' access to digital devices. Moreover, developmental characteristics, such as limited reflective abilities, can make it challenging for preschoolers to fully understand the potential consequences of excessive media use,³⁸ putting preschool children in a particularly vulnerable position when exposed to PMU. Accordingly, it is paramount to investigate the underlying mechanisms contributing to PMU in this age group.

Numerous studies have consistently demonstrated that parental phubbing contributes to adolescents' increased dependence on digital media, ultimately leading to problematic internet use.^{23,24,29} For instance, Wang et al found that parental phubbing was positively linked with adolescent addition to short-form videos.³⁰ Similarly, a longitudinal study focusing on adolescents found that early parental phubbing strongly predicted problematic smartphone use later in adolescence.²³ Based on the theories and previous studies, the current study hypothesizes that maternal phubbing is positively associated with children's PMU.

Temperament: Negative Affectivity and Effortful Control

As suggested by Nuñez and Radtke's model, reflective coping strategies, including PMU, vary among children with different individual levels of specific personality traits.²⁷ One specific personality trait related to maladaptive online behavior is temperament. From a psychobiological perspective, temperament is characterized as a biological combination of traits unique to each individual, distinguished by variations in reactivity and self-regulation.^{39,40} Rothbart et al integrated a temperament model that portrays three broad temperament dimensions manifest in early childhood, including surgency, negative affectivity and effortful control.^{40,41} In the present study, we specifically focused on the dimensions of negative affectivity (NA) and effortful control (EC), as previous research has indicated their significance in understanding the development of young children's PMU.^{42,43} For example, toddlers with high NA were more likely to exhibit PMU behaviors,⁴⁴ while toddlers with lower EC were indirectly associated with increased screen use.⁴⁵ NA, a reactivity dimension of temperament, is manifested through intense emotions reacting to stressors, such as anger, irritability, fear, or sadness.⁴⁶ Children with high NA tend to be more prone to nervousness, are more difficult to appease, and react negatively to unfamiliar or novel stimuli.⁴⁶ On the other hand, EC, a core aspect of self-regulation, refers to an individual's voluntary ability to manage their behavior and emotions, particularly in situations that require self-control and the inhibition of impulsive responses. This temperament dimension involves processes such as attentional focusing, shifting, and inhibitory control.^{46,47}

Child temperament reflects individual variances across emotional, activity, and attention domains, shaping ultimately children's varying responsiveness to environmental stressors.⁴⁶ High NA leads to intense emotional reactions and potential difficulties in coping, yielding more problematic outcomes.³⁹ Conversely, high EC enables effective emotion and behavior regulation, fostering resilience and positive outcomes in challenging situations.³⁹ Developmental studies in children have emphasized the moderating role of these two temperaments in shaping child outcomes,^{48,49} with EC potentially modulating the relationship between NA and child outcomes.^{50,51} Therefore, by examining how these temperament dimensions independently and interactively influence the connections between maternal phubbing and preschoolers' PMU, we can gain valuable insights into the child characteristics and family dynamics shaping PMU.

The Moderating Effect of Negative Affectivity

The diathesis-stress model supports the notion that children with vulnerability factors (eg, high NA) are more susceptible to adverse external environments and stressors.⁵² This increased vulnerability can result in increased developmental difficulties, such as an increased maladaptive consequence associated with screen use.²⁸ NA has been found to play an essential moderating role in the association between environmental predictors and media use.²⁸ For example, McArthur et al found that as social risk exposure increased, children with high NA demonstrated significantly higher levels of screen use compared to children with low NA.²⁸ When facing frustrating situations (eg, maternal phubbing), children

with high NA are more likely to express negative emotions,⁵³ such as temper tantrums which may increase parenting stress, leading parents to make more frequent use of their cell phones.^{44,54} Additionally, parents who are distracted by their phones tend to exhibit decreased parental responsiveness and lower emotional availability during interactions with their children.^{32,55,56} This decreased parenting quality may lead parents to choose digital media as an easier regulatory strategy to soothe children rather than utilizing behavioral management or emotion regulation strategies,^{57,58} which may further reinforce PMU in children. Moreover, children with high NA are more likely to experience negative emotions (eg, a feeling of exclusion) triggered by parental phubbing. In response, they may turn to digital media as a means of emotional compensation,⁴⁵ potentially developing a higher dependency on digital media.⁵⁹ Consequently, children's higher reliance on digital media may contribute to the development of PMU. Therefore, this study hypothesizes that children's NA may serve as a moderating factor in the relationship between maternal phubbing and children's PMU. Specifically, when mothers engage in phubbing, children with high NA were more likely to develop PMU compared to their low NA counterparts.

The Moderating Effect of Effortful Control

In today's digital age, individuals are constantly exposed to a myriad of stimuli and distractions through various digital platforms. EC, as the ability to focus attention on essential tasks and resist impulsive urges to excessively engage with digital media, is particularly valuable, especially among children and adolescents who tend to be more susceptible to external influences. According to the reflective-impulsive model, children's PMU is characterized by impulsivity and a lack of control.^{60,61} EC plays an important role in helping children resist the temptation to use screens by inhibiting maladaptive behavioral responses. EC can serve as a protective factor against adolescents' problematic smartphone use, mitigating the effects of adverse family environments. For instance, it was found that self-control, a self-regulation indicator similar to EC, could buffer the effect of parental phubbing on problematic mobile phone use in adolescents, suggesting that adolescents with higher self-control were less susceptible to the negative effects of parental phubbing on problematic mobile phone use.²⁹ Similarly, Liu et al found that adolescents with low EC were more likely to exhibit high levels of problematic mobile phone use when experiencing psychological distress compared to those with high EC.⁶² Therefore, it is reasonable to assume that children's EC may play a moderating role between maternal phubbing and PMU in preschoolers. Specifically, when mothers engage in phubbing, children with low EC were more likely to develop PMU than children with high EC.

The Moderated Moderating Effect of Effortful Control

Research has indicated that children's temperament dimensions can interact with one another.^{50,51,63} High EC can regulate the adaptive function of NA (ie, digital media usage to manage their intense emotional expression when being phubbed) and serve as a protective factor against maladaptive consequences related to NA. Conversely, individuals with low EC may exhibit heightened vulnerability to maladaptive consequences resulting from high NA. For example, Wang et al discovered that EC could mitigate the reinforcing impact of NA on the intergenerational transmission of corporal punishment—the process through which the use of corporal punishment as a disciplinary practice is passed down from one generation to the next within a family.⁵¹ Specifically, the stability of intergenerational transmission of corporal punishment was found to be weakest or even disappeared for parents of children with high EC and low NA.⁵¹ In addition, Suurland et al found that negative emotionality (indicative of high NA) and inhibitory control (indicative of low EC) could directly and interactively predict aggression.⁵⁰ Children with high negative emotionality and low inhibitory control displayed the highest levels of aggression.⁵⁰

Therefore, if high NA intensifies children's negative experiences with maternal phubbing, it is plausible that high EC may exert a protective effect against the exacerbating influence of NA on the negative consequences of maternal phubbing by restraining their behavioral impulsivity. Specifically, children with high EC and NA are more likely to use effective strategies to cope with and regulate a high level of negative emotion triggered by maternal phubbing. They are less reliant on external digital media as a means to regulate their emotions. In contrast, children with low EC and high NA may struggle to regulate their own negative emotional experiences and control impulsive screen use when exposed to high levels of maternal phubbing, ultimately leading to PMU in children.

The Present Study

While contemporary parenting roles have evolved, with both parents often sharing nurturing responsibilities, mothers continue to hold a central role in a family unit's caregiving.⁶⁴ Maternal involvement remains an important factor in children's upbringing, making it necessary to explore how maternal behaviors, such as phubbing, may shape children's PMU. The roles of child temperament, specifically NA and EC, were also examined to understand the underlying mechanism linking maternal phubbing and children's PMU. A moderated moderation model (see Figure 1) was proposed to illustrate the independent and interactive roles of children's NA and EC in moderating the relationship between maternal phubbing and preschoolers' PMU.

Based on relevant theories and empirical literature, it was hypothesized that maternal phubbing would be positively associated with preschoolers' PMU. Furthermore, both NA and EC were expected to independently moderate the relationship between maternal phubbing and preschoolers' PMU. Specifically, it was predicted that high levels of child NA would intensify the negative effect of maternal phubbing on PMU, whereas high levels of child EC were anticipated to weaken the relation. Finally, the current study examined whether EC moderated the moderating effects of NA in the relationship between maternal phubbing and preschoolers' PMU. It was expected that children with high NA and low EC would exhibit the highest level of PMU.

Materials and Methods

Participants

Participants consisted of 1986 mothers whose children (972 boys, 1014 girls, $M_{\text{age}} = 4.73$ years, $SD = 1.23$) were studying in public kindergartens in Shanghai, China. Participants were all from urban areas. The mothers' age ranged from 24 to 52 ($M_{\text{age}} = 34.77$ years, $SD = 3.95$). Regarding mothers' education level, 4.7% of mothers attained a high school or technical secondary school education or below, 15.3% obtained an associate degree, 61.2% had earned a bachelor's degree, and 18.8% had a master's degree or higher.

Procedure

The current study was reviewed and approved by the Ethics Review Board of Shanghai Normal University (Ethics of Shanghai Normal University [2022] No. 043). From May 1st to June 10th, 2022, mothers who are 18 years and older and have at least one preschooler aged 3–6 years old were recruited from public kindergartens in Shanghai using stratified cluster sampling. The present questionnaires were hosted on Wenjuanxing (a popular online survey platform in China). The kindergarten teachers were contacted to distribute the study information and the link of questionnaires to the mothers of their students using WeChat group chats. Before presenting the study questionnaire, willing participants who met the inclusion criteria were fully informed about the study purpose, the voluntary and anonymous nature of their participation, and their right to withdraw from the study at any time. Those who consented were then presented with a study questionnaire. No financial incentives were given. However, as compensation and appreciation for the participants' time and contribution to the present study, we furnished participating mothers with a developmental report concerning their children after the study concludes. Informed consent was obtained, with participants indicating their agreement by clicking the "agree" button at the beginning of the questionnaire. Participants' data were included for further analysis

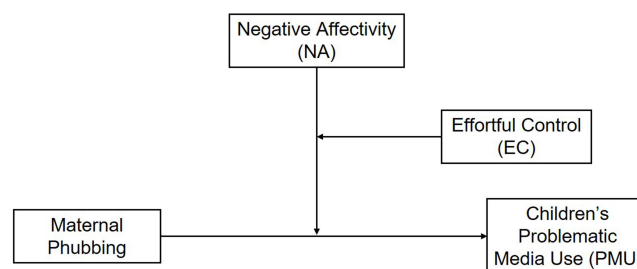


Figure 1 Conceptual model of the moderated moderation model.

upon obtaining informed consent (97% agreement rate). Mothers rated their children's PMU and temperament and completed measures of parental phubbing online.

Measures

Parental Phubbing Scale

Mothers' phubbing behaviors were assessed using the revised Chinese version of the Parental Pubbing Scale (PPS),^{34,65} which has demonstrated good reliability and validity in China.³⁶ The questionnaire contains 9 items regarding mothers' mobile use while interacting with their children (eg, "During the time that I communicate with my child, I will check my cell phone"). Mothers rated each item on a 5-point scale (1 = *Never*, 5 = *All the time*). Higher average scores indicate a higher level of maternal phubbing behavior. The PPS scales show adequate to good internal consistency reliability, with coefficient alphas was 0.80.

Problematic Media Use Measure

The Chinese version of Problematic Media Use Measure is a 23-item scale designed to assess preschoolers' PMU (PMUM).^{66,67} This scale consists of two subscales: (1) *Psychosocial Problems*, which focuses on behavioral and emotional problems associated with children's media use (eg, "My child lies in order to use screen media") and (2) *Tolerance & Withdrawal*, which explores children's increasing dependence on screen media and their difficulty in disengaging from it (eg, "It is hard for my child to stop using screen media"). Mothers rated how often each item described their children's media use on a 5-point scale (1 = *Never*, 5 = *Always*). The scores for individual items were summed and averaged, with higher scores indicating a higher level of PMU in children. The Chinese version of PMUM has demonstrated reliability and validity in young Chinese children,⁶⁸ and in the present study, the internal consistency coefficient was 0.97.

Child Behavior Questionnaire

Children's temperament was assessed using the short form of the Child Behavior Questionnaire (CBQ),⁶⁹ which has demonstrated good reliability and validity in Chinese children.⁷⁰ The original CBQ scale consists of 36 items across three subscales: surgency/extraversion, negative affectivity (NA), and effortful control (EC). For this study, only data from *Negative Affectivity* subscale (12 items, eg, "uncomfortable with how child and I get along") and *Effortful Control* subscale (12 items, eg, "reacts strongly to separation from me") were analyzed. Mothers rated each item on a 7-point scale (1 = *Definitely does not apply*, 7 = *Definitely applies*). Mean scores were calculated, with higher scores indicating higher levels of negative affectivity or effortful control. In cases where the child's behavior described in the item was not applicable, a response option was provided as "Not Applicable". The Cronbach α was 0.83 for overall CBQ, 0.73 for NA subscale, and 0.82 for EC subscale.

Data Analysis

We used SPSS 24 software for data analysis. Prior to conducting the analyses, all relevant variables were standardized into z-scores. Given that the variables of interest in this study are exclusively obtained from mothers' self-report, Harman's single factor test is conducted to examine potential common method biases. The result of the test indicated that common method bias was not significant, as the initial factor accounted for 27.30% of the variance which is below the critical threshold of 40%.⁷¹ Independent sample *t*-tests and correlational analyses were conducted to assess the relationships between study variables, maternal education level, and child characteristics (age, gender). A series of hierarchical regression analyses were then performed to examine whether the relations between maternal phubbing and children's PMU were independently or interactively moderated by children's NA and EC. The children's age, gender and maternal education level were entered in Step 1. Maternal phubbing and children's NA and EC were entered simultaneously in the second step. Finally, the interaction of phubbing \times NA, phubbing \times EC, and phubbing \times NA \times EC were entered in the final step. When significant interactions were found, follow-up simple slopes analyses were conducted to explore the relationships between maternal phubbing and children's PMU in a high value (+1 SD above the mean) and a low value

(−1 SD below the mean) of NA and EF.⁷² Furthermore, significant regions of maternal phubbing on PMU at different values of NA and EF were probed using the Johnson–Neyman (J–N) technique.⁷³

Results

Preliminary Analyses

The means, standard deviations, and correlation matrices for each variable are shown in Table 1. Maternal phubbing was positively associated with children's PMU ($r = 0.27, p < 0.001$). NA was positively associated with maternal phubbing ($r = 0.23, p < 0.001$) and children's PMU ($r = 0.40, p < 0.001$). Additionally, EC was negatively associated with maternal phubbing ($r = -0.07, p < 0.01$) and children's PMU ($r = -0.22, p < 0.001$).

In addition, children's age was significantly positively associated with EC ($r = 0.10, p < 0.001$). Maternal education level was positively associated with phubbing ($r = 0.10, p < 0.001$) and children's EC ($r = 0.09, p < 0.001$). Independent samples t-tests revealed that there were significant gender differences in PMU ($M_{\text{boy}} = 1.88, SD = 0.70; M_{\text{girl}} = 1.78, SD = 0.63, t = 2.81, p < 0.001$). That is, boys had higher levels of PMU than girls. Accordingly, these variables were included as covariates in the subsequent analysis.

Testing for the Interactions

To test the potential moderating role of children's NA and EC in the relations between maternal phubbing and children's PMU, we conducted a series of hierarchical regression analyses. Table 2 shows all significant regression models. After controlling for children's age and gender and maternal education level, maternal phubbing was significantly predictive of children's PMU ($\beta = 0.18, p < .001, [0.14, 0.22]$).

Two-Way Phubbing \times NA Interactions

Regarding the two-way interaction effects of maternal phubbing \times NA, the results of the moderating effect analysis suggested that preschoolers' NA moderated the relationship between maternal phubbing and preschoolers' PMU ($\beta = 0.05, t = 2.69, p < 0.05$). Figure 2 shows the simple slopes at high and low values of NA. For preschoolers with a high level of NA, maternal phubbing was more strongly associated with preschoolers' PMU ($b = 0.24, t = 8.44, p < .001$). For preschoolers with a low level of NA, this relationship was still significant but much weaker ($b = 0.16, t = 5.70, p < .001$). To understand at what levels of NA the interaction effect occurs, the Johnson–Neyman analysis (see Figure 3) revealed that when the score of NA was higher than −2.38 SD, maternal phubbing was significantly and positively associated with PMU. However, when the score of NA was lower than −2.38 SD, maternal phubbing was no longer associated with PMU.

Table 1 Descriptive Statistics and Spearman Correlations Among All Study Variables

	1	2	3	4	5	6
1.Age	1					
2.Maternal education level	0.07**	1				
3.Maternal phubbing	−0.03	0.10***	1			
4.Problematic media use	−0.02	−0.04	0.27***	1		
5.Negative Affectivity	−0.02	−0.03	0.23***	0.40***	1	
6.Effortful Control	0.10***	0.09***	−0.07**	−0.22***	−0.05*	1
Minimum	3.00	1.00	1.00	1.00	1.00	1.00
Maximum	6.00	4.00	5.00	5.00	6.42	8.00
M	4.73	—	2.81	1.88	3.64	5.41
SD	1.27	—	0.59	0.70	0.84	0.85

Notes: $N = 1986$; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Abbreviations: M, Means; SD, Standard Deviations.

Table 2 Regression Analyses Testing Children's NA and EC as Moderator Variables of the Relations Between Maternal Phubbing and Children's PMU

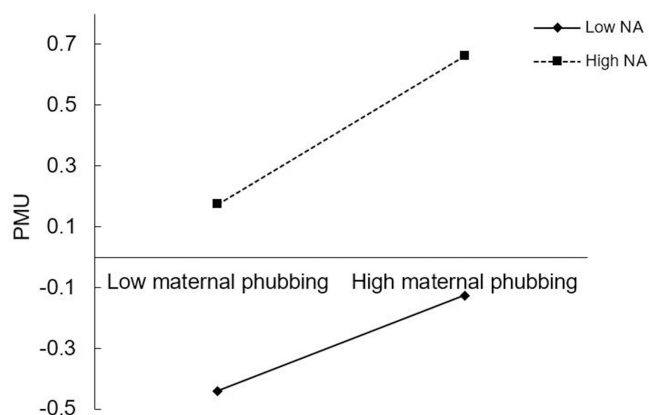
Variable	Problematic Media Use					
	Model 1		Model 2		Model 3	
	β	SE	β	SE	β	SE
Step 1						
Gender	-0.08**	0.05	-0.05**	0.04	-0.05*	0.04
Age	-0.02	0.02	0.00	0.02	0.00	0.02
Maternal education level	-0.04	0.02	-0.03	0.02	-0.04*	0.02
Step 2						
Maternal phubbing			0.18***	0.02	0.18***	0.02
NA			0.35***	0.02	0.37***	0.02
EC			-0.18***	0.02	-0.20***	0.02
Step 3						
Phubbing \times NA					0.05*	0.02
Phubbing \times EC					-0.09***	0.02
EC \times NA					-0.07**	0.02
Phubbing \times NA \times EC					0.02	0.02
R^2	0.01		0.23		0.25	
F	5.42**		76.55***		65.64***	

Notes: N = 1986. Bootstrap sample size = 5000. SE = standard error. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Abbreviations: NA, negative affectivity; EC, effortful control.

Two-Way Phubbing \times EC Interactions

Regarding the two-way interaction effects of maternal phubbing \times EC, the results of the moderating effect analysis suggested that preschoolers' EC moderated the relationship between maternal phubbing and preschoolers' PMU ($\beta = -0.10$, $t = -5.00$, $p < 0.001$). Figure 4 shows the simple slopes at high and low values of EC. For preschoolers with a low level of EC, there is a negative and profound relationship between maternal phubbing and preschoolers' PMU ($b = 0.34$, $t = 12.26$, $p < .001$). For preschoolers with a high level of EC, such connection was weakened ($b = 0.18$, $t = 6.65$, $p < .001$). Results of the Johnson–Neyman analysis (see Figure 5) revealed that when the score of EC was lower

**Figure 2** Interaction between NA and maternal phubbing on child PMU.

Abbreviations: NA, negative affectivity; PMU, problematic media use.

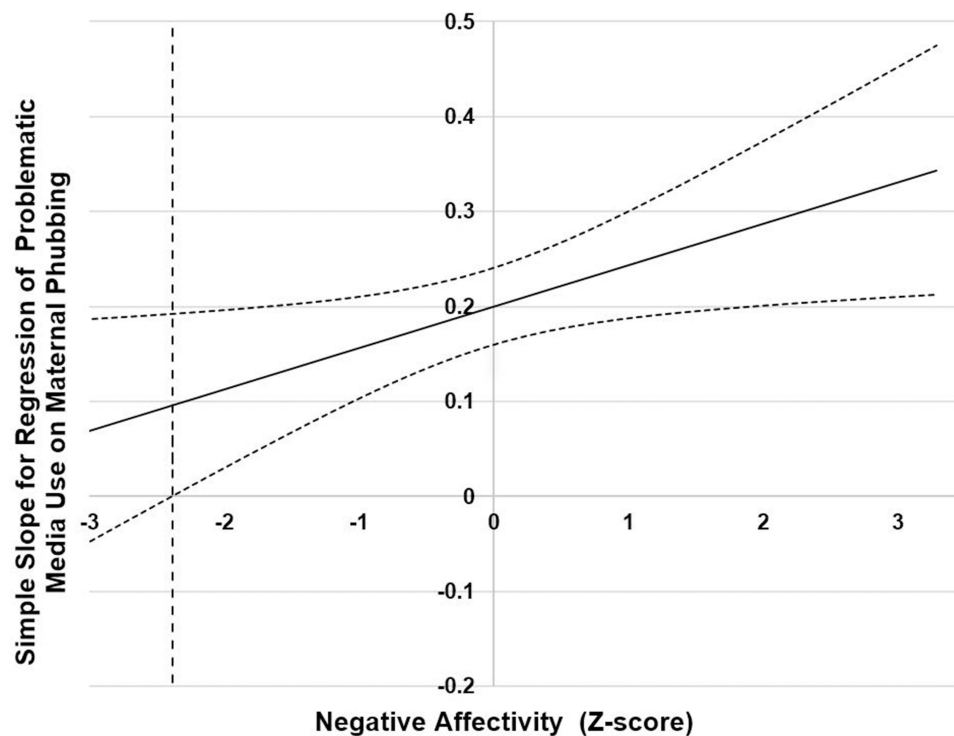


Figure 3 Johnson-Neyman regions of significance and confidence bands for maternal phubbing along child NA in relation to PMU.

Notes: Solid diagonal line represents the regression coefficient for maternal phubbing along child negative affectivity. Dashed diagonal lines are confidence bands—upper and lower bounds of 95% confidence interval for maternal phubbing regression coefficient along child negative affectivity. The vertical dashed line indicates the point along child negative affectivity at which the maternal phubbing regression coefficient transitions from nonsignificance (left of vertical dashed line) to statistical significance (right of vertical dashed line). The value of the vertical dashed line is -2.38 .

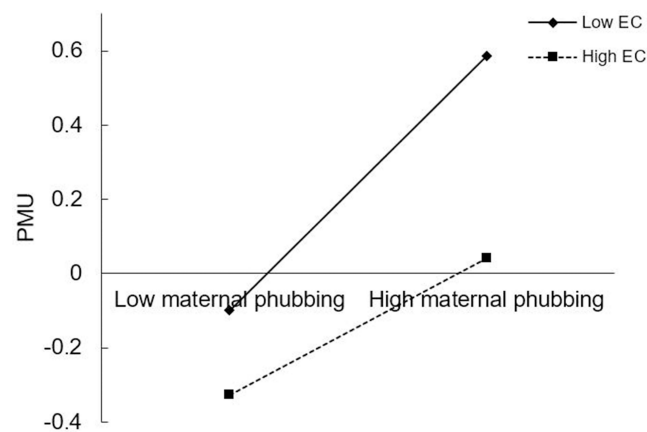


Figure 4 Interaction between EC and maternal phubbing on child PMU.

Abbreviations: EC, effortful control; PMU, problematic media use.

than 2.21 SD, maternal phubbing was significantly and positively associated with PMU. However, when the score of EC was higher than 2.21 SD, the relationship was no longer significant.

Three-Way Phubbing \times NA \times EF Interactions

In our hypothesis, we expected to find a three-way interaction between maternal phubbing, children's NA and EC. However, after conducting hierarchical regression analyses, no significant three-way interaction was found in the present study ($\beta = 0.02$, $t = 0.02$, $p > 0.05$).

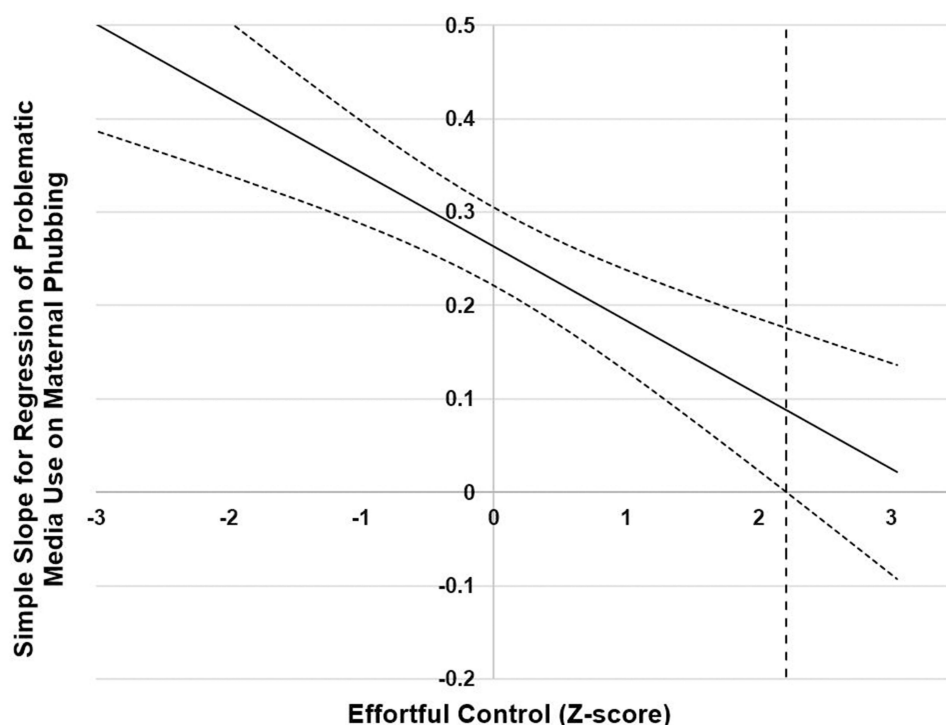


Figure 5 Johnson-Neyman regions of significance and confidence bands for maternal phubbing along child EC in relation to PMU.

Notes: Solid diagonal line represents the regression coefficient for maternal phubbing along child effortful control. Dashed diagonal lines are confidence bands—upper and lower bounds of 95% confidence interval for maternal phubbing regression coefficient along child effortful control. The vertical dashed line indicates the point along child effortful control at which the maternal phubbing regression coefficient transitions from statistical significance (left of vertical dashed line) to nonsignificance (right of vertical dashed line). The value of the vertical dashed line is 2.21.

Discussion

The profound reliance on digital devices has a long-lasting effect on contemporary family life in the digital era. Phubbing, a state of parental uninvolved and exclusion, was a risk factor contributing to children's prolonged or addictive media use.^{23,29,74} However, previous research primarily examines such links among adolescents, with limited attention directed to the preschool population. In addition, although it is well-acknowledged that children's temperament predisposes their emotional reactivity and behavioral response under a stressful event (eg, maternal phubbing),⁷⁵ no research has taken children's temperament as an underlying mechanism to explore the related strength between maternal phubbing and PMU. To fill in the research gap, the overarching objective of the present study includes two folds. First, to investigate the association between maternal phubbing and preschoolers' PMU. Second, to further understand the moderating role of two temperament dimensions (ie, NA and EC) in the relationship between maternal phubbing and PMU, both independently and interactively.

Phubbing and Problematic Media Use

Consistent with our hypothesis, a positive association was observed between maternal phubbing and preschoolers' PMU. This finding aligns with previous studies that focus on families with adolescents, indicating that higher levels of parental phubbing aggravate maladaptive digital media practices.^{23,27,29,74,76,77} Our findings highlight the importance of investigating risk factors contributing to the early onset of PMU in young children (ie, under age 12).

According to social learning theory, children, especially younger ones, tend to view their parents as primary role models from whom they observe and imitate behavioral patterns.³⁷ During the socialization process, children often play an active role in selecting which of their parents' behaviors they intend to internalize.⁷⁸ Interestingly, in contrast to the traditional interpretation of social learning theory, where children actively select and internalize behaviors from their role models, the dynamics of maternal phubbing suggest a different process.

During instances of maternal phubbing, when a mother diverts her attention away from her child and towards a mobile device during mother-child interactions,⁵⁴ children unavoidably find themselves in the role of observers. This experience of witnessing their mothers shift their focus from them to the digital device may result in a sense of exclusion and emotional disconnection for the child. Therefore, maternal phubbing behavior may challenge children's sense of belonging and lead to feelings of being left out or not valued during what should be a nurturing and bonding interaction between parent and child.²⁷

Accordingly, children's exposure to maternal phubbing prompts the development of (mal)adaptive coping strategies, such as actively seeking their parents' attention and resorting to increased digital media use to regain a sense of inclusion.^{23,79,80} Moreover, it was found that adolescents who were frequently subjected to phubbing by others were more likely to perceive phubbing as a norm in interpersonal interaction,^{77,81} and had a weaker intention to control their mobile device usage.⁸⁰ Therefore, children's involuntary observation of their mothers' frequent phubbing behaviors may influence them to adopt and imitate their mothers' maladaptive media use, which could lead to the acceptance of such behavioral practices as they grow older.

The Moderating Role of Child Negative Affectivity

As expected, children's NA moderated the relationship between maternal phubbing and PMU. Specifically, when compared with children with low NA, children with high NA traits were more likely to engage in PMU as their mother's phubbing behavior increased. This result highlights the important role of children's NA as it exacerbated the association between phubbing and PMU.

The experience of being phubbed is perceived as stressful for children as it violates their fundamental need for inclusion, leading to negative emotional arousal.^{31,82,83} Based on the diathesis-stress model, children's temperament predisposes them to handle stress differently.⁵² Children with high NA tend to be more susceptible to experiencing psychological distress and have more difficulty regulating their emotional responses to stressful events.^{84,85} As a result, children with high NA may turn to external sources to alleviate these negative feelings. Indeed, high NA has often been associated with high maladaptive media use,^{28,43,86} and the same correlation was also observed in the present study. According to the compensatory Internet use theory, children with high NA engage in more internet use as a way to escape from stressful events in reality.^{43,59,87}

Given the age of the children in our study, our finding significantly contributes to our understanding of how NA and phubbing jointly influence PMU. Unlike adolescents who have more autonomy and control over their media usage, preschoolers' access to media largely depends on their parents' decisions.⁶⁶ Unfortunately, it appears that mothers who engage in more phubbing behaviors are also the ones who tend to "give up" their authority to regulate their children's PMU. Research has shown that mothers with high attentiveness to mobile devices often compromise their active efforts to manage their children's digital media consumption.^{67,80}

Moreover, mothers with high levels of phubbing tend to be less prepared for children's negative responses. Consistent with this notion, it has been observed that mothers who were preoccupied with their mobile devices experienced higher levels of parenting stress.⁸⁸ This, in turn, leads to mothers' increased tendency to use mobile technology as a means to soothe their children's frequent crying and tantrums.⁵⁸ Consequently, children with high NA may experience more PMU, as they are more likely to be left in charge of digital device use alone without proper parental mediation.

The Moderating Role of Child Effortful Control

The effects of maternal phubbing on PMU vary by the level of children's EC, supporting our hypothesis. Compared to children with low EC, those with high EC remain less affected by their mothers' phubbing behaviors, leading to less PMU. This finding suggests that EC serves as a resilience factor that mitigates the tension between maternal phubbing and PMU.

Children with high EC traits are inclined to modulate negative reactivity by voluntarily directing their attention, inhibiting negative responses, and engaging in goal-driven behaviors.^{89,90} Our finding provides additional empirical support for the risk-buffering hypothesis, which posits that an individual's EC, a temperament predisposition for regulating negative emotions, reduces the likelihood of problem behaviors in the face of stressful events.⁹¹ It has been

found that children with high EC experience less perceived arousal and unpleasantness when exposed to social stress tests.⁹² Similarly, children with high EC may experience reduced emotional arousal and a lesser inclination to seek digital devices for comfort when encountering frequent maternal phubbing.

In addition, previous research has consistently shown a significant connection between low EC and high dependency on screen or media use.^{45,93,94} For example, children with low EC were found to engage in more maladaptive thinking and exhibit a higher incidence of internalizing behaviors,^{62,95,96} which may result in maladaptive coping mechanisms. Furthermore, parents of children with low EC tend to provide digital devices to their children as a way to alleviate the stress linked to parenting and to soothe their children.⁴⁵

It is worth noting that children's high EC did not shield them from the negative impact of phubbing on PMU. This phenomenon might be a result of ego depletion. According to the strength model of self-control,⁹⁷ self-control is not an infinite commodity; instead, it is a limited resource that can be exhausted over time (ie, ego depletion). The duration of effort, perceived difficulty, and subjective fatigue all contribute to the effect of ego depletion.⁹⁷

Perhaps children with higher EC traits are equipped with greater self-regulatory capability, allowing them to resist the psychological distress of exclusion resulting from maternal phubbing and the temptation of media use. However, over time, their self-control could eventually be depleted, potentially reducing their self-regulatory capability in the long run, causing more instances of self-control failure (ie, more PMU). In partial support of this argument, it has been found that increased media use reduced preschoolers' EC in the following year.⁴² Additionally, parental phubbing was found to be positively correlated with children's ego depletion in a cross-sectional study.⁹⁸ Nevertheless, longitudinal studies are needed to confirm this premise in the future.

The Moderated Moderating Role of Effortful Control

Originally, we expected to find a three-way interaction among maternal phubbing, children's NA and EC. More specifically, when facing maternal phubbing, children with high EC were anticipated to regulate their negative emotions and protect themselves from PMU, regardless of their NA level. Meanwhile, children with low EC were expected to be more susceptible to their NA traits, leading to more profound PMU. However, contrary to previous findings among the adolescent population,^{50,51,63} our hypothesis was not supported.

The absence of a significant three-way interaction might be due to the age characteristics of preschoolers. Younger children are more sensitive to stressors from their immediate environment, such as social exclusion. A systematic review has highlighted the adverse effect of parental phubbing is more severe than partner phubbing,²⁷ implying that young children are more vulnerable to inclusion threats, especially those with high NA traits. Furthermore, younger children lack sufficient resources and experience to effectively manage stressful events.⁹⁹ It has been found that children's EC and its corresponding behavioral manifestations, such as self-control and inhibitory abilities, continue to develop from early childhood to early adolescence.^{100–102} Therefore, compared with adolescents, although preschoolers with high EC are prone to regulate distress and emotional outbursts, they may not have mastered sufficient strategies to overcome the negative influence of NA and cope with mothers' frequent phubbing.

Gender Difference in Problematic Media Use

Aside from our main findings, the detected disparity in PMU between boys and girls in the present study is also worth discussion. Our findings revealed that boys exhibit more PMU than girls, consistent with a recent systematic literature review on gender differences in PMU among children under 10 years old.¹⁰³ However, no definitive gender-specific explanations have been confirmed, as research on preschoolers' PMU is still in its early stages and requires further investigation.

Nevertheless, existing research on PMU among adolescents may provide valuable insights. For instance, while male adolescents generally score higher on problematic internet use than female adolescents, this gender difference varies depending on the type of media device considered.¹⁰⁴ Specifically, compared with male adolescents, female adolescents tend to prefer using social media over playing video games.¹⁰⁵ This pattern may reflect similar gender-specific preferences in young children.

Moreover, research has shown that female children's problematic smartphone use for social networking increases as they age.¹⁰⁴ This suggests that children's developmental stages and their evolving need for social connections may influence their motivation to engage with digital devices. In preschool age, the most significant social connections are typically with family members. As a result, the need to establish connections with extrafamilial members through media devices is less pronounced at this stage of development. This could help explain why girls in this age group exhibit lower levels of PMU compared to boys.

In addition, parents' gender-specific parenting practices may also contribute to these potential gender differences in PMU. For example, parents of high school boys tend to be more tolerant of their children's internet use than parents of high school girls.¹⁰⁶ Compared to girls, boys are also about twice as likely to have personal TVs, game consoles, and computers in their bedrooms, which contributes to more extended media consumption and higher rates of problematic media use.¹⁰⁷

Therefore, while more comprehensive research is needed to better understand the gender differences in preschoolers' PMU, children's gender- and age-specific preferences for media use, the nature of their social connections, and the gender-specific attitudes of parents toward media use may provide potential explanations for our findings.

Limitations and Future Directions

Several limitations should be acknowledged, and these limitations also suggest potential directions for future research. First, it is important to note that this study employed a cross-sectional design, which limits our ability to make causal inferences regarding the relationship between maternal phubbing and children's PMU. Longitudinal research should be further conducted to better elucidate the bidirectional dynamics between these variables and investigate the long-term interpersonal and intrapersonal consequences of maternal phubbing.

Second, the reliance on self-report measures to assess parental phubbing introduces the possibility of response biases. Factors such as social desirability tendencies and underestimation of one's phubbing behavior may have affected the reported scores. To enhance the objectivity and accuracy of measurements, future studies could consider employing more objective methods, such as smartphone applications that automatically record phubbing behavior or conducting experimental research. Supplementing with multiple data sources, such as observation methods or reports from other family members is also worth considering.

Third, gender role theory posits that fathers and mothers assume distinct roles within the family system, each with varying impacts on children's developmental outcomes.³³ Therefore, paternal and maternal phubbing may exert different effects on child development. In line with this, Wang et al found that paternal phubbing is more likely to escalate children's aggression relative to maternal phubbing.¹⁰⁸ Future research should simultaneously examine both paternal and maternal phubbing behaviors to gain a comprehensive understanding of the impact of family dynamics on children's PMU.

Lastly, it is worth noting that the limited regional sample size in this study may restrict the generalizability of the findings. Studies have shown that temperament traits and attitudes towards phubbing may vary across different cultures.^{35,109} Therefore, it is essential to conduct further research with diverse population samples to enhance the applicability of the study's findings.

Implications

Despite these limitations, this study offers several practical implications. First, while digital advancements have brought numerous conveniences to daily life, they have also introduced new challenges for families with young children, such as maternal phubbing and PMU. Our findings suggest that these families could benefit from prevention programs aimed at reducing parental phubbing practices. Specifically, policymakers should consider implementing cognitive-behavioural programs to raise awareness among young parents about the negative influence of phubbing on their children and to promote healthier habits for mobile device use. Children raised in such environments are more likely to adopt these healthy media use habits.

Second, interventions are needed to disrupt the transmission of PMU in families already affected by parental phubbing, especially in those where children are more vulnerable to environmental stressors due to high NA. Our

findings suggest that children with high NA, when exposed to stressors (eg, parental phubbing), are more likely to intensify their PMU and use media devices as maladaptive tools to regulate their emotions. In contrast, children with high EC are less drawn to digital devices when faced with parental neglect, highlighting the crucial role of a child's innate self-control and regulation competence in breaking this vicious circle. Therefore, interventions might be more effective if they target both the mother and child. These intervention programs should consider incorporating training to enhance parental sensitivity, improve parental mediation skills, and strengthen children's emotional and behavioral regulation abilities.

Conclusion

Our findings revealed that mothers' frequent phubbing behaviors are related to their children's higher instances of PMU. Children's lower level of NA and higher level of EC uniquely mitigate the negative effect of maternal phubbing on PMU to some extent. Specifically, the positive associations between maternal phubbing and PMU were stronger among preschoolers with higher levels of NA and weaker among those with higher levels of EC. No interaction effect was found among maternal phubbing and children's NA and EC on PMU. That is, Children's responses to maternal phubbing vary based on their temperament, ultimately leading to their varying psychosocial development. Those more vulnerable to stress may struggle with emotional regulation, potentially leading to heightened emotional or behavioral issues (eg, PMU) as they navigate the challenges of childhood. Conversely, children with strong self-regulation, such as high EC, may show resilience to maternal phubbing, promoting relatively more adaptive outcomes. Therefore, continued research endeavors are imperative to elucidate the intricate, long-term dynamics of how temperament and parental phubbing interact, influencing the developmental trajectory of children's psychosocial well-being. Overall, our results suggested that preschoolers' characteristics exert some influence, albeit limited, in regulating the adverse effect of maternal phubbing on their media use. Active parental mediation and involvement might be warranted to scaffold children's proper digital development.

Data Sharing Statement

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

Ethics Approval

All procedures performed in the study involving human participants were in accordance with the ethical standards of the Research Ethics Committee of Shanghai Normal University (Ethics of Shanghai Normal University [2022] No. 043). The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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